CANADA
DEPARTMENT OF MINES
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TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

WATER SUPPLY PAPER No. 270

GROUND-WATER RESOURCES OF TOWNSHIPS 39 TO 42, RANGES 9 TO 12, WEST OF 4th. MERIDIAN, ALBERTA

Records collected by P. S. Warren and
G. S. Hume; compiled by G. S. Hume

OTTAWA
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C A N A D A

DEPARTMENT OF MINES AND RESOURCES

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BUREAU OF GEOLOGY AND TOPOGRAPHY

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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 central 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 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. C. 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 concerning 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 11, 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 subtracting 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 lines 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 salts 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 IN EAST-CENTRAL ALBERTA

The formations that outcrop in east-central Alberta are mainly of Upper Cretaceous age, but Tertiary beds occur to the southwest in the Red Deer area. These higher strata are sandstones and shales with thin coaly and carbonaceous beds. Commercial coal beds occur in the Upper Cretaceous Edmonton formation, but other thin coal seams are present, particularly in the Ribstone Creek formation and in the Pale and Variegated Beds. Carbonaceous beds also occur in the Bearpaw formation and are widely scattered through other formations. The Edmonton formation contains some harder sandstones, but almost the whole Upper Cretaceous succession consists of softer sands and sandstones alternating with shales in which ironstone nodules are commonly present. The succession, character, and estimated thickness of the formations are shown in the following table:

Age	Formation	Character	Thickness
			Feet
Tertiary	Paskapoo	Sandstones and shales with thin coal seams and carbonaceous beds; basal sandstones, massive and crossbedded; some siliceous limestone 150 to 200 feet above the base of the formation.	A few hundred feet thick in Red Deer area. The thickness increases to the south and west.

	Edmonton	Grey to white bentonitic 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 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 northwest.
Upper Cretaceous	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 with a few minor sand horizons; marine origin, with 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 seams in the vicinity of Wainwright; mostly non-marine, but intermediate 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.	950 to 1,100

Paskapoo Formation

The Paskapoo formation was first named by Tyrrell from exposures of the lower part of the formation occurring along Blindman

River near its confluence with the Red Deer. It is composed essentially of sandstones and shales of freshwater deposition, and includes some thin coal seams and carbonaceous beds. The basal beds are massive, crossbedded sandstones that weather buff-yellow, and are in striking contrast to the underlying, light-coloured, bentonitic clays of the Edmonton formation. About 150 to 200 feet above the base of the formation are beds of siliceous limestones containing gastropods and pelecypods, but these beds are lenticular rather than continuous, although a zone of them appears widely distributed at about the same stratigraphic level.

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 eastwards, 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 dip in that direction and are bevelled across at the surface.

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 whiten 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. Water occurs in these sands, and, hence, 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, Alberta, 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 Macklin 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 lenticular, 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, Pale and Variegated Beds occur over a wide area from Macklin 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 eastwards 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 sulphate 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 noted 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 aquifer, 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 Jasper 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 eastwards 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. 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, the upper part of the lower sand member of this formation outcrops. 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 180 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 southern boundary on the Alberta-Saskatchewan meridian is in the south part of township 44, south of Battle River, whereas the northern boundary is in township 51, a few miles north of Lloydminster. 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 Tit 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 only 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. Consequently, 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 freshwater 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.

TOWNSHIPS 39 to 42, RANGES 9 to 12, WEST FOURTH MERIDIAN, ALBERTA

Physical Features

Battle Creek crosses this area from southwest to northeast. It has cut a valley 300 to 350 feet deep, and is joined by deeply incised but rather short tributary streams. The highest part of the area is Flagstaff Hill with an altitude of 2,650 feet, or about 650 feet above the lowest part of Battle River to the east. The area immediately west of Battle River, in township 40, 41, and 42, is rather hilly, but farther west on the west margin of the area the country is flat farming land. All the area is north of the treeless plains, and is in the parklands belt where groves of poplar trees occur.

Geology

The northeast part of the area is underlain by Pale Beds, but the western and southwestern part is underlain by the Bearpaw formation with the Edmonton appearing along the west margin. With the exception of a small area of Pale Beds outcrops that occur east of Bellshill Lake in tp. 42, rge. 11, all bedrock exposures are confined to Battle River Valley and tributaries.

Water Supply

The drift in this area is believed to be comparatively thin, but a few wells in the southwest part are thought to obtain water from it. There are several water-bearing sands in the Bearpaw and also a considerable number in the Pale Beds, but many wells have had to be sunk deeply to obtain an adequate supply.

Township 39, Range 9. The surface elevation of part of this township is slightly less than in that to the east, and there is less regularity in the elevations of the water-bearing beds. An aquifer at an approximate elevation of 2,400 feet occurs in a few wells, and it is possible if this is in the Bearpaw formation that other wells such as that 80 feet deep on NW. section 3 are also in bedrock. It is thought that a well, 490 feet deep, drilled on SE. section 5 struck a water sand in the Pale Beds at a depth of 171 feet, or an elevation of 2,271 feet. Below this to 490 feet no further water was reported. It is presumed that at this locality the Pale Beds are covered by a few feet of Bearpaw strata.

Township 39, Range 10. In this township one sand in the Bearpaw formation at an approximate elevation of 2,350 feet yields water in a few wells. A higher sand at an elevation of 2,425 feet occurs in a few wells, but it is uncertain whether it is a Bearpaw or glacial sand. The shallower wells are in glacial drift, and as the glacial sands are irregularly distributed the water-bearing beds in them show little or no uniformity of level.

Township 39, Ranges 11 and 12. In these townships, as in the one to the east, water occurs in sands at an elevation of about 2,425 feet, but here these sands seem definitely to be in glacial materials. One well on SE. section 21, which reaches a depth of 100 feet or an elevation of 2,325 feet, is known with certainty to be in Bearpaw strata.

As indicated by outcrops on Battle River in tp. 39, rge. 11, the contact between the Pale Beds and Bearpaw formation occurs at an elevation of about 2,100 feet. Thus wells in tp. 39, rges. 11 and 12, that obtain water in bedrock above this level are probably in the Bearpaw formation. Such a well on NE. sec. 33, tp. 39, rge. 12, 180 feet deep, which reaches a water-bearing sand at about 2,200 feet, is thought to be in the Bearpaw,

as is another well on NW. sec. 34, tp. 39, rge. 12, which obtains water at 75 feet or at an elevation of 2,308 feet. All other wells are thought to be in sands in the glacial drift and show no uniformity of level.

Township 40, Range 9. In this township Pale Beds outcrop along the banks of Battle River below an elevation of 2,200 feet. The elevation of the Bearpaw-Pale Beds contact is not known, although it is assumed to be considerably higher than this. Bearpaw beds are thought to cover the south part of this township, but the northern part is underlain only by Pale Beds. One well on NE. section 6 reports gravel at 75 feet, so that glacial materials may have a considerable depth. Several wells between 100 and 200 feet deep obtain water from sands in the Pale Beds, and indicate the presence of at least three sands at elevations of about 2,340, 2,390, and 2,230 feet respectively. A deeper water-bearing sand at an elevation of about 2,000 feet is present in a well 400 feet deep on NE. section 26.

Township 40, Range 10, North of Battle River. Some of the wells in this township obtain water from sands in the glacial drift and others reach the underlying bedrock sands. Many of the deeper wells obtain water in sands believed to be Bearpaw, but one well, 346 feet deep, on NW. section 6 reached a water-bearing sand presumably in the Pale Beds at an elevation of 2,068 feet. It is thought that many sands in the Pale Beds would yield water should it become necessary to secure a further supply.

Township 40, Range 11. This township is entirely underlain by beds of the Bearpaw formation in which a number of water-bearing sands occur in wells up to 150 feet deep. A water-bearing sand occurs at an elevation of about 2,385 feet and is present in a well 42 feet deep on NE. section 2, in a well 40 feet deep on NW. section 5, in a well 30 feet deep on NE. section 10, and in a well 60 feet deep on NE. section 30. The uniformity in elevation of this aquifer suggests that it might be a sand in the Bearpaw formation. If this is so, probably all the wells of which records are available are in the Bearpaw, although some of them may be in sands in the glacial drift. It thus is concluded that the Bearpaw offers good prospects for a supply of water. Deeper sands than any reached in this township are undoubtedly water-bearing.

Township 40, Range 12. In this township the drift appears to be comparatively thin and contains few water-bearing sands. Most of the wells appear to have been sunk into the underlying Bearpaw formation, where water is obtained at various levels. The sand that in tp. 40, rge. 11, yields water at an elevation of 2,385 feet is also productive in several wells in this township. In most of the township, however, the surface has been eroded below this level. Deeper beds appear to contain only local lenticular bodies of sand, which are water-bearing over limited areas.

Township 41, Range 9. Conditions in this township are similar to those in tp. 41, rge. 8. A few wells at depths of 15 to 40 feet obtain water at various levels in sands in the drift, and three others have been drilled into Pale Beds, where sands have been encountered. A well 135 feet deep, on SE. section 2, reached a sand at an elevation of 2,285 feet. This may be the same sand that in tp. 41, rge. 8, occurs at 2,275 feet, but due to possible inaccuracies in reported depths it should not be concluded that a northeast dip is present. Another water-bearing sand occurs in a well, 150 feet deep, on SW. section 36 at an elevation of about 2,225 feet, and a somewhat higher sand was found to yield water on NW. section 36 at a depth of 165 feet or an elevation of 2,181 feet. This is about the elevation of a water-bearing horizon in tp. 41, rge. 7, but it is not certain that it is at the same stratigraphic level.

Township 41, Range 10. A few wells in this township obtain water in glacial drift that in SE. section 2 is at least 50 feet thick. Most of the wells, however, are believed to have reached the underlying bedrock, and in them water occurs at various levels. A well, 75 feet deep,

on SE. section 18 reaches water in what may be the Bearpaw formation at an elevation of 2,305 feet, but presumably the other wells are in sands in the Pale Beds. One sand occurs at an elevation of 2,240 feet, another at 2,205 to 2,210 feet, and the lowest one, in a well 150 feet deep on NW. section 34, at an elevation of 2,160 feet.

Township 41, Range 11. In this township some wells obtain water from sands in the drift, but there is no regularity in the level of the producing beds. Other wells, however, reach the underlying bedrock. Most wells obtain water in the Bearpaw formation, but in one well 210 feet deep on SE. section 31 a water-bearing sand, presumably in the Pale Beds, has been reached at an elevation of 2,058 feet. The most persistent horizon in the Bearpaw is at an elevation of about 2,280 feet, but water is not always found at this level in every well. It is certain that wells that do not find a sufficient supply in the Bearpaw will encounter other water-bearing sands in the Pale Beds.

Township 41, Range 12. In this township a few wells obtain water from sands in the glacial drift, but other deeper wells reach bedrock. Water occurs both in the Bearpaw formation and in the Pale Beds. In the Bearpaw only one sand, at an elevation of 2,360 feet, is known. Three sands, at least, are known to be present in the Pale Beds, the lowest one occurring at an elevation of 2,006 feet in a well 246 feet deep on NE. section 35.

Township 42, Range 9. Several shallow wells, 10 to 25 feet deep, obtain water in this area in glacial materials. Springs also occur along Battle River Valley. Most wells, however, are 100 to 225 feet deep, and reach water-bearing sands in the Pale and Variegated Beds. The highest bed is at an elevation of about 2,180 feet in two wells, respectively on SW. section 1 at a depth of 166 feet and on NE. section 1 at a depth of 155 feet. A zone of sands between elevations of 2,050 and 2,080 feet provides water in wells on NE. section 15 at a depth of 210 feet, on SE. section 16 at a depth of 193 feet, on SE. section 22 at a depth of 226 feet, on NW. section 28 at a depth of 180 feet, on SE. section 34 at a depth of 220 feet, and on SW. section 35 at a depth of 226 feet. Thus, this seems to be a particularly good water-bearing sand zone in this township.

Township 42, Range 10. In this township many wells are drilled into the Pale Beds for their water supply. In only two wells, however, is a common sand productive at an elevation of 2,095 feet. Other water-bearing sands within these beds are found at both higher and lower levels, and are probably lenticular masses of no considerable lateral continuity. The Pale Beds appear, however, to everywhere offer the prospect of an adequate supply of water.

Township 42, Range 11. In this township all but a few wells are more than 100 feet deep and are believed to obtain their supply of water from the Pale Beds. The highest known water sand occurs at an elevation of 2,135 to 2,140 feet in two wells, namely, in a well 90 feet deep on NW. section 9 and in a well 110 feet deep on NE. section 29. Several wells get water between elevations of 2,095 and 2,100 feet, and presumably this is the same horizon as in tp. 42, rge. 10, at an elevation of 2,095 feet. Three wells, one on SW. section 3 at a depth of 180 feet, another on SE. section 17 at a depth of 150 feet, and a third on SW. section 21 at a depth of 200 feet, obtain water at an elevation of about 2,075 feet. Most of the wells, however, reach water-bearing beds between elevations of 2,010 and 2,065 feet, probably in a zone of sand beds that shows considerable variation in porosity and thus produces from slightly different levels at different localities. In this township there are probably other deeper sands than any so far reached. One well, 300 feet deep, on SW. section 31 reaches a water-bearing sand at an elevation of 1,954 feet, and as such is the deepest well in this area.

Township 42, Range 12. Nearly all the wells in this township are deep and obtain their water from sands in the Pale Beds. In a few wells isolated sands produce water, but most of the sands are of considerable extent and yield water in more than one well. The highest widespread sand occurs at an elevation of 2,130 to 2,140 feet. Other similar sands occur at elevations of 2,085 to 2,095 feet, 2,060 to 2,065 feet, 2,045 feet, 2,020 to 2,035 feet, 1,990 to 1,995 feet, 1,960 to 1,965 feet, and 1,930 to 1,940 feet. Two wells in the group of six that obtain water from sands at elevations of 2,020 to 2,035 feet are flowing, the surface elevation of the highest being 2,212 feet. In a few other wells water rises above this level, but the surface is too high to allow these to flow. The Pale Beds in this township are the main source of water, and probably there are deeper water-bearing beds than any so far reached.

WELL RECORDS—Rural Municipality of TOWNSHIPS 39-42, RANGES 9-12, WEST OF 4TH MERIDIAN, ALBERTA

B 4-4
1800—10,000

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	NW	3	39	9	4	Bored	80	2433	-60	2373	80	2353	Bearpaw	Hard		D.S.	Limited supply
2	SW	4				"	72	2465	-30	2435	72	2393	" ?	"		"	Good supply
3	SE	4				"	65	2475			65	2410	Bearpaw ?	"		"	Limited supply
4	SE	5				Drilled	490	2442	-70	2372	171	2271	Pale Beds	Soft Br.		"	Sufficient
5	NW	10				Bored	47	2402	-25	2377	47	2355	Glacial	Hard		"	Limited supply
6	NE	10				Dug	27	2408	-20	2388	27	2381	"	"		"	" "
7	SW	10				"	8	2323	- 5	2318	8	2315	"	"		"	Sufficient
8	NW	13				"	8	2359	- 4	2355	8	2351	"	Soft		"	"
9	NW	16				Bored	72	2380			72	2308	"	Hard		"	Limited supply
10	SE	16				"	71	2377	-21	2356	71	2306	"	"		"	Good "
11	SE	18				Dug	30	2474	-24	2450	30	2444	"	"		"	Limited "
12	NE	19				Bored	40	2444			40	2404	" ?	"		"	" "
13	SW	20				Dug	45	2441			45	2396	Bearpaw Gray sand	"		"	" "
14	SW	28				"	72	2395	-20	2375	72	2323	Bearpaw sand	Soft		"	Good supply
15	SW	30				"	35	2431	-20	2411	35	2396	Glacial ?	Hard		"	" "
16	SW	32				Bored	55	2380	-30	2350	55	2325	" gravel	"		"	Sufficient
17	SE	34				"	45	2361	-35	2326	45	2316	"	"		"	Limited supply
1	SW	2	39	10	4	Dug	40	2500			40	2460	Glacial sand	Hard		D.S.	Sufficient
2	NE	6				"	20	2450	-12	2438	20	2430	" "	"		"	"
3	SW	12				Bored	45	2450	-40	2410	45	2405	"	Hard Alk.		S.	Good supply
4	NW	14				"	42	2468			42	2426	Sand	"		D.S.	Sufficient
5	NE	14				"	84	2510			84	2426	Glacial	"		"	Good supply
6	NW	16				Dug	22	2470			22	2448	Glacial sand	"		"	Sufficient
7	NE	16				Bored	103	2465	-16	2449	103	2362	Clay-Bearpaw?	"		"	"
8	SE	18				"	47	2475			47	2428	Sand-Bearpaw?	"		"	"
9	NE	20				"	76	2418	-74	2344	76	2342	Fine sand	"		"	Limited supply
10	SW	22				"	60	2485			60	2425	" "	" Alk.		S.	Poor "
11	SW	24				"	162	2510	-142	2368	162	2348	Bedrock	Soft		D.S.	Limited "
12	SE	28	39	10	4	"	73	2433	-43	2390	73	2360	Sandy clay-Bearpaw?	Hard		"	Good supply
13	NW	36	"	"	"	Dug	26	2390	-25	2365	26	2364	Glacial sand	"		"	Limited
1	SW	4	39	11	4	Dug	40	2430	-35	2395	40	2390	Blue sand	Hard		D.S.	Limited supply
2	SE	6				"	40	2410	-36	2374	40	2370	Sand	"		S.	Sufficient. Numerous springs in vicinity.
3	SE	12				Bored	32	2455	-26	2429	32	2423	Glacial sand	"		D.S.	Poor supply.
4	SW	12				Dug	35	2460	-30	2430	35	2425	Fine sand	"		"	Sufficient
5	SE	21				"	100	2425	-98	2327	100	2325	Bearpaw	"		"	Poor supply
6	NE	24				"	65	2460	-60	2400	65	2395	Fine sand	"		"	Sufficient
1	SW	32	39	11	4	Bored	57	2400			57	2343	Glacial sand	Hard		D.S.	Limited supply
2	NE	32				Dug	45	2420	-40	2380	45	2375	Glacial	Soft		"	" "
3	NW	34				Drilled	80	2402	-40	2362	80	2322	Black sand	Hard		"	Sufficient
1	SW	2	39	12	4	Dug	40	2309			40	2369	Blue sand	"		"	Limited supply
2	NE	32	39	12	4	Bored	60	2361	-58	2303	60	2301	Sand	Hard		D.S.	Poor supply
3	NE	33				Drilled	180	2379			180	2199	Bearpaw Pale Beds sand	Soft		"	Good "

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.

(Br) Brown (Alk) Alkaline

WELL RECORDS—Rural Municipality of

B 4-4
1800—10.00

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
4	NW	34	39	12	4	Drilled	75	2383	-45	2338	75	2308	Bearpaw sand	Hard		D.S.	Sufficient
5	SE	36				Dug	44	2402			44	2358	Sand	Soft		"	"
1	SW	2	40	9	4	Bored	65	2390	-45	2345	65	2325	Glacial	Hard		"	Limited supply
2	SW	4				"	60	2384	-55	2329	60	2324	"	"		"	Poor "
3	NE	6				"	75	2375	-55	2320	75	2300	Glacial gravel	"		"	Limited "
4	NE	10				"	110	2422	-90	2332	110	2312	Bearpaw	"		"	" "
5	NW	12				Dug	15	2465			15	2450	Glacial	"		"	" "
6	SE	16				Drilled	135	2402	-100	2302	115	2287	Pale Beds	"		"	Good "
7	NW	17				"	180	2410			180	2230	Pale Beds sand	"		"	" "
8	SE	18				Bored	66	2420			66	2354	Glacial	"		"	Poor "
9	NE	23				Drilled	150	2442	-50	2392	150	2292	Pale Beds	"		"	Good supply
10	SW	24				Dug	35	2386	-30	2356	35	2351	Glacial gravel	"		"	Limited supply
11	SE	24				Drilled	165	2503			165	2338	Bearpaw sand	"		"	Good supply
12	NE	24				Bored	36	2467	-16	2451	36	2431	Glacial	"		"	Poor "
13	NE	24				"	121	2467			121	2346	Bearpaw sand	"		"	
14	NE	26				Drilled	65	2397			65	2332	"	"		"	Sufficient
15	NE	26				"	400	2397			400	1997	Pale Beds	Soft		"	Sand trouble.
1	NW	2	40	10	4	Bored	40	2340	-20	2320	40	2300	Sand	Hard		"	Sufficient
2	NW	6	40	10	4	Drilled	346	2414	-266	2148	346	2068	Pale Beds sand	Soft		D.S.	Limited supply.
3	NE	16				Dug	60	2410	-40	2370	60	2350	Sand	Hard		"	Good supply
4	SW	18				Bored	56	2404			56	2348	"	" Alk.		"	Sufficient
5	NW	18				Drilled	242	2390	-27	2363	186	2204	Pale Beds sand	"		"	Good supply
6	NE	18				Bored	84	2390			84	2306	Bearpaw "	"		"	Sufficient
7	SE	28				Dug	41	2350	-26	2324	41	2309	Glacial sand	"		"	Poor supply
8	NE	28				Drilled	169	2425	-100	2325	169	2256	Pale Beds sand	"		"	Good supply
9	NE	30				Bored	120	2439			120	2319	Bearpaw sand	"		"	
10	SE	32				Drilled	117	2410	-40	2370	117	2293	" "	Soft		"	" "
11	SW	32				"	114	2403			114	2289	" "	Hard		"	Sufficient
12	NW	32				"	135	2426	-80	2346	135	2291	" "	"		"	Good supply
13	SE	34				Bored	50	2380			50	2330	Sand	"		"	Poor "
1	NE	2	40	11	4	Dug	42	2426	-41	2385	42	2384	Bearpaw sand	Hard		D.S.	Sufficient
2	NW	4				"	57	2416			56	2360	Fine "	"		"	"
3	NW	5				"	40	2427			40	2387	Bearpaw sand	"		"	"
4	NE	10				"	30	2413	-26	2387	30	2383	" "	"		"	"
5	SE	11				"	70	2428			70	2358	Clay	"		"	Poor supply
6	SE	14				Drilled	82	2430	-22	2408	82	2348	Bearpaw sand	"		"	Sufficient
7	NW	22				Bored	52	2412			52	2360	Blue clay	"		"	"
8	NE	28				"	100	2427			100	2327	Bearpaw	"		"	Limited supply
9	NE	30				Dug	60	2447			60	2387	" clay	"		"	Sufficient
10	NW	34				Drilled	150	2452	-40	2412	150	2302	Bearpaw sand	"		"	"
11	NE	36				Dug	100	2421	-97	2324	100	2321	Bearpaw sand	"		"	"
1	NE	1	40	12	4	Drilled	48	2422			48	2374	Sand	Hard		D.S.	Sufficient
2	SE	2				"	76	2385	-15	2370	76	2309	Bearpaw sand	"		"	"
3	NW	2				"	60	2390	-20	2370	60	2330	Gray sand	"		"	"
4	NW	8				"	100	2355	-17	2338	100	2255	Bearpaw or Pale Beds sand	Soft		"	"

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. (Br) Brown (Alk) Alkaline

WELL RECORDS—Rural Municipality of

B 4-4
1860—10,000

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
5	NW	9				Drilled	102	2375	-85	2290	102	2273	Bearpaw sand	Soft		D.S.	Sufficient
6	NE	9				Dug	25	2369	-20	2349	25	2344	Glacial sand	Hard		"	"
7	NW	10				Bored	40	2420	-15	2405	40	2380	Bearpaw sand	"		"	"
8	SW	13				Dug	33	2414	-33	2381	33	2381	" "	"		"	"
9	NW	14				"	52	2440	-50	2390	52	2388	" "	"		"	"
10	NW	18				"	32	2352	-30	2322	32	2320	Glacial	Soft		"	"
11	SW	18				Drilled	115	2342	-15	2327	115	2227	Bearpaw or Pale Beds sand	"		"	"
12	NE	18				"	120	2358	-18	2340	120	2238	Bearpaw sand	Hard Alk.		"	Good supply
13	NW	20				"	83	2355	-20	2335	83	2272	Bearpaw or Pale Beds sand	Soft		"	" "
14	SE	22				Dug	40	2430	-35	2395	40	2390	Bearpaw clay	Hard		"	Sufficient
15	NE	35				Drilled	120	2407			120	2287	Bearpaw or Pale Beds sand	"		"	Good supply
16	NE	36				"	123	2439			123	2316	Bearpaw "	"		"	Sufficient
1	SE	2	41	9	4	Drilled	135	2420	- 8	2412	135	2285	Pale Beds	"		"	Sufficient
2	SE	11				Dug	40	2425			40	2385	Clay	"		"	Poor supply
3	SE	12				"	25	2435			25	2410	Fine sand	"		"	" "
4	SW	22				"	16	2421	- 5	2416	16	2405	Glacial	"		"	Limited supply
5	NW	22				"	22	2431	-16	2415	22	2409	" clay	Soft		"	" "
6	NE	32				"	32	2147	-30	2117	32	2115	" sand	"		"	" "
7	NW	34				"	37	2381	-34	2347	37	2344	" "	Hard		"	Sufficient
8	SW	36				Drilled	150	2376	-135	2241	150	2226	Pale & Variegated Beds	" Alk.		"	"
9	NW	36				"	165	2346	-135	2211	165	2181	Pale & Variegated Beds	"		"	"
1	SE	2	41	10	4	Bored	50	2350	-42	2308	50	2300	Glacial gravel	Hard		D.S.	Poor supply
2	NW	5				Drilled	165	2404			165	2239	Pale Beds sand	"		"	Good "
3	SW	14				Dug	22	2234	-19	2215	22	2212	Glacial sand	"		"	Sufficient
4	SE	15				"	46	2262	-42	2220	46	2216	Glacial clay	"		"	Limited supply
5	SE	18				"	75	2380	-73	2307	75	2305	Bearpaw?sand	"		"	Sufficient
6	NE	18				Drilled	155	2383			155	2228	Pale Beds	"		"	Good supply
7	NE	19				"	160	2366			160	2206	Pale Beds sand	"		"	" "
8	NW	20				"	155	2383	-40	2343	155	2228	" " "	"		"	" "
9	NE	20				Bored	64	2303	-10	2293	64	2239	Sand	"		"	Sufficient
10	NE	21				Drilled	114	2354			114	2240	Pale Beds	"		"	"
11	NW	22				Bored	40	2235			40	2195	Glacial sand	"		"	"
12	SE	28				Drilled	150	2360			150	2210	Pale Beds	"		"	"
13	NE	30				"	165	2353	-65	2288	165	2188	" "	"		N.	Plugged with sand. Another Well 50 feet deep.
14	SW	32				Dug	33	2332	-30	2302	33	2299	Fine sand	"		D.S.	Good supply.
15	SE	33				Drilled	125	2337	-57	2280	125	2212	Pale Beds sand	"		"	Sufficient
16	NE	33				"	135	2331			135	2196	Pale Beds sand	"		"	"
17	NW	34				"	150	2312			150	2162	" " "	"		"	"
1	SE	2	41	11	4	Dug	92	2427			92	2335	Bearpaw	Hard		D.S.	Sufficient
2	SW	2				Drilled	140	2369			140	2229	" sand	"		"	"
3	SW	4				"	190	2468			190	2278	" "	"		"	Good supply

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

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

WELL RECORDS—Rural Municipality of

B 4-4
1860—10,000

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
4	NE	4	41	11	4	Dug	60	2461	-53	2408	60	2401	Sand	Hard		D.S.	Sufficient
5	SW	5				Drilled	180	2460			180	2280	Bearpaw sand	"		"	Good supply
6	SW	6				Bored	40	2455			40	2415	Glacial sand	"		"	Sufficient
7	NW	10				Drilled	195	2484	-75	2409	195	2289	Bearpaw sand	"		"	Good supply
8	NW	15				"	202	2470	-85	2385	202	2268	" "	"		"	Sufficient
9	NE	17				Dug	87	2570			87	2483	" "	Soft		"	Good supply
10	SE	18				Drilled	210	2590	-190	2400	210	2380	Bearpaw sand	"		"	Sufficient
11	NE	19				Dug	28	2351	-26	2325	28	2323	Glacial sand	"		"	Limited supply
12	NW	20				"	26	2370			26	2344	" "	Hard		"	" "
13	NW	22				"	35	2402	-30	2372	35	2367	" "	"		"	Sufficient
14	NE	24				Bored	64	2356	-54	2302	64	2292	Sand	"		"	"
15	SW	30				"	65	2308			65	2243	Glacial clay	"		"	Limited supply
16	SE	31				Drilled	210	2268	-30	2238	210	2058	Pale Beds	Soft		"	Sufficient
17	SW	36				Dug	35	2316	-20	2296	35	2281	Glacial (?) clay	Hard		"	"
18	NW	36				Drilled	100	2346	-68	2278	100	2246	Bearpaw sand	"		"	"
1	NE	10	41	12	4	Drilled	120	2477			120	2357	Bearpaw sand	Hard		D.S.	Good supply
2	SW	11				Dug	45	2515			45	2470	Glacial sand	"		"	Sufficient
3	NW	12				Drilled	120	2481			120	2361	Bearpaw "	"		"	Good supply. Dry Hole 180 Feet.
4	SW	23				Dug	66	2317	-20	2297	66	2251	Glacial	"		"	Sufficient
5	NE	28				Drilled	200	2282	-50	2232	200	2082	Pale Beds sand	Soft		"	"
6	NW	32				Dug	70	2262	-60	2202	70	2192	Fine sand	Hard		"	"
7	NE	32				"	29	2260	-23	2237	29	2231	Sand	"		"	Poor supply
8	SW	33				"	30	2270	-26	2244	30	2240	Glacial sand	"		"	Sufficient
9	NE	35				Drilled	246	2252	-40	2212	246	2006	Pale Beds	Soft		"	Good supply
10	SW	36				"	227	2250			227	2023	" "	"		"	Sufficient
1	SW	1	42	9	4	Drilled	166	2351			166	2185	Pale & Variegated Beds	Hard		D.S.	Good supply
2	NE	1				"	155	2331			155	2176	Pale & Variegated Beds	"		"	" "
3	NW	7				Dug	25	2121	-20	2101	25	2096	Glacial	"		"	Poor "
4	NW	12				"	15	2251			15	2236	" sand	"		"	Sufficient
5	NE	15				Drilled	210	2286	-140	2146	210	2076	Pale & Variegated Beds	"		"	Good supply
6	SE	16				"	193	2241			193	2048	Pale & Variegated Beds	"		"	Sufficient
7	NE	18				"	145	2171			145	2026	Pale & Variegated Beds	"		"	"
8	NW	20				Dug	12	2116	-10	2106	12	2104	Glacial sand	Soft		"	"
9	SE	22				Drilled	226	2276	-80	2196	226	2050	Pale & Variegated Beds	"		"	Good supply
10	SW	28				"	120	2226	-80	2146	120	2106	Pale & Variegated Beds	Hard		"	Poor
11	NW	28				"	180	2261	-120	2141	180	2081	Pale & Variegated Beds	"		"	Sufficient
12	NE	31				"	210	2200			210	1990	Pale & Variegated Beds	"		"	"
13	NW	32				Dug	20	2210	-17	2193	20	2190	Sand	"		"	Poor supply
14	SW	33				Drilled	262	2251			262	1989	Pale & Variegated Sand ?	"		"	Sufficient

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

WELL RECORDS—Rural Municipality of .....

B 4-4
1960—10,000

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in°F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
15	SE	34	42	9	4	Drilled	220	2291	-180	2111	220	2071	Pale & Variegated Beds	Hard		D.S.	Sufficient
16	SW	35				"	226	2296	-194	2102	226	2070	Pale & Variegated Beds	"		"	"
1	NW	6	42	10	4	Bored	60	2317			60	2257	Glacial	"		"	Poor supply
2	NW	10				"	56	2256	-25	2231	56	2200	"	"		"	Sufficient
3	NW	15				Drilled	195	2287			195	2092	Pale Beds	Soft		"	Limited supply
4	NE	19					120	2306			120	2186				N.	Supply exhausted
5	SE	20				Drilled	198	2260	-60	2200	198	2062	Pale Beds	"		D.S.	Sufficient
6	NE	21				Bored	110	2274			110	2164	" "	Hard		"	
7	SE	28				Drilled	208	2305			208	2097	" "	"		"	Sufficient
8	SE	32				"	160	2277			160	2117	" "	"		"	"
1	SW	1	42	11	4	Drilled	300	2317			300	2017	Pale Beds	Soft		"	Sufficient
2	SW	1				"	300	2312			300	2012	" "	"		"	"
3	NW	1				"	300	2307			300	2007	" "	Hard		"	"
4	SE	2				Dug	48	2302	-40	2262	48	2254	Sand	"		"	"
5	SW	3				Drilled	180	2253			180	2073	Pale Beds	Soft		"	"
6	SE	3				"	200	2265			200	2065	" "			"	"
7	SE	4				Bored	65	2217			65	2152		Hard		"	Limited supply
8	SE	6				Drilled	212	2237	-16	2221	212	2025	Pale Beds	Soft		"	Good supply
9	SE	9				"	205	2236			205	2031	" "	"		"	" "
10	NW	9				"	90	2227	-10	2217	90	2137	" "	Salty		"	Sufficient
11	NE	9				"	200	2241			200	2041	" "	Soft		"	"
12	NW	12				"	212	2257	-20	2237	212	2045	" "	"		"	Good supply
13	SE	13				"	230	2255	-50	2205	230	2025	" "	"		"	Sufficient
14	SW	13				"	185	2250			185	2065	" "	"		"	"
15	NW	13				"	180	2277			180	2097	" "	"		"	"
16	SW	15				"	160	2261	-100	2161	160	2101	" "	"		"	"
17	NW	16				Dug	45	2262			45	2217		Hard		"	Limited supply
18	NE	16				Drilled	204	2261			204	2057	" "	Soft		"	Good supply
19	SE	17				"	150	2227			150	2077	" "	"		"	Sufficient
20	NW	19				"	140	2234			140	2094	" "	Hard		"	Poor supply
21	SW	21				"	200	2277			200	2077	" "	Soft		"	Limited supply
22	NE	29				Bored	110	2250			110	2140	" "				Poor supply
23	SW	31				Drilled	300	2254	-120	2134	300	1954	" "	Hard		"	Sufficient
24	NE	31				"	270	2287	-87	2200	270	2017	" "	"		"	"
25	SW	32				"	250	2297	-100	2197	250	2047	" "	"		"	"
26	SE	33				"	300	2331			300	2031	" "	Soft		"	"
27	NE	33				"	200	2300			200	2100	" "	Hard		"	"
1	SE	1	42	12	4	Drilled	280	2244			280	1964	Pale Beds	Soft		D.S.	Sufficient
2	SE	2				"	276	2240	-30	2210	276	1964	" "	"		"	Good supply
3	NW	2				"	205	2250			205	2045	" "	"		"	Sufficient
4	NE	2				"	256	2222	- 5	2217	256	1966	" "	"		"	"
5	NE	3				"	227	2250			227	2023	" "	"		"	"
6	SE	4				"	301	2240	-40	2200	301	1939	" "	"		"	"
7	SW	4				"	260	2282	-20	2262	260	2022	" "	"		"	"
8	SW	5				"	235	2297			235	2062	" "	"		"	"

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(#) Sample taken for analysis. (Br) Brown (Alk) Alkaline

WELL RECORDS—Rural Municipality of

B 4-4
1800—10,000

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
9	SE	7	42	12	4	Drilled	190	2287			190	2097	Pale Beds	Soft		D.S.	Sufficient
10	NW	7				"	150	2278			150	2128	" "	"		"	Poor supply
11	SE	9				"	200	2265	-60	2205	200	2065	" "	"		"	Sufficient
12	SE	13				"	250	2234			250	1984	" "	"		"	"
13	SW	13				"	200	2236	-25	2211	200	2036	" "	"		"	"
14	SE	14				"	160	2192	Flows	2192+	160	2032	" "	"		"	Flowing well
15	SW	14				"	180	2212	"	2212+	180	2032	" "	"		"	" "
16	NW	15				"	100	2260	-10	2250	100	2160	" " sand	"		"	Sufficient
17	SW	16				"	160	2297	-140	2157	160	2137	" "	"		"	"
18	SE	17				"	200	2287	-185	2102	200	2087	" "	"		"	Limited supply
19	SE	18				"	190	2287			190	2097	" "	"		"	Sufficient
20	SW	20				"	150	2292	-50	2242	150	2142	" "	"		"	"
21	SE	23				"	200	2194	Flows	2194+	200	1994	" "	"		"	Flowing well
22	SW	23				"	220	2250			220	2030	" "	"		"	Good supply
23	SE	24				"	260	2220	-30	2190	260	1960	" "	"		"	Sufficient
24	SW	25				"	210	2255	-25	2230	210	2045	" "	"		"	Good supply
25	NE	25				"	325	2254			325	1929	" "	"		"	Good supply
26	NE	26				"	263	2254	-40	2214	263	1991	" "	"		"	" "
27	SW	27				"	250	2317	-50	2267	250	2067	" " sand	"		"	" "
28	SW	30				Dug	56	2317			56	2261		Hard		"	Poor supply
29	NE	30				Drilled	122	2339			122	2217	Bearpaw	"		"	Sufficient
30	SE	31				"	200	2342			200	2142	" or Pale Beds	"		"	"
31	NE	32				Dug	140	2267			140	2127	Bearpaw or Pale Beds	"		"	
32	NW	35				Drilled	200	2308			200	2108	Bearpaw or Pale Beds	"		"	Good supply

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