CANADA

DEPARTMENT OF MINES

AND

TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

WATER SUPPLY PAPER No. 224

PRELIMINARY REPORT

GROUND-WATER RESOURCES OF THE RURAL MUNICIPALITY OF .... NO. 80 SASKATCHEWAN

By

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

OTTAWA

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NOTE:

Because of difficulties involved in reproduction, the tables of well records referred to are not included with this report. Information regarding individual wells may be obtained by writing to the Director, Geological Survey of Canada, Ottawa.

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INTRODUCTION

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

Publication of Results

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

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

How to Use the Report

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

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

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

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

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

GLOSSARY OF TERMS USED

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

WATER-BEARING HORIZONS OF THE MUNICIPALITY

Rural Municipality, No. 80, comprises an area of 324 square miles on the Cypress Hills uplands in the southwestern part of southern Saskatchewan. The municipality consists of nine townships described as tps. 7, 8, and 9, ranges 22, 23, and 24, W. 3rd mer. There are no towns within the area. The chief trading centres lying in adjoining districts are the town of Eastend and the village of Ravenscrag, situated on the Shaunavon Branch of the Canadian Pacific railway a short distance south of the municipality, and the town of Maple Creek, situated on the main line of the same railway, about 12 miles northwest of the northwest corner of the municipality.

The maximum relief of the municipality approximates 750 feet. The greater part of the area consists of a moderately rolling upland that in some places is deeply dissected by well developed northern and southern drainage systems. In many places the interstream areas form regions of comparatively level benchland, with surface elevations ranging from 3,600 feet above sea-level on the lower slopes to 3,950 feet in the central part of the municipality.

Drainage of the southern two-thirds of the municipality is to the south, through tributaries of Frenchman river, forming part of the Missouri drainage system. The northeast corner of the municipality drains to the north by Bone creek, a part of the Saskatchewan River drainage system. The headwaters of the northerly flowing Skull, Bear, and Piapot creeks drain small areas along the northern boundary. The streams of both the north and southern parts have excavated deep, steep-banked coulées, the main channels of which cross the north and southern borders, at elevations between 3,200 and 3,300 feet above sea-level. The largest streams in the area are the North Branch of Frenchman river, which flows southward through townships 7 and 8, range 22, and crosses the southern border in the southeastern part of township 7, range 23, and Fairwell creek, which flows southward through range 24.

As the stream channels have a fairly steep gradient, the surface run-off is rapid. Most of the streams, however, are fed by springs and maintain a fairly constant flow of clear water throughout the year. These streams form the chief source of water for range stock, and the springs are utilized at many places for domestic uses where they are convenient to farm or ranch buildings.

As the farms are confined largely to the higher benches, where springs are not of common occurrence, these residents have been obliged to sink wells for their water supplies in the unconsolidated deposits or into the underlying bedrock.

Water-bearing Horizons in the Unconsolidated Deposits

The unconsolidated deposits consist of Recent sediments laid down by flood waters in the bottoms of the stream channels, and the glacial drift that mantles the bedrock throughout the rest of the area.

In the stream deposits, ground waters accumulate in the porous beds of sand and gravel that occur interspersed through the less pervious clay and silt that forms the major part of these deposits. The small stream channels usually have a steep gradient, and their deposits consist largely of coarser sediments thinly distributed over the valley bottom. Such deposits readily lose this water by underground flow, and are not likely to contain any large supplies, unless they are constantly replenished by springs seeping from the valley sides or by direct seepage from the streams. In the larger stream channels, such as the North Branch of Frenchman river and Fairwell creek, the gradient is more gentle and the deposits consist largely of the fine grained silt and clay such as would be carried away by more swiftly flowing streams. These fine sediments are interbedded with coarser sands and gravels that are usually water-bearing. A number of wells are yielding water from the stream deposits in various parts of the municipality. Most of these wells are not over 15 feet in depth, and the water-bearing bed in nearly all places consists of gravel. The supply varies, but in most of the wells it is adequate for the requirements of the farm on which the well is located. These waters are all reported to be of excellent quality for domestic use, and most of them are soft or only moderately hard.

The glacial drift overlying the rest of the municipality consists essentially of boulder clay interspersed with, and in some places underlain by, well-sorted sands and gravels. This drift was deposited by a great continental ice-sheet that many thousands of years ago spread in a general southwesterly direction over the province of Saskatchewan. At some places where the ice-sheet paused for any considerable period of time during its gradual retreat, it deposited an uneven and possibly greater accumulation of boulder clay interspersed with well-sorted beds of sand and gravel. The ground surface of such areas is irregularly rolling and characterized by numerous low hills and intervening undrained depressions or sloughs, and they are referred to as moraines as distinguished from the less rolling areas of evenly distributed drift deposits known as till plains. The moraines in this municipality are confined largely to areas of higher land in range 22, where they occur as irregular-shaped deposits in the southern part of township 7, the western side of township 8, and through the northern part of township 9. The thickness of the glacial drift probably nowhere greatly exceeds 50 feet on the uplands. At many places over the steeper valley slopes it is very thin and at some localities the bedrock is exposed at the surface. Little ground water is obtainable from the boulder clay, and such water as does occur is concentrated largely in embedded porous pockets of sand and gravel. Owing, however, to the generally pervious character of the underlying bedrock, these sediments in most places are unable to retain any large water supplies. The erratic distribution of the water-bearing beds also reduces the possibility of locating a water supply at places convenient to farm buildings.

The low depressions and draws between the ridges are generally regarded as being more favourable for the occurrence of water-bearing beds than are the ridges or level till plains.

Wells, producing from the drift, range in depth from 10 to 50 feet. The yields of the individual wells are reported in nearly all cases to have decreased in the drought years prior to and including 1935. Many of the wells when visited in 1935 were yielding sufficient water only for household use, and few large yields were reported. These waters, however, are all of good quality, and are being used for the household drinking supply. Most of them are soft or only moderately hard.

Water-Bearing Horizons in the Bedrock

Five bedrock formations known as the Cypress Hills, Ravenscrag, Whitemud, Eastend, and Bearpaw, are known to immediately underlie the drift or Recent deposits in different parts of the municipality. All of these formations at one time, presumably, extended over the entire area. Erosion, most of which took place prior to the deposition of the glacial drift, has reduced the original thickness or entirely removed the upper formations in some parts of the area. Still later erosion by the North Branch of Frenchman river and Fairwell creek, in the southern part of the area, has cut through the upper four formations into the lowest or Bearpaw formation. Outcrops of the various formations may be seen at many points on the valley sides.

The uppermost, or Cypress Hills, formation is composed essentially of alternating layers of medium- to coarse-grained sands and sandstones, and hard, cemented quartzite conglomerate. This formation caps the uplands that extend over most of the municipality, down to elevations ranging from about 3,650 feet above sea-level in the northwestern part to a minimum of about 3,400 feet in the northeast corner. The base of the formation in the southern part of the area occurs at an average elevation of about 3,500 feet above sea-level.

The Cypress Hills formation is the chief source of water supply from the bedrock. Water is encountered in wells sunk to depths ranging from about 40 to 150 feet. The upper water-bearing beds do not occur at any definite horizon, but appear to be interspersed at irregular intervals through the formation. Where lower beds have been encountered they provide more constant water supplies, and they may form a fairly continuous horizon overlying the less pervious beds of the Ravenscrag formation throughout large areas. At places where the stream channels have cut through the porous beds that form the aquifers, springs are found. These springs are a common occurrence in all parts of the municipality that have suffered any extensive denudation.

The water from the Cypress Hills beds is invariably of good quality, and in many places is reported to be soft or only moderately hard.

In very few places has it been necessary to sink wells through the Cypress Hills beds into the underlying Ravenscrag formation, in order to obtain a water supply. The Ravenscrag, however, forms the bedrock immediately underlying the drift in a fairly extensive area of lowlands along Fairwell Creek and the North Branch of Frenchman River valleys, in the southern half of the area, and in a narrow belt extending along the northern border of township 9, range 24. This formation consists chiefly of silts and soft shales interbedded with variable thicknesses of sands and sandstones, and occasionally thin seams of lignite coal. The sands are usually grey to greenish grey, but weather to a light grey or buff in rock exposures. The colour of the shales ranges through a series of dark greys, green, and browns, with the darker colours predominant, particularly in the lower beds. The sand and coal seams are sufficiently porous to form reservoirs for ground water, and may be the source of many of the springs that are reported to occur in the coulées in the southern part of the municipality. Several wells are also yielding water from these aquifers. These waters are of good quality, and apparently do not differ essentially from other waters obtained in the municipality.

Beds of white clay forming the Whitemud formation are known to occur below the Ravenscrag in the southeastern corner of the municipality. This white clay where it outcrops forms a conspicuous white band along the banks of Frenchman River valley, just south of the area, and it probably extends northward through at least the southern townships of this municipality. It is doubtful, however, if it is continuous over the entire area, as it is known to have been considerably eroded before the Ravenscrag beds were deposited. The Whitemud is not regarded as a potential water-bearing formation, although it serves as a marker separating the Ravenscrag from the underlying Eastend formation, and can be readily recognized in well samples. It occurs at elevations of about 3,350 to 3,400 feet above sea-level, and should not be confused with beds of a white, calcareous clay that occasionally occur interspersed through the Cypress Hills formation, at much higher elevations.

The Eastend formation underlies the entire area below the Whitemud, or in its absence occurs below the Ravenscrag formation, except in the deep valleys in the southern parts where stream erosion has cut down into the underlying Bearpaw formation. The Eastend formation is composed largely of grey clay shales and silts, interbedded with a few, thin, porous layers of sand and sandstone. Its base probably occurs at an elevation of about 3,250 feet above sea-level, although its position is not definitely determined, as it apparently grades without break into the more compact grey shales of the underlying Bearpaw formation. Both the Eastend and the upper beds of the Bearpaw formation are in places sufficiently porous to be water-bearing. In most parts of the area they lie beneath 400 to 600 feet of Ravenscrag and Cypress Hills sediments, and at those depths their water supplies are not likely to be used.

One well, situated in the lower southeastern part of the area, is yielding water from an aquifer in the Eastend formation. This water is hard and is reported to be suitable for household use. In general, the Eastend and Bearpaw waters are expected to be more highly mineralized than waters from the upper formations or from the unconsolidated deposits. The Bearpaw formation probably becomes more shaly in its middle and lower parts, and since the formation is of marine origin, it will undoubtedly contain such large amounts of mineral salts as to be unfit for drinking, and probably unfit for watering stock. Hence deep drilling much below the level of the bottom of the North Branch of Frenchman river, where it crosses the southern boundary of the municipality, is not considered advisable in any part of the municipality.

GROUND WATER CONDITIONS BY TOWNSHIPS

Township 7, Range 22

The maximum relief in this township approximates 600 feet. The land surface rises in a northwesterly direction from an elevation of about 3,200 feet above sea-level in the valley of the North Branch of Frenchman river to over 3,800 feet in the interstream uplands of the northern sections. The surface is very irregular, and in the northwestern half is deeply dissected by the river and its numerous tributary coulées from the north. The southeastern half is poorly drained. Much of it is occupied by small hills and undrained depressions typical of a moraine-covered area.

Owing to the irregular land surface most of the township is devoted to ranching. Springs flowing from the coulée banks are the chief source of water for stock. A few wells are yielding water from both the unconsolidated deposits and bedrock formations.

The North Branch of Frenchman River valley and its tributary coulées are floored with fairly thick deposits of Recent silt, sand, and gravel. Wells dug to depths of 10 to 20 feet in these deposits, as a rule, encounter moderately large supplies of drinkable water. The water is usually concentrated in the sand and gravel beds that occur interbedded with the less pervious clay and silt. Some of the smaller stream channels have a relatively steep gradient. Their deposits may be too thin in some places to contain large supplies, unless they are continually replenished by spring waters seeping from the bedrock on the valley sides.

The upland areas between the stream channels are covered by glacial drift, ranging in thickness from only a few feet to 40 feet, or possibly more at isolated points. The drift consists for the most part of boulder clay. The unstratified clay contains in some places irregular pockets of well-sorted sands and gravels. These pockets are probably more numerous in the moraine-covered area that extends through the southern part of the township, than in the till that blankets the remainder of the area. Several wells, put down to depths averaging about 18 feet, in section 4, encountered water-bearing sands overlying the blue boulder clay. Similar shallow water supplies probably occur in other parts of the area, although in most places it may be necessary to sink several test-holes before a suitable water supply is located. Wells drawing water from this type of deposit are affected by drought conditions, and can rarely be depended upon for a permanent water supply. Their waters are usually of good quality and may be used in the household.

Several wells and a number of springs are yielding water from the bedrock formations. The Cypress Hills formation occurs only in the north and western uplands where the surface lies above 3,500 feet above sea-level. No wells in the township are known to be producing from these beds, although some of the springs that are reported to occur in the coulées may have their source in this formation. Depths to water cannot be predicted, however, owing to the irregular topography and the generally erratic distribution of the aquifers through the formation. In adjoining townships, waters from the Cypress Hills formation are moderately soft and are quite suitable for household use. A similar type of water may be expected from these beds in this township.

The Ravenscrag formation is also known to be water bearing. This formation underlies the Cypress Hills, and with the exception of the North Branch of Frenchman River valley it immediately underlies the drift throughout the rest of the township down to an elevation of about 3,350 feet above sea-level. Wells situated in sections 3 and 19 obtain at a depth of 20 feet or less adequate supplies of soft to moderately hard water from coal seams or their associated sand beds. This formation is no doubt a potential source of water in other parts of the township, although the depths to the productive aquifers in most places are probably much greater than 20 feet. Where they have been obtained, waters from the Ravenscrag are not highly mineralized, and are being used for the domestic drinking supply.

The Whitemud formation is believed to underlie the Ravenscrag throughout the area at an approximate elevation of 3,350 feet above sea-level. Suitable water supplies are not expected to occur in these compact white clays.

The Eastend formation underlying the Whitemud nowhere in the area attains a thickness of more than about 100 feet. The exact position of its base is undetermined, but it probably merges into the underlying Bearpaw formation, at an elevation of about 3,250 feet above sea-level. A well sunk to a depth of 182 feet or to an elevation of about 3,243 feet in the SE.$\frac{1}{4}$, section 3, encountered an adequate yield of water in a sand bed in what is either the lower part of the Eastend formation or the upper part of the underlying Bearpaw formation. This water is hard, and is reported to be suitable for domestic use. The areal extent of this aquifer has not been determined.

An adequate supply of water for the average farm requirements may be obtained in most parts of the township from one of the above-mentioned formations at depths not greater than 150 feet, and more probably less than 100 feet.

Township 7, Range 23

Drainage of this township is carried southward by the North Branch of Frenchman river, and its numerous small tributaries from the north. These stream channels are confined largely to the southeastern half of the township. The main stream has cut its channel down to an elevation of about 3,200 feet, or about 400 feet below the bordering prairie uplands. The northwestern half of the township is only slightly dissected. The surface here consists of a moderately rolling to flat benchland, with surface elevations ranging generally between 3,700 and 3,800 feet above sea-level. Sediments slightly exceeding 3,875 feet occur at several places near the northern border of the township. Farms in the township are confined mostly to the more level western part.

Water supplies in the farming settlement are obtained chiefly from wells sunk in the unconsolidated deposits, or into the underlying bedrock. Range stock obtain water from springs and from the small spring-fed creeks.

The Recent stream deposits are possibly the best potential source of water at depths of less than 20 feet. Several wells in the township yield water from these deposits. The water is found in sand and gravel beds that occur under the clays and silts in the coulée bottoms. As these aquifers obtain their water mostly by seepage from the bedrock, or from the creek, they contain relatively small concentrations of mineral salts in solution, and their waters are quite suitable for drinking.

The glacial drift is also a potential source of water. This deposit consists of boulder clay interspersed, and more occasionally underlain, by irregular beds and pockets of sand and gravel. The sand and gravel pockets may be water-bearing in some places, particularly if they are underlain by impervious clay. Their presence is not indicated by the surface topography, but they are more commonly located at the bases of steep slopes, and in the draws, than on the ridges or level plains. The water from these deposits is usually of good quality, but the supply is as a rule inadequate for more than household use and for a few head of stock.

The chief source of ground water in the township is in the Cypress Hills formation. The sands and gravels, or conglomerates comprising this formation underlie the drift throughout the township, where the surface elevations are above 3,600 feet. This horizon has been encountered by a number of wells situated on the west-central part of the area which wells all appear to be drawing their water from an horizon at depths ranging from 65 to 109 feet, or at elevations of 3,698 to 3,617 feet above sea-level. At most places, alternating beds of dry sand and gravel or conglomerate were dug through before water was encountered. The water is under little or no hydrostatic pressure, but in most wells the supply is sufficient for the requirements of the farms on which they are located. The water table within the area has dropped appreciably during the recent years of drought, and those wells that were sunk only a short distance below the upper water-level are now nearly dry. Other wells have partly filled in with loose sand. The original production of these wells could no doubt be partly restored by cleaning or deepening the wells. These waters are all reported to be moderately soft, and of excellent quality for household use.

No wells in the township are reported to yield water from the Ravenscrag formation. This formation underlies the Cypress Hills beds, and immediately underlies the unconsolidated deposits in the south and southwestern sections, at elevations below 3,600 feet above sea-level. The Ravenscrag formation contains numerous beds of porous sand, sandy shale, and several seams of coal, all of which are regarded as being sufficiently porous to yield adequate supplies of drinkable water. These productive beds probably extend down to elevations as low as 3,400 feet above sea-level. Some of the springs reported to occur in the coulées probably have their source in these beds.

The Eastend formation underlies the Ravenscrag, and is thought to underlie the unconsolidated deposits on the lower slopes of the deep valleys in the southeastern part of the township. The Bearpaw formation may underlie the Recent deposits in the valley bottom. Both these formations are a potential source of water, although it is improbable that supplies from them will be required in the near future, as the overlying Ravenscrag and Cypress Hills formations are thought to be capable of supplying adequate water in most parts of the township.

Township 7, Range 24

A wide valley or lowland area, with surface elevations ranging from 3,400 to 3,600 feet above sea-level, occupies most of the southwestern half of this township. Toward the north and west the surface rises rather abruptly to elevations of 3,700 to 3,800 feet at the borders of the township. Drainage is carried southwestward by Fairwell creek. This stream enters the lowlands through a wide valley in section 35, at an elevation of about 3,575 feet above sea-level. Toward the southwest the creek has excavated a deep channel through the lowlands, so that where it crosses the southern border in section 5 it lies at an elevation of about 3,200 feet or 200 to 250 feet below the bordering lowlands. Several tributaries from the north also occupy deep, steep-banked coulées.

Water supplies of the township are obtained chiefly from wells, although residents situated in Fairwell Creek valley and in the tributary coulées depend largely upon the creek or springs for their water supplies.

The coulée bottoms are underlain by fairly extensive beds of sand and gravel. These deposits are in most places overlain with less pervious clay and silts. Wells sunk in the valley sediments should yield large supplies of water of excellent quality, although this source of water is little used at present. Most residents situated in the coulée bottoms have located near springs and obtain their water from them. The springs are mostly of bedrock origin, and the water is quite suitable for domestic use. The rest of the township is mantled by glacial drift, the thickness of which ranges from about 10 feet to 50 feet. Several wells in the township are believed to yield water from gravel or sandy beds in the drift, although these deposits are not readily distinguished from the underlying loose gravel deposits formed from the pre-glacial weathering of the Cypress Hills bedrock formation. Wells on sections 12, 16, and 18 are producing moderate yields of soft, drinkable water from these sediments, at depths of 35, 48, and 32 feet, respectively. Other pockets of water-bearing sand or gravel may occur interspersed through the drift at shallower depths, particularly along the bases of steep slopes, and in shallow draws where materials washed down from the uplands are most likely to collect.

Three wells in the township are reported to be producing water from the Cypress Hills formation. This formation was deposited on the unevenly eroded surface of the underlying Ravenscrag formation, hence it does not occur everywhere at the same elevation. In sections 2 and 3, wells put down to depths of 52 to 65 feet obtain an adequate yield of water from what is believed to be Cypress Hills sandstones, at elevations ranging from 3,566 to 3,623 feet above sea-level. This horizon is similar to that encountered in wells located on the western side of the township bordering on the east, and may be expected to extend throughout the part of this township lying west of Fairwell Creek valley. A belt of land about 1½ miles in width, extending along the western side of the township, is also thought to be underlain by the Cypress Hills formation, and may be water-bearing in some places at depths not expected to exceed 100 feet. A dry hole is reported to have been put down to a depth of 71 feet in section 18. This hole may not have reached the base of this formation where water is most likely to occur. The underlying Ravenscrag formation is also water-bearing, however, and the possibility of striking water at greater depths in the above location is regarded as quite favourable.

The Ravenscrag formation is believed to immediately underlie the unconsolidated deposits in an extensive lowland area , west of Fairwell Creek valley. A 60-foot well, put down in section 21, yields an adequate supply of soft, drinkable water from a bed of sand, in what is believed to be this formation, at an elevation of about 3,508 feet above sea-level. Springs also occur at intervals along the banks of Fairwell creek and its tributaries, and are thought to have their source in sands and coal seams of the Ravenscrag formation. The springs were not examined in detail, and only a few are listed in the table of wells accompanying this report.

Although large water supplies are usually obtainable from the Cypress Hills or Ravenscrag formations, the underlying Eastend and the upper part of the Bearpaw formation are also potential sources of water. These formations form the bedrock on the lower banks and bottom of Fairwell Creek valley, in the southern part of the township. The elevation of the top of the Eastend has not been definitely determined, but it probably occurs at about 3,375 feet above sea-level. Waters from this source are usually drinkable, although they may be more highly mineralized than water from the upper formations.

Township 8, Range 22

The land surface of this township consists for the most part of level benchland, at an average elevation of about 3,700 feet above sea-level. It is deeply dissected by the North Branch of Frenchman River valley, a deep, steep-banked coulée that extends southward from sections 34 and 35 to cross the southern border in sections 4 and 5. The bottom of the coulée in the southern sections lies at an elevation of about 3,400 feet above sea-level. Tributary coulées have also deeply eroded the southwestern and south-eastern parts of the area. Farms are confined mostly to the benchland in the western half of the township. The valley bottoms and most of the steeply eroded western part of the area are devoted to ranching. Springs that occur on the valley sides, and a small creek that derives its supply largely from spring waters are the chief source of water for range stock. These also supply water for some of the residents situated in the valley bottoms.

Flood-plain deposits consisting largely of clay and silt, interbedded with pockets of sand and gravel, mantle the bottoms of many of the coulées. These deposits are best developed in the North Branch of Frenchman River valley, where they form flats in some places nearly half a mile in width. Wells sunk in these deposits can be expected to yield moderately large water supplies, particularly if sand or gravel beds are encountered. There has been little need of developing these supplies, however, as the creek provides ample water for stock in this vicinity.

The glacial drift covering the uplands in this township nowhere greatly exceeds 30 feet in thickness. It is more variable in thickness in the deeply eroded areas, and at many points along the valley sides the underlying bedrock is exposed. No wells are reported as obtaining water from the drift in the township, although it may be water-bearing in some places, particularly in the irregular moraine-covered area that extends through sections 13, 14, and 24. Residents in search of water at shallow depths in the drift are advised to prospect the selected location with a test auger, as the presence of porous beds at the surface is not always an indication of water at depth. The drift is in most places underlain by porous sands and gravels of the underlying Cypress Hills beds, and unless the drift aquifers are underlain by impervious clays they may be unable to retain any large supplies of water.

The base of the Cypress Hills formation occurs at an approximate elevation of 3,500 feet above sea-level. It immediately underlies the drift throughout the area with the exception of the deeper coulées. Several wells situated in the western half of the township are yielding water from sand and sandstone beds in what is thought to be the lower part of the Cypress Hills formation, or possibly the upper Ravenscrag beds, at elevations ranging from about 3,587 to 3,555 feet above sea-level, or at depths of 143 to 170 feet from the surface. The water is reported to be soft, and the supply obtained is adequate for farm requirements. Similar water-bearing beds are expected to occur on the western side of the North Branch of Frenchman river. In the township bordering on the west, wells are producing from this formation at depths ranging from 60 to 80 feet. These aquifers are expected to extend through the western part of this township at approximately the same depth.

The Ravenscrag formation underlying the Cypress Hills beds consists chiefly of shales, although it also contains some thick beds of sand and seams of coal. These porous beds are expected to be water bearing throughout most of the area, but it may be necessary in some places to sink wells to depths of 200 to 250 feet, to ensure an adequate supply. The Ravenscrag waters are usually of good quality.

There should be little necessity to sink wells through the upper formations down into the Eastend or Bearpaw formations occurring at greater depths.

Township 8, Range 23

The land surface of this township is for the most part irregularly rolling, with elevations ranging from about 3,800 feet to 3,900 feet above sea-level. Fairwell creek occupies a wide valley that extends southward along the western side of the township. The southeastern part of the township is drained southeastward through several small tributaries of the North Branch of Frenchman river.

Water supplies of the area are derived chiefly from wells sunk in the glacial drift, and into the underlying Cypress Hills formation, although Fairwell creek, and springs that occur commonly along this stream channel and its tributaries in the western part of the area, also contribute a valuable addition to the stock water supplies.

The thickness of the glacial drift mantling this township may vary considerable. A number of wells are reported to have been sunk through the drift to the underlying bedrock, but the contact at most places was not accurately determined, owing to the presence of similar appearing unconsolidated sands and gravels in both the drift and the bedrock. Several wells situated on the western half of the township are evidently drawing water from sand or gravel pockets that occur interspersed at irregular intervals through the boulder clay. These wells range in depth from 14 to 33 feet. Their waters are all reported to be soft and of good quality for drinking. The supply, however, is in many cases inadequate for the farm requirements. Residents in search of water in the unconsolidated deposits are advised to locate the water-bearing beds by means of a test-auger before undergoing the expense of putting down a well. The depressions and draws, or coulée bottoms, are usually the most favourable sites for locating this type of water-bearing bed.

On most farms in the eastern two-thirds of the township, little or no water has been located in the drift deposits. Adequate supplies of soft, drinkable water are obtainable, however, in the underlying Cypress Hills formation, at depths generally less than 100 feet. The depth of these wells is more nearly uniform than the elevations at which the water occurs. The individual water-bearing beds are apparently of small extent and erratic in their distribution, In some places they may overlap at shallow depths, whereas at a few points it may be found necessary to sink wells 100 feet deep before striking water. At most locations, however, an adequate yield is obtained before reaching this depth. The majority of the wells are drawing their water from unconsolidated sands and quicksand. These water-bearing beds in some places are overlain by sandstone. Several wells are partly plugged with sand and are in need of cleaning, and nearly all the wells decreased in yield during the drought years. In 1935 most of them provided sufficient water for the average farm requirements of 30 to 40 head of stock.

There is apparently no scarcity of ground water in this township, providing wells are sunk to suitable depths of about 100 feet. Should it be necessary to sink wells through the Cypress Hills beds, water may be expected to occur in the underlying Ravenscrag formation. The upper beds of the Ravenscrag are thought to occur at an elevation of about 3,650 feet above sea-level, and its base at approximately 3,400 feet. These beds immediately underlie the unconsolidated deposits in the valley of Fairwell creek in sections 7 and 18. No wells are reported to have been put down to this formation. Its waters, however, should be of suitable quality for domestic use.

Township 8, Range 24

The maximum relief in this township approximates 300 feet. The surface is steeply rolling, with elevations ranging from 3,600 to slightly more than 3,900 feet above sea-level. Small areas of fairly level land occur scattered throughout the township and as a rule the points of highest elevation. The well developed drainage system of Fairwell creek carries the surface run-off southward. The larger of the tributary streams are spring-fed and maintain a fairly constant flow throughout the year, and supply water for stock and for residents situated in the valley bottoms. At some places, shallow wells have been dug in the sand and gravel beds that floor the coulées. These wells are usually situated in close proximity to the stream or to a spring, and derive their water by seepage from this source. The water is of good quality, and if not contaminated by decaying organic matter is quite suitable for drinking. Sand and gravel beds situated more remote from the stream may also be water bearing, particularly in the larger stream channels where the gradient is low.

The glacial drift mantling the uplands is also a source of water supply in the township. Several wells situated in the eastern third of the area are producing small to moderate yields of soft, drinkable water, at depths of generally less than 30 feet. The water is concentrated in sand and gravel pockets that occur interspersed through the boulder clay. The water-bearing pockets as a rule are located in the drift in the depressions between the ridges and in the bottoms of shallow draws and are not essentially different from the stream deposits. Wells drawing their supplies from the drift have nearly all shown a marked decrease in yield during drought years, and in 1935 a number of small springs were reported to have ceased flowing.

Only three wells in the township are reported to be drawing water from the bedrock. The Cypress Hills formation forms the bedrock, except in the deep valleys in the southern part where surface elevations lie below 3,750 feet above sea-level and where the unconsolidated deposits are underlain by the Ravenscrag formation. Wells situated in sections 27 and 34 encountered water in fine sand, at depths of 96 and 70 feet, respectively, or at an elevation of about 3,855 feet above sea-level. A third well, sunk to a depth of 37 feet in section 23, is obtaining its water from a sand bed at an elevation of about 3,791 feet. All these wells penetrate the Cypress Hills formation. Alternating layers of dry sand and gravel or conglomerate were passed through before water was struck. The water is under little or no pressure, and its level has been lowered considerably since the wells were first dug, making it necessary, in section 34, to deepen the well several times in order to maintain an adequate water supply. The analysis of water from the well in section 27 is listed in the table of water analyses in a later section of this report.

As no wells are reported to be yielding water from the Ravenscrag formation in this township, or in its vicinity, its ground water resources are not well known. The occurrence of springs in areas underlain by this formation suggests the presence of water-bearing beds. Should wells be sunk to depths of 200 feet in any part of the township, an adequate supply of drinkable water could probably be obtained either from the Cypress Hills or the Ravenscrag formation.

Township 9, Range 22

The surface of this township rises toward the southwest, from an elevation of about 3,550 feet in section 36, to an elevation of slightly less than 3,600 feet in section 6. It consists for the most part of gently rolling, irregularly dissected prairie land. Bone creek flows in a northeasterly direction across the southeastern part of the area. It occupies a steep-banked valley, the bottom of which lies about 200 feet below the bordering plains. This stream is fed by springs and maintains a fairly constant flow. It has only a few short tributaries, however, and hence drains only a comparatively small part of the area. The uplands regions remote from this stream are poorly drained, and small sloughs occupying depressions between the hills are a common occurrence, particularly in the northern half of the township.

Water supplies of the township are obtained chiefly from wells sunk in the bedrock formations, although the overlying glacial drift and Recent stream deposits are also sources of shallow water supplies in some parts of the area.

Recent flood-plain deposits are confined chiefly to Bone Creek valley, and its short tributary coulées. A well, put down to a depth of 12 feet in a tributary coulée in section 4, yields an adequate supply of soft, drinkable water, from a bed of gravel in these deposits. Similar supplies are expected to occur elsewhere along the bottom of Bone Creek valley, although careful prospecting may be required in some places in locating water-bearing sand or gravel beds, as the surface is largely overlain by clay and silt. The glacial drift forming the surface covering throughout the rest of the township consists essentially of boulder clay, ranging from 30 to 40 feet in thickness. The drift in the northern half of the township is in the form of an irregular moraine. The southern half forms a more evenly distributed till plain.

Wells obtaining water from the drift are confined largely to the moraine-covered area in the western part of the township. The water in this region is concentrated in pockets of sand or gravel that occur interspersed at irregular intervals through the boulder clay. Depths of wells tapping these pockets range between 23 and 36 feet. The waters obtained are reported to be soft to moderately hard, and are apparently quite suitable for drinking. The yield in most places is sufficient only for household use.

Throughout most of the area wells have been sunk into the Cypress Hills formation before a suitable water supply was located. These wells range in depth from 40 to 150 feet. Individual aquifers are apparently of small areal extent, as only in a few places are neighbouring wells drawing water from the same elevation. In most of the wells the water was struck in beds of sand or gravel after penetrating alternating layers of dry sand, gravel, sandstone, and conglomerate. The largest yields are obtained from wells in the northwestern part of the area sunk to depths of 112 to 150 feet. Here the water is under sufficient hydrostatic pressure to cause it to rise in the wells 25 to 30 feet above the water-bearing bed. Lower water pressures and as a rule smaller yields are encountered toward the south and west. As the wells here are shallower and are tapping higher aquifers, it is presumed that they could obtain larger yields at greater depths, particularly near the base of the formation, at elevations of 3,400 to 3,450 feet above sea-level.

Only one well in the township is known to be yielding water from the Ravenscrag formation that lies beneath the Cypress Hills beds. This well, situated on the SE.$\frac{1}{4}$, section 24, encountered a good supply of hard, drinkable water in a seam of coal at an elevation of about 3,390 feet, or at a depth of 160 feet from the surface, after passing a bed of quicksand in the lower part of the Cypress Hills formation. Although the Cypress Hills aquifers are capable of producing sufficient water for the needs of most of the farms in the township, supplies similar to that encountered in the Ravenscrag in section 24 may be regarded as potential reserves. Depths to the Ravenscrag will be considerably greater, however, in the southwestern part of the township where surface elevations are relatively high.

Township 9, Range 23

The southern third of this township is fairly level, with an average surface elevation of about 3,800 feet above sea-level. Toward the north the surface becomes more irregular, and in the northwestern part it drops away rather abruptly to elevations ranging from 3,400 to 3,200 feet along the northern and western borders.

Springs are a very common occurrence on the coulée banks along the northern slopes, and provide an ample water supply for range stock in this part of the area. Surface water supplies are relatively scarce in the southeastern upland part, and most of the residents here have been obliged to sink wells in the unconsolidated deposits or into the underlying bedrock for their water supplies.

Most wells in the township are yielding water from the glacial drift. The thickness of the drift varies from place to place, but its average is probably between 35 and 40 feet. It consists largely of boulder clay near the surface, but becomes more porous at depths with beds of sand and gravel intermixed with less pervious clay. These porous beds are water bearing, although in some locations it was necessary to put wells down to depths of 30 to 40 feet, or to near the base of the drift, before water was obtained. The exact contact between the drift and the underlying Cypress Hills formation was not determined in most of the deeper wells, and some of those listed as being in glacial drift may be drawing water from the bedrock. There is no apparent continuity of aquifers between the wells, their depths being variable within short distances. The yield from the individual wells is also variable, so that it is impossible to predict the quantity of water to be obtained in any one locality. Where obtained the drift waters contain very little mineral salts in solution, and are quite suitable for household use. At most places the waters are reported to be hard.

The springs flowing from the gravels in the drift in the northern part of the area are believed to have their origin in the underlying bedrock. They are listed as coming from the drift, however, as these deposits are their ultimate source beds. The spring waters are as a whole even less highly mineralized than the well waters. Most of them are reported as being soft and of excellent quality for all farm requirements.

At several places in the township either inadequate supplies or no water has been located in the unconsolidated deposits, and the residents have been obliged to sink wells to greater depths into the Cypress Hills formation, where satisfactory yields are obtained. There wells, situated in sections 2, 3, 7, and 23, range in depth from 65 to 88 feet. The water-bearing beds consist of sand or sandstone, and loosely consolidated gravel. The water is hard, and is quite suitable for the domestic drinking supply. Similar aquifers no doubt occur in the unexplored areas. The base of the Cypress Hills formation is thought to lie at an elevation of about 3,500 feet above sea-level, although it may vary somewhat in different localities.

The Ravenscrag formation underlies the Cypress Hills beds and is believed to immediately underlie the drift on the lower slopes in the northern and northwestern parts of the township. This formation is also a potential source of water supply, although to date there has been no need of sinking wells sufficiently deep to tap the beds in this formation. Springs and aquifers in the drift deposits provide adequate supplies on the lowlands, and on the upper benches water may be obtained from the aquifers in the underlying Cypress Hills formation.

Township 9, Range 24

This township is largely given over to range land, owing to the irregular topography existing throughout most of the area. Farms are confined almost entirely to the moderately rolling to level benchland, extending along the southern border at an average elevation of about 3,950 feet above sea-level. The central part of the township is dissected by wide, flat-bottomed valleys. In the northern third the surface slopes abruptly to the northwest and northeast, from an elevation of about 3,800 feet above sea-level, to elevations of 3,300 feet or slightly less in the northern corners of the township.

Springs that flow from the coulée banks are the chief source of water supply in the central and northern part of the area. In the southern sections, wells provide water from both the glacial drift and the underlying bedrock.

The thickness of the drift in the southern part of the township is estimated at 20 to 40 feet, which thickness is probably not greatly exceeded in other parts of the area. The drift consists largely of boulder clay that is interspersed with, and in many places underlain by, beds of sand and gravel. These porous beds are water bearing at some places, although no large yields have been obtained. This is probably due to the pervious character of the underlying bedrock which permits the water in the drift to seep downward. Springs flowing from the drift gravel in sections 15, 16, and 22, in the central part of the township and at many places along the steep slopes in the northern part, are believed to be formed by seepage from the bedrock. These waters are soft to moderately hard and are of excellent quality for household use.

Only three wells, situated in the southwestern part of the township, are reported to be producing from the Cypress Hills formation. This formation embraces the bedrock of the uplands and extends down the northern slopes to an elevation of about 3,650 feet above sea-level. Wells situated in sections 5, 6, and 7 struck water in these beds at depths of 48, 45, and 30 feet, respectively. The supply obtained in the 30-foot well is inadequate, but no doubt could be increased by deepening the well. The occurrence of the above-mentioned springs suggests the prevalence of these aquifers throughout the uplands.

The Ravenscrag formation underlying the Cypress Hills formation is also thought to be water bearing. This formation is thought to have a thickness of about 250 feet, and extends down to an elevation of about 3,400 feet above sea-level, and thus it underlies the drift on the lower slopes in the northwestern and northeastern corners of the township. This formation may also be water bearing, although wells of 250 and 400 feet would be required to tap the aquifers in this formation throughout most of the uplands. The Eastend formation below the Ravenscrag is thought to underlie the drift in sections 31 and 32, at elevations below 3,400 feet above sea-level. The ground water conditions existing in this formation are unknown, but it is improbable that the formation will ever be extensively prospected for water, since the overlying drift is expected to contain ample supplies of water for the requirements of this locality.

STATISTICAL SUMMARY OF WELL INFORMATION IN RURAL MUNICIPALITY OF NO. 80, SASKATCHEWAN

West of 3rd mer. Township / Range	7 / 22	7 / 23	7 / 24	8 / 22	8 / 23	8 / 24	9 / 22	9 / 23	9 / 24	Total No. in Municipality
Total No. of Wells in Township	19	15	18	19	28	21	28	39	12	199
No. of wells in bedrock	7	9	9	16	23	9	20	6	3	102
No. of wells in glacial drift	10	2	6	0	5	9	8	32	9	81
No. of wells in alluvium	2	4	3	3	0	3	0	1	0	16
Permanency of Water Supply										
No. with permanent supply	10	15	16	19	28	18	27	35	10	178
No. with intermittent supply	9	0	1	0	0	3	1	4	2	20
No. dry holes	0	0	1	0	0	0	0	0	0	1
Types of Wells										
No. of flowing artesian wells	0	0	0	0	0	0	0	0	0	0
No. of non-flowing artesian wells	1	0	0	0	0	0	8	0	0	9
No. of non-artesian wells	18	15	17	19	28	21	20	39	12	189
Quality of Water										
No. with hard water	16	1	1	1	4	3	10	20	4	60
No. with soft water	3	14	16	18	24	18	18	19	8	138
No. with salty water	0	0	0	0	0	0	0	0	0	0
No. with "alkaline" water	0	0	0	0	0	0	0	0	0	0
Depths of Wells										
No. from 0 to 50 feet deep	18	6	13	12	18	19	15	33	10	144
No. from 51 to 100 feet deep	0	8	5	1	8	1	3	6	2	34
No. from 101 to 150 feet deep	0	1	0	3	2	1	9	0	0	16
No. from 151 to 200 feet deep	1	0	0	3	0	0	1	0	0	5
No. from 201 to 500 feet deep	0	0	0	0	0	0	0	0	0	0
No. from 501 to 1,000 feet deep	0	0	0	0	0	0	0	0	0	0
No. over 1,000 feet deep	0	0	0	0	0	0	0	0	0	0
How the Water is used										
No. usable for domestic purposes	11	15	16	18	28	21	26	35	12	182
No. not usable for domestic purposes	8	0	1	1	0	0	2	4	0	16
No. usable for stock	19	15	17	19	28	21	27	39	12	197
No. not usable for stock	0	0	0	0	0	0	1	0	0	1
Sufficiency of Water Supply										
No. sufficient for domestic needs	10	15	16	19	27	18	27	35	10	177
No. insufficient for domestic needs	9	0	1	0	1	3	1	4	2	21
No. sufficient for stock needs	9	11	16	17	25	14	22	29	9	152
No. insufficient for stock needs	10	4	1	2	3	7	6	10	3	46

ANALYSES AND QUALITY OF WATER

General Statement

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

Total Dissolved Mineral Solids

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

Mineral Substances Present

Calcium and Magnesium

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

Sodium

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

Sulphates

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

Chlorides

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

Iron

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

Hardness

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

Analyses of Water Samples from the Municipality No. 80, 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.	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.	18	7	23	3	65	329											(1)		(3)					(2)	ж 2
2	NW.	10	8	23	3	50	260	220	120	100	13	215	70	43	16	11	242	125		75	21			21		ж 2
3	SE.	27	8	24	3	101	200	180	80	100	6	175	70	21	4	6	183	125		42	3		3	10		ж 2

Water samples indicated thus, ж 2, are from bedrock, Cypress Hills formation.
Analyses are reported in parts per million; where numbers (1), (2), and (3) 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. 1, by Provincial Analyst, Regina.
For interpretation of this table read the section on Analyses and Quality of Water.

Water From the Unconsolidated Deposits

No samples of water were taken for analysis from the unconsolidated deposits in this municipality by the Geological Survey. The following discussion of the general characteristics of these waters is based upon opinions of the residents, and upon analyses of water from the unconsolidated deposits in adjoining municipalities where the source beds are somewhat similar. In general, water from both the unconsolidated deposits and from the bedrock in this municipality is superior in quality to waters from most other municipalities in southern Saskatchewan.

All waters obtained from the stream deposits apparently contain very small concentrations of mineral salts in solution, and most of them are soft or only moderately hard. This type of water is expected to be fairly general throughout the municipality, since the stream sediments consist largely of gravels containing relatively small amounts of the readily soluble salts. The spring waters that seep from the bedrock on the sides of the coulées are the chief source of the water that occurs in the stream sediments. These waters are relatively pure when first entering the sediments, and owing to their fairly rapid circulation through the gravels are afforded little opportunity of taking up soluble salts in solution.

In the finer stream sediments, such as occur in the lower reaches of the North Branch of Frenchman River and Fairwell Creek valleys, the waters may contain greater mineral salt concentrations, for there the sediments are derived partly from the marine shales of the Bearpaw and Eastend beds, and contain fairly large amounts of readily soluble salts. The slower water circulation through the fine sediments also tends to a greater concentration of salts. It is doubtful, however, if these waters are at any place so highly mineralized as to prohibit their use in the household.

The glacial drift waters are also characterized by a low mineral salt content. The boulder clay is usually regarded as the chief source of most of the objectionable salts found in the ground waters at shallow depths. In this municipality, however, the drift is more porous and contains less clay than that commonly found on the lower plains. The underlying bedrock is also porous, allowing a fairly free downward percolation of ground waters, thus causing removal of much of the readily soluble salts. Waters obtained from the drift deposits are invariably of good quality, and at most places they are reported to be soft.

Water from the Bedrock

Waters obtained from the Cypress Hills formation in various parts of the municipality contain very small quantities of mineral salts in solution. The sediments comprising the formation are composed largely of sand and boulders of quartzite, cemented in places by a carbonate cement. The carbonates are the only readily soluble salts present, and form the chief constituents in waters from this formation. The three analyses listed in the accompanying table are of water from the Cypress Hills beds. The carbonates of calcium ($CaCO_3$) and magnesium ($MgCO_3$) are present in the greatest abundance, with calcium carbonate forming the predominant salt. These compounds are tasteless, and are regarded as harmless, although they contribute to the hardness of the water; a large part of this hardness is temporary and is removable by boiling. The magnesium sulphate ($MgSO_4$) or Epsom salts, if present in large quantities imparts a laxative effect to drinking water. It is present here in such small quantities as to be harmless, although it contributes slightly to the permanent hardness of the water.

As only a few wells tap aquifers in the Ravenscrag formation, its waters are not so well known as those of the upper formation. Where obtained, these waters are not noticeably different from those of the Cypress Hills formation, although they may contain slightly greater concentrations of mineral salts. It is doubtful, however, if at any place water will be obtained from the Ravenscrag with a concentration sufficiently great to render it unsuitable for domestic use.

The Eastend and Bearpaw formations in many places yield waters containing noticeable amounts of the objectionable sulphate salts, but their waters are so variable that it is impossible to predict the type to be expected in any one locality. As a rule, waters from greater depths in the Bearpaw formation become increasingly more highly mineralized, and the small seepages derivable from the compact shales may be unfit for any farm use, due to the presence of large amounts of sulphate salts and common salt in solution. Fortunately, deep drilling in the Bearpaw formation is not necessary in this municipality, as large supplies of water of better quality are available at shallower depths.

WELL RECORDS—Rural Municipality of 80.

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE: Above (+) Below (−) Surface	HEIGHT TO WHICH WATER WILL RISE: Elev.	PRINCIPAL WATER-BEARING BED: Depth	PRINCIPAL WATER-BEARING BED: Elev.	PRINCIPAL WATER-BEARING BED: Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
1	SE	3	7	22	3	Drilled	182'	3425	3	3273		3243	Eastend	Hard.			
2	SW	3	7	22	3	Dug	19'	3460		3445		3445	Ravenscrag	Soft.			
3	SW	3	7	22	3	Dug	16'	3450		3439		3439	Ravenscrag	Soft.			
4	NW	4	7	22	3	Dug	18'	3480'		3477		3477	Recent all.	Hard			
5	NW	4	7	22	3	Dug	16'	3500		3497		3497	Recent all	Hard			16' sand / blue clay.
6	NW	8	7	22	3	Dug	16'	3300		3289		3289	Recent all.	Hard.			
7	SW	9	7	22	3	Dug	9'	3500		3495		3491	Recent	Hard.			
8	SE	14	7	22	3	Dug	40'	3525		3493		3493	Glacial Sand				
9	SE	19	7	22	3	Dug	20'	3500		3488		3488	Ravenscrag	Hard.			
	NW	33	7	22	3	Spring		3625					Recent All.	Soft			Water on farm from springs and creeks.
1	NW	8	7	23	3	Dug	71'	3720		3659		3659	Cypress Hills	Soft.			
2	SE	7	7	23	3	Dug	12'	3700		3696		3696	Recent All.	Soft.			
3	NE	18	7	23	3	Dug	65'	3740		3680		3680	Cypress Hills	Soft.			Well in quick sand.
4	SW	17	7	23	3	Dug	85'	3700		3617		3617	Cypress Hills	Hard			
5	NE	13	7	23	3	Dug	8'	3650		3650		3650	Recent All.	Soft.			
6	SE	21	7	23	3	Dug	75'	3755		3683		3683	Cypress Hills	Soft.			Gravel
7	SW	21	7	23	3	Dug	96'	3755		3665		3665	" "	Soft.			Gravel.
8	SW	20	7	23	3	"	80'	3760		3686		3686	" "	"			"
9	NW	20	7	23	3	"	95'	3775'		3693		3693	" "	"			Sst.
10	NW	19	7	23	3	"	109'	3800		3695		3695	" "	Med. "			Grvl.
11	SE	30	7	23	3	"	85'	3775		3698		3698	" "	Soft			Sst.
12	NW	28	7	23	3	"	10'	3800		3796		3796	Recent	"			All.
13	SE	33	7	23	3	"	20'	3755		3737		3737	Recent All	Soft.			Sand
14	SW	36	7	23	3	"	20'	3800		3780		3799?	Cyp. Hills	Soft			Sand
15	SE	36	7	23	3	"	12'	3800		3790		3790	" "	"			"

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 80

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	SW	2	7	24	3	Dug	65'	3625'		3566		3566	Cypress Hills	Soft			Clay
2	NW	2	7	24	3	"	58'	3675'		3623		3623	Cyp. Hills Ravenscrag?	Med Soft			Clay - sst.
3	NE	3	7	24	3	"	52'	3625'		3585'		3585	Cyp. Hills	Med Hard			Clay
4	NW	10	7	24	3	Spring		3400		3400			Ravenscrag	Soft		~~Soft.~~	
5	NE	12	7	24	3	Dug	35'	3760		3745'		3745	Cyp Hills Eastend?	Soft.			
6	NW	15	7	24	3	"	12'	3400		3392		3392	Recent	Soft			Gravel
7	SW	16	7	24	3	Drilled	48'	3475'		3433		3433	Eastend	Soft.			"
8	NW	18	7	24	3	Dug	32'	3575'		3570		3533	Cyp. Hills	Soft			Gvl.
9	NW	18	7	24	3	Dug	32'	3475'		3470		3433	Cyp Hills	Soft			~~Gvl~~ Clay
10	NW	18	7	24	3	Dug	71'	3600		—		-	Cyp Hills	~~Soft~~			Clay
11	NE	21	7	24	3	Dug	60'	3560		3508		3508	Ravenscrag	Soft			Sand.
12	SW	32	7	24	3	"	10'	3650		3642		3642	Recent	Soft			Gvl.
13	NE	35	7	24	3	"	12'	3550		3540		3540	Recent	Soft			Gvl.
#1	SE	13	8	24	3	"	12'	3670		3661		3661	Glacial	Soft			Gvl.
2	NW	14	8	24	3	"	25'	3775'		3753		3753	Glacial? Cyp. Hills?	Soft			Sand
3	SW	19	8	24	3	"	16'	3900		3885'		3885'	Rec.	Soft.			Gvl.
4.	NW	21	8	24	3	"	8'	3810		3808		3808	Rec.	Hard			Gvl.
5.	NE	23	8	24	3	"	12'	3800		3791		3791	Glacial	Hard			Sand
6	SE	23	8	24	3	"	37'	3825		3791		3741	Cyp Hills	Hard			Sand
7	SE	24	8	24	3	"	26'	3760		3737		3737	Cyp Hills? Glacial?	Soft			Sand and clay
8	NE	26	8	24	3	"	27'	3875'		3848'		3848'	Cyp Hills? Glacial?	Med Soft.			
9	SE	27	8	24	3	"	101'	3950		3854		3854	Cyp Hills	Soft			Gvl.
10	SE	28	8	24	3	Spring		3850		3850		3850	Rec. Gel.	Soft.			Gvl.
11	NE	33	8	24	3	Dug	20'	3875		3859		3859	Glacial Cyp Hills	Med Soft			Snd & gvl
12	NW	34	8	24	3	Dug	74'	3925'		3855'		3855'	Cyp Hills	Soft			" " "
13	SW	35	8	24	3	"	18'	3875'		3871		3871	Cyp Hills? Glacial?	Soft			Gvl.
1	NE	3	8	23	3	"	112'	3850		3740		3740	Cyp Hills	Soft			Sand.
2	NW	4	8	23	3	"	33'	3890		3859		3859	Cyp Hills	Soft			Clay
3	NE	5	8	23	3	"	104'	3800		3699		3699	Cyp Hills	Soft			Gvl.
4	NE	6	8	23	3	"	14'	3700		3688		3688	Glacial	Soft			Sand.

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 80

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE: Above (+) Below (−) Surface	HEIGHT TO WHICH WATER WILL RISE: Elev.	PRINCIPAL WATER-BEARING BED: Depth	PRINCIPAL WATER-BEARING BED: Elev.	PRINCIPAL WATER-BEARING BED: Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
5	SW	9	8	23	3	Dug	17'	3825'		3810		3810	Cyp Hills	Soft			Gvl.
6	SE	9	8	23	3	Spring		3875'		3875'			Cyp Hills	Soft			Quicksand
7	NW	10	8	23	3	Dug	50'	3825'		3779		3777	" "	Soft			Clay & Sand
8	SE	10	8	23	3	"	60'	3810		3753		3752	" "	"			Sand
9	SE	14	8	23	3	"	54'	3800		3752		3750	" "	"			"
10	NW	15	8	23	3	"	30'	3740		3716		3712	" "	Hard			Sand & gvl.
11	NE	16	8	23	3	"	50'	3750		3703		3703	" "	Soft			Sand
12	NE	17	8	23	3	Spring	–	3700		3700		3700	" "	Soft			Gravel
13	NW	18	8	23	3	"	—	3700		"		"	" "	"			
14	NW	20	8	23	3	Dug	14'	3700		3688		3688	Glacial	"			Sand
15	NW	21	8	23	3	"	65'	3750		3687		3687	Cyp Hills	"			"
16	SW	22	8	23	3	"	50'	3730		3683		3683	Cyp Hills	Med "			"
17	NW	22	8	23	3	Bored	32'	3750		3726		3726	" "	Soft			"
18	NW	23	8	23	3	Dug	30'	3750		3724		3724	Glacial	Hard			"
19	SE	23	8	23	3	Dug	80'	3740		3663		3663	Cyp Hills	"			"
20	SW	26	8	23	3	Bored	30'	3775'		3750		3750	" "	Soft			"
21	SW	27	8	23	3	"	35'	3760		3735'		3730'	" "	Soft			"
22	SE	28	8	23	3	Dug	71'	3795'		3727		3727	" "	"			Clay
23	SW	30	8	23	3	Spring	—	3735'		3735'		3735'	" "	"			Gvl.
24	SE	31	8	23	3	"	—	3760		3760		3760	" "	"			"
25	SE	34	8	23	3	Bored	96'	3825'		3735'		3733	" "	"			Sand
26	SW	35	8	23	3	"	34'	3800		3770		3770	" "	"			Quicksand.
27	SW	36	8	23	3	Dug	80'	3775'		3708		3708	" "	Hard			Sand
28	NW	36	8	23	3	Bored	82'	3775'		3698		3698	" "	Soft			"
1	SE	13	8	22	3	Dug	28'	3655'		3632		3632	Recent	Med Soft			Sand
2	NE	13	8	22	3	Drilled	150'	3710		3572		3572	Cyp Hills	Soft			Sand
3	NW	14	8	22	3	"	154'	3710		3570		3570	" "	"			"
4	SW	15	8	22	3	Dug	95'	3730		3640		3640	" "	"			"
5	SE	17	8	22	3	Spring	—	3575'		3575'		3575	" "	"			"

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 80

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE: Above (+) Below (−) Surface	HEIGHT TO WHICH WATER WILL RISE: Elev.	PRINCIPAL WATER-BEARING BED: Depth	PRINCIPAL WATER-BEARING BED: Elev.	PRINCIPAL WATER-BEARING BED: Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
6	NE	20	8	22	3	dug	14'	3520		3512		3572	Recent	Soft			Silt
7	SE	23	8	22	3	dug	143'	3710		3587		3587	Cyp Hills	"			—
8	NE	25	8	22	3	drilled	152'	3705		3583		3583	" "	"			Sand
9.	SW	25	8	22	3	"	148'	3710		3575		3575	" "	"			"
10	SE	26	8	22	3	"	170'	3700		3555		3555	" "	"			"
11	NW	34	8	22	3	dug	22'	3450		3430		3432	Recent	Hard			Silt
1	NE	3	9	22	3	Spring		3500		3500		3500	Cyp Hills	Soft			Sand
2	SE	4	9	22	3	dug	12'	3580		3572		3568	Glacial	"			Grvl.
3	SW	9	9	22	3	"	40'	3650		3612		3610	Cyp Hills	"			Sand
4	NE	9	9	22	3	"	45'	3650		3607		3605	Cyp Hills	Hard			Sand
5	SW	12	9	22	3	Spring	—	3450		3450		3450	" "	Soft			" West bank Bone Creek.
6	NW	14	9	22	3	drilled	112'	3600		3516		3488	" "	Hard			Grvl
7	SW	15	9	22	3	dug	120'	3660		3610?		3544	" "	Soft			sand
8	SW	17	9	22	3	"	42'	3700		3660		3670	" "	"			"
9	NW	18	9	22	3	"	34'	3675		~~3607~~		3641	Glacial	Hard			"
10	NE	19	9	22	3	"	25'	3650		3627		3625	"	Soft			Quicksand
11	SE	21	9	22	3	drilled	130'	3675		3549		3549	Cyp Hills	"			"
12	NE	22	9	22	3	dug	66'	3650		3596		3584	Glacial	Hard			clay
13	NW	23	9	22	3	dug	109'	3650		3544		3549	Cyp Hills	"			Grvl.
14.	SE	24	9	22	3	drilled	160'	3550		3440		3390	Ravenscrag	"			coal
15	NW	25	9	22	3	"	150	3600		3470		3450	Cyp Hills	Soft			Grvl.
16	SE	27	9	22	3	"	135'	3650		3545		3515	" "	"			"
17	NE	27	9	22	3	"	148'	3650		3546		3502	" "	"			Sand
18	SE	28	9	22	3	"	105'	3675		3605		3570	" "	"			Grvl
19	SW	28	9	22	3	dug	25'	3600		3577		3580	Glacial	"			Sand
20	NW	28	9	22	3	dug	33'	3600		3571		3571	? "	Hard			"
21	NE	30	9	22	3	"	66'	3650		3586		3586	Cyp Hills	Soft			Sst.
22	SW	33	9	22	3	"	36'	3575		3543		3543	Glacial	Hard			Grvl.
23	SW	34	9	22	3	drilled	130'	3600		3500		3470	Cyp Hills	Soft			Sst.
24	NE	36	9	22	3	"	86'	3550		3489		3464	Cyp Hills	Hard		S	Cgl + Sst.
1	NW	1	9	23	3	dug	10'	2740		2737		2730	Glacial	Soft			Sand
2	SW	2	9	23	3	"	88'	3800		3715		3712	"	Hard			Gravel - Bedrock Cyp Hills at 85' depth

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of 80

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE: Above (+) Below (−) Surface	HEIGHT TO WHICH WATER WILL RISE: Elev.	PRINCIPAL WATER-BEARING BED: Depth	PRINCIPAL WATER-BEARING BED: Elev.	PRINCIPAL WATER-BEARING BED: Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
3	SE	3	9	23	3	Bored	85'	3750		3699		3699	Cyp Hills ?	Hard			sand
4	SW	3	9	23	3	dug	80'	3800		3732		3730	Cyp Hills	"			egl
5	SE	5	9	23	3	"	20'	3800		3783		3780	Glacial	"			Quicksand
6	NE	5	9	23	3	"	20'	3800		3783		3780	"	"			"
7	NW	5	9	23	3	"	40'	3800		3763		3763	"	"		•	Gvl.
8	SE	6	9	23	3	"	35'	3800		3768		3768	"	"			"
9	SE	7	9	23	3	"	20'	3800		3733		3733	"	"			"
10	SE	10	9	23	3	"	21'	3800		3786		3786	"	Soft			"
11	NW	10	9	23	3	"	65'	3790		3730		3730	"	Hard			sand.
12	SE	13	9	23	3	"	16'	3690		3683		3674	"	Soft			clay
13	NE	13	9	23	3	"	8'	3660		3656		3656	"	"			Quicksand
14	SE	14	9	23	3	"	30'	3710		3681		3681	"	Med.			sand
15	SW	16	9	23	3	Spring	—	3735'		3735'		3735'	Glacial	"			gvl.
16	SE	20	9	23	3	dug	2'	3605'		3603		3603	"	"			"
17	SW	20	9	23	3	Spring	—	3600		3600		3600	"	Soft			gvl
18	NW	20	9	23	3	Spring	—	3590		3590		3590	"	"			"
19	SE	22	9	23	3	dug	5'	3650		3650		3646	"	"			"
20	SE	23	9	23	3	"	20'	3700		3686		3686	"	"			Quicksand
21	NE	23	9	23	3	Spring	—	3730		3730		3730	"	hard			—
22	NW	24	9	23	3	dug	28'	3660		3632		3632	"	Soft			snd & gvl
23	SW	26	9	23	3	Spring	—	3570		3570		3570	"	"			gvl. Many small springs in sect 26
24	SE	28	9	23	3	dug	12'	3700		3691		3691	"	hard			sand.
25	NW	30	9	23	3	Spring	—	3360		3360		3360	"	Soft			Gvl.
26	NW	32	9	23	3	Spring	—	3400		3400		3399	"	Hard			"
27	SE	34	9	23	3	Spring	—	3500		3500		3500	"	Soft			" Flow 1.5 bbl./min. = 60gpm?
28	SW	36	9	23	3	dug	12'	3580		3571		3571	"	hard			"
1	SW	3	9	24	3	"	22'	3945'		3925'		3925'	"	Soft			"
2	SW	5	9	24	3	"	52'	3930		3882		3882	Cyp Hills	Med Hard			clay and sand.
3	NE	5	9	24	3	"	36'	3950		3918		3915'	Glacial	"			snd & gvl.
4.	NW	6	9	24	3	"	55'	3995'		3950		3950	"	Soft			clay
5	SE	7	9	24	3	dug	40'	3935'		3905		3895'	"	hard			Gravel
6	NW	15	9	24	3	spring	—	3900		3900		3900	"	Soft			"

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of 80

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
7	NE	16	9	24	3	Spring	–	3905′		3905′		3905′	Glacial	soft			Sand
8	SW	22	9	24	3	dug	6′	3915′		3910		3910	"	"			gvl
9	SW	22	9	24	3	Spring	–	3910		3910		3910	"	"			" good flow
10	SW	34	9	24	3	spring	–	3800		3800		3800	"	hard			" not a good flow

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.