CANADA

DEPARTMENT OF MINES

AND

TECHNICAL SURVEYS

---

GEOLOGICAL SURVEY OF CANADA

WATER SUPPLY PAPER No. 238

# GROUND-WATER RESOURCES OF THE RURAL MUNICIPALITY OF EYE HILL, NO. 382 SASKATCHEWAN

Records collected by C. O. Hage

Compilation by G. S. Hume and C. O. Hage



---

OTTAWA
1947

CANADA
DEPARTMENT OF MINES AND RESOURCES

MINES AND GEOLOGY BRANCH
BUREAU OF GEOLOGY AND TOPOGRAPHY

---

GEOLOGICAL SURVEY

WATER SUPPLY PAPER NO. 238

# GROUND-WATER RESOURCES OF THE RURAL MUNICIPALITY OF EYE HILL, NO. 382, SASKATCHEWAN

Records Collected by C. O. Hage
Compilation by G. S. Hume and C. O. Hage

---

OTTAWA
1947

CONTENTS



Illustrations

# INTRODUCTION

Information on the ground-water resources of east-central Alberta and western Saskatchewan was collected, mostly in 1935, during the progress of geological investigations for oil and gas. The region studied extends from Edmonton in the west to Battleford in the east, and from township 32 on the south to township 59 in western Alberta, township 63 in eastern Alberta, and in part as far north as township 56 in western Saskatchewan.

This region is crossed by North Saskatchewan and Battle Rivers, and includes other more or less permanent streams. Most of the lakes within the area, however, are alkaline, and water is obtained in wells from two sources, namely, from water-bearing sands in surface or glacial deposits, and from sands in the underlying bedrock.

A division has been made in the well records, in so far as possible, between glacial and bedrock water-bearing sands. In investigations for oil and gas, however, the bedrock wells were used to trace the lateral extent of geological formations, with the result that the records deal more particularly with this type of well. No detailed studies were made of the glacial materials in relation to the water-supply, nor were the glacial deposits mapped adequately for this purpose. In almost all of the region investigated in Alberta, and in all but the northeast part of the region studied in Saskatchewan, water can be obtained from bedrock. In a few places, however, the water from the shallower bedrock sands is unsatisfactory, and deeper drilling may be necessary.

The water records were obtained mostly from the well owners, some of whom had acquired the land after the water supply had been found, and hence had no personal knowledge of the water-bearing beds that had been encountered in their wells. Also the elevations of the wells were taken by aneroid barometer and are, consequently, only approximate. In spite of these defects, however, it is hoped that the publication of these water records may prove of value to farmers, town authorities, and drillers in their efforts to obtain water supplies adequate for their needs.

In collecting this information several field parties were employed. These were under the direction of Professors R. L. Rutherford and P. S. Warren of the University of Alberta, C. H. Crickmay of Vancouver, and C. O. Hage, until recently a member of the Geological Survey. The oil and gas investigations of which these water records are a part were undertaken under the general supervision of G. S. Hume.

## Publication of Results

The essential information pertaining to ground-water conditions is being issued in reports that in Saskatchewan cover each municipality, and in Alberta cover each square block of sixteen townships beginning at the 4th meridian and lying between the correction lines. The secretary-treasurer of each municipality in Saskatchewan and Alberta will be supplied with the information covering that municipality. Copies of the reports will also be available for study at offices of the Provincial and Federal Government Departments. Further assistance in the interpretation of the reports may be obtained by applying to the Chief Geologist, Geological Survey, Ottawa. Technical terms used in the reports are defined in the glossary.

## How to Use the Report

Anyone desiring information concering ground water in any particular locality will find the available data listed in the well records. These should be consulted to see if a supply of water is likely to be found in shallow wells sunk in the glacial drift, or whether a better supply may be obtained at greater depth in the underlying bedrock formations. The wells in glacial drift commonly show no regional level, as the sands or gravels in which the water occurs are irregularly distributed and of limited extent. As the surface of the ground is uneven, the best means of comparing water wells is by the elevations of their water-bearing beds. For any particular well this elevation is obtained by subtracting the figure for the depth of the well to the water-bearing bed from that for the surface elevation at the well. For convenience both the elevation of the wells and the elevation of the water-bearing bed or beds in each well are given in the well record tables. Where water is obtained from bedrock, the name of the formation in which the water-bearing sand occurs is also listed in these tables, and this information should be used in conjunction with that provided on bedrock formations, pages 4 to 8, which describes these formations and gives their thickness and sequence. Where the level of the water-bearing sand is known, its depth at any point can easily be calculated by substracting its elevation, as given in the well record tables, from the elevation of the surface at that point.

With each report is a map consisting of two figures. Figure 1 shows the bedrock formations that will be encountered beneath the unconsolidated surface deposits. Figure 2 shows the position of all wells for which records are available, the class of well at each location, and the contour line or lines of equal surface elevation. The elevation at any location can thus be roughly judged from the nearest contour line, and the records of the wells show at what levels water is likely to be encountered. The depth of the well can then be calculated, and some information on the character and quantity of water can be obtained from a study of the records of surrounding wells.

## GLOSSARY OF TERMS USED

Alkaline. The term "alkaline" has been applied rather loosely to some ground waters that have a peculiar and disagreeable taste. In the Prairie Provinces, water that is commonly described as alkaline usually contains a large amount of sodium sulphate and magnesium sulphate, the principal constituents of Glauber's salt and Epsom salts respectively. Most of the so called alkaline waters are more correctly termed sulphate waters, many of which may be used for stock without ill effect. Water that tastes strongly of common salt is described as salty.

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 porous bed, lens, or pocket in unconsolidated deposits or in bedrock that carries water.

Buried pre-Glacial Stream Channels. A channel carved into 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 first encountered.

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 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.

(2) Wells in which the water is under pressure but does not rise to the surface.

(3) Wells in which the water does not rise above the water table.

BEDROCK FORMATIONS OF WEST-CENTRAL SASKATCHEWAN AND EAST-CENTRAL ALBERTA

The formations that outcrop in west-central Saskatchewan are an extension of similar formations that occur in east-central Alberta. They are of Upper Cretaceious age, and consist entirely of relatively soft shales and sands, with some bands of hard sandstone and layers of ironstone nodules. The succession, character, and estimated thickness of the formations are shown in the following table:

| Formation | Character | Thickness Feet |
|---|---|---|
| Edmonton | Grey to white, bentonitic sands and sandstones with grey and greenish shales; coal seams prominent in some areas, as at Castor, Alberta. | 1,000 to 1,150 |
| Bearpaw | Dark shales, green sands with smooth black chert pebbles; partly non-marine, with white bentonitic sands, carbonaceous shales or thin coal seams similar to those in Pale Beds; shales at certain horizons contain lobster claw nodules and marine fossils; at other horizons are abundant selenite crystals. | 300 to 600 thins rapidly to the north-west |
| Pale and Variegated Beds | Light grey sands with bentonite; soft, dark grey and light grey shales with selenite and ironstone; carbonaceous shales and coal seams; abundant selenite crystals in certain layers. | 950 to 1,000 in Czar-Tit Hills area; may be thinner elsewhere |
| Birch Lake | Grey sand and sandstone in upper part; middle part of shales and sandy shales, thinly laminated; lower part with grey and yellow weathering sands; oyster bed commonly at base. | 100 in west, but less to east and south |
| Grizzly Bear | Mostly dark grey shale of marine origin, with a few minor sand horizons; selenite crystals and nodules up to 6 or 8 inches in diameter | Maximum, 100 |
| Ribstone Creek | Grey sands and sandstones at the top and bottom, with intermediate sands and shales; thin coal seam in the vicinity of Wainwright; mostly non-marine, but middle shale in some areas is marine. | Maximum, 325 at Viking; thins eastward |
| Lea Park | Dark grey shales and sandy shales with nodules of ironstone; a sand 70 feet thick 110 feet below the top of the formation in the Ribstone area, Alberta. | 950 to 1,100 |

## Edmonton Formation

The name Edmonton formation was first applied to the beds containing coal in the Edmonton area, and later to the same beds in adjoining areas. The formation has a total thickness of 1,000 to 1,150 feet, but is bevelled off eastward and the east edge of the formation follows a northwest line from Coronation through Tofield to a point on North Saskatchewan River about midway between Edmonton and Fort Saskatchewan. No Edmonton beds occur northeast of this line, but the formation becomes progressively thicker to the southwest due to the fact that the beds incline in that direction and the surface bevels across them.

The Edmonton formation consists of poorly bedded grey and greenish clay shales, coal seams, and sands and sandstones that contain clay and a white material known as bentonite. This material when wet is very sticky and swells greatly in volume, and when dry tends to give a white appearance to the beds containing it. Such beds are relatively impervious to water, and at the surface produce the "burns" of barren ground where vegetation is scanty or absent.

Water is relatively abundant in the Edmonton formation, which contains much sand, commonly in the form of isolated lenses distributed irregularly through the formation. Consequently, there is little uniformity in the depth of wells even within a small area. Water also occurs commonly with coal seams and, unlike the sand lenses, these beds are much more regular and persistent. In contrast with the water from the bentonitic sands, which is generally "soft", water from the coal seams, as the water from the shallow surface deposits, may be "hard". The basal beds of the Edmonton formation usually contain fresh water, but this may become brackish locally where the underlying Bearpaw beds contain highly alkaline or salty water.

## Bearpaw Formation

In southern Alberta, where the Bearpaw formation is thickest, the beds composing it are mainly shales that have been deposited in sea water. In the area north of township 32 the formation thins to the northwest and becomes a shoreline deposit composed of shales containing bentonite, impure sands, and thin coal seams. In some areas, as at Ryley and near Monitor, and in the Neutral Hills, the Bearpaw contains pebble beds. At Ryley these are consolidated into a conglomerate, but mostly the pebbles are loosely distributed in shale or sandy beds.

In the area immediately north of township 32 the Bearpaw occupies a widespread belt beneath the glacial drift, but farther northwest the belt narrows, and at Ryley and northwestward it is only a few miles wide. This belt crosses North Saskatchewan River about midway between Edmonton and Fort Saskatchewan. Bearpaw beds form the main bedrock deposits of the Neutral Hills. Farther south, where they have an exposed thickness of at least 400 feet, they contain green sands, and beds of marine shale interfinger with the bentonitic shales and sands of the underlying formation. To the north, on the banks of North Saskatchewan River, the division between the Bearpaw and the overlying and underlying formations is indefinite, and the thickness of beds of Bearpaw age is relatively small.

The water in the Ryley area is from the Bearpaw formation, and is salty. In other areas to the south the marine Bearpaw formation carries green sand beds that yield fresh water, but commonly a much better supply is found by drilling through the Bearpaw into the underlying Pale Beds.

In Saskatchewan, Bearpaw beds occur southeast of Maclin and south of Luseland and Kerrobert. Only the basal beds are present, and these contain green sands that are commonly water-bearing.

## Pale and Variegated Beds

Underlying the Bearpaw formation is a succession of bentonitic sands, shales, and sandy shales containing a few coal seams. The upper part of this succession, due to the bentonitic content, is commonly light coloured and has been described as the Pale Beds, whereas the lower part is darker, and is known as Variegated Beds. In part, dark shales are present in both Pale and Variegated Beds; others are greenish, grey, brown, and dark chocolate, carbonaceous types. The sands may also be yellow, but where bentonite is present it imparts a light colour to the beds. Both Pale and Variegated Beds are characterized by the presence of thin seams of ironstone, commonly dark reddish, but in part purplish, Selenite (gypsum) crystals are, in places, abundant in the shales.

The best sections of Pale Beds exposed in the region are in the Tit Hills, southwest of Czar. These hills carry a thin capping of Bearpaw shales, beneath which, and around Bruce Lake, more than 200 feet of Pale Beds are exposed. The total thickness of Pale and Variegated Beds in the Tit Hills area is about 970 feet. Variegated Beds outcrop near Hawkins on the Canadian National Railway west of Wainwright, but no area exposes the complete succession, which is considered to comprise about 200 feet of beds.

Records of wells drilled into the Pale and Variegated Beds do not, in general, indicate lateral persistence of sands for long distances, nor any uniform average depth to water-bearing sands in a local area. This points to the conclusion that the sands are mainly local lenses, but as such lenses are numerous, few wells fail to obtain water. In the Cadogan area many flowing wells have been obtained from sands about midway in the succession. In western Saskatchewan Paleland Variegated Beds occur over a wide area from Maclin and Kerrobert northeast through Wilkie to the Eagle Hills, south of Battleford. Numerous outcrops occur in the area south of Unity at Muddy Lake, but south and east around Biggar these beds are almost wholly concealed by glacial drift.

The water from the sands of the Pale and Variegated Beds is generally soft. The supply, apparently, is dependent in part on the size of the sand body that contains the water and in part on the ease with which water may be replenished in the sand. Small sand lenses surrounded by shales may be filled with water that has infiltrated into them, but when tapped by a well the supply may be very slowly replenished. In many instances such wells yield only a small supply, although this is commonly persistent and regular.

## Birch Lake Formation

The Birch Lake formation underlies the Variegated Beds, but in many areas the division is not sharp. The type area of the formation is along the north shore of Birch Lake south of Innisfree, where a section 65 feet thick, composed mostly of sand, is exposed. The total thickness of the formation in this area is about 100 feet, and although this is dominantly sand a central part is composed of alternating thin sand and shale beds. At the base of the formation, in a number of places, is an oyster bed, and this is exposed in a road cut in a section 73 feet thick on the east side of Buffalo Coulée in sec. 3, tp. 47, rge. 7, W. 4th mer. In both upper and lower parts of the formation the sand is commonly massive and outcrops tend to consolidate into hard, nodular masses from a foot to a few feet in diameter. Apparently these are formed through the deposition of salts from the water that finds an outlet at the outcrops. In fact, in some areas the sand may be traced along the side of a hill by the presence of small springs or nodular masses of sandstone.

The Birch Lake formation occurs under the drift and in outcrops in a large area south of North Saskatchewan River and northeast of a line from Willingdon to Innisfree and Minburn. East of this area the southwest boundary is more irregular, but outcrops are persistent on the banks of Battle River from a few miles north of Hardisty to and beyond the mouth of Grizzly Bear Coulée in tp. 47, rge. 5. It is believed, too, that a large area near Edgerton and Chauvin is underlain by the Birch Lake formation and that it extends southeastward into Saskatchewan around Manitou Lake and southeast to Vera.

It is thought that the Birch Lake formation thins eastward from its type section at Birch Lake, and that it loses its identity in western Saskatchewan. Deep wells drilled at Czar, Castor, and elsewhere no longer show the Birch Lake as a clearly recognizable sand formation, so that its southern limit beneath younger formations is unknown. Wherever it occurs as a sand, however, it is water-bearing, although in some areas the sand is apparently too fine to yield any considerable volume of water. In other areas, however, it persistently yields good wells. There is no apparent uniformity in the character of the water, which is either hard or soft in different wells in the same general area. Direct contact with surface waters that contain calcium sulphates may in time change a "soft" water well to a "hard" water well, and many wells are not sufficiently cased to prevent the percolation of water from surface sands into the well, and hence into the deeper, soft water producing sands. In part this accounts for the change in character of the water in a well, a feature that has been noticed by many well owners.

## Grizzly Bear Formation

The type locality for the Grizzly Bear formation, which underlies the Birch Lake beds, is near the mouth of Grizzly Bear Coulée, a tributary of Battle River with outlet in tp. 47, rge. 5. The formation is mainly composed of dark shales that were deposited in sea water. At the mouth of Grizzly Bear Coulée two shale sections, each about 100 feet thick, are separated by a zone of thin sand beds. It is now recognized that the upper section is the Grizzly Bear shale, and that the lower one, very similar in character and also deposited in sea water, occurs in the next lower formation, the Ribstone Creek. The Grizzly Bear shale contains a thin nodular zone about 50 feet above the base, that is, at about the centre of the formation. This zone is sandy, and is believed to yield water in various wells. Other thin sands, in places water-bearing, are also present. The impervious nature of the Grizzly Bear shales makes the overlying Birch Lake sand a strong acquifer, as water collects in the sand above the shale. The contact of the Birch Lake and Grizzly Bear formations can be traced in some places by the occurrence of springs issuing from the base of the Birch Lake sand even where this is not exposed.

Grizzly Bear shales occur in a road cut on the south side of Battle River near the highway bridge at Fabyan. The shales in this area are about 100 feet thick. It is thought they extend as far west as the Viking gas field, where they have been recognized in samples from deep wells. It is probable, however, that the shales thin westward and thicken eastward so that their general form is a wedge between both higher and lower sand beds. The position of the thin edge of the wedge to the west is unknown, but evidently the Grizzly Bear marine shale underlies a large area in east-central Alberta extending into Saskatchewan mainly in the area south of Battle River.

## Ribstone Creek Formation

The type area of the Ribstone Creek formation is on Ribstone Creek near its junction with Battle River in tp. 45, rge. 1, W. 4th mer. At this place the lower sand beds of the formation are well exposed. The upper part of the lower sand member of this formation outcrops on the north side of Battle River, in the northeast part of sec. 26, tp. 47, rge. 5, near the mouth of Grizzly Bear Coulée. Above it, higher on the bank and at a short distance from the river, there is a 12 foot zone of carbonaceous and coaly beds in two layers, each about 2 feet thick, separated by 8 feet of shale. Above this are 90 feet of dark shales that are thought to have been deposited in sea water, that is, they are marine shales. These marine shales in turn are overlain by a sandy zone about 20 feet thick containing oysters in the basal part. This sandy zone is the upper sand member of the Ribstone Creek formation.

It thickens to the east and west from the Grizzly Bear area but is probably at no place much more than 50 feet thick.

The lower sand member of the Ribstone Creek formation also varies in thickness from a minimum of about 25 feet. On the banks of Vermilion Creek, north of Mannville, the basal sand is at least 60, and may be 75, feet thick. It is overlain by shaly sand and sandy shale beds, which replace the shale beds in the central part of the formation as exposed at the mouth of Grizzly Bear Coulée. In the Wainwright area, where the formation has been drilled in deep wells, the basal sand is 60 feet thick, with the central part composed of shale containing sand streaks. The upper sand member is about 20 feet thick in this area. The total thickness of the formation in the Wainwright area is 100 to 200 feet, but this increases to the west and in the Viking area exceeds 300 feet.

The Ribstone Creek formation is widely exposed in a northwest-trending belt in east-central Alberta. The southwest boundary of this northwest-trending belt passes through the mouth of Grizzly Bear Coulée in tp. 47, rge. 5, and beyond to the Two Hills area in tp. 54, rge. 12, whereas the northeast boundary crosses North Saskatchewan River southwest of Elk Point and extends northwest to include an area slightly north of St. Paul des Metis and Vilna to tp. 60, rge. 14. Within this belt water wells are common in the Ribstone Creek sands, which are almost without exception water-bearing in some part of the formation. The limits of the belt to the northeast determine the limits of water from this source, but to the southwest of the belt, as here outlined, water may be obtained in this formation by drilling through the younger beds that overlie it. The Ribstone Creek sands are a prolific source of water in many places and hence the distribution of this formation is of considerable economic importance. Where the formation consists of upper and lower sands with a central shale zone only the sands are water-bearing, although thin sand members may occur in the shale. Where the formation is largely sand the distribution of water may be in any part of the formation, although the upper and lower sands are perhaps the better aquifers. To the east of Alberta, along Battle River and Big Coulée in Saskatchewan, the Ribstone Creek sands are marine. Marine conditions apparently become more prevalent to the southeast and it is believed that in this direction the sands are gradually replaced by marine shales. Thus at some distance southeast of Battleford the Ribstone Creek formation loses its identity and its equivalents are shales in a marine succession.

## Lea Park Formation

The Lea Park formation is largely a marine shale, and only in the upper 180 feet is there any water. In the Dina area south of Lloydminster the upper beds of the Lea Park consist of silty shales about 110 feet thick underlain by silty sands 70 feet thick. Below these sands are marine shales only, and these yield no fresh water either in east-central Alberta or west-central Saskatchewan. The sand in the upper Lea Park formation is thus the lowest freshwater aquifer within a very large area. The extent of this sand in the Lea Park, particularly to the northeast, is not known, but as the strata in east-central Alberta have a southwest inclination, progressively lower beds occur at the surface to the northeast. Thus at a short distance beyond the northeast boundary of the Ribstone Creek formation, as previously outlined, the sand in the upper Lea Park reaches the surface, and represents the last bedrock aquifer in that direction. Farther northeast water must be obtained from glacial or surface deposits only. In Alberta this area without fresh water in the bedrock includes the country north of North Saskatchewan River in the vicinity of Frog Lake and a large area extending to and beyond Beaver River. In this area, however, more fresh water streams are present than farther south, and bush lands help to retain the surface waters. The area northeast of North Saskatchewan River in Saskatchewan is almost wholly within the Lea Park formation, where water can be found only in surface deposits.

## WATER ANALYSES

### Introduction

Analyses were made of water samples collected from a large number of wells in west-central Saskatchewan. Their purpose was to determine the chemical characteristics of the waters from different geological horizons, and thereby assist in making correlations of the strata in which the waters occur. Although this was the main objective of the analyses, it was also realized that a knowledge of the mineral content of the water is of interest and value to the consumer. The analyses were all made in the laboratory of the Water Supply and Borings Section of the Geological Survey, Ottawa.

### Discussion of Chemical Determinations

The dissolved mineral constituents vary with the material encountered by the water in its migration to the reservoir bed. The mineral salts present are referred to as the total dissolved solids, and they represent the residue when the water is completely evaporated. This is expressed quantitatively as "parts per million", which refers to the proportion by weight in 1,000,000 parts of water. A salt when dissolved in water separates into two chemical units called "radicals", and these are expressed as such in the chemical analyses. In the one group is included the metallic elements of calcium (Ca), magnesium (Mg), and sodium (Na), and in the other group are the sulphate ($SO_4$), chloride (Cl), and carbonate ($CO_3$) radicals.

The analyses indicate only the amounts of the previously mentioned radicals, thus neglecting any silica, alumina, potash, or iron that may be present. It will be noticed that in most instances the total solids are accounted for by the sum total of the radicals as shown by the analyses. Actually, the residue when the water is completely evaporated still retains some combined water of crystallization, so that the figures for the "total solids" are higher than the sum total of the radicals as determined. These radicals are also "calculated in assumed combinations" to indicate the theoretical amounts of different salts present in the water. The same method was followed in each analysis, so that the table presents a consistent record of the different compounds present.

### Mineral Constituents Present

Calcium. Calcium (Ca) in the water comes from mineral particles present in the surface deposits, the chief source being limestone, gypsum, and dolomite. Fossil shells provide a source of calcium, as does also the decomposition of igneous rocks. The common compounds of calcium are calcium carbonate ($CaCO_3$) and calcium sulphate ($CaSO_4$).

Magnesium. Magnesium (Mg) is a common constituent of many igneous rocks and, therefore, very prevalent in ground water. Dolomite, a carbonate of calcium and magnesium, is also a source of the mineral. The sulphate of magnesia ($MgSO_4$) combines with water to form "Epsom salts" and renders the water unwholesome if present in large amounts.

Sodium. Sodium (Na) is derived from a number of the important rock-forming minerals, so that sodium sulphate and carbonate are very common in ground waters. Sodium sulphate ($Na_2SO_4$) combines with water to form "Glauber's salt" and excessive amounts make the water unsuitable for drinking purposes. Sodium carbonate ($Na_2CO_3$) or "black alkali" waters are mostly soft, the degree of softness depending upon the ratio of sodium carbonate to the calcium and magnesium salts. Waters containing sodium carbonate in excess of 200 parts per million are unsuitable for irrigation purposes[1]. Sodium sulphate is less

---

1 "The extreme limit of salts for irrigation is taken to be 70 parts per 100,000, but plants will not tolerate more than 10 to 20 parts per 100,000 of black alkali (alkaline carbonates and bicarbonates)" Frank Dixey in "A Practical Handbook of Water Supply", Thos. Murby & Co., 1931, p. 254.

---

harmful.

Sulphates. The sulphate ($SO_4$) salts referred to in these analyses are calcium sulphate ($CaSO_4$), magnesium sulphate ($MgSO_4$), and sodium sulphate ($Na_2SO_4$).

Chloride. Chlorine (Cl) is with a few exceptions, expressed as sodium chloride (NaCl), that is, common table salt. It is found in all of the analyses, most of the waters containing less than 200 parts per million, but some as much as 2,000 or 3 ,000 parts. These waters have a brackish taste.

Alkalinity. The alkalinity determined in these water analyses is based on the assumption that the only salts present in the samples that will neutralize acids are carbonates, and that, consequently, the degree of alkalinity is proportional to the amount of the carbonate radical ($CO_3$) present.

Hardness. The hardness of water is the total hardness, and has been determined by the amount of a standard soap solution required to form a lather that will stand up (persist) for 2 minutes. Hardness is of two kinds, temporary and permanent. Temporary hardness is caused by calcium and magnesium bicarbonates, which are soluble in water but are precipitated as insoluble normal carbonates by boiling, as shown by the scale that forms in teakettles. Permanent hardness is caused by the presence of calcium and magnesium sulphates, and is not removed by boiling. The two forms of hardness are not distinguished in the water analyses. Waters grade from very soft to very hard, and can be classified according to the following system[2]:

---

2 The "Examination of Waters and Water Supplies", Thresh & Beale, page 21, Fourth Ed. 1933 .

---

A water under 50 degrees (that is, parts per million) of hardness may be said to be very soft.
A water with 50 to 100 degrees of hardness may be said to be moderately soft.
A water with 100 to 150 degrees of hardness may be said to be moderately hard.
A water with more than 200 and less than 300 degress of hardness may be said to be hard.
A water with more than 300 degrees of hardness may be said to be very hard.

Hard waters are usually high in calcium carbonate. Almost all of the waters from the glacial drift are of this type, especially those associated with sand and gravel deposits that come close to the surface.

In soft water the calcium carbonate has been replaced by sodium carbonate, due to natural reagents present in the sand and clays. Bentonite and glauconite are two such reagents known to be present. Montmorillinite, one of the clay-forming minerals, has the same property of softening water, owing to the absorbed sodium that is available for chemical reaction[1].

---

[1] Piper, A. M. "Ground Water in Southwestern Pennsylvania", Penn. Geol. Surv., 4th series.

---

If surface water reaches the lower sands by percolating through the higher beds it may be highly charged with calcium salts before reaching the bedrock formations containing bentonite or glauconite. The completeness of the exchange of calcium carbonate for sodium carbonate will, therefore, depend upon the length of time that the water is in contact with the softening reagent, and also upon the amount of this material present. The rate of movement of underground water will, consequently, be a factor in determining the extent of the reaction.

The amount of iron present in the water was not determined, owing to the possibilities of contamination from the iron casings in the wells. Iron is present in most waters, but the amount may be small. Upon exposure to air a red precipitate forms, the water becomes acid, and, hence, has a corrosive action. When iron is present in large amounts the water has an inky taste.

## WATER ANALYSES IN RELATION TO GEOLOGY

### Glacial Drift

The quality of the water from glacial drift depends largely on the nature of the deposit from which it comes and on the depth of the aquifer below the surface. Glacial deposits may be divided roughly into three types.

(1). Sand and gravel beds that form the surface deposit, such as outwash material and glacial lake sands.

(2). Buried outwash and interglacial deposits between two tills of boulder clay.

(3). Pockets or lenses of sand and gravel irregularly distributed through the till.

Water from surface sand deposits is normally low in dissolved salts, the total being generally less than 1,000 parts per million. Where large amounts of limestone occur in the glacial sand and gravel beds a characteristic constituent of the glacial water is calcium carbonate, the amount present varying from 300 to 700 parts per million.

Water from buried outwash deposits contains more dissolved salts than the surface sands, as the water in order to reach them has to percolate through overlying till. Rain water contains carbonic acid, which acts as a solvent and dissolves a great deal of calcium, magnesium, and sodium from the rock-forming minerals. Sulphate salts are commonly present, though their proportions vary greatly in the different waters. The shales that are incorporated in the drift are high in calcium sulphate, so that the amount of shale present will modify the quality of the water. The oxidized upper part of the drift contains less sulphate than the deeper, less oxidized boulder clay. The character of the water in the buried outwash deposits will, therefore, depend largely on the composition and amount of till that overlies it.

Water from irregularly distributed sand and gravel beds will vary in its content of dissolved salts depending upon the character of the material surrounding the reservoir beds. As the water in this type of deposit does not flow to any marked extent, it is apt to be more highly impregnated with soluble salts than where the underground movement is more rapid. Soft water in the drift is mostly confined to shallow wells in sands low in calcium carbonate. Waters from glacial lake clays are sometimes high in soluble salts. The sample from a well in glacial lake clay on N.W. ¼ sec. 27, tp. 42, rge. 17, has 11,040 parts per million of soluble salts, largely magnesium sulphate and sodium sulphate. The sample from SE. ¼ sec. 13, tp. 42, rge. 16, which is believed to come from glacial lake silts, has a very different composition. The total solids in it are only 440 parts per million, of which 250 are calcium carbonate. The great difference in these waters is due to the high soluble salt content that is associated with the lake clays but absent in the silts. Average drift water contains between 1,000 and 3,000 parts per million of dissolved mineral salts.

## Bearpaw Formation

The Bearpaw formation consists of dark marine shales and beds of green sand. Water from these sands has a total solid count ranging from 300 to 1,600 parts per million and a hardness of more than 300 degrees. Calcium carbonate is very marked in all samples, due, perhaps, to the proximity of the water sands to the glacial drift. Sodium sulphate is the chief salt present, followed by calcium carbonate, magnesium sulphate, magnesium carbonate, and sodium chloride in decreasing amounts. These waters are distinguished from the overlying drift waters by being relatively low in total dissolved solids, and in containing no calcium sulphate and only moderate amounts of sodium sulphate, magnesium sulphate, and magnesium carbonate.

## Pale Beds

Pale Beds underlie the Bearpaw formation. Total solids in waters from these beds vary from 700 to 1,300 parts per million. The water is, in most instances, soft, as it contains sodium carbonate in excess of calcium and magnesium carbonates, but when mixed with surface water high in calcium carbonate, it will become hard. The high concentration of sodium salts, especially sodium carbonate, in contrast with the calcium and magnesium salts distinguishes this water from that in Bearpaw sands. The Pale Beds include much bentonite, and it is this mineral that acts as a water softener within the formation. The following analyses are typical of waters from the Pale Beds:

| Salts | SE. sec. 16, tp.38, rge. 21 | NE. sec. 3, tp.39, rge. 25, | SW. sec. 7, tp.37, rge.24, | SE. sec. 21 tp. 38, rge.23 |
|---|---|---|---|---|
| $CaCO_3$ | 73 | 18 | 53 | 35 |
| $CaSO_4$ | - | - | - | - |
| $MgCO_3$ | 52 | 14 | 45 | 38 |
| $MgSO_4$ | - | - | - | - |
| $Na_2CO_3$ | 297 | 679 | 464 | 562 |
| $Na_2SO_4$ | 297 | 158 | 266 | 437 |

| | | | | |
|---|---|---|---|---|
| NaCl | 31 | 45 | 46 | 130 |
| Total solids | 760 | 1,020 | 940 | 1,260 |
| Hardness | 100 | 20 | 30 | 75 |

## Variegated Beds

In Senlac Rural Municipality, Saskatchewan, are a number of wells that have water very similar in character to that found in the Bearpaw formation. These wells tap an horizon that corresponds with the Variegated Beds in Alberta, although they have not been separated from the Pale Beds. They are less bentonitic than the Pale Beds and darker in colour. The water is hard and has a low dissolved solid content. The three analyses given below show a great deal of similarity and suggest a common horizon.

| Salts | NW. sec. 21, tp.41,rge.26 | NW. sec. 3, tp.41,rge.28 | SE. sec. 28, tp.40,rge.28 |
|---|---|---|---|
| $CaCO_3$ | 250 | 305 | 125 |
| $CaSO_4$ | - | - | - |
| $MgCO_3$ | 1109 | 80 | 155 |
| $MgSO_4$ | 149 | 104 | 69 |
| $Na_2CO_3$ | - | - | - |
| $Na_2SO_4$ | 98 | 132 | 386 |
| NaCl | 12 | 12 | 18 |
| Total solids | 640 | 640 | 780 |
| Hardness | 600 | 600 | 500 |

## Ribstone Creek Formation

Chemical analyses of water from the Ribstone Creek formation vary more than in the Pale Beds, the reason being that at several different horizons the sediments show considerable lateral variation. The formation includes both marine and non-marine beds, thin coal seams being present in the basal part of the formation around Paynton, whereas south of Lashburn, on Battle River, marine fossils were found in strata considered to be at approximately the same horizon. The water analyses show similarities within limited areas, but long distance correlations cannot be made safely except for the saline waters that occur in the flowing wells at Vera, Muddy Lake, and at the south end of Tramping Lake. Analyses of these waters are given in the following table:

| Salts | SE.sec.25, tp.41,rge. 24 | SE.sec.22, tp.41,rge. 24, | NE.sec.36, tp.41,rge. 24, | SW.sec.7 tp.41,rge 24, | SE.sec.30, tp.38, rge. 22, | SW.sec10, tp.35, rge.20, |
|---|---|---|---|---|---|---|
| $CaCO_3$ | 73 | 73 | 73 | 198 | 108 | 90 |
| $CaSO_4$ | - | - | - | - | - | - |
| $MgCO_3$ | 38 | 38 | 38 | 52 | 69 | 52 |
| $MgSO_4$ | - | - | - | - | - | - |

| | | | | | | |
|---|---|---|---|---|---|---|
| $Na_2CO_3$ | 129 | 119 | 129 | 11 | 106 | 125 |
| $Na_2SO_4$ | 55 | 55 | 61 | 61 | 49 | 43 |
| NaCl | 2,929 | 3,036 | 2,690 | 2,863 | 3,531 | 3,861 |
| Total solids | 3,840 | 3, 460 | 3,120 | 3,200 | 3,860 | 4,460 |
| Hardness | 135 | 90 | 110 | 100 | 130 | 130 |

The similarity in these anlayses suggests a common source bed. The distance between the Tramping Lake well and the Vera wells is about 40 miles. This water, which is thought to come from the basal sand of the Ribstone Creek formation, is not typical of water from the same stratigraphical horizon in the vicinity of Battle River, one reason being, possibly, that at Battle River the stream has cut through the Ribstone Creek formation exposing the sand members along its banks. This may cause a more rapid movement of the underground water in this area than farther south, and it is known that the rate of flow is a controlling factor that governs the change of calcium carbonate to sodium carbonate when the softening reagents of bentonite or glauconite are present in the sand.

Some of the soft waters from the Ribstone Creek formation cannot be distinguished from those of the Pale Beds, whereas others are quite different. The following analyses illustratetsome of the different types of water from this formation:

| Salts | Se.sec. 11, tp. 46, rge. 28 | Ind.Agent Little Pine I.R. | SW.sec. 24, tp. 46, rge. 21 | NE.sec. 36, tp. 43, rge. 18 | Se.sec. 26. tp. 43, rge. 18 | NE.sec. 36. tp. 41, rge. 24 | NW.sec. 22. tp. 42. rge. 23 |
|---|---|---|---|---|---|---|---|
| $CaCO_3$ | 90 | 90 | 410 | 73 | 35 | 73 | 125 |
| $CaSO_4$ | - | - | - | - | - | - | - |
| $MgCO_3$ | 97 | 59 | 168 | 38 | 31 | 38 | 97 |
| $MgSO_4$ | - | - | 64 | - | - | - | - |
| $Na_2CO_3$ | 217 | 392 | - | 283 | 592 | 129 | 196 |
| $Na_2SO_4$ | 1,644 | 777 | 2,518 | 225 | 522 | 61 | 1,541 |
| NaCl | 249 | 63 | 76 | 12 | 83 | 2,690 | 71 |
| Total solids | 2,220 | 1,340 | 3,000 | 620 | 1,230 | 3,120 | 1,900 |
| Hardness | 280 | 160 | 750 | 110 | 35 | 110 | 600 |

The above chemical analyses show such a wide range in the dissolved salts present in the different waters in the Ribstone Creek formation that they cannot be used for correlation purposes over a large area.

## Conclusions

(1) In most instances water from glacial drift is quite different from water from bedrock.

(2) Some of the bedrock horizons carry waters that show definite chemical characteristics.

(3) Most waters from glacial till carry total solids amounting to between 1,000 andn3,000 parts per million.

(4) Bedrock waters are commonly low in dissolved salts. Exceptions to this are to be found in water from the Ribstone Creek formation.

(5) Water from the Bearpaw formation is hard. An average of ten wells gave a total solid content of 1,100 parts per million.

(6) Water from the Variegated Beds resembles that from the Bearpaw formation.

(7) Waters from the Pale Beds is mostly soft. An average of ten wells gave a total solid of 1,000 parts per million.

(8) All soft waters contain sodium carbonate ($Na_2CO_3$), which is present in water from the Pale Beds and Ribstone Creek formations but absent from the Bearpaw formation and Variegated Beds.

# RURAL MUNICIPALITY OF EYE HILL, NO. 382, SASKATCHEWAN

## Physical Features

The highest land in this municipality is above 2,500 feet, and the lowest, along Eyehill Creek, is below 2,100 feet, giving a relief in excess of 400 feet. The hills, however, are broad, with gentle slopes. Eyehill Creek cuts across the northwest corner of the municipality, but does not flow in late summer. The railway from Macklin to Denzil follows a former drainage valley.

## Geology

There is little evidence to suggest that the higher land east and south of Primate is underlain by the lower beds of the Bearpaw formation. The probability is, however, that these beds are very thin, and in places may have been completely removed by glacial erosion. Outcrops of Pale Beds occur along Eyehill Creek Valley both southwest and northeast of Macklin, and these carry poor seams of lignite. The entire municipality is underlain at depth by Pale Beds, either directly beneath the drift or beneath a thin veneer of Bearpaw strata.

## Water Supply

No widespread water-bearing horizons are known in the drift in this municipality. Apparently, where wells are obtained in the drift, the water comes from isolated sand or gravel lenses widely distributed and showing no relationship to one another. A few wells obtain water from sands near the base of the Bearpaw, but a large number have been drilled to sands in the Pale Beds. It is probable, too, in one well at least the Variegated Beds have been reached, whereas one other well at a depth of 525 feet reached the sand that yields salty water and gas from the Ribstone Creek formation.

Township 37, Range 26. Most of the wells in this township obtain their water supply from sand and gravel beds in the glacial drift, and there is no uniformity of level of the water horizons. Obviously, therefore, the sand and gravel beds are widely scattered and not continuous laterally. A few wells penetrate the drift and obtain their water supply from sands in the underlying Pale Beds. Three horizons have been reported, one at an elevation of 2,104 feet in a well 200 feet deep on NW. section 26, another at 1,996 feet in a well 250 feet deep on NE. section 33, and a third at 1,868 feet in a well 457 feet deep on SW. section 20. The Pale Beds are undoubtedly a source of water for the whole area, but probably the water horizons would not be encountered in any place at a depth of less than 150 feet, and at most places the depth would be considerably more.

Township 37, Range 27. Black pebbles were found in a well 85 feet deep on NE. section 5 at an elevation of 2,332 feet. These are probably Bearpaw pebbles, so that this well is assumed to have reached a water-bearing horizon within that formation. Other wells apparently reach the same horizon between elevations of 2,320 and 2,345 feet, as follows: NE. section 3, depth 60 feet; NW. section 10, depth 70 feet; NE. section 10, depth 73 feet; SE. section 17, depth 82 feet; SE. section 26, depth 107 feet; and NW. section 28, at 46 feet. The depth, of course, depends on the elevation of the surface. A deeper water-bearing horizon, probably in the Pale Beds, was encountered in two wells, on NW. section 34 and NE. section 35, at an elevation of 2,255 feet. The thickness of the drift is not definitely known, but a water horizon occurs in it at an elevation of 2,370 feet in wells on SW. section 18, NW. section 21, and SE. section 23. This may be a small outwash deposit now buried in the drift.

Township 37, Range 28. In the eastern part of this township the land surface is high, and it is thought that Bearpaw beds may be present beneath the drift. A water-bearing horizon, occuring at an elevation of 2,320 to 2,345 feet in the Bearpaw, was encountered in a well 63 feet deep on NW. section 13 at an elevation of 2,330 feet, and in a well 90 feet deep on NW. section 24 at an elevation of 2,339 feet. It is probable that another water horizon, presumably at the base of the Bearpaw or top of the Pale Beds, occurs at an elevation of 2,310 to 2,330 feet, as encountered in wells on NW. section 12, NE. section 13, SE. section 14, NE. section 25, and SE. section 26. This water horizon occurs only in the eastern part of the township and has probably been eroded in the western part where, as in sections 16 and 17, glacial drift occurs down to an elevation of 2,172 feet. A few wells at deeper horizons have encountered the Pale Beds, as in a well 325 feet deep on NW. section 5 and another 320 feet deep on SE. section 7. Several water-bearing horizons are known in the Pale Beds, but available information does not allow for exact correlation between wells.

Township 38, Range 26. Some Bearpaw beds may be present in the western part of this township, although proof of this is not conclusive. In the eastern part of the area, on SE. section 25, glacial gravel occurs as low as 2,250 feet, but probably is much lower there than farther west. In NW. section 12 a coal streak occurs at a depth of 80 feet in a well 100 feet deep. The coal is at an elevation of 2,225 feet, so that the base of the drift or the top of the Pale Beds in this general vicinity is between 2,225 and 2,250 feet in elevation. In some wells, as for example those on NE. section 20 and NW. section 23, it is uncertain whether the water-bearing sand is in the drift or in the Pale Beds. Two horizons in the Pale Beds are, however, definitely known to carry water. One of these was encountered in a well 180 feet deep on NW. section 12, at an elevation of 2,127 feet, and the other in a well 312 feet deep on SE. section 15 at an elevation of 1,988 feet. The lower horizon is obviously the same as the one that produces in a well 250 feet deep on NE. sec. 33, tp. 37, rge. 26, at an elevation of 1,996 feet.

Township 38, Range 27. A few wells in this area obtain water from sand and gravel beds in the drift, but the water horizons show no uniformity of level. The Pale Beds below the drift have been reached in several wells, and a number of sands have been found to be water-bearing. One of these is apparently the same as that already referred to in tp. 38, rge. 26, at an elevation of 1,996 feet. In this township wells 260 to 280 feet deep have encountered this aquifer at approximately the same elevation on NW. section 21, SE. section 28, NW. section 30, and NE. section 32. A higher horizon occurs in a well 260 feet deep on SE. section 33 at an elevation of 2,046 feet, and a lower horizon occurs in a well 320 feet deep on NE. section 18 at an elevation of 1,900 feet.

Township 38, Range 28. In this township a few wells obtain water from sand and gravel beds in the drift, but these deposits are very irregularly distributed. On NW. section 14, in a well 60 feet deep, gravel occurs at an elevation of 2,180 feet, and in another well, on SW. section 25, Pale Beds are believed to occur at 2,170 feet. Thus the base of the drift is fairly closely defined. Several deep wells penetrate the drift into sands in the underlying Pale Beds. The most prominent water-bearing horizon occurs at an elevation of 1,925 to 1,950 feet in wells 250 to 325 feet deep on SW. section 3, NE. section 4, NW. section 4, and NE. section 23. A deeper horizon, at an elevation of 1,906 feet, is also reached in the well 350 feet deep on NE. section 23, and is apparently the same horizon as is present on NE. sec. 18, tp. 38, rge. 27. In this same well a small supply of water was obtained at a depth of 250 feet, or an elevation of 2,006 feet, at the same horizon as that in the well on NE. sec. 33, tp. 37, rge. 26, the one on SE. sec. 15, tp. 38, rge. 26, and from several wells in tp. 38, rge. 27.

Township 39, Range 26. A few wells in this area produce water from glacial sand and gravel beds between elevations of 2,170 and 2,190 feet, but apparently these beds are of only local extent. Most of the wells penetrate the drift to sands in the underlying Pale Beds. Horizons are indicated by the well records at elevations of approximately 2,140, 2,120, 2,080, and 1,935 feet. The lowest of these is, apparently, within the same series of sand beds as those that produce in several wells in tp. 38, rge. 28, at elevations of between 1,925 and 1,950 feet.

Township 39, Range 27. Outcrops of Pale Beds occur in this township on section 18, in a small gully east of the railroad. The drift, in this part of the township at least, is very thin, although in section 4 gravel was reported at a depth of 60 feet, or an elevation of 2,192 feet. Outcrops of Pale Beds occur slightly above an elevation of 2,100 feet, and on NW. section 31, at a depth of 65 feet, or an elevation of 2,129 feet, gravel was reported, so that the base of the drift is probably close to the bottom of this well. On SE. section 32, at a depth of 90 feet or an elevation of 2,069 feet, coal occurs in the Pale Beds. This same horizon is known from the Pale Beds in a well 101 feet deep on NE. section 17, at an elevation of 2,065 feet. In the well on NE. section 17 the water associated with the coal is unfit for human consumption and would have to be cased off, though it is certain that potable water can be obtained at a greater depth. In a well on

SE. section 5, a water horizon that only yielded a small supply was encountered at a depth of 280 feet or an elevation of 1,991 feet. This is apparently a widespread horizon, having been encountered in several deep wells in tp. 37, rge. 26, tp. 38, rge. 27, and tp. 38, rge. 28. In the same well, on SE. section 5, a deeper water horizon was encountered at a depth of 365 feet or an elevation of 1,906 feet. This horizon is also widespread, having been encountered in a well in tp. 38, rge. 27.

Township 39, Range 28. The wells in the glacial drift in this township are relatively unimportant, most of the water being obtained from wells drilled into the underlying formations. One well, 525 feet deep on NE. section 3, reaches a sand in the Ribstone Creek formation at an elevation of 1,649 feet. This is the same salty water horizon with gas that occurs at an elevation of 1,681 feet in the wells drilled for oil and gas at Vera, and at an elevation of 1,600 feet in two wells a short distance south of Muddy Lake. The distance from the well in this township to the wells south of Muddy Lake is about 35 miles, representing an easterly dip of less than 1½ feet a mile. Most of the wells, however, find water in sands in the Pale Beds, and in a great many of these wells it is obvious that the water-bearing sand has not been recorded at the exact depth at which it was struck. This is probably due to drilling with a jetting rig using a circulating mud fluid, and as a result passing through the water-bearing horizon before its presence was detected. In certain wells, however, the producing water horizons can be correlated approximately: in tp. 38, rge. 28, the most prominent water-bearing zone was found between elevations of 1,925 and 1,950 feet. This zone is represented in tp. 39, rge. 28, in wells on NE. sec. 3, SE. sec. 10, SW. sec. 11, NE. sec. 14, SE. sec. 17, NE. sec. 28, NE. sec. 34, and SE. sec. 36.

In tp. 37, rge. 26, tp. 38, rge. 26, and tp. 38, rge. 28, a water-bearing horizon occurs in the Pale Beds at an approximate elevation of 1,990 to 2,000 feet. This same horizon is represented in tp. 39, rge. 28, by wells on SW. sec. 13, NE. sec. 17, SE. sec. 21, NE. sec. 25, and SW. sec. 32. Some other horizons are also present, and one well 490 feet deep on NE. section 25 probably reached a sand in the Variegated Beds at an elevation of 1,752 feet. In a well on SE. sec. 18, tp. 36, rge. 22, at a depth of 546 feet, a sand presumed to be in the Variegated Beds was encountered at an elevation of 1,709 feet. The distance between the wells on NE. sec. 25, tp. 39, rge. 28, and SE. sec. 18, tp. 36, rge. 22, is 38 miles. It is not known that this horizon is sufficiently persistent to justify an exact correlation between these two wells, but the southeast dip is probably very slight, as indicated by the wells in the Ribstone Creek formation.

## ANALYSES OF WATER SAMPLES FROM RURAL MUNICIPALITY OF EYE HILL NO. 382, SASKATCHEWAN

| No. | ¼ Sec. | Tp. | Rge. | Depth in feet | Elev. of Aquifer | Total dissolved solids | Constituents as Analysed | | | | | | Total Hardness | Constituents as Calculated in assumed Combinations | | | | | | | Source of Water |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Ca | Mg | Na | $SO_4$ | Cl. | Alk. | | $CaCO_3$ | $CaSO_4$ | $MgCO_3$ | $MgSO_4$ | $Na_2CO_3$ | $Na_2SO_4$ | NaCl | |
| 91 | SW 20 | 37 | 26 | 457 | 1868 | 940 | 7 | 4 | 340 | 176 | 14 | 570 | 30 | 18 | | 14 | | 567 | 260 | 23 | Pale Beds - |
| 84 | NE 5 | 37 | 27 | 85 | 2332 | 3960 | 172 | 316 | 539 | 2411 | 30 | 355 | 2900 | 355 | 112 | | 1564 | | 1600 | 50 | Glacial drift |
| 90 | SE 26 | 37 | 27 | 107 | 2344 | 940 | 71 | 37 | 219 | 205 | 26 | 555 | 380 | 178 | | 128 | | 239 | 303 | 43 | Similar to Pale Beds |
| 89 | NW 34 | 37 | 27 | 80 | 2254 | 960 | 157 | 55 | 93 | 332 | 71 | 375 | 750 | 375 | 24 | | 272 | | 145 | 117 | Not typical of Bedrock water |
| 86 | NW 5 | 37 | 28 | 320 | 2023 | 960 | 7 | 7 | 345 | 152 | 72 | 535 | 45 | 18 | | 24 | | 517 | 235 | 119 | Pale Beds |
| 85 | NW 12 | 37 | 28 | 80 | 2297 | 740 | 64 | 17 | 166 | 135 | 11 | 435 | 200 | 160 | | 59 | | 217 | 200 | 18 | Pale Beds |
| 88 | NE 25 | 37 | 28 | 100 | 2301 | 420 | 93 | 33 | 3 | 82 | 13 | 270 | 400 | 233 | | 31 | 103 | | | 7 | MgCl 7, not typical bedrock water |
| 87 | NE 4 | 38 | 28 | 400 | 1848 | 980 | 7 | 4 | 339 | 82 | 57 | 605 | 30 | 18 | | 14 | | 604 | 121 | 94 | Pale Beds |
| 98 | SE 18 | 38 | 27 | 320 | 1900 | 820 | 7 | 13 | 505 | 398 | 66 | 660 | 25 | 18 | | 45 | | 623 | 589 | 109 | Pale Beds |
| 97 | SE 28 | 38 | 27 | 280 | 1999 | 1040 | 93 | 37 | 312 | 467 | 22 | 545 | 340 | 233 | | 128 | | 170 | 691 | 36 | Pale Beds |
| 100 | NW 30 | 38 | 27 | 365 | 1950 | 760 | 36 | 63 | 125 | 385 | 16 | 200 | 400 | 90 | | 92 | 183 | | 354 | 26 | Similar to Bearpaw |
| 96 | SW 36 | 38 | 27 | 30 | 2314 | 6140 | 336 | 397 | 826 | 3214 | 310 | 480 | 3000 | 480 | 490 | | 1965 | | 1924 | 512 | Drift |
| 93 | NW 12 | 38 | 26 | 180 | 2127 | 960 | 64 | 31 | 251 | 295 | 8 | 515 | 240 | 160 | | 108 | | 240 | 437 | 13 | Pale Beds |
| 92 | SE 15 | 38 | 26 | 312 | 1988 | 900 | 150 | 63 | 80 | 213 | 15 | 565 | 750 | 375 | | 160 | 84 | | 216 | 25 | Pale Beds High in CaCo3 |
| 95 | SE 30 | 38 | 26 | 66 | 2315 | 780 | 129 | 61 | 58 | 250 | 15 | 420 | 650 | 323 | | 81 | 188 | | 148 | 25 | Bearpaw |
| 94 | SW 3 | 39 | 26 | 260 | 2017 | 1040 | 14 | 9 | 386 | 262 | 35 | 585 | 40 | 35 | | 31 | | 544 | 388 | 58 | Pale Beds |
| 107 | SE 32 | 39 | 26 | 300 | 1923 | 760 | 43 | 20 | 220 | 115 | 23 | 515 | 140 | 108 | | 69 | | 345 | 170 | 38 | Pale Beds |
| 102 | NE 17 | 39 | 27 | 101 | 2065 | 1400 | 79 | 37 | 296 | 316 | 20 | 635 | 280 | 198 | | 128 | | 302 | 468 | 33 | Pale Beds |
| 103 | NE 25 | 39 | 28 | 490 | 1752 | 760 | 36 | 11 | 236 | 123 | 31 | 475 | 120 | 90 | | 38 | | 360 | 182 | 51 | Pale Beds |
| 104 | NE 28 | 39 | 28 | 275 | 1949 | 1080 | 122 | 61 | 188 | 201 | 18 | 730 | 600 | 305 | | 212 | | 183 | 297 | 30 | Pale Beds |

## RECORD OF WELLS IN RURAL MUNICIPALITY OF EYE HILL, NO. 382, SASKATCHEWAN

| Well No. | LOCATION ¼ Sec. | Tp. | Rge. | Mer. | Type of Well | Depth of Well | Altitude of Well | WATER LEVEL Above+ or Below- Surface | WATER LEVEL Elev. Above Sea Level | PRINCIPAL WATER-BEARING BED Depth Ft. | Elev. | Geol. Horizon. | Character of Water | Use to Which Water Is Put[x] | Yield & Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | N.W. 3 | 37 | 26 | 3 | Bored | 45 | 2256 | | | 45 | 2211 | Pale Beds ? | Hard | D.S. | Sufficient |
| 2 | S.W. 4 | " | " | " | " | 60 | 2272 | -40 | 2232 | 60 | 2212 | " " | " | " | " |
| 3 | S.W. 6 | " | " | " | " | 25 | 2300 | -21 | 2279 | 25 | 2275 | Sand | " | " | " |
| 4 | N.E. 9 | " | " | " | " | 50 | 2239 | | | 50 | 2189 | Pale Beds ? | " | " | " |
| 5 | N.E.11 | " | " | " | " | 85 | 2318 | | | 85 | 2233 | Sand | " | " | " |
| 6 | N.W.12 | " | " | " | " | 52 | 2326 | | | 52 | 2274 | " | " | " | " |
| 7 | N.E.12 | " | " | " | " | 60 | 2306 | | | 60 | 2246 | " | " | " | " |
| 8 | S.W.13 | " | " | " | " | 72 | 2338 | | | 72 | 2266 | " | " | " | " |
| 9 | S.W.14 | " | " | " | Dug | 25 | 2342 | | | 25 | 2317 | " | " | " | " |
| 10 | N.E.17 | " | " | " | Bored | 85 | 2254 | -35 | 2219 | 85 | 2169 | Pale Beds sand | " | D. | " |
| 11 | S.W.18 | " | " | " | Dug | 40 | 2400 | -20 | 2380 | 40 | 2360 | Gravel | " | D.S. | " |
| 12 | N.E.18 | " | " | " | Bored | 80 | 2376 | -70 | 2306 | 80 | 2296 | Sand F. | " | " | " |
| 13 | S.W.20 | " | " | " | Drilled | 457 | 2325 | -200 | 2125 | 457 | 1868 | Pale Beds | Soft Br. | " | Good supply, Coal in Well |
| 14 | S.E.23 | " | " | " | Bored | 103 | 2338 | -68 | 2270 | 103 | 2235 | | Hard | " | Sufficient |
| 15 | N.W.26 | " | " | " | Drilled | 200 | 2304 | | | 200 | 2104 | Pale Beds | Soft Br. | " | Good supply |
| 16 | S.E.28 | " | " | " | Bored | 46 | 2271 | -16 | 2255 | 46 | 2225 | | Hard | " | Sufficient |
| 17 | S.W.30 | " | " | " | " | 60 | 2382 | -46 | 2336 | 60 | 2322 | Gravel | " | " | " |
| 18 | N.E.31 | " | " | " | " | 68 | 2389 | -62 | 2327 | 68 | 2321 | " | | " | Poor supply |
| 19 | N.E.32 | " | " | " | Dug | 40 | 2260 | | | 40 | 2220 | | Hard | " | Poor " |
| 20 | N.E.33 | " | " | " | Drilled | 250 | 2246 | -80 | 2166 | 175 | 2071 | | | | Denzil Well |
| | | | | | | | | | | 250 | 1996 | Pale Beds | Soft | " | Good supply |
| 21 | N.E.34 | " | " | " | Bored | 86 | 2309 | | | 86 | 2223 | Sand | Hard | " | Sufficient |
| 22 | S.E.36 | " | " | " | " | 82 | 2349 | -78 | 2271 | 82 | 2267 | | " | " | " |
| 23 | N.W.36 | " | " | " | " | 90 | 2329 | -80 | 2249 | 90 | 2239 | | " | " | " |
| 1 | N.E. 2 | 37 | 27 | 3 | Dug | 35 | 2342 | -30 | 2312 | 35 | 2307 | | Hard | D.S. | Sufficient |
| 2 | N.W. 3 | " | " | " | Bored | 60 | 2404 | -51 | 2353 | 60 | 2344 | Sand Bearpaw ? | " | S. | Poor supply |
| 3 | N.E. 5 | " | " | " | " | 85 | 2417 | -63 | 2354 | 85 | 2332 | "black | " | D.S. | Sufficient |
| 4 | N.W.10 | " | " | " | " | 70 | 2399 | -25 | 2374 | 70 | 2329 | "pebbles Bearpaw" | | " | " |
| 5 | N.E.10 | " | " | " | " | 73 | 2400 | -38 | 2362 | 73 | 2327 | " blue " | " | " | " |
| 6 | S.E.14 | " | " | " | Dug | 18 | 2408 | | | 18 | 2390 | Glacial sand | " | " | " |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Well No. | S.E.17 | 37 | 27 | 3 | Bored | 82 | 2423 | -60 | 2363 | 82 | 2341 | Blue sand | Hard | D.S. | Sufficient |
| 8 | S.W.18 | 37 | 27 | 3 | Dug | 40 | 2412 | | | 40 | 2372 | | Hard | D.S. | Sufficient |
| 9 | N.W.21 | " | " | " | " | 30 | 2399 | -16 | 2383 | 30 | 2369 | Gravel | " | " | " |
| 10 | S.E.23 | " | " | " | Bored | 70 | 2440 | -45 | 2395 | 70 | 2370 | | " | " | " |
| 11 | S.E.26 | " | " | " | " | 107 | 2451 | | | 107 | 2344 | Bearpaw | " | " | Limited |
| 12 | N.W.28 | " | " | " | " | 46 | 2367 | -36 | 2331 | 46 | 2321 | " | " | " | Sufficient |
| 13 | N.W.34 | " | " | " | " | 80 | 2334 | -65 | 2269 | 80 | 2254 | Pale Beds | " | " | " |
| 14 | N.E.35 | " | " | " | " | 60 | 2318 | | | 60 | 2258 | Sand " " | " | " | " |
| 1 | S.W. 3 | 37 | 28 | 3 | Dug | 14 | 2275 | | | 14 | 2261 | | Soft | D.S. | Sufficient |
| 2 | N.W. 5 | " | " | " | Drilled | 325 | 2213 | -35 | 2178 | 190 | 2023 | Pale Beds | | | |
| | | | | | | | | | | 320 | 1893 | Pale Beds | Soft | " | Good supply |
| 3 | S.E. 7 | " | " | " | " | 320 | 2259 | -90 | 2169 | 200 | 2059 | Coal below | | | Thin seam of coal |
| | | | | | | | | | | 320 | 1939 | 160'Pale Beds | Soft br. | " | Good supply |
| 4 | S.E. 9 | " | " | " | Dug | 19 | 2200 | | | 19 | 2181 | | " | " | Sufficient |
| 5 | S.W. 9 | " | " | " | Bored | 30 | 2185 | -25 | 2160 | 30 | 2155 | Sand | " | " | " |
| 6 | N.W.12 | " | " | " | " | 80 | 2377 | | | 80 | 2297 | Bearpaw ? | Hard | " | " |
| 7 | N.W.13 | " | " | " | Dug | 63 | 2393 | -30 | 2363 | 63 | 2330 | Shale(Bearpaw ?) | " Alk | " | " |
| 8 | N.E.13 | " | " | " | Bored | 90 | 2402 | -60 | 2342 | 90 | 2312 | Bearpaw ? | " | " | Limited |
| 9 | S.E.14 | " | " | " | " | 80 | 2345 | | | 35 | 2310 | Bearpaw ? sand | " | " | Sufficient |
| 10 | N.W.15 | " | " | " | " | 40 | 2249 | -35 | 2214 | 40 | 2209 | | " | " | " |
| 11 | S.E.16 | " | " | " | " | 40 | 2212 | -36 | 2176 | 40 | 2172 | Gravel | " | D. | Poor supply |
| 12 | N.W.17 | " | " | " | Dug | 20 | 2216 | -15 | 2201 | 20 | 2196 | Sand | Soft | D.S. | Sufficient |
| 13 | N.W.22 | " | " | " | Bored | 100 | 2363 | -90 | 2273 | 100 | 2263 | " F. | Hard | " | " |
| 14 | S.W.23 | " | " | " | Dug | 18 | 2360 | | | 18 | 2342 | Bearpaw sand | " | " | " |
| 15 | S.E.24 | " | " | " | Bored | 90 | 2429 | -60 | 2369 | 90 | 2339 | Bearpaw | " | " | " |
| 16 | N.E.25 | " | " | " | " | 100 | 2401 | -40 | 2361 | 100 | 2301 | Bearpaw ? | " | " | " |
| 17 | S.E.26 | " | " | " | " | 45 | 2355 | -30 | 2325 | 45 | 2310 | | " | " | " |
| 1 | S.E. 4 | 38 | 26 | 3 | Bored | 104 | 2285 | | | 55 | 2230 | | Hard | D.S. | Sufficient |
| 2 | N.W. 7 | " | " | " | " | 49 | 2402 | -40 | 2362 | 49 | 2353 | | " | " | |
| 3 | N.W.12 | " | " | " | Drilled | 180 | 2307 | -40 | 2267 | 180 | 2127 | Pale Beds | Soft Green | | " Coal at 80' in 100' Well. |
| 4 | S.E.15 | " | " | " | " | 312 | 2300 | -160 | 2140 | 312 | 1988 | Pale Beds sand | Soft | " | Abundant. |
| 5 | N.E.20 | " | " | " | Bored | 90 | 2270 | -70 | 2200 | 90 | 2180 | Sand | Hard | " | Sufficient |
| 6 | S.W.22 | " | " | " | Dug | 35 | 2264 | | Low | 35 | 2229 | Glacial sand | " | D. | Limited |
| 7 | N.W.23 | " | " | " | Bored | 90 | 2290 | -70 | 2220 | 90 | 2200 | Grey " | " | D.S. | Sufficient |
| 8 | S.E.24 | " | " | " | " | 40 | 2382 | -36 | 2346 | 40 | 2342 | Gl. gravel | " | " | " |
| 9 | S.E.25 | " | " | " | " | 60 | 2310 | -58 | 2252 | 60 | 2250 | Gravel | " | " | " |

| Well No. | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | S.E.28 | 38 | 26 | 3 | Bored | 45 | 2262 | | | 45 | 2217 | | Hard | D.S. | Sufficient |
| 11 | S.E.30 | " | " | " | " | 66 | 2381 | -20 | 2361 | 66 | 2315 | Bearpaw ? | " | " | " |
| 1 | N.W. 5 | " | 27 | 3 | Bored | 49 | 2305 | -22 | 2283 | 49 | 2256 | Clay | " | D.S. | Sufficient |
| 2 | N.W. 7 | " | " | " | " | 63 | 2357 | | | 63 | 2294 | Sand | " | " | Limited |
| 3 | N.E. 9 | " | " | " | Spring | | 2217 | | | | | | Soft | | Large Flow.C.P.R. Water Supply. |
| 4 | S.W.13 | " | " | " | Bored | 51 | 2445 | -42 | 2403 | 51 | 2394 | Glacial sand | Hard | D.S. | Sufficient |
| 5 | S.E.14 | " | " | " | " | 75 | 2429 | -10 | 2419 | 75 | 2354 | Gravel | | " | " |
| 6 | S.E.15 | " | " | " | " | 60 | 2363 | -45 | 2318 | 60 | 2303 | | " | " | " |
| 7 | S.E.16 | " | " | " | " | 63 | 2256 | -56 | 2200 | 63 | 2193 | Sand | " | " | " |
| 8 | S.E.17 | " | " | " | " | 57 | 2226 | -15 | 2211 | 57 | 2169 | Pale Beds | Soft | D.S.M. | " |
| 9 | S.E.18 | " | " | " | Drilled | 320 | 2220 | -70 | 2150 | 320 | 1900 | Pale Beds Sand | Soft Br. | D.S. | Good supply |
| 10 | N.W.21 | " | " | " | " | 275 | 2253 | -75 | 2178 | 275 | 1978 | Pale sand | Soft | " | Sufficient |
| 11 | S.E.24 | " | " | " | Bored | 40 | 2431 | -38 | 2393 | 40 | 2391 | Sand | Hard | " | " |
| 12 | S.W.26 | " | " | " | " | 96 | 2423 | -60 | 2363 | 96 | 2327 | Gl. gravel | | " | Good supply |
| 13 | S.E.28 | " | " | " | Drilled | 280 | 2279 | -40 | 2239 | 280 | 1999 | Pale Beds | Soft | " | " " |
| 14 | N.W.30 | " | " | " | " | 265 | 2234 | -100 | 2134 | 250 | 1984 | Pale Beds | " $H_2S$ | " | " " |
| 16 | S.E.33 | " | " | " | " | 260 | 2306 | -70 | 2236 | 260 | 2046 | " " | " | " | " " Coal Seams |
| 17 | S.W.36 | " | " | " | Bored | 30 | 2344 | -25 | 2319 | 30 | 2314 | Bearpaw ? sand | | " | Sufficient. Dry Hole 60' Deep. |
| 15 | N.E.32 | " | " | " | Drilled | 275 | 2260 | -100 | 2160 | 275 | 1985 | Pale Beds | " | " | Good supply. |
| 1 | S.E. 1 | " | 28 | 3 | Bored | 40 | 2344 | -30 | 2314 | 40 | 2304 | Sand | Hard | D.S. | Sufficient |
| 2 | S.W. 3 | " | " | " | Drilled | 280 | 2228 | -80 | 2148 | 280 | 1948 | Pale Beds Sand | Soft Br. | " | Good supply |
| 3 | N.E. 4 | " | " | " | " | 400 | 2248 | -70 | 2178 | 320 | 1928 | " " | | | |
| | | | | | | | | | | 400 | 1848 | " " " | " " | " | Good " |
| 4 | N.W. 4 | " | " | " | Drilled | 300 | 2241 | -220 | 2021 | 300 | 1941 | " " " | " " | " | " " |
| 5 | N.W.14 | " | " | " | Bored | 60 | 2240 | -25 | 2215 | 60 | 2180 | Gravel | Hard | " | Sufficient |
| 6 | N.E.18 | " | " | " | Dug | 9 | 2156 | - 6 | 2150 | 9 | 2147 | Sand | " | " | " |
| 7 | N.E.19 | " | " | " | " | 10 | 2178 | - 6 | 2172 | 10 | 2168 | " | " | " | " |
| 8 | S.W.22 | " | " | " | " | 4 | 2230 | | | 4 | 2226 | " | Soft | D. | " |
| 9 | N.E.23 | " | " | " | Drilled | 350 | 2256 | -100 | 2156 | 250 | 2006 | Pale Beds | | | |
| | | | | | | | | | | 325 | 1931 | " " | | | Coal at 330'. |
| | | | | | | | | | | 350 | 1906 | " " | | D.S. | Good supply |

| Well No. | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 | S.W.25 | 38 | 28 | 3 | Bored | 40 | 2211 | -20 | 2191 | 40 | 2171 | Pale Beds ? | Soft | | D.S. | Good supply |
| 11 | S.W.26 | " | " | " | Dug | 45 | 2235 | | | 45 | 2190 | Sand | Hard | | " | Limited |
| 12 | S.W.32 | " | " | " | Bored | 50 | 2216 | | | 50 | 2166 | " | " | | " | Good supply |
| | | | | | | | | | | | | | | | | |
| 1 | S.E. 1 | 39 | 26 | 3 | Bored | 50 | 2225 | -30 | 2195 | 50 | 2175 | Sand | Hard | | D.S. | Sufficient |
| 2 | S.E. 3 | " | " | " | Dug | 18 | 2190 | - 9 | 2181 | 18 | 2172 | Gravel | " | | " | " |
| 3 | S.W. 3 | " | " | " | Drilled | 260 | 2277 | -120 | 2157 | 260 | 2017 | Pale Beds Sand | Soft | | " | Abundant |
| 4 | N.E.15 | " | " | " | Bored | 40 | 2207 | -38 | 2169 | 40 | 2167 | Clay | Hard | | D. | Limited |
| 5 | S.E.16 | " | " | " | " | 60 | 2213 | | | 60 | 2153 | | " | | D.S. | Poor supply |
| 6 | S.E.17 | " | " | " | Dug | 40 | 2257 | -38 | 2219 | 40 | 2217 | Sand | " | | " | Limited |
| 7 | N.E.19 | " | " | " | Bored | 80 | 2206 | -30 | 2176 | 60 | 2146 | Pale Beds | " | | " | Sufficient |
| 8 | N.E.23 | " | " | " | " | 150 | 2221 | | High | 150 | 2071 | Pale Beds | " | | " | " |
| 9 | N.W.23 | " | " | " | " | 90 | 2208 | -80 | 2128 | 90 | 2118 | " " | " | | " | Good supply |
| 10 | N.E.24 | " | " | " | Drilled | 220 | 2165 | -60 | 2105 | 220 | 1945 | Pale Beds | " | | S. | Sufficient |
| 11 | N.W.27 | " | " | " | Bored | 30 | 2212 | | | 30 | 2182 | Gravel | " | | D.S. | Poor supply |
| 12 | N.W.28 | " | " | " | " | 35 | 2224 | -33 | 2191 | 35 | 2189 | Sand | " | Alk. | " | Limited |
| 13 | S.W.29 | " | " | " | " | 65 | 2184 | -18 | 2166 | 65 | 2119 | Pale Beds | " | " | " | Sufficient |
| 14 | N.E.30 | " | " | " | " | 80 | 2210 | | | 80 | 2130 | | " | | " | " |
| 15 | S.E.32 | " | " | " | Drilled | 300 | 2223 | -70 | 2153 | 300 | 1923 | Pale Beds Ironstone 1923. | Soft | | " | 100 Bbl. per day. |
| 16 | S.W.32 | " | " | " | Bored | 96 | 2237 | -93 | 2144 | 96 | 2141 | Pale Beds. | Hard | | " | Good supply |
| 17 | N.W.35 | " | " | " | " | 80 | 2171 | -70 | 2101 | 80 | 2091 | " " | " | | " | Sufficient |
| 18 | N.E.35 | " | " | " | " | 54 | 2177 | -25 | 2152 | 54 | 2123 | Pale Beds. Sand | " | | " | " |
| | | | | | | | | | | | | | | | | |
| 1 | S.E. 4 | 39 | 27 | 3 | Bored | 60 | 2252 | | | 60 | 2192 | Glacial gravel | Hard | | | |
| 2 | S.E. 5 | " | " | " | Drilled | 365 | 2271 | -110 | 2161 | 280 | 1991 | Pale Beds | | | | |
| | | | | | | | | | | 365 | 1906 | " " | Soft | | D.S. | Sufficient |
| 3 | N.E. 9 | " | " | " | Bored | 80 | 2274 | -70 | 2204 | 80 | 2194 | | Hard | | " | Good supply |
| 4 | N.W.12 | " | " | " | " | 48 | 2268 | -41 | 2227 | 48 | 2220 | | " | | " | Poor " |
| 5 | S.W.14 | " | " | " | " | 39 | 2244 | -18 | 2226 | 39 | 2205 | | " | | " | Sufficient |
| 6 | N.E.17 | " | " | " | " | 101 | 2166 | | | 101 | 2065 | Coal 7' thick. | Bad | | S. | " |
| 7 | S.W.22 | " | " | " | " | 40 | 2220 | -32 | 2188 | 40 | 2180 | Sand | Hard | Alk. | D.S. | " |
| 9 | N.E.27 | " | " | " | Dug | 40 | 2252 | -14 | 2238 | 40 | 2212 | | " | | S. | " |
| 10 | S.W.27 | " | " | " | Bored | 68 | 2204 | | | 55 | 2149 | | " | | D.S. | Poor supply |
| 8 | N.E.25 | " | " | " | " | 55 | 2212 | | | 55 | 2157 | | " | | " | Sufficient. |

| Well No. | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11 | N.E.28 | 39 | 27 | 3 | Dug | 32 | 2163 | | | 32 | 2131 | | Hard | D.S. | Limited |
| 12 | S.W.28 | " | " | " | Bored | 40 | 2199 | | | 40 | 2159 | | " | " | Poor Supply |
| 13 | N.W.31 | " | " | " | " | 65 | 2194 | | | 65 | 2129 | Glacial gravel | " | " | Sufficient |
| 14 | S.E.32 | " | " | " | " | 40 | 2159 | | | 40 | 2119 | Coal at 90' | | | " |
| | | | | | | | | | | | | in another Well | " | D.S.M. | |
| 1 | N.E. 3 | " | 28 | 3 | Drilled | 525 | 2174 | -45 | 2129 | 250 | 1924 | Pale Beds | | | |
| | | | | | | | | | | 525 | 1649 | Ribstone Ck. | Salty | | Good supply, Gas |
| 2 | " " " | | | | " | 250 | 2174 | -60 | 2114 | 250 | 1924 | Pale Beds | Soft | D.S.M. | " " |
| 3 | S.E.10 | " | " | " | " | 265 | 2203 | | | 265 | 1938 | " " | " | D.M. | " " |
| 4 | S.W.11 | " | " | " | " | 260 | 2217 | | | 260 | 1957 | " " | | | |
| 5 | S.W.13 | " | " | " | " | 225 | 2214 | -90 | 2124 | 225 | 1989 | " " | " | D.S. | Sufficient |
| 6 | N.E.14 | " | " | " | " | 280 | 2210 | -80 | 2130 | 280 | 1930 | " " | " | " | Good supply |
| 7 | S.W.14 | " | " | " | " | 340 | 2258 | -140 | 2118 | 340 | 1918 | " " sand | " | D. | Sufficient |
| 8 | N.W.16 | " | " | " | " | 225 | 2311 | -100 | 2211 | 225 | 2086 | " " ? | " | D.S. | Good supply |
| 9 | S.E.17 | " | " | " | " | 285 | 2214 | -10 | 2204 | 260 | 1954 | " " | " | " | Waters 100 head. |
| 10 | N.E.17 | " | " | " | " | 280 | 2289 | -180 | 2109 | 280 | 2009 | " " | " | " | Abundant |
| 11 | S.W.20 | " | " | " | Dug | 80 | 2328 | -76 | 2252 | 80 | 2248 | Glacial | Hard | " | Sufficient |
| 12 | S.E.21 | " | " | " | Drilled | 300 | 2289 | -120 | 2169 | 300 | 1989 | Pale Beds | Soft | " | Abundant |
| 13 | N. W22 | " | " | " | " | 225 | 2253 | -115 | 2138 | 225 | 2028 | " " | Hard | " | " |
| 14 | N.W.24 | " | " | " | Bored | 100 | 2225 ± | | | 100 | 2125 | Sand F. | " | " | Sufficient |
| 15 | N.E.25 | " | " | " | Drilled | 490 | 2242 | -60 | 2182 | 250 | 1992 | Pale Beds | Soft | " | |
| | | | | | | | | | | 490 | 1752 | Variegated Beds | " | " | Sufficient |
| 16 | N.W.26 | " | " | " | Bored | 60 | 2160 | -56 | 2104 | 60 | 2100 | Sand | Hard | " | Limited |
| 17 | N.E.28 | " | " | " | Drilled | 275 | 2224 | | High | 275 | 1949 | Pale Beds | Soft | " | Abundant |
| 18 | S.W.32 | " | " | " | " | 380 | 2270 | -100 | 2170 | 280 | 1990 | " " sand | | | |
| | | | | | | | | | | 380 | 1890 | " " " | Soft | " | Abundant |
| 19 | N.E.34 | " | " | " | Drilled | 180 | 2122 | -15 | 2107 | 180 | 1942 | " " " | " | D. | Sufficient. School. |
| 20 | N.E.34 | " | " | " | Bored | 50 | 2146 | -30 | 2116 | 50 | 2096 | " "? " | Hard | D.S. | " |
| 21 | S.E.36 | " | " | " | Drilled | 300 | 2214 | -120 | 2094 | 260 | 1954 | Pale Beds | | | |
| | | | | | | | | | | 300 | 1914 | " " | Soft | " | Good supply |
| 22 | N.E.36 | " | " | " | " | 100 | 2145 | | | 100 | 2045 | Pale Beds | Hard | " | Sand trouble. |
| | | | | | | | | | | | | Coal at 40'. | | | |