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PRELIMINARY REPORT

GROUND-WATER RESOURCES OF THE RURAL MUNICIPALITY OF HAPPYLAND NO. 231 SASKATCHEWAN

By
B. R. MacKay, H. H. Beach and R. Johnson

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GROUND WATER RESOURCES OF THE RURAL MUNICIPALITY OF HAPPYLAND, NO. 231, SASKATCHEWAN

INTRODUCTION

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

Publication of Results

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

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

How to Use the Report

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

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

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

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

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

GLOSSARY OF TERMS USED

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

WATER-BEARING HORIZONS OF THE MUNICIPALITY

The rural municipality of Happyland, No. 231, covers an area of approximately 487 square miles in the western part of southern Saskatchewan. The municipality consists of twelve full townships and parts of three townships. The townships are described as tps. 19, 20, 21, and 22, ranges 25, 26, and 27, and those parts of tps. 23, ranges 25, 26, and 27, that lie south of South Saskatchewan river, all W. 3rd mer.

The Lemsford Section of the Canadian Pacific railway extends in an east-west direction through the northern part of the municipality, and on it are located the town of Leader, the village of Prelate, and the hamlet of Westerham. Another branch line of this railway extends southwestward from Leader to cross the western border of the municipality in the northwest corner of township 20, range 27. The village of Mendham, in sec. 10, tp. 21, range 27, is located on this line.

South Saskatchewan river flows in an easterly direction along the northern boundary of the municipality, with a drop in water-level from an approximate elevation of 1,895 feet, at the western boundary, to 1,875 feet at the eastern boundary. In ranges 26, 27, and the western part of range 25, the valley extends 4 to 5 miles southward from the river. The surface rises gradually through a gently sloping sand plain, from the river to the southern edge of the valley, where a steep rise of 50 to 100 feet occurs. In the eastern part of range 25 the south slopes of the river valley are steep and rugged, the surface rising more than 300 feet from the river channel in a distance of less than a mile. From an average elevation of about 2,200 feet above sea-level at the south edge of the river valley it rises gradually southward over a distance of 12 miles or more as a gently rolling plain reaching elevations of 2,300 to 2,350 feet in the northern sections of township 20. In ranges 26 and 27 the surface rises

some 100 to 200 feet above this plain in a steeply rolling upland having a width of 4 and 5 miles. South of this upland in township 19, along the southern boundary of the municipality, the surface again drops to a plain with elevations ranging between 2,300 and 2,375 feet. The hilly upland extends only a short distance into the western part of range 25, and here the central plains extend through to the southern boundary of the municipality. The western end of the Great Sand hills extends into the eastern part of township 20, range 25.

South Saskatchewan river constitutes practically the only usable supply of surface water in this municipality. A few sloughs and dugouts excavated by farmers store some water for stock in wet seasons. The river provides an easily accessible supply of water for range stock in its valley, and water is pumped from it to the town of Leader by the Canadian Pacific Railway Company. The water is used in the town, and hauled by many farmers of the district for domestic purposes. Most of the water used in the area is obtained from wells.

Throughout the southern six townships of the municipality, and township 21, ranges 26 and 27, water supplies are generally obtained from shallow wells, and from wells between 50 and 120 feet deep in the glacial drift. In the remaining area south of the river valley the greater part of the supply is derived from wells between 200 and 500 feet deep that penetrate aquifers in the Belly River bedrock formation, underlying the unconsolidated deposits. In many places the water from these deep wells is too highly mineralized for domestic use, and water for this purpose is hauled from wells in adjoining areas, from the Canadian Pacific Railway supply in Leader, or directly from South Saskatchewan river. In the river valley, water is obtained chiefly from shallow wells sunk in depressions among the sand hills.

Water-bearing Horizons in the Unconsolidated Deposits

The unconsolidated deposits, consisting of several types of glacial deposits collectively referred to as drift, and Recent stream deposits and dune sands, overlie the bedrock throughout the municipality. The glacial drift varies greatly in thickness. The thickest accumulation of drift reported occurs in the hilly uplands in the southern part of the municipality, where a well in sec. 9, township 20, range 21, indicates a thickness of at least 335 feet. The glacial drift is also thick in the vicinity of the river valley, test holes in Westerham indicating a thickness of at least 250 feet. These great thicknesses are believed to be due to the filling-in of a pre-glacial valley. Throughout the remainder of the municipality the drift is believed to be between 100 and 200 feet thick. The glacial drift was laid down by a great continental ice-sheet that many thousands of years ago advanced and retreated across the province of Saskatchewan, and by the action of waters resulting from the melting ice. As the ice-sheet advanced it probably dropped part of its load of rock flour and boulders, which on being overridden by the ice formed a layer of bluish grey boulder clay. During the retreat there was probably deposited a much greater thickness of this material. This material, generally referred to as glacial till, occurs at the surface over large areas in the southern part of the municipality, and along the uplands south of the river valley. At those places where the ice front halted for a considerable period during its retreat a greater accumulation of a more porous type of drift, known as moraine, was deposited. Such a moraine occurs in the higher parts of the uplands in the southern part of the municipality. These areas are characterized by an irregularly rolling land surface, with many low knolls, and intervening undrained depressions. The drainage channels to the north being blocked by the ice-sheet

the water resulting from the melting ice gradually collected to form a large lake that covered the eastern part of this municipality. Into the central part of this lake fine sediments that on settling formed lake clays were carried in suspension whereas in the shallow part of the lake and near its margin the coarser and more sandy sediments were deposited. The areal extent of this lake is indicated by a deposit of blue-grey lake clay 5 to 30 feet thick that mantles much of the plains south of the river valley, and somewhat greater thicknesses of sandy deposits that cover areas, along the southern part of the eastern boundary of the municipality and along the river valley in township 23, ranges 25, 26, and 27, over an area 1½ miles in average width extending 7 miles east and 3 miles west of Westerham on the south side of South Saskatchewan river. In an area in township 20, range 25, on the eastern boundary of the municipality, and in a small area in township 21, range 27, on its western boundary, the lake sands have been reworked by wind action to form dunes or low sand hills. Stream deposits consisting of interbedded silts, sands, and gravels form the flood-plain of the river. The distribution of these different types of surface deposits is shown on Figure 1 of the map accompanying this report.

Throughout the areas covered by the stream sediments and the dune and lake sands, ground water can usually be obtained at depths of 20 feet or less. Surface waters percolate downward through the sand and sandy clay and collect in depressions in the surface of the more impervious underlying boulder clay. Since the undulations of the top of the boulder clay conforms roughly to those of the land surface, wells sunk in depressions and valleys are more likely to be productive than those sunk on higher ground. In the river valley the supplies available from this source are nearly always adequate for local requirements, but in the sand-covered areas on the uplands the supplies obtained

are rarely sufficient for more than household needs. The water from the sand is soft or only moderately hard, and well adapted to domestic use.

The lake clay, due to its compact nature, will seldom yield ground water, and in places covered by the clay it is necessary to extend wells into the underlying boulder clay or even into the bedrock. Scattered pockets of sand and gravel occur interspersed in the upper part of the boulder clay, both where it occurs at the surface, as till or moraine, and where it underlies the more recent lake sand and clay. Shallow wells, 40 feet or less in depth, tapping these porous pockets, will in some places yield adequate supplies of hard, drinkable water. Several residents in the southern six townships of the municipality obtain their entire water supply from wells of this type, and many others depend upon them for household supplies, where water from deeper wells is too highly mineralized to be drinkable. In a large area in the plains, south of the river valley, such productive pockets are rarely encountered at shallow depths.

At greater depths in the glacial drift more extensive beds of sand and gravel are found. In places, single beds may extend continuously over areas of a few square miles, but for the most part they are more limited in extent. Throughout the southern half of the municipality most of the water supplies used are obtained from wells between 50 and 120 feet deep, which tap these sands and gravels. A few wells sunk to greater depths are believed to be drawing their supplies from sands and gravels, at or near the base of the glacial drift. In the northern part of the municipality just south of the river valley, several wells between 100 and 220 feet in depth are considered to be drawing their supplies from sands and gravels at the base of the glacial drift; water is seldom found at higher horizons in this area. The water from the deeper wells in the glacial drift is almost

invariably hard and highly mineralized, and in many places is reported to be unfit for drinking. More detailed discussions of the water-bearing horizons known to occur in the glacial drift are given in the following reports on the individual townships.

Water-bearing Horizons in Bedrock

Two bedrock formations, known as the Bearpaw and Belly River formations, underlie the glacial drift in this municipality. The Bearpaw formation immediately underlies the drift in the southern three townships of the municipality, and, at least, the southern parts of the adjoining township to the north. It may extend still farther north, but information obtained from existing well logs does not indicate its presence. This formation is composed largely of compact, dark grey, to nearly black, marine shales that may be distinguished from the boulder clay of the overlying drift by their darker colour, their soapy feel, and by the absence in them of stones or pebbles. Only small seepages of water can be expected in these shales. The total thickness of this formation does not exceed 100 feet, even in the southern part of the area.

The Belly River formation underlies the Bearpaw wherever it is present, and occurs immediately beneath the drift throughout the remainder of the municipality. It is composed largely of beds of sand or loosely consolidated sandstone, interbedded in places by buff to grey shales and thin seams of coal. The sand beds form almost certain sources of water supply in all parts of the municipality. In the northeastern corner of the area, in townships 21 and 22, range 25, several wells between 200 and 300 feet deep are believed to be drawing large supplies from sands in the upper part of this formation. Throughout the remainder of the municipality the productive wells penetrating this formation range

in depth between 300 and 500 feet. A few wells have been sunk to depths as great as 730 feet. The individual water-bearing beds in this formation do not usually extend over large areas and hence considerable variation occurs in the depths necessary to obtain water at different sites. Except where the wells have been allowed to become plugged with fine sands, fairly large supplies of water are almost sure to be obtained from the sand beds of this formation. The water is under considerable hydrostatic pressure, rising to points about 200 feet below the surface in most wells. The quality of the water is inferior to that obtained from the upper part of the drift, in that much of it is found to be highly charged with dissolved mineral salts, and in many places it is suitable only for watering stock.

The 730-foot well in sec. 17, tp. 22, range 26, is drawing its supply from a sand bed at an approximate elevation of 1,475 feet. This is believed to be near the base of the Belly River formation and drilling to much lower levels is inadvisable as the underlying Lea Park formation consists of some 1,000 feet of dark grey, marine shales closely resembling the Bearpaw formation and from which water is not likely to be obtained. Even drilling to the lower part of the Belly River formation will not be necessary in most places, as with few exceptions water has been found within 350 feet from the surface.

GROUND WATER CONDITIONS BY TOWNSHIPS

Township 19, Range 25

The northeastern and southern parts of the township consist of a gently rolling plain. In the northwestern section the land surface is higher and more steeply rolling. A deposit of glacial lake clay mantles an area at the southern boundary of the township and glacial lake sands cover the northeastern plains to depths probably nowhere exceeding 30 feet. The clay and sands are underlain by glacial drift, composed mostly of boulder clay. The glacial drift at the surface over the remainder of the area occurs as moraine in the rolling lands of the northwestern part of the township and as till in the narrow belts bordering the moraine on the south and northeast, and separating it from the areas of lake sands and clays. The distribution of these deposits is shown on Figure 1 of the accompanying map.

In the area covered by glacial lake sands, small supplies of water are usually available at depths of 30 feet or less, either in the sands or in localized pockets of sand and gravel, occurring in the upper part of the underlying drift. The yields obtained are rarely adequate for stock requirements, but the water is satisfactory for drinking and extensive prospecting at shallow depths may be necessary to satisfy household requirements, where water from the deeper wells is highly mineralized. Shallow wells sunk in depressions and near sloughs are expected to be more productive than those sunk on higher ground. The lake clay covering the southern sections will seldom yield ground water, but a few localized water-bearing pockets of sand and gravel may occur in the upper part of the underlying boulder clay. However, considerable prospecting at shallow depths would probably be necessary to obtain adequate supplies even for household needs. The possibility of obtaining water at shallow depths in the till-covered areas is only slightly better than in the lake clay area.

In the moraine-covered area localized pockets of sand and gravel will be more numerous and productive, and in some places sufficient water for all farm needs may be obtained at shallow depths. The water from shallow wells is nearly always hard, but suitable for drinking.

Most residents of this township have sunk wells to depths of 50 to 100 feet in the glacial drift to obtain sufficient water for stock. The greater number of the wells have penetrated water-bearing sands or gravels, at elevations between 2,335 and 2,275 feet, and fairly extensive beds probably occur at this level. The supplies obtained are usually adequate, but in some places fine sands are encountered that yield only comparatively small supplies. The water is hard and highly charged with sulphate salts in solution, and although satisfactory for stock it is as a rule used for drinking only by persons accustomed to highly mineralized waters. In some places the water is too highly mineralized to be fit for any domestic use, and residents have been obliged to haul household supplies.

In sections 5 and 26, wells drilled to depths of 182 and 150 feet yield small supplies of hard, highly mineralized water from fine sands, at approximate elevations of 2,178 and 2,180 feet, respectively. These sands are believed to occur near the contact of the glacial drift with the underlying Bearpaw shale and this horizon may be continuously productive throughout most of the township. In some places coarse sands or gravels that should yield fairly large supplies of water may occur at this horizon. However, as in the wells described above, the supplies obtained may be inadequate for local requirements.

The Bearpaw formation, which immediately underlies the drift in this area, is composed mostly of compact marine shales that will not yield water. The formation is not more than 100 feet thick, however, and is underlain by the Belly River formation in

which water-bearing sand beds are of general occurrence. The individual water-bearing beds in the Belly River formations do not extend over large areas, but as a large part of the formation is made up of sandy beds water is almost certain to be obtained from it, if drilling is carried to sufficient depth. In section 3 a fairly large supply of hard, highly mineralized water is being obtained at a depth of 360 feet in this formation. Similar supplies can usually be expected in all parts of the township at depths of 300 to 500 feet. The water from the well in section 3 is too highly mineralized to be used for drinking, but in some places a softer water of better quality may be obtained.

Township 19, Range 26

A gently rolling glacial till plain extends over the southern part of the township and grades into an irregularly rolling upland area of moraine in the northern sections. A thin deposit of glacial lake clay covers the till in small areas in the southwestern and southeastern corners of the township.

The glacial drift in the moraine and till-covered areas is composed mostly of boulder clay in which are interspersed water-bearing pockets and beds of sand and gravel. Small supplies of soft, or only moderately hard, water are to be expected wherever these pockets are penetrated. They are of common occurrence in the upper 30 feet of the weathered zone of the drift. The yields from shallow wells are rarely adequate for farm requirements, but they form important sources of water for household purposes in areas where water from deeper wells is too highly mineralized to be drinkable. Larger supplies of water are usually obtained from more extensive beds of sand and gravel in the glacial drift, at depths of 40 to 120 feet. These sands and gravels seem to be most plentiful at elevations of 2,260 to 2,230 feet, along the southern boundary of the township and at increasing elevations toward the

north and west, where they occur at elevations of 2,330 to 2,270 feet. This horizon is probably made up of numerous lenses and beds of sand and gravel, some of small areal extent and others that may cover a few square miles. The wells tapping these porous beds yield varying quantities of water. In most places the supplies are adequate for farm requirements, but on a few farms only small supplies have been obtained from fine sands or thin layers of gravel. An 84-foot dry hole in the SW.$\frac{1}{4}$, section 36, may indicate that the sands or gravels are absent at this site, but what is more probable is that the well has not been sunk to sufficient depth to reach them.

The most probable horizons at which water is to be expected by deep drilling in this township are at the contact of the glacial drift with the underlying Bearpaw shales and in sand beds in the Belly River formation that underlies the Bearpaw shales. The glacial drift is thought to be at least 150 feet thick in the areas of low elevation in the southern part of the township, and may reach thicknesses of 250 feet in the higher lands in the northwestern sections. In some places water-bearing sands and gravels that would yield fairly large supplies of water may occur at or near the base of the drift. However, wells have been drilled to depths of 475 and 300 feet, in sections 25 and 36 of this township, and to similar depths in the adjoining township to the north and northwest, and none of these wells encountered any appreciable supply of water at this horizon.

The Bearpaw formation is not more than 100 feet thick in this township. It is composed mostly of compact marine shales, from which little or no water can be obtained. It is underlain by the more porous sandy beds of the Belly River formation. Adequate supplies of hard, highly mineralized water suitable for stock can as a rule be expected in this formation if wells are sunk to depths of 300 to 500 feet. Wells sunk to this horizon, however, may become

plugged with sand. Wells 475 and 300 feet deep, in sections 25 and 36, yield only small supplies of water due to the flow having been largely shut off by sand entering the wells.

Township 19, Range 27

The greater part of this township consists of a gently rolling, till-covered plain, rising gently in a northerly direction to merge into a steeply rolling upland in the moraine-covered northeastern corner of the township. In a few small areas in the southern part of the area the till is mantled by a thin layer of glacial lake clay. The surface distribution of these different deposits is indicated on Figure 1 of the accompanying map.

The lake clay is usually too compact to yield water, but since the deposit is only a few feet thick it appears to have little or no effect upon ground water conditions existing at greater depths in the underlying boulder clay.

Scattered water-bearing pockets of sand and gravel occur interspersed in the upper 30 to 40 feet of the boulder clay that makes up the greater part of both the glacial till and moraine. Small supplies of soft, or only moderately hard, water are being obtained from shallow wells tapping these pockets. The yields are rarely sufficient for stock requirements, but form satisfactory sources of water for domestic purposes, particularly where the water from deeper wells is highly mineralized.

Most of the water supplies used in the township are obtained from wells tapping sands and gravels in the boulder clay, at depths between 40 and 100 feet. In some places these sands and gravels occur at fairly consistent horizons over areas of a few square miles, and they may be in continuous beds. However, most of the beds appear to be local in extent. The supplies obtained are for the most part adequate for local requirements, but in a few places quicksand or thin, porous beds are encountered which yield

only small seepages of water. Only one, deep, dry hole was reported in the area, indicating that the sands and gravels, even if not in a continuous bed, are seldom absent. This hole is on section 15 and was drilled 150 feet deep. The water obtained from the porous beds in the glacial drift is hard, and in many places highly mineralized, but in the absence of supplies of better quality these waters can mostly be used for drinking. Should wells of this type fail to yield adequate supplies the most probable sources of supplies at greater depths are at the contact between the glacial drift and the underlying Bearpaw formation, or in the sand beds of the Belly River formation that underlies the Bearpaw.

The glacial drift is probably at least 150 feet thick in the southern part of the township, and may be as much as 250 feet thick in the higher lands at the north. In some places adequate supplies of water might be obtained from sands and gravels occurring at the base of the glacial drift. In section 9, of the township adjoining on the north, a 335-foot well is drawing its supply from sands believed to be at the base of the glacial drift, at an approximate elevation of 2,215 feet. Other wells in the same township, however, were drilled to depths of 375 to 475 feet, probably into the upper sands of the Belly River formation, before productive beds were encountered.

The Bearpaw formation, which underlies the glacial drift in this area, is composed mostly of compact, dark marine shales, and is not expected to be water-bearing. The formation is considered to be less than 100 feet thick, however, and water-bearing sand beds will almost certainly be encountered in the Belly River formation at depths between 300 and 500 feet. The water obtained from wells of this type is hard and highly mineralized, as a rule, and may be suitable only for watering stock.

Township 20, Range 25

The western part of this township is a gently rolling plain. The east-central sections lie within the western part of the Great Sand hills. Such areas are not suitable for cultivation, and are hence given over entirely to grazing. Adjacent to this area on the west and south is a narrow area of slightly rolling land, covered by glacial lake sands. Lake sands also cover the greater part of the more level lands to the west, except in the northwestern corner where the sands grade into lake clay, and in the southwestern corner where the glacial drift occurring at the surface is in the form of till and moraine.

In the dune sand area and the adjoining hilly areas the sand attains a thickness of 20 feet or more. The sands are porous and absorb a large percentage of surface waters, and shallow dug wells can be expected to yield large supplies of only moderately hard water. Driven sand-points may be necessary where the sand is too fine to permit digging. To the west and near the northern and southern boundaries of the township the sands are thinner and interspersed with layers of clay. In this area small supplies of water are usually available at depths of 30 feet or less in localized pockets of sand and gravel in the upper part of the underlying glacial drift. Most residents of the area obtain their supplies from shallow wells of this type. Two or more wells may be necessary to provide stock requirements and in many places the supplies are inadequate. The waters obtained from the shallow wells vary from soft to hard and highly mineralized, but are nearly always used for drinking.

The lake clay covering the northwestern corner of the township is in itself too compact to yield water, but small supplies of hard, drinkable water can in many places be obtained at depths not exceeding 40 feet in scattered pockets of sand and gravel in the underlying drift.

In sections 6 and 7, in the southwestern corner of the township, where the glacial drift is in the form of till and moraine, adequate supplies of moderately soft, to hard, drinkable water have been obtained at depths of 18 and 20 feet, in localized sand and gravel pockets.

At scattered sites throughout the township wells sunk to depths of 40 to 100 feet in the boulder clay have penetrated porous water-bearing beds. Most of these wells yield adequate supplies of water, but in a few places the sands encountered were too fine-grained to yield more than small supplies. The waters obtained from wells of this type are, as a rule, more highly mineralized than waters from shallow wells, but are rarely unfit for drinking.

Should bored or dug wells less than 100 feet deep fail to yield sufficient water, the most probable sources of supply by deep drilling are in sands and gravels at the base of the glacial drift, or in sand beds in the underlying Belly River bedrock formation.

Wells 180 and 188 feet deep, in sections 20 and 28, are yielding ample supplies of hard, "alkaline" water from gravels and sands, believed to be at the base of the glacial drift at approximate elevations of 2,130 to 2,112 feet. This horizon is not a certain source of supply, but water is to be expected in other parts of the township at approximately the same depths. The water in some places may be unfit for drinking, but should be suitable for stock.

Wells in sections 30, 31, and 32, 456, 347, and 515 feet deep, respectively, apparently did not encounter satisfactory supplies of water in the lower part of the glacial drift, and are drawing their supplies from sand beds in the Belly River formation. The wells in sections 31 and 32 yield fairly large supplies of water, but the well in section 30 is plugged with fine sand and

consequently gives only a small supply. The Belly River formation is believed to contain many, porous, sandy beds and is an almost certain source of water supply. However, the individual water-bearing beds are usually of small areal extent and considerable variation can be expected in the depths at which water will be obtained, as indicated by the three wells described above. The water from the formation is generally too highly mineralized to be suitable for domestic use, but is satisfactory for stock.

Township 20, Range 26

An irregularly rolling area of moraine extends over the southern third of the township, and grades into more gently rolling till in the central part. A thin deposit of lake clay overlies the till in the northern third of the township.

Water can rarely be obtained from the lake clay in the northern part of the township. This clay is seldom more than 20 feet thick, however, and small supplies of water can usually be obtained at depths of 40 feet or less in localized pockets of sand and gravel in the upper part of the underlying boulder clay. These supplies are rarely adequate for stock requirements, but are used to provide domestic supplies where the water from deeper wells is highly mineralized. In several places in the moraine and till-covered areas in the southern part of the township, adequate supplies of water for local farm requirements are obtained from wells tapping pockets of sand and gravel at shallow depths. In other places, where the shallow wells are less productive, they serve to provide household supplies, and more highly mineralized water from deeper wells is used for stock. The water obtained at shallow depths in this township varies from soft to hard and highly mineralized, but it is seldom unfit for drinking.

Throughout the entire township wells sunk to depths between 40 and 120 feet have penetrated water-bearing sands and

gravels in the lower part of the glacial drift. These sands and gravels are believed to occur in localized beds, but in some places they may extend continuously over areas of several square miles. Most of the wells yield adequate supplies of hard, highly mineralized water. However, in some places fine sands or only thin, porous beds have been encountered, and yields are correspondingly smaller. The water obtained is not as a rule satisfactory for domestic use, but can be used for stock.

Where wells of these depths fail to yield adequate supplies, deep drilled wells may reach productive beds near the base of the glacial drift, or in the Belly River formation. The glacial drift is believed to be between 150 and 200 feet thick in the plains at the north of the township, and may be 250 to 300 feet thick on the uplands to the south. In some places water-bearing sands or gravels will probably occur at the base of the drift and when tapped by wells will yield fairly large supplies of water. A 200-foot well in section 36 yields a large supply of hard, highly mineralized water from sand believed to be at the base of the drift, at an approximate elevation of 2,130 feet. This water is unfit for domestic use, but suitable for stock.

The Bearpaw formation is believed to underlie the glacial drift in the southern part of the township, and may be present in the northern sections. The marine shales comprising most of this formation will not yield water. However, the formation is probably not more than 75 feet thick, even in the southern part of the township. The Belly River formation, which underlies it, is composed in large part of sandy beds that are an almost certain source of water. The water-bearing beds in the Belly River formation do not usually occur in extensive horizons and, therefore, considerable variation is to be expected in the depths at which water will be obtained. In section 25 a 374-foot well did yield a fairly large supply of water from a sand bed in the formation, but it has

become plugged with fine sand and rendered practically useless. In general, adequate supplies of water for stock can be expected at depths of 300 to 600 feet in this formation, but difficulty may be experienced in screening the fine sands. The water obtained from the Belly River formation is usually too highly mineralized to be satisfactory for domestic purposes, but it is suitable for watering stock.

Township 20, Range 27

The northern third of the township consists of a gently rolling plain. It is covered by glacial lake sands in the western sections and by glacial lake clay in the eastern part. The land rises to the south to form a steeply rolling upland that is covered by glacial till and moraine.

In the northwestern corner of the township a few residents obtain adequate supplies of water from wells less than 20 feet in depth sunk in the sandy glacial lake deposits. The sandy clay and sand are rarely more than 20 feet thick, and water collects in these depressions in the surface of the underlying boulder clay. The surface of the boulder clay usually conforms to the land surface and consequently wells dug in depressions and valleys are more likely to be productive than those dug on higher lands. The water being obtained from the sand varies from soft to hard and is highly mineralized, but in all places is reported to be suitable for drinking.

Where the sands are unproductive small supplies of water may be obtained at depths of 30 feet or less, from scattered pockets of sand or gravel in the upper part of the underlying boulder clay. A 30-foot well in the SW.$\frac{1}{4}$, section 34, is yielding an adequate supply of hard, drinkable water from this source.

The lake clay in the northeastern corner of the township is generally too compact to yield water, but in some places small

supplies of hard water suitable for household use may be obtained at depths of less than 30 feet in localized pockets of sand or gravel, in the upper part of the underlying boulder clay.

Throughout the till and moraine-covered areas in the southern part of the township, water can usually be obtained from sand or gravel pockets at shallow depths. In a few places adequate supplies are derived by sinking one or more such shallow wells, but usually they will satisfy only household requirements. The water varies in character, from soft to hard and highly mineralized, but nowhere in the township has it been reported to be unfit for domestic use.

Throughout the entire township considerable prospecting has been done in the glacial drift at depths between 40 and 160 feet. In most places sand or gravels have been encountered within this range of depths and adequate supplies of water obtained. However, in some places wells sunk to depths exceeding 100 feet in the boulder clay have either failed to penetrate porous beds or yield only small supplies of water from thin beds of sand or gravel. These findings would indicate that the water-bearing sands and gravels occur mostly in localized beds interspersed irregularly in the boulder clay. In general, however, if productive beds are present at these depths they will be of sufficient areal extent that one hole will indicate their presence or absence in any locality. The water obtained from the deeper wells in the glacial drift is hard and almost invariably highly mineralized and in many places cannot be used for drinking.

The most probable sources of ground water obtainable by deep drilling in this township are in sands and gravels near the base of the glacial drift or in the sand beds of the Belly River formation. The glacial drift is believed to be between 150 and 200 feet thick in the northern sections of the township, and more than 300 feet thick in places in the uplands at the south. A 335-foot

well in section 9 yields a large supply of hard, highly mineralized, iron-bearing water from sand, believed to be at the base of the glacial drift at an approximate elevation of 2,215 feet. In sections 2, 14, 16, and 20 wells drilled to depths of 475, 425, 425, and 378 feet, respectively, apparently did not encounter any appreciable supply of water at this horizon, but obtained large supplies from the underlying bedrock.

The Bearpaw formation is believed to underlie the glacial drift in the southern part of the township, but may not be present in the northern sections. The compact, dark marine shales comprising most of this formation are too compact to yield water. The formation is probably considerably less than 100 feet thick in any part of the township. Water is to be expected from sand beds in the underlying Belly River formation.

This formation contains many sand beds of limited individual areal extent, which form an almost certain source of water supply obtainable by deep drilling. Considerable variation can be expected in the depths at which water will be obtained. The aquifers may lie at depths of 300 to 500 feet in the northern sections and at depths as great as 600 feet in the southern uplands. The wells that have been drilled in the uplands, in sections 2, 14, 16, and 20, are yielding adequate supplies at depths between 378 and 475 feet. The water from the Belly River formation is too highly mineralized to be suitable for domestic use, but can be used for stock.

Township 21, Range 25

This township is situated in an undulating plain covered entirely by glacial lake clay, except in parts of sections 1, 2, and 3, where the clay grades into lake sand. These lake deposits are rarely more than 20 feet thick, and are underlain by bluish grey boulder clay. Little water is obtainable from the lake

clay because of its compact nature, but scattered water-bearing pockets of sand and gravel occur interspersed in the upper part of the underlying boulder clay. A few residents obtain adequate supplies of hard, drinkable water from wells not exceeding 40 feet in depth that tap such pockets. In some places in the area of lake sand in the southeastern corner of the township small supplies of water might be obtained at shallow depths in the drift.

In most parts of the township the supplies available at shallow depths will be small, and deeper wells must be sunk in order to obtain sufficient water for stock. A few localized beds of sand and gravel occur interspersed in the boulder clay at depths between 40 and 100 feet, and in the few places where they have been tapped by wells they yield adequate supplies of water. A well 56 feet deep, on section 6, and two others, 45 and 50 feet deep, on section 18, are yielding satisfactory supplies of hard, clear, drinkable water from localized beds of sand. In most places, however, productive beds in the drift are not reached at depths less than 100 feet, and most of the water supplies used in this township are obtained from sands and gravels occurring at or near the base of the glacial drift or from sands in the upper part of the Belly River formation. In a few places productive sands and gravels have been encountered in the drift at depths between 115 and 184 feet, but for the most part wells have been drilled to depths of 200 to 265 feet, before reaching productive beds. Many of these water-bearing beds occur at elevations between 2,100 and 2,000 feet and are considered to represent a porous horizon that may be the lower sands and gravels of the glacial drift, or the upper sands of the Belly River formation. Water obtained from this horizon is hard and drinkable, and the yields from individual wells are sufficient for the local requirements.

Should wells of these depths be unproductive, water is to be expected in lower sand beds irregularly interspersed through

the Belly River formation. In sections 3, 6, 15, and 25, wells ranging in depth between 318 and 386 feet draw supplies from sands at elevations between 1,900 and 1,800 feet. In sections 3, 15, and 25 adequate supplies of hard, highly mineralized, drinkable water are obtained, but in two wells on section 6 fine sands were encountered that have practically plugged the wells, so that only small supplies of water are obtained. A hole was reported to have been drilled to a depth of 500 feet on the NE.$\frac{1}{4}$, section 20, but failed to produce any water. Water-bearing sands may have been penetrated in the sinking of this well as a supply is now being obtained from a 246-foot well nearby. In section 4 a 666-foot well yields a large supply of highly mineralized water from a sand bed in the lower part of the Belly River formation. As, however, adequate supplies can be obtained at higher horizons in this formation, in most places drilling to these depths is usually not necessary.

Township 21, Range 26

This township consists of a gently rolling plain, covered entirely by glacial lake clay. In the absence of surface water accumulation all water supplies are obtained from wells.

The lake clay is as a rule too compact to yield water, but it is rarely more than 20 feet thick, and is underlain by boulder clay in which occur scattered pockets of sand and gravel. In places where such pockets have been tapped by wells they have yielded water. A few residents obtain adequate supplies from wells, 40 feet or less in depth, that tap such pockets. The water is hard, but rarely too highly mineralized to be used for drinking.

In most places the supplies available at shallow depths are inadequate and it is necessary to extend wells to greater depths. Most of the water supplies used in the township are being obtained from wells between 50 and 160 feet in depth that tap beds

of sand and gravel in the lower part of the glacial drift. Many of these wells, 100 feet or less in depth, appear to be drawing their supplies from isolated beds,but they usually yield adequate supplies of water. In the northeastern section and in a few places in the southwest corner, wells have penetrated water-bearing sands and gravels at a fairly consistent horizon. In the northern half of the township wells between 100 and 160 feet in depth draw their supplies from sands at elevations between 2,124 and 2,056 feet above sea-level. In the southern half of the township the water-bearing beds have been encountered at slightly higher elevations, between 2,130 and 2,100 feet. These beds were penetrated at depths of 110 and 163 feet, in sections 2, 12, 14, and 15, and at depths of 84 and 65 feet, in sections 17 and 18, where the surface elevations are relatively lower. Most of the wells drawing their supplies from this horizon yield sufficient water for farm requirements. In section 25, however, wells 160 and 180 feet deep penetrated fine sands that yield very little water. The water obtained from wells deeper than 50 feet in the glacial drift is, as a rule, very hard and highly mineralized, but in only a few places is it reported to be unfit for drinking.

Should the supplies available from the glacial drift prove inadequate, large supplies of water are almost certain to be obtained by deep drilling into the underlying Belly River formation. In sections 10 and 30 productive sands were penetrated in the Belly River formation at depths of 344 and 340 feet. The well in section 10 yields a large supply of hard, "alkaline", salty water, suitable for stock use. The well in section 30 did yield a fairly large supply, but went dry, probably due to the well being plugged by a fine sand commonly encountered in this formation. The water-bearing beds in this formation are seldom of large individual areal extent, and the depth necessary to obtain water varies considerably within short distances. The sandy beds

are sufficiently numerous in the formation, however, to ensure the finding of large quantities of water at most points in the municipality at depths between 300 and 500 feet. Much of the water is highly charged with dissolved sulphate salts and is unsatisfactory for household uses.

Township 21, Range 27

This township consists of a gently rolling plain sloping gradually down to the northern border. It is covered by sandy lake deposits in the western part and by compact clay in the eastern part. Small, isolated areas of sand dunes occur along the western boundary of the area. The distribution of these different deposits is indicated on Figure 1. The lake sand and clay are seldom more than 20 feet thick and are underlain by boulder clay.

In the lake sand area small supplies of soft or only moderately hard water are being obtained at depths of 30 feet or less from sand beds or from localized pockets of sand and gravel in the upper part of the underlying boulder clay. A few residents obtain adequate supplies of water for farm requirements from two or more shallow wells, but in most places these supplies are used only for household needs. The lake clay covering the eastern part of the township is not sufficiently porous to form reservoirs for water. A few residents in the area also obtain water from wells not exceeding 40 feet in depth that tap pockets of sand and gravel in the upper part of the underlying boulder clay. Some of these wells yield sufficient water for all farm requirements. The water obtained at shallow depths in this area is more highly mineralized than that obtained in the lake sand area, but it is quite suitable for household use.

Most of the ground water used in this township is obtained from wells between 50 and 160 feet deep that draw their

supplies from sand and gravel pockets that occur irregularly interspersed in the boulder clay. Little difficulty has been experienced in obtaining adequate supplies of water from wells of this type. The water-bearing beds encountered at these depths are usually of sufficient areal extent, so that one hole will show their presence or absence in any locality. It is, therefore, considered advisable to continue wells to greater depths rather than to sink other shallow holes at other sites in the same vicinity should an adequate supply not be obtained in the upper part of the drift.

Should the supplies at depths of 160 feet or less prove inadequate, large supplies of water are almost certain to be obtained by deep drilling into the Belly River formation. The water-bearing sands in the Belly River formation do not generally occur at consistent horizons over large areas, but as much of the formation is composed of sandy beds satisfactory supplies can be obtained in nearly all places by drilling to sufficient depth. In general, adequate supplies can be expected at depths between 300 and 500 feet. In sections 27 and 29, hard, highly mineralized water is being obtained at depths of 360 and 300 feet. Water from the Belly River formation is usually too highly mineralized to be satisfactory for domestic use, but it is being used in some places where supplies of better quality have not been found at shallower depths.

Township 22, Range 25

The central and east-central parts of the township are rolling. The remainder of the area consists of a gently undulating plain, except in the extreme northwestern corner where a tributary stream of South Saskatchewan river extends into the township. A thin deposit of glacial lake clay forms the upper part of the glacial drift throughout the greater part of the township. In the east-central sections and the northwest corner the lake clay is

absent and the boulder clay is exposed at the surface, forming a till plain. In very few places in this township has water been obtained at shallow depths. The lake clay is too compact to yield water, and only a few scattered water-bearing pockets of sand and gravel occur interspersed in the upper part of the boulder clay. Unless only small supplies of water are required for domestic purposes, the sinking of shallow test holes is hardly advisable.

In a few places, adequate supplies of hard, drinkable water may be obtained at depths of 40 to 100 feet from localized beds of sand or gravel in the glacial drift, but the many wells already sunk in the area indicate, however, that in most places it will be necessary to sink wells down to the lower sands and gravels of the glacial drift or into the upper sands of the Belly River formation.

On a few farms wells sunk to depths between 100 and 160 feet have encountered water-bearing beds in the lower part of the glacial drift and are yielding adequate supplies of water. Generally, however, wells have been drilled to depths of 200 to 285 feet and are believed to be drawing supplies from sands and gravels at the base of the glacial drift, and from the upper sands of the underlying Belly River bedrock formation. The productive sands and gravels have been reached at elevations between 2,040 and 1,935 feet, and although they probably do not form any single continuous bed, they present an almost certain source of adequate supply at this horizon. The water obtained is hard and highly mineralized, but can be used for drinking.

Should this horizon fail to be productive, other water-bearing sand beds are expected to occur at greater depths in the Belly River formation. A 360-foot well in section 3 yields a fairly large supply of hard, iron-bearing water from a sand bed at an approximate elevation of 1,865 feet. The individual sand beds in the formation seldom extend over large areas and considerable

variation is to be expected in the depths at which water will be obtained. It should not be necessary to sink wells to depths greater than 500 feet in any part of the township.

Township 22, Range 26

The greater part of this township consists of an undulating plain that extends to the southern edge of South Saskatchewan River valley in the northern sections of the township. At the edge of the valley the surface drops sharply some 75 to 100 feet to a plain sloping northward toward the river in the adjoining township to the north. Most of the area south of the river valley is covered by a thin deposit of glacial lake clay. In a belt along the valley edge the glacial drift occurs at the surface as till, but in the valley in the northwestern corner of the township the till is covered by glacial lake sand and clay. The distribution of these different deposits is indicated on Figure 1 of the accompanying map.

Throughout the area south of the valley, little or no water can be obtained at shallow depths. The lake clay is too compact to yield water, and no productive pockets of sand or gravel have been encountered in the upper part of the boulder clay. In the valley, however, in the northwestern part of the township, adequate supplies of soft or only moderately hard water have been found by digging wells less than 30 feet deep in the lake sand or in sand and gravel pockets in the upper part of the glacial till. Residents of this area obtain all of their water supplies from these shallow wells.

In the vicinity of Leader, conditions for finding any large supplies of ground water suitable for drinking, either at shallow depths or in the lower part of the drift and in the Belly River formation, are not considered favourable. Careful prospecting in the till-covered area, particularly at the bases of slopes and in depressions, may yield small supplies.

In the area south of the valley the compact boulder clay usually extends down to depths of 120 to 160 feet, and contains few, if any, beds of sand and gravel sufficiently porous or extensive to yield more than small seepages of water. Thicker and more extensive beds have been encountered at depths between 100 and 200 feet. These porous beds are believed to occur at the base of the glacial drift or possibly, in some places, at the top of the Belly River formation. Several residents of the area obtain from these sands and gravels adequate supplies of hard, highly mineralized, but drinkable, water. On many of the farms very fine sands are encountered at this horizon. These sands tend to plug the wells and materially decrease the supply obtainable. Many residents have extended wells down to the porous sand and soft sandstone beds of the underlying Belly River formation. Individual beds probably do not extend over large areas, and the depths at which water was found in the different wells vary considerably. In most places adequate supplies of hard, highly mineralized water are obtained at depths between 300 and 500 feet, but in some places fine sands have so plugged the wells that the supply is practically entirely cut off. In sections 7 and 17, wells have been drilled to depths of 684 and 730 feet, respectively, and in the town of Leader in section 21 to a depth of 660 feet. All of these wells yield large supplies of highly mineralized water. The waters obtained from wells drawing their supplies from the Belly River formation can rarely be used for drinking and most residents of the area have been obliged to haul their household supplies from Saskatchewan river or from the Canadian Pacific Railway supply in the town of Leader, which is also derived from the river by pumping. A few dugouts have been excavated in the area to provide water for stock.

In South Saskatchewan River valley, along the northern sections of the township, the glacial drift is probably thicker

than in the uplands, as it is possible that the river covered a much deeper channel before the advance of the continental ice-sheet than occurs today. This old valley has been filled in with drift and the present channel has been excavated since glacial times. Test holes sunk in Westerham indicate a thickness of drift of approximately 280 feet at the edge of this buried valley. A 320-foot well in section 2, of the adjoining township to the north, probably penetrated the Belly River formation, but no information is available to indicate the thickness of the drift passed through in drilling. Although sand and gravel beds were reported to have been encountered in the glacial drift in these wells, no satisfactory supply of water was obtained. The 320-foot well in the township to the north did yield a small supply of hard, iron-bearing water from fine sands believed to be in the Belly River formation. Larger supplies might be obtained at greater depths, but considerable prospecting at shallow depths is believed advisable before drilling deep wells.

Township 22, Range 27

The northern sections of this township lie along the southern edge of South Saskatchewan River valley. The land rises sharply some 75 to 100 feet at the valley edge to a gently rolling plain extending over most of the remainder of the township. A small area in the southwestern corner is covered by a thin layer of glacial lake sand. The sand grades into the glacial lake clay that covers a large area extending over most of the southwestern half of the area. Along the valley edge the lake clay is absent and the glacial till occurs at the surface. The surface along the valley slopes is irregularly rolling and covered in many places by low sand hills that merge toward the edges of the area into a narrow plain of lake sands that have been less affected by wind action.

In the area south of the river valley a great deal of difficulty has been experienced in obtaining any water at shallow depths. The lake clay is mostly too compact to form reservoirs for water accumulation, and porous pockets of sand or gravel occur very sparingly in the upper part of the underlying boulder clay. In section 30 a 32-foot well near a slough yields a small seepage of water. However, even such small supplies are not available at shallow depths in most areas. The lake sands in the southwestern corner of the township might yield small supplies of water at depths of 20 feet or less, and they are worthy of extensive prospecting by residents seeking a small domestic supply. The compact boulder clay probably extends down to depths of 100 to 180 feet before water-bearing sands or gravels, known to occur at or near the base of the drift, are reached. A few of the wells that have been sunk to this horizon yield moderately large supplies of hard, highly mineralized water. Such water is of poor quality for domestic requirements, but has been used for drinking where better supplies are not available.

In most places, the supplies derived from wells tapping this horizon are inadequate and wells have been drilled to greater depths. Fairly large supplies of water are almost certain to be obtained from sand beds in the Belly River formation, at depths between 250 and 425 feet. Several wells in this township reached productive beds at an horizon occurring at elevations between 1,940 and 1,880 feet. However, scattered wells are drawing their water from sands occurring both above and below this horizon, and it is difficult to predict the actual depths necessary to reach productive beds at any particular site. Most of the waters obtained from the Belly River sands are too highly mineralized to be used for drinking, and most residents of the township haul their domestic supplies from shallow wells located in the sand hills, in the river valley, or in the adjoining township to the

southwest. A few farmers haul water from the Canadian Pacific Railway supply in Leader.

In the sand hills in the river valley adequate supplies of soft, or only moderately hard, water can be expected from the sand beds at depths of 20 feet or less. The sands are seldom more than 20 feet thick and are underlain by boulder clay. Wells should not be continued into the boulder clay unless considerable prospecting has proved the sand deposits of the area to be unproductive. However, should the supplies from the sand deposits prove inadequate, water might be obtained at depths of 40 feet or less in localized pockets of sand or gravel interspersed in the upper part of the boulder clay. Supplies obtained from this source will probably be small and the water more highly mineralized than that obtained from the sand.

Test holes sunk to depths of 272, 274, and 315 feet, in Westerham, indicate a thickness of glacial drift of at least 260 feet. Small supplies of water were encountered in sands and gravels in the boulder clay, and in the 315- and 274-foot wells water-bearing sands believed to be in the Belly River formation were encountered at a depth of 268 feet. No satisfactory supply of water was obtained from any of these wells. Deeper drilling into the Belly River formation might prove more productive, but shallow wells appear to be the most probable source of adequate water supplies in the dune sand-covered slopes.

Township 23, Range 25

Only the 22 square miles of this township lying to the south of South Saskatchewan river lie in this municipality. In the western part the much dissected slopes of the river valley have cut headward to the southern border of the township. Toward the northeast the valley becomes much narrower, leaving an upland plain extending over the southeastern sections at elevations approximately

300 feet higher than the valley bottom. Settlement in this township is confined to this southeastern upland area.

The river provides a readily accessible water supply for stock pasturing in its valley, and if required a water of sufficiently good quality for domestic use. On the uplands water supplies are being obtained entirely from deep, drilled wells.

A thin deposit of glacial lake clay covers a small area in the southeastern corner of the township. The clay is underlain by glacial till, which occurs at the surface over 16 square miles of this part of the township. In small areas along the river edge the surface deposits consist of Recent stream deposits and glacial lake sands.

In the uplands in the southeastern corner of the township little or no water can be obtained at shallow depths. The lake clay is too compact to yield water and no water-bearing pockets of sand and gravel have been encountered in the upper part of the boulder clay. Wells in the area indicate that the boulder clay extends down to depths of approximately 200 feet and throughout appears to be almost entirely barren of water-bearing beds of sand or gravel.

In sections 1 and 11, adequate supplies of hard, drinkable water are being obtained from sands believed to be in the upper part of the Belly River formation at depths of 221 and 194 feet. In the SE.$\frac{1}{4}$, section 2, and the NE.$\frac{1}{4}$, section 11, however, wells were drilled to depths of 348 and 450 feet before satisfactory supplies were obtained in this formation. In general, satisfactory supplies can be obtained from sand beds of this bedrock formation, but due to the small areal extent of the individual porous beds the depths of productive wells vary considerably at different localities.

In the river valley the most probable source of satisfactory ground water supplies is at shallow depths. Although

no wells have been sunk in the glacial lake and Recent stream sands along the river supplies of soft, or only moderately hard, water could probably be obtained from them at shallow depths. At sites more remote from the river shallow wells sunk in tributary valleys and near the bottoms of steep slopes can be expected, in many places, to penetrate porous beds formed by sands and gravels that have been washed down from the higher lands.

Township 23, Range 26

The part of this township lying within this municipality is situated on the southern slopes of South Saskatchewan River valley. Small areas of Recent stream-deposited sands occur in the flats adjacent to the river. Glacial lake sand and dune sand cover most of the remaining parts of the township. These sandy deposits are underlain at depths of less than 20 feet by boulder clay. The boulder clay occurs at the surface of the upper edge of the valley in the southeastern corner of the township. A small area of glacial lake clay also occurs near the edge of the valley in this part of the township. The distribution of these different deposits is shown on Figure 1 of the accompanying map.

The river provides water for stock in the northern part of the area, and the water has also been used for domestic purposes. It would probably be better to excavate shallow seepage wells beside the stream for domestic supply, as by the natural filtering sediment is excluded and a slight amount of purification may be obtained. The Canadian Pacific railway pump water from the river to the town of Leader, in the adjoining township to the south, where it is used by residents of the towns and hauled for domestic use by farmers of the district. In this township, however, supplies of good quality water are usually available at shallow depths and residents are seldom obliged to haul water.

Most of the ground water supplies are obtained at depths of 15 feet or less in the dune and lake sands in this area. In some places the supplies obtained are small and two or more wells are necessary to provide adequately for stock requirements. The water is soft or only moderately hard, and the wells are adapted to household uses. The water collects in the sand in depressions in the surface of the underlying boulder clay. The surface of the boulder clay conforms roughly to the land surface, and wells sunk in depressions and valleys are, therefore, most likely to be productive.

Should the surface prove unproductive in any locality small supplies of hard, drinkable water may be obtained at depths not exceeding 30 feet, from localized pockets of sand and gravel in the upper part of the underlying boulder clay. A supply from this source is being obtained in a shallow well in section 2, where the sands are absent. In this area the sinking of wells to depths exceeding 30 feet will be neither necessary nor advisable. The glacial drift is considered to be 250 or more feet thick in most localities, and no assurance can be given that water-bearing sands or gravels will be encountered at any depth in it. In section 2, a 320-foot well apparently passed through the glacial drift without encountering any satisfactory water supply. For a short time this well did yield a small supply of water from fine sand at its base, probably in the Belly River formation. Large supplies might be obtained at greater depths in the Belly River formation, but no assurance can be given that water will be found or that the sand will not be so fine as to plug the wells in a short time.

Township 23, Range 27

South of South Saskatchewan River

In the western part of this fractional township the river flows within a mile of the southern boundary, but it bends and flows northward for a distance of approximately 4 miles in the centre of the township, leaving an area of some 12 square miles south of the river in the southeastern corner of the township. This area is situated in the river valley and consists of a plain sloping toward the river. The southern sections are covered by dune sands and the flats adjacent to the river by stream deposit sediments comprised of silts, sands, and, more occasionally, thin beds of gravels. The intervening area is covered by glacial lake sands. The area south of the river in the southwestern part of the township is situated on the steep banks of the valley and consists of a rugged area of deeply eroded glacial drift.

Water supplies used in this area are obtained from the river and from shallow wells sunk into the surface sands. One 60-foot well draws its supply from sand in the glacial drift.

In section 24 a 41-foot well sunk to below river level in the sands adjacent to the river yields a fairly large supply of moderately hard water. Similar supplies will probably be available in most parts of the area covered by the stream sands.

Adequate supplies of soft, or only moderately hard, water can as a rule be obtained at depths of 20 feet or less in the lake and dune sands that cover the southeastern part of the township. The sands are rarely more than 20 feet thick, and water from the surface percolates downward and collects in depressions in the surface of the underlying boulder clay. The surface of the underlying clay conforms to some extent to the undulations of the present land surface, and wells sunk in depressions and valleys are more likely to be productive than those sunk on higher lands. In some places, two or more wells are required to provide stock requirements.

The sinking of wells into the boulder clay underlying the sand is inadvisable unless supplies from the sand are altogether inadequate. The glacial drift consists mostly of boulder clay and is probably more than 200 feet thick in most parts of the area, except in the lowlands adjacent to the river. No assurance can be given that any suitable supply of water will be obtained at any depth in the glacial drift. Small supplies of hard, drinkable water might be obtained at depths of 30 feet or less from localized pockets of sand or gravel in the upper, weathered part of the boulder clay. At greater depths the porous beds, if present, will in most places be of sufficient areal extent to indicate their presence or absence in any locality by one test hole. In section 1 a 60-foot well penetrated a sand bed in the drift and obtained an adequate supply of hard, highly mineralized water suitable for stock. In section 2, however, only a small seepage of water was obtained from the boulder clay at a depth of 70 feet. Similar variations can be expected in supplies from the glacial drift at other sites in the area. In Westerham, in section 34 of the adjoining township to the south, test holes were sunk to depths of 212, 214, and 315 feet. The records of these wells indicated the glacial drift to be approximately 260 feet thick. Although sands and gravels were encountered in the drift at various depths in these wells no appreciable supply of water was encountered in them. Similar conditions may be encountered in deep drilling in this township.

The Belly River formation that underlies the glacial drift is believed to contain many sandy beds sufficiently porous to be water bearing. The 314-foot well in Westerham is considered to have penetrated at least 50 feet into the formation without an appreciable water supply. Large supplies might be obtained at greater depths, but the drilling of such deep wells is expensive and careful prospecting at shallow depths seems more advisable.

STATISTICAL SUMMARY OF WELL INFORMATION IN RURAL MUNICIPALITY OF HAPPYLAND, No.231, SASKATCHEWAN

Township	19	19	19	20	20	20	21	21	21	22	22	22	23	23	23	Total No. in municipality
West of 3rd meridian Range	25	26	27	25	26	27	25	26	27	25	26	27	25	26	27	
Total No. of Wells in Township	31	93	87	43	74	81	39	50	57	29	32	41	4	10	14	691
No. of wells in bedrock	1	2	0	3	1	3	14	2	2	20	12	23	4	1	0	88
No. of wells in glacial drift	30	91	87	40	73	78	25	48	55	9	20	18	0	15	14	603
No. of wells in alluvium	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Permanency of Water Supply																
No. with permanent supply	31	78	83	43	67	63	38	46	54	29	32	37	4	10	13	634
No. with intermittent supply	0	0	1	0	5	5	0	1	0	0	0	0	0	0	1	19
No. dry holes	0	9	3	0	2	13	1	3	3	0	0	4	0	0	0	38
Types of Wells																
No. of flowing artesian wells	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No. of non-flowing artesian wells	10	32	48	9	24	20	17	17	21	20	23	24	4	1	0	287
No. of non-artesian wells	21	52	30	34	48	42	21	30	33	3	4	13	0	15	14	300
Quality of Water																
No. with hard water	29	63	67	30	61	51	32	44	40	23	29	34	4	10	10	543
No. with soft water	2	21	17	7	11	17	0	3	8	1	3	3	0	7	4	110
No. with salty water	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	2
No. with "alkaline" water	13	27	25	11	30	19	7	19	11	7	14	19	0	1	1	174
Depths of Wells																
No. from 0 to 50 feet deep	8	45	42	33	35	41	14	15	23	1	4	5	0	15	12	293
No. from 51 to 100 feet deep	20	38	42	5	31	23	1	17	22	1	0	2	0	0	1	203
No. from 101 to 150 feet deep	1	8	3	0	6	12	4	12	9	4	8	10	0	0	0	77
No. from 151 to 200 feet deep	1	0	0	2	1	0	5	4	1	0	0	0	1	0	1	28
No. from 201 to 500 feet deep	1	2	0	2	1	5	14	2	2	17	11	24	3	1	0	85
No. from 501 to 1,000 feet deep	0	0	0	1	0	0	1	0	0	0	3	0	0	0	0	5
No. over 1,000 feet deep	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
How the Water is Used																
No. usable for domestic purposes	25	62	60	40	52	57	37	43	48	29	23	35	4	14	14	543
No. not usable for domestic purposes	0	22	24	3	20	11	1	4	0	0	9	2	0	2	0	110
No. usable for stock	31	82	80	43	66	68	37	46	53	29	28	36	4	16	14	633
No. not usable for stock	0	2	4	0	0	0	1	1	1	0	4	1	0	0	0	20
Sufficiency of Water Supply																
No. sufficient for domestic needs	29	73	79	39	58	62	37	45	51	29	26	37	4	15	13	597
No. insufficient for domestic needs	2	11	5	4	14	6	1	2	3	0	0	0	0	1	1	50
No. sufficient for stock needs	18	49	60	27	47	48	35	41	38	29	20	26	4	9	7	459
No. insufficient for stock needs	13	35	24	16	25	20	3	6	16	0	12	11	0	6	7	194

ANALYSES AND QUALITY OF WATER

General Statement

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

Total Dissolved Mineral Solids

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

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

Mineral Substances Present

Calcium and Magnesium

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

Sodium

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

Sulphates

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

Chlorides

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

Iron

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

Hardness

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

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

Analyses of Water Samples from the Municipality of Happyland, No. 231, Saskatchewan

LOCATION						Depth of Well, ft.	Total dis'vd solids	HARDNESS			CONSTITUENTS AS ANALYSED						CONSTITUENTS AS CALCULATED IN ASSUMED COMBINATIONS									Source of Water
No.	Qtr.	Sec.	Tp.	Rge.	Mer.			Total	Perm.	Temp.	Cl.	Alka-linity	CaO	MgO	SO_4	Na_2O	Solids	$CaCO_3$	$CaSO_4$	$MgCO_3$	$MgSO_4$	Na_2CO_3	Na_2SO_4	NaCl	$CaCl_2$	
1	NE.	31	19	25	3rd	96	1,220	560	400	150	50	840	30	202	135	306	1,060	54		422		301	200	83		*1
2	NE.	31	19	27	3rd	35	1,470											(4)	(1)		(2)		(3)		(5)	*1
3	NW.	20	20	25	3rd	180	2,160	340	200	140	50	270	30	101	1,263	834	2,180	54		182	42		1,819	83		*1
4	NW.	31	20	25	3rd	347	860	600	550	50	12	100	90	108	570	174	899	100	83		322		374	20		*2
5	SW.	24	22	27	3rd	400	3,100	280	220	60	121	285	40	83	1,919	1,348	3,292	72		173		7	2,840	200		*2
6	SE.	30	22	27	3rd	358	960	700	600	100	33	145	70	155	570	171	960	125		17	438		326	54		*2

Water samples indicated thus, *1, are from glacial drift or other unconsolidated deposits.
Water samples indicated thus, *2, are from bedrock, Belly River formation.
Analyses are reported in parts per million; where numbers (1), (2), (3), (4), and (5) are used instead of parts per million, they represent the relative amounts in which the five main constituents are present in the water.
Hardness is the soap hardness expressed as calcium carbonate ($CaCO_3$).
Analysis No. 2 by Provincial Analyst, Regina.
For interpretation of this table read the section on Analyses and Quality of Water.

Water from the Unconsolidated Deposits

The water from South Saskatchewan river is used for domestic purposes by many residents in the northern part of the municipality. No analyses have been made of the water along this part of the river course, but analyses made at the city of Saskatoon may be considered as somewhat indicative of its character in this region. The dissolved solid content varies seasonally, usually between 200 and 410 parts per million, and the total hardness between 100 and 250 parts per million. The permanent hardness due to the presence of calcium and magnesium sulphates ($CaSO_4$ and $MgSO_4$) seldom exceeds 100 parts per million; the temporary hardness formed by the dissolved carbonates of calcium and magnesium comprises the greater part of the total. This water is much lower in dissolved mineral salts and softer than waters commonly obtained from wells, and except during periods of flood when there is a large amount of sediment in the water it is well adapted to either stock or household use.

No analyses were made of waters from the dune or lake sands in this municipality. The following general discussion is based on analyses made of waters from similar deposits in adjoining municipalities, on observations made at the wells, and on reports of residents using the water. Water from the sand usually contains between 400 and 900 parts per million of dissolved mineral salts and has a total hardness of between 200 and 500 parts per million. This water is not excessively hard and the concentrations of the laxative acting salts, magnesium sulphate ($MgSO_4$, Epsom salts) and sodium sulphate (Na_2SO_4, Glauber's salt), are not sufficiently high to affect the quality of the water for drinking. In a few lowland places, where continued surface evaporation has caused the salts to become fairly highly concentrated, the water from the sands may be too highly mineralized to be used for domestic purposes. The character of the upper 30 or 40 feet of the glacial drift varies

considerably even within small areas, and similar variation may be expected in the quality of the water obtained from shallow wells only short distances apart. The boulder clay, and to a lesser extent the lake clay, are considered to be the sources of the sulphate salts present in varying amounts in waters from the drift. Hence, beds of sands and gravels not covered by any appreciable thickness of clay yield water that is soft or only moderately hard, whereas waters from porous beds under 30 feet or more of clay are generally excessively hard and "alkaline". Many shallow wells in the drift in the southern part of this municipality yield relatively soft water of good quality for household use. Analysis No. 2, on the accompanying table of analyses, of water from a 35-foot well in the NE.$\frac{1}{4}$, sec. 31, tp. 19, range 27, is representative of the more highly mineralized water obtained at shallow depths in the glacial drift. The total solid content of the water is 1,470 parts per million, made up of the following mineral salts in order of their decreasing quantities; calcium sulphate ($CaSO_4$), magnesium sulphate ($MgSO_4$), sodium sulphate (Na_2SO_4), calcium carbonate ($CaCO_3$), and calcium chloride ($CaCl_2$). This water is very hard and might have a laxative effect on persons unaccustomed to its use, but it is being used for domestic purposes.

The above general discussion applies to waters from the glacial drift where it occurs as till and moraine and where it is covered by lake sands or clays. At greater depths in the glacial drift the water is almost invariably hard and highly mineralized. Analyses Nos. 1 and 3 are of waters from the 96- and 180-foot wells located, respectively, in the NE.$\frac{1}{4}$, sec. 31, tp. 19, range 25, and the NW.$\frac{1}{4}$, sec. 20, tp. 20, range 25. The water from the 96-foot well has a total dissolved solid content of 1,220 parts per million and a total hardness of 560 parts per million. The sulphate salt content is not excessive and the water, although not particularly satisfactory for drinking, could possibly be used if better quality

water were not available. The water from the 180-foot well has a total dissolved solid content of 2,160 parts per million, but has a total hardness of only 340 parts per million. The greater part of the total solid content is made up of sodium sulphate. This salt does not cause hardness, but is laxative when present in water in large quantities. This water, however, is being used for domestic purposes with no reported ill effects. In many places waters obtained from the deeper wells in the glacial drift are unfit for drinking. These waters probably contain higher concentrations of magnesium sulphate (Epsom salts) than the waters analysed. This salt has a much greater laxative effect than sodium sulphate.

Water from the Bedrock

No water is being obtained from the Bearpaw shales in this municipality. Any small seepages that might occur in these compact marine shales would probably contain high concentration of sodium sulphate and sodium chloride (common salt).

Three samples of water obtained from sand beds in the Belly River formation were collected and analysed by the Geological Survey. These waters are fairly typical of waters obtained from the formation in all parts of the municipality. Analyses Nos. 4 and 6 are of waters from 347- and 358-foot wells in the NW.$\frac{1}{4}$, sec. 31, tp. 20, range 25, and the SE.$\frac{1}{4}$, sec. 30, tp. 22, range 27. The waters are similar in character, having total solid contents of 860 and 960 parts per million and total hardnesses of 600 and 700 parts per million. The predominant mineral salts are, in both cases, sodium and magnesium sulphates. These salts are not present in sufficient quantities to render the water unfit for domestic use. The most objectionable feature of the water from the Belly River formation is the large amount of iron present. As much of the iron may be precipitated by being exposed to the air,

it is in many cases found desirable to let the water stand in an open container for a considerable length of time before it is used.

At greater depths in the Belly River formation the water becomes more highly charged with mineral salts, but is softer due to the predominance of sodium salts and lesser amounts of calcium and magnesium salts that cause hardness. Analysis No. 5, of water from a 406-foot well in the SW.$\frac{1}{4}$, sec. 24, tp. 22, range 27, is typical of the water obtained at lower horizons in this formation. This water has a total dissolved solid content of 3,160 parts per million and a hardness of only 280 parts per million. The total solid content is made up largely of sodium sulphate. Some of the waters obtained from this formation, usually at depths of 400 feet or more, will probably contain large quantities of sodium carbonate (soda) and sodium chloride (common salt). In many places the high concentrations of these salts will render the water unfit for drinking and harmful for irrigation. In general, waters from the Belly River formation are unsatisfactory for domestic purposes, although they are being used in some places where supplies of better quality have not been found at shallow depths.

WELL RECORDS—Rural Municipality of HAPPYLAND NO.231, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
1	SE.	3	19	25	3	Drilled	360	2,335	- 15	2,320	360	1,975	Belly River	Hard, clear, "alkaline"		S	Sufficient supply; laxative; 60-foot well for house use.
2	NE.	5	"	"	"	Drilled	1?2	2,345	-167	2,178	167	2,178	Glacial sand	Hard, clear, "alkaline"		S	Insufficient supply; shallow well for house use.
3	NE.	5	"	"	"	Dug	32′	2,380	- 26	2,354	26	2,354	Glacial drift	Hard, iron, colouration		D, S	Insufficient supply.
4	NW.	6	"	"	"	Bored	72	2,395	- 42	2,353	42	2,353	Glacial quick-sand	Hard, iron, "alkaline" rusty		D, S	Sufficient supply; laxative.
5	SW.	7	"	"	"	Dug	40	2,395	- 28	2,367	28	2,367	Glacial drift	Hard, iron, "alkaline" rusty		D, S	Insufficient supply.
6	NW.	7	"	"	"	Bored	60	2,370	- 45	2,325	45	2,325	Glacial sand	Hard, iron, "alkaline" rusty		D, S	Insufficient supply.
7	NW.	8	"	"	"	Bored	80	2,385	- 77	2,308	77	2,308	Glacial quick-sand	Hard, iron, "alkaline"		D, S	Another similar well.
8	SE.	9	"	"	"	Dug	54	2,340	- 20	2,320	54	2,286	Glacial gravel	Iron colour Hard, clear, "alkaline"		D, S	Sufficient supply.
9	SW.	10	"	"	"	Bored	63	2,350	- 23	2,327	63	2,287	Glacial gravel	Hard, clear		D, S	Sufficient supply.
10	NW.	10	"	"	"	Bored	95	2,390	- 70	2,320	70	2,320	Glacial drift	Soft, clear		D, S	Sufficient supply.
11	NE.	11	"	"	"	Bored	70	2,345	- 20	2,325			Glacial sand	Hard, clear		D, S	Sufficient supply.
12	SW.	12	"	"	"	Dug	58	2,340	- 2	2,338	54	2,286	Glacial sand	Hard, iron, rusty		D, S	Sufficient supply.
13	SW.	16	"	"	"	Bored	86	2,375	- 61	2,314	86	2,289	Glacial gravel	Hard, iron, rusty		D, S	Sufficient supply.
14	SW.	20	"	"	"	Bored	60	2,370	- 57	2,313	57	2,313	Glacial quick-sand	Hard, clear		D, S	Insufficient supply.
15	SW.	21	"	"	"	Dug	20	2,390	- 15	2,375	15	2,375	Glacial quick-sand	Soft, clear		D, S	Insufficient supply.
16	NW.	21	"	"	"	Bored	89	2,380	- 19	2,361	85	2,295	Glacial quick-sand and gravel	Hard, iron, "alkaline" rusty		D, S	Good supply.
17	NW.	24	"	"	"	Bored	60	2,300	- 10	2,290	?	?	Glacial sand	Hard, clear, iron		D, S	Sufficient supply.
18	NE.	26	"	"	"	Bored	150	2,330	- 30	2,300	150	2,180	Glacial sand	Hard, iron, "alkaline" rusty		D, S	Insufficient supply; laxative.
19	NW.	27	"	"	"	Bored	65	2,360					Glacial drift	Hard, clear, iron		D, S	Sufficient supply.
20	NE.	27	"	"	"	Bored	60	2,360	- 40	2,320	40	2,320	Glacial drift	Hard, iron, rusty		S	Sufficient supply; laxative.
21	NE.	28	"	"	"	Dug	25	2,350	- 15	2,335	15	2,335	Glacial sand	Medium hard, clear		D, S	Sufficient supply.
22	NE.	30	"	"	"	Bored	90	2,375	- 81	2,294	81	2,294	Glacial sand	Hard, iron, "alkaline" iron, colour-ation		S	Insufficient supply; laxative.
23	NE.	31	"	"	"	Bored	96	2,385	- 84	2,301	84	2,301	Glacial quick-sand	Hard, "alka-line" green		S	Just sufficient; another similar well. #

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

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

WELL RECORDS[2]—Rural Municipality of HAPPYL ND NO. 231, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE: Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED: Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
24	SW.	32	19	25	3	Bored	90	2,365	- 50	2,315	50	2,315	Glacial drift	Hard, iron, "alkaline" rusty			Sufficient supply; laxative.
25	SE.	33	"	"	"	Bored	50	2,390	- 38	2,352	48	2,342	Glacial sand	Hard, clear		D, S	Sufficient supply; shallow seepage well for house water.
26	SE.	35	"	"	"	Dug	20	2,320	- 18	2,302	18	2,302	Glacial sand	Hard, clear, "alkaline"		D, S	Insufficient supply; laxative.
1	SE.	1	19	26	3	Bored	74	2,300	- 72	2,228	72	2,228	Glacial quick-sand	Hard, clear, "alkaline" iron	44	D, S	Intermittent supply; a dry hole 40 feet deep.
2	NW.	1	"	"	"	Bored	65	2,332	- 50	2,282	65	2,267	Glacial drift	Hard, clear, iron	45	D, S	Sufficient supply; another well 40 feet deep filled in with quicksand 20 feet; soft water.
3	SE.	2	"	"	"	Bored	79	2,335	- 47	2,288	79	2,256	Glacial quick-sand	Hard, iron, yellow	44	D, S	Sufficient supply; another well 79 feet deep filled in from bottom with quicksand; bitter water.
4	NE.	2	"	"	"	Dug	18	2,335	- 12	2,323	12	2,323	Glacial drift	Hard, clear, "alkaline"	47	D, S	Sufficient supply; another well 16 feet deep, 6 feet water similar; house use.
5	NE.	3	"	"	"	Bored	93	2,352	- 53	2,299	90	2,262	Glacial sand	Hard, iron, "alkaline" yellow		S	Sufficient supply; a 16-foot well for house use.
6	SW.	4	"	"	"	Bored	93	2,332	- 43	2,289	93	2,239	Glacial quick-sand	Hard, clear, "alkaline" iron	44	S	Sufficient supply; unfit for domestic use; another well 106 feet deep, but caved in to 55 feet, hard drinking water.
7	SW.	5	"	"	"	Bored	80	2,310	- 55	2,255	80	2,230	Glacial sand	Hard, "alkaline", iron, yellow	44	S	Sufficient supply; a 25-foot well for house use; with soft water.
8	NE.	6	"	"	"	Bored	48	2,330	- 28	2,302	48	2,282	Glacial drift	Hard, iron, yellow	46	S	Sufficient supply; haul drinking water; another 18-foot well; 2 foot water soft.
9	SW.	7	"	"	"	Bored	90	2,320	- 30	2,290	90	2,230	Glacial sand	Hard, clear, "alkaline" iron	44	S	Sufficient supply; another 20-foot well, 5 foot water used for drinking.
10	SE.	8	"	"	"	Bored	93	2,340	- 33	2,307	88	2,252	Glacial quick-sand	Hard, yellow, "alkaline" iron	45	S	Sufficient supply; a 20-foot well, 10 foot soft water for domestic use.
11	SW.	9	"	"	"	Bored	75	2,338	- 45	2,293	75	2,263	Glacial sand	Hard, yellow, iron	44	D, S	Sufficient supply.
12	SW.	10	"	"	"	Bored	98	2,385	- 58	2,327	98	2,287	Glacial quick-sand	Hard, yellow, "alkaline" iron	44	S	Sufficient supply.
13	NE.	10	"	"	"	Bored	100	2,400	- 82	2,318	100	2,300	Glacial quick-sand	Hard, iron, yellow, "alkaline"	44	D, S	Sufficient supply; hauls drinking water.
14	SW.	11	"	"	"	Bored	98	2,380	- 58	2,322	98	2,282	Glacial quick-sand	Hard, iron, yellow, "alkaline"	44	D, S	Sufficient supply.
15	NE.	12	"	"	"	Dug	46	2,322	- 45	2,277	40	2,282	Glacial drift	Hard, clear, "alkaline" iron	46	D, S	Insufficient supply.
16	NW.	12	"	"	"	Bored	40	2,350	- 24	2,326	36	2,314	Glacial sand	Hard, clear, "alkaline"	45	D, S	Sufficient supply.
17	SE.	13	"	"	"	Bored	50	2,326	- 35	2,291	50	2,276	Glacial sand	Hard, clear, "alkaline"	44	D	Sufficient supply.

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

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

WELL RECORDS—Rural Municipality of HAPPYLAND NO.231, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
18	SW.	13	19	26	3	Bored	70	2,360	- 67	2,293	70	2,290	Glacial gravel	Hard, iron, clear	45	D, S	Insufficient supply; haul water for stock in summer.
19	NW.	14	"	"	"	Dug	25	2,385	- 20	2,365	25	2,360	Glacial drift	Soft, clear	46	D, S	Sufficient supply.
20	SW.	15	"	"	"	Bored	86	2,340	- 85	2,255	86	2,254	Glacial gravel	Hard, iron, "alkaline" yellow	44	S	Intermittent supply; 25-foot well, 2 feet water for house use; dry holes 70 to 90 feet deep.
21	NW.	15	"	"	"	Bored	105	2,439	- 75	2,364	100	2,339	Glacial sand	Hard, iron, "alkaline" yellow	44	S	Sufficient supply; a well 25 feet deep, 2 feet soft water for house use.
22	SE.	16	"	"	"	Bored	53	2,338	- 39	2,299	39	2,299	Glacial sand and gravel	Hard, clear, "alkaline"	44	S	Insufficient supply; well 17 feet deep for house use; soft water. Dry holes 52 feet.
23	SE.	17	"	"	"	Bored	80	2,369	- 40	2,329	79	2,290	Glacial sand	Hard, iron, yellow	45	D, S	Sufficient supply.
24	NW.	17	"	"	"	Bored	75	2,368	- 35	2,333	73	2,295	Glacial sand	Hard, iron, yellow	45	S	Sufficient supply; 10-foot well, 4 feet water for house use.
25	SE.	18	"	"	"	Bored	60	2,430	- 30	2,400	60	2,370	Glacial sand	Hard, iron, yellow	44	S	Sufficient supply; well 35 feet deep, water for drinking.
26	NW.	19	"	"	"	Bored	54	2,400	- 44	2,356	44	2,356	Glacial sand and gravel	Hard, clear	46	D, S	Insufficient supply.
27	SW.	20	"	"	"	Bored	68	2,385	- 48	2,337	60	2,325	Glacial quick-sand	Hard, iron, yellow	44	S	Sufficient supply; well 12 feet for drinking soft water.
28	SE.	20	"	"	"	Bored	60	2,400	- 52	2,348	52	2,348	Glacial drift	Hard, iron, "alkaline" yellow	45	S	Insufficient supply; well 15 feet 4 foot water for house use; soft water.
29	SW.	21	"	"	"	Bored	85	2,408	- 77	2,321	77	2,321	Glacial quick-sand	Hard, iron, yellow	44	S	Insufficient supply.
30	NE.	21	"	"	"	Bored	102	2,462	- 92	2,370	92	2,370	Glacial quick-sand	Hard, iron, "alkaline" yellow	44	S	Sufficient supply; 17-foot well for house use soft water.
31	NW.	21	"	"	"	Bored	95	2,425	- 70	2,355	90	2,335	Glacial sand	Hard, iron, yellow	44	D, S	Sufficient supply.
32	SE.	22	"	"	"	Bored	108	2,447	- 98	2,349	98	2,349	Glacial quick-sand	Hard, iron, yellow "alkaline"	44	S	Insufficient supply; 22-foot well, soft water, for house use.
33	SW.	22	"	"	"	Bored	126	2,460	-110	2,350	110	2,350	Glacial quick-sand	Hard, iron, "alkaline" yellow	44	S	Insufficient supply; 2 wells 14 and 20 feet deep, soft water for house use.
34	SW.	23	"	"	"	Bored	112	2,395	- 92	2,303	112	2,283	Glacial quick-sand	Hard, iron, yellow	43	S	Insufficient supply; haul water for house.
35	NE.	23	"	"	"	Bored	70	2,380	- 62	2,318	70	2,310	Glacial quick-sand	Hard, "alkaline" clear	44	D, S	Insufficient supply.
36	NW.	23	"	"	"	Dug	16	2,390	- 12	2,378	10	2,380	Glacial drift	Soft, clear	48	S	Intermittent supply; another well not used.
37	SW.	24	"	"	"	Bored	75	2,370	- 69	2,301	75	2,295	Glacial sand	Hard, iron, clear	44	D, S	Sufficient supply.
38	NW.	25	"	"	"	Drilled	475	2,410					Belly River	Hard, iron, "alkaline" yellow		S	No information.
39	NW.	25	"	"	"	Bored	75	2,400	- 59	2,341	59	2,341	Glacial quick-sand	Hard, clear, "alkaline" iron	44	D, S	Sufficient supply.
40	NE.	27	"	"	"	Dug	38	2,404	- 18	2,386	18	2,386	Glacial gravel	Soft, clear	42	D, S	Insufficient supply; a 38-foot well also.

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

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

WELL RECORDS—Rural Municipality of HAPPYLAND NO.231, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
41	SW.	28	19	26	3	Bored	97	2,435	- 87	2,348	87	2,348	Glacial sand	Soft, clear, "alkaline"	44	D, S	Insufficient supply; two other wells 87 and 35 feet deep.
42	SE.	29	"	"	"	Dug	10	2,425	- 4	2,421	4	2,421	Glacial sand	Soft, clear	48	S	Intermittent supply.
43	SE.	30	"	"	"	Bored	60	2,415	- 50	2,365	60	2,355	Glacial quick-sand	Hard, iron, yellow	45	S	Insufficient supply; two other wells.
44	NE.	30	"	"	"	Bored	58	2,425	- 50	2,375	50	2,375	Glacial quick-sand	Hard, clear, "alkaline"	46	D, S	Insufficient supply; 115-foot well, water hard, iron, yellow, "alkaline".
45	NE.	31	"	"	"	Dug	26	2,420	- 18	2,402	18	2,402	Glacial gravel	Soft, clear	46	D, S	Insufficient supply; 4 dry holes.
46	SE.	32	"	"	"	Dug	20	2,321	- 10	2,311	10	2,311	Glacial gravel	Soft, clear	47	D, S	Intermittent supply.
47	SW.	33	"	"	"	Bored	97	2,421	- 67	2,354	92	2,329	Glacial sand	Hard, iron, yellow	45	S	Sufficient supply; 28-foot well, 15 feet soft water for house use only.
48	SE.	34	"	"	"	Bored	60	2,385	- 45	2,340	45	2,340	Glacial quick-sand	Hard, clear, "alkaline" iron	45	S	Sufficient supply; 2 other wells; soft water.
49	NW.	35	"	"	"	Bored	85	2,375	- 77	2,298	77	2,298	Glacial quick-sand	Hard, rusty, yellow	44	S	Insufficient supply; 14-foot well for domestic use; soft water.
50	SE.	36	"	"	"	Dug	14	2,388	- 12	2,376	12	2,376	Glacial sand	Soft, clear	48	D	Intermittent supply.
51	SW.	36	"	"	"	Bored	84	2,388									Dry hole in glacial drift; hauls water.
52	NE.	36	"	"	"	Bored	120	2,360	- 95	2,265	120	2,240	Glacial quick-sand	Hard, "alkaline", clear	44	S	Sufficient supply; 25-foot well, 3 feet soft water for house; a 300-foot well not used in Belly River formation.
1	SE.	1	19	27	3	Bored	80	2,320	- 50	2,270	80	2,240	Glacial sand	Hard, clear, "alkaline" iron	45	S	Sufficient supply; haul drinking water.
2	NW.	1	"	"	"	Bored	40	2,332	- 20	2,312	40	2,292	Glacial sand	Hard, iron, (oily) clear	46	D, S	Sufficient supply.
3	SE.	2	"	"	"	Bored	70	2,338	- 40	2,298	70	2,268	Glacial drift	Hard, "alkaline", iron, clear	45	S	Sufficient supply; 30-foot well, 3 feet soft water for house.
4	NW.	2	"	"	"	Bored	35	2,338	- 23	2,315	35	2,303	Glacial sand	Hard, "alkaline" iron, turns yellow	46	D, S	Sufficient supply.
5	NW.	3	"	"	"	Bored	60	2,355	- 35	2,320	50	2,305	Glacial gravel	Hard, iron, clear	44	S	Sufficient supply; 20-foot well used for house, water soft.
6	SE.	4	"	"	"	Bored	78	2,352	- 41	2,311	78	2,274	Glacial drift	Hard, iron, yellow	46	S	Sufficient supply; 65-foot well for house use.
7	NW.	4	"	"	"	Bored	48	2,340	- 23	2,317	48	2,292	Glacial gravel	Hard, iron, yellow	44	D, S	Sufficient supply; two other similar wells 48 feet deep.
8	NE.	5	"	"	"	Bored	55	2,340	- 30	2,310	54	2,286	Glacial sand	Hard, "alkaline", clear	45	S	Sufficient supply; two other wells 16 and 18 feet deep, house use, soft water.
9	SE.	6	"	"	"	Bored	65	2,345	- 40	2,305	65	2,280	Glacial drift	Hard, iron, clear	44	D, S	Sufficient supply.
10	SW.	6	"	"	"	Dug	16	2,358	- 8	2,350	8	2,350	Glacial drift	Medium clear	47	S	Insufficient supply; similar well 12 feet deep.
11	SW.	7	"	"	"	Bored	73	2,360	- 12	2,348	73	2,287	Glacial sand	Hard, iron, "alkaline" yellow	44	S	Sufficient supply; 9-foot well, 4 feet water for drinking, soft water.
12	NE.	7	"	"	"	Bored	58	2,375	- 46	2,329	58	2,317	Glacial drift	Hard, clear	44	D, S	Sufficient supply.

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

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

WELL RECORDS—Rural Municipality of HAPPYLAND NO. 231, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
13	NW.	8	19	27	3	Bored	46	2,315	- 26	2,289	45	2,270	Glacial gravel	Hard, iron, clear	45	D, S	Sufficient supply; 39-foot similar well.
14	SW.	9	"	"	"	Dug	50	2,330	- 40	2,290	48	2,282	Glacial sand	Hard, clear	44	S	Sufficient supply; 35-foot well for house use; soft water.
15	SW.	10	"	"	"	Bored	40	2,340	- 22	2,318	40	2,300	Glacial drift	Hard, iron, "alkaline" turns yellow	46	S	Insufficient supply; 12-foot well for house use, soft water.
16	NE.	10	"	"	"	Bored	60	2,358	- 20	2,338	60	2,298	Glacial drift	Hard, iron, yellow(pale)	44	D, S	Sufficient supply.
17	SE.	12	"	"	"	Dug	90	2,315	- 20	2,295	80	2,235	Glacial drift	Hard, clear, "alkaline, iron	45	S	Sufficient supply; 16-foot well, 8 feet water for drinking.
18	NE.	12	"	"	"	Bored	90	2,315	- 60	2,255	90	2,225	Glacial sand	Hard, clear, "alkaline" iron	44	S	Sufficient supply; 20-foot well, used for drinking, soft water.
19	SE.	13	"	"	"	Bored	100	2,334	- 40	2,294	100	2,234	Glacial sand	Hard, clear, iron	44	S	Sufficient supply; 20-foot well, 10 feet water for drinking, soft water.
20	SW.	14	"	"	"	Bored	45	2,358	- 30	2,328	45	2,313	Glacial drift	Hard, clear, "alkaline"	46	D, S	Sufficient supply.
21	SW.	14	"	"	"	Bored	90	2,345	- 40	2,305	90	2,255	Glacial sand	Hard, iron, "alkaline" yellowish	44	D, S	Sufficient supply.
22	SW.	15	"	"	"	Bored	66	2,328	- 50	2,278	66	2,262	Glacial drift	Hard, iron, "alkaline"	44	S	Insufficient supply; unfit for humans; dry holes 150 feet in glacial drift.
23	SE.	15	"	"	"	Dug	52	2,398	- 36	2,362	36	2,362	Glacial drift	Hard, clear, iron	45	D, S	Sufficient supply; 63-foot well, 50 feet water for stock.
24	SE.	17	"	"	"	Bored	86	2,330	- 46	2,284	86	2,244	Glacial sand	Hard, iron, "alkaline" yellowish green	44	S	Sufficient supply; 14-foot well, 2 feet water for house use, soft water.
25	NW.	17	"	"	"	Bored	85	2,350	- 75	2,275	85	2,265	Glacial sand	Hard, clear, "alkaline" iron	44	N	
26	SE.	18	"	"	"	Bored	65	2,400	- 59	2,341	59	2,341	Glacial drift	Hard, "alkaline" iron, yellow	45	S	Insufficient supply; another well 54 feet deep.
27	NE.	18	"	"	"	Bored	42	2,350	- 32	2,318	32	2,318	Glacial drift	Hard, "alkaline" iron, turns yellow	44	D, S	Insufficient supply.
28	NE.	19	"	"	"	Bored	68	2,380	- 38	2,342	66	2,314	Glacial sand	Hard, iron, "alkaline" yellow	44	S	Sufficient supply; 74-foot similar well for house use.
29	NW.	19	"	"	"	Bored	95	2,390	- 45	2,345	95	2,295	Glacial gravel	Hard, iron, "alkaline" yellow	44	S	Sufficient supply; 30-foot well, 6 feet water for drinking, soft water.
30	SW.	20	"	"	"	Bored	40	2,390	- 15	2,375	40	2,350	Glacial sand	Medium hard, clear	46	D, S	Sufficient supply.
31	SE.	21	"	"	"	Bored	114	2,365	- 69	2,296	60	2,305	Glacial drift	Hard, iron, yellow	44	S	Sufficient supply; 80-foot well for house use
32	NW.	21	"	"	"	Bored	73	2,490	- 68	2,422	68	2,422	Glacial sand	Hard, clear, "alkaline" iron	44	S	Insufficient supply; 34-foot well, 5 feet water for house use, soft water.
33	SE.	22	"	"	"	Bored	50	2,360	- 2	2,358	48	2,312	Glacial sand	Hard, iron, "alkaline" yellow	44	S	Sufficient supply.

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

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

WELL RECORDS—Rural Municipality of HAPPYLAND NO. 231, SASKATCHEWAN

B 4-4
R. 7526

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE: Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED: Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
34	W½.	22	19	27	3	Bored	96	2,420	- 70	2,350	?	?	Glacial drift	Hard, iron	?	?	Sufficient supply.
35	SE.	23	"	"	"	Bored	72	2,393	- 62	2,331	72	2,321	Glacial drift	Hard, iron, yellow	44	S	Insufficient supply; 14-foot well, 8 feet soft water for house use.
36	NE.	23	"	"	"	Bored	89	2,408	- 19	2,389	79	2,329	Glacial sand	Hard, "alkaline" black	44	D, S	Sufficient supply; another 70-foot well, 10 feet water.
37	SE.	24	"	"	"	Bored	54	2,350	- 28	2,322	54	2,296	Glacial gravel	Hard, clear, iron	46	S	Sufficient supply.
38	NE.	24	"	"	"	Bored	50	2,380	- 20	2,360	46	2,334	Glacial gravel	Hard, clear, "alkaline" iron	45	S	Sufficient supply.
39	SE.	25	"	"	"	Bored	25	2,408	- 22	2,386	25	2,383	Glacial sand	Hard, clear, "alkaline" iron	45	S	Insufficient supply; 20-foot well used for drinking water, soft water.
40	SE.	26	"	"	"	Bored	90	2,434	- 50	2,384	90	2,344	Glacial sand	Hard, iron, yellow	44	D, S	Sufficient supply; 12-foot well, 2 feet water for house use, soft water.
41	SE.	27	"	"	"	Bored	93	2,454	- 33	2,421	93	2,361	Glacial drift	Hard, iron, clear	44	S	Sufficient supply; a 70-foot well caved in.
42	SW.	27	"	"	"	Dug	45	2,434	- 30	2,404	45	2,389	Glacial sand and gravel	Hard, clear	46	D, S	Sufficient supply.
43	NE.	27	"	"	"	Bored	56	2,482	- 41	2,441	54	2,428	Glacial quick-sand	Hard, clear	44	N	Sufficient supply.
44	SW.	28	"	"	"	Bored	75	2,460	- 68	2,392	75	2,385	Glacial sand	Hard, iron, yellow	44	N	
45	NW.	28	"	"	"	Bored	80	2,480	- 4	2,476	?	?	Glacial sand	Hard, clear	44	D, S	Sufficient supply.
46	SW.	30	"	"	"	Bored	44	2,394	- 36	2,358	36	2,358	Glacial sand	Hard, iron, "alkaline" yellow	45	S	Intermittent supply; 17-foot well for house use; a 90-foot well caved in.
47	NE.	31	"	"	"	Bored	35	2,410	- 25	2,385	35	2,375	Glacial gravel	Hard, "alkaline", iron, turns yellow	44	D, S	Sufficient supply. #
48	NE.	33	"	"	"	Bored	74	2,440	- 44	2,396	74	2,366	Glacial drift	Hard, iron, yellow	44	D, S	Sufficient supply; dry hole 48 feet deep.
49	NE.	33	"	"	"	Bored	45	2,445	- 35	2,410	45	2,400	Glacial drift	Hard, clear, iron	45	D, S	Sufficient supply.
50	NW.	34	"	"	"	Bored	70	2,430	- 66	2,364	70	2,360	Glacial drift	Hard, iron, yellow	44	D, S	Sufficient supply.
51	NW.	35	"	"	"	Dug	17	2,520	- 11	2,509	11	2,509	Glacial drift	Soft, clear	48	D, S	Insufficient supply.
52	SW.	36	"	"	"	Bored	90	2,472	- 60	2,412	86	2,386	Glacial sand	Hard, iron, yellow	45	S	Sufficient supply.
53	SE.	36	"	"	"	Bored	100	2,510	- 90	2,420	90	2,420	Glacial drift and sand	Hard, clear, "alkaline"	44	D, S	Sufficient supply; 20-foot well used for drinking water, soft water.
54	NW.	36	"	"	"	Bored	50	2,480	- 25	2,455	46	2,434	Glacial gravel	Soft clear	46	D, S	Sufficient supply.
1	SE.	2	20	25	3	Drilled	90	2,320	- 40	2,280	88	2,232	Glacial sand	Hard, iron, rusty		D, S	Sufficient supply.
2	NE.	4	"	"	"	Bored	50	2,335	- 10	2,325	47	2,288	Glacial sand	Hard, iron, rusty		S	Sufficient supply.
3	NE.	6	"	"	"	Dug	20	2,280	- 17	2,263	17	2,263	Glacial sand	Soft, clear		D, S	Sufficient supply; well 18 feet deep used for stock.
4	SW.	7	"	"	"	Dug	18	2,290	- 16	2,274	16	2,274	Glacial sand	Hard, clear		D, S	Sufficient supply.

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

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

WELL RECORDS—Rural Municipality of HAPPYLAND NO. 231, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE: Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED: Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
5	NE.	7	20	25	3	Bored	48	2,280	- 40	2,240	40	2,240	Glacial drift	Hard, clear, "alkaline"		S	Insufficient supply.
6	NE.	7	"	"	"	Bored	65	2,270	- 40	2,230	65	2,205	Glacial gravel	Hard, clear, "alkaline"		S	Sufficient supply.
7	SE.	9	"	"	"	Bored	60	2,290	- 20	2,270	60	2,230	Glacial sand	Hard, rusty, "alkaline"		D, S	Sufficient supply; another well 25 feet deep, 3 pails a day.
8	NW.	9	"	"	"	Dug	17	2,300	- 15	2,285	15	2,285	Glacial quick-sand	Fairly hard		D, S	Insufficient supply.
9	NW.	10	"	"	"	Dug	24	2,320	- 22	2,298	22	2,298	Glacial quick-sand	Hard, "alka-line"		D, S	Insufficient supply; 2 other wells, small supply.
10	NE.	10	"	"	"	Dug	23	2,300	- 20	2,280	20	2,280	Glacial sand	Soft, clear		D, S	Sufficient supply.
11	SW.	15	"	"	"	Dug	24	2,330	- 20	2,310	20	2,310	Glacial quick-sand	Fairly hard, slightly "alkaline", clear		D, S	Insufficient supply.
12	NW.	15	"	"	"	Dug	18	2,300	- 15	2,285	15	2,285	Glacial quick-sand	Hard, clear, slightly "alkaline"		D, S	Barely sufficient.
13	NE.	17	"	"	"	Dug	50	2,350	- 48	2,302	48	2,302	Glacial quick-sand	Fairly hard, clear		D	Insufficient supply ; another well 50 feet deep, small supply.
14	SE.	19	"	"	"	Dug	40	2,335	- 37	2,298	37	2,298	Glacial sand	Fairly hard, clear		D, S	Insufficient supply.
15	SW.	20	"	"	"	Dug	50	2,340	- 47	2,293	47	2,293	Glacial sand	Fairly soft, clear		D, S	Sufficient supply.
16	NW.	20	"	"	"	Drilled	180	2,310	-100	2,210	180	2,130	Glacial gravel	Hard, clear		D, S	Sufficient supply. #
17	SW.	21	"	"	"	Dug	25	2,270	- 24	2,246	24	2,246	Glacial sand	Soft, clear		D, S	Insufficient supply; 15-foot well, 4 feet of water used for stock.
18	NE.	22	"	"	"	Dug	26	2,330	- 23	2,307	23	2,307	Glacial quick-sand	Hard, clear, slightly "alkaline"		D, S	Insufficient supply.
19	SW.	28	"	"	"	Drilled	188	2,300	-108	2,192	188	2,112	Glacial sand	Hard, "alka-line"		D, S	Sufficient supply; another 40-foot well has 1½ feet of water.
20	SE.	30	"	"	"	Dug	35	2,330	- 30	2,300	30	2,300	Glacial quick-sand	Fairly hard, clear		D, S	Insufficient supply.
21	NE.	30	"	"	"	Drilled	456	2,340	- 96	2,244	?	?	Belly River?	Hard, clear, "alkaline" clear		S	Insufficient supply; 40-foot well, 3 feet water is used.
22	NW.	31	"	"	"	Drilled	347	2,290	-200	2,090	341	1,949	Belly River sand	Hard, clear, "alkaline" iron		S	Sufficient supply; 98-foot well, 4 feet of water used for house. #
23	SW.	32	"	"	"	Dug	40	2,335	- 35	2,300	35	2,300	Glacial sand	Failry hard, clear		D, S	Sufficient supply.
24	NE.	32	"	"	"	Bored	66	2,345	- 65	2,280	65	2,280	Glacial quick-sand	Fairly hard, clear		D	Sufficient for household.
25	NE.	32	"	"	"	Drilled	515	2,350	-100	2,250	515	1,835	Belly River sand	Hard, clear, "alkaline"		S	Sufficient supply.
26	SE.	33	"	"	"	Dug	14	2,300	- 12	2,288	12	2,288	Glacial quick-sand	Hard, clear		D, S	Sufficient supply; 2 similar wells in immediate vicinity.
27	SW.	34	"	"	"	Dug	14	2,320	- 11	2,309	11	2,309	Glacial quick-sand	Hard, clear		D, S	Sufficient supply; a similar well 50 yards northwest.
28	SE.	35	"	"	"	Dug	12	2,340	- 10	2,330			Glacial quick-sand	Fairly hard, clear		D, S	Insufficient supply.

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

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

WELL RECORDS—Rural Municipality of HAPPYLAND NO.231, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
29	SW.	35	20	25	3	Dug	16	2,330	- 14	2,316	14	2,316	Glacial drift and sand	Soft, clear		D	Sufficient supply.
30	SE.	36	"	"	"	Dug	22	2,330	- 19	2,311	19	2,311	Glacial sand	Soft, clear		D, S	Sufficient supply.
31	SW.	36	"	"	"	Dug	14	2,340	- 11	2,329	11	2,329	Glacial sand	Soft, clear		D, S	Sufficient supply.
1	SE.	1	20	26	3	Dug	18	2,386	- 16	2,370	16	2,370	Glacial sand	Soft, clear	46	D	Sufficient supply.
2	NW.	3	"	"	"	Dug	10	2,410					Glacial drift	Soft, clear	48	N	Intermittent supply.
3	NW.	4	"	"	"	Bored	68	2,400	- 54	2,346	68	2,332	Glacial sand	Hard, clear, "alkaline"	44	S	Sufficient supply.
4	SE.	5	"	"	"	Bored	14	2,420	- 12	2,408	12	2,408	Glacial drift	Hard, iron, yellow	47	S	Intermittent supply; haul water for stock and house use.
5	NW.	5	"	"	"	Bored	68	2,378	- 48	2,330	66	2,312	Glacial sand	Hard, clear, "alkaline"	47	D, S	Sufficient supply.
6	SE.	6	"	"	"	Bored	103	2,450	- 85	2,365	85	2,365	Glacial drift	Hard, clear	44	D, S	Insufficient supply.
7	NE.	6	"	"	"	Dug	25	2,440	0	2,440			Glacial gravel	Soft, clear	47	D, S	Sufficient supply; another similar well 20 feet deep.
8	SE.	7	"	"	"	Bored	32	2,430	- 12	2,418	12	2,418	Glacial gravel	Medium clear	46	D, S	Sufficient supply.
9	NW.	7	"	"	"	Dug	12	2,490	- 7	2,483	7	2,483	Glacial quick-sand	Soft, clear	48	D, S	Sufficient supply; another 33-foot well practically dry.
10	NW.	8	"	"	"	Bored	78	2,458	- 57	2,401	78	2,380	Glacial drift	Hard, clear	45	D, S	Insufficient supply; 97-foot well hard, "alkaline" yellow also 4 other wells 70 to 120 feet none of these in use.
11	SE.	9	"	"	"	Dug	71	2,422	- 63	2,359	63	2,359	Glacial sand	Hard, clear, "alkaline"	44	D, S	Insufficient supply.
12	NW.	9	"	"	"	Dug	76	2,390	- 51	2,339	76	2,314	Glacial blue sand	Hard, iron, "alkaline" yellow	44	D, S	Sufficient supply.
13	SE.	10	"	"	"	Bored	90	2,390	- 75	2,315	90	2,300	Glacial quick-sand	Hard, iron, "alkaline" yellow	44	S	Sufficient supply; 15-foot well, 2 feet water for house use.
14	SW.	10	"	"	"	Bored	75	2,420	- 63	2,357	75	2,345	Glacial quick-sand	Hard, clear	44	D, S	Sufficient supply; another well 75 feet deep hard, iron
15	NW.	10	"	"	"	Bored	46	2,380	- 38	2,342	15	2,365	Glacial gravel	Soft, clear	46	D, S	Intermittent supply.
16	SE.	12	"	"	"	Bored	30	2,282	- 28	2,254	28	2,254	Glacial sand	Hard, clear, "alkaline" iron	48	D, S	Sufficient supply.
17		13	"	"	"	Drilled & Bored	40	2,300	- 5	2,295	5	2,295	Glacial drift	Soft, clear		D, S	Sufficient supply.
18	NE.	14	"	"	"	Dug	12	2,255	- 9	2,246	9	2,246	Glacial quick-sand	Soft, clear	48	D, S	Sufficient supply; another 20-foot well little water.
19	NW.	14	"	"	"	Bored	20	2,320	- 17	2,303	17	2,303	Glacial drift	Medium "alkaline", clear		S	Intermittent supply; another well 22 feet deep, 3 feet water, slow in coming in.
20	SW.	16	"	"	"	Bored	80	2,343	- 72	2,271	72	2,271	Glacial drift	Hard, iron, "alkaline" yellow	45	S	Sufficient supply; 15-foot well, 4 feet water for house use.
21	SE.	17	"	"	"	Dug	26	2,333	- 23	2,310	23	2,310	Glacial sand and gravel	Hard, clear, "alkaline"	46	D, S, I	Sufficient supply.

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

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

WELL RECORDS—[9] Rural Municipality of HAPPYLAND NO.231, SASKATCHEWAN

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
22	SE.	18	20	26	3	Bored	100	2,375	- 40	2,335	40	2,335	Glacial gravel	Hard, clear, "alkaline" iron	43	S	Sufficient supply; 20-foot well used for drinking.
23	SW.	18	"	"	"	Dug	30	2,396	- 24	2,372	24	2,372	Glacial sand	Soft, clear	46	D, S	Sufficient supply.
24	NE.	18	"	"	"	Bored	60	2,365	- 50	2,315	50	2,315	Glacial drift	Hard, clear, iron	45	D, S	Sufficient supply; 13-foot well, soft water used for washing.
25	NW.	19	"	"	"	Bored	61	2,340	- 30	2,310	61	2,279	Glacial drift and gravel	Hard, clear, "alkaline" iron	45	D, S	Sufficient supply.
26	SE.	20	"	"	"	Bored	56	2,300	- 23	2,277	56	2,244	Glacial gravel	Hard, iron, "alkaline" yellow	46	S	Sufficient supply; 36-foot well, hard and clear, for house use; also 2 wells, 45 and 70 feet, dry holes.
27	NW.	20	"	"	"	Dug	50	2,320	- 35	2,285	50	2,270	Glacial drift with gravel	Hard, iron, "alkaline" yellowish	46	D, S	Sufficient supply.
28	NE.	21	"	"	"	Bored	50	2,313	- 35	2,278	35	2,278	Glacial sand and gravel	Hard, clear, "alkaline"	45	S	Sufficient supply; 25-foot well, 10 feet water for house use.
29	NW.	21	"	"	"	Bored	52	2,324	- 32	2,292	52	2,272	Glacial sand	Hard, iron, "alkaline" yellow	44	S	Sufficient supply.
30	NE.	22	"	"	"	Bored	35	2,317	- 28	2,289	35	2,282	Glacial sand	Hard, rusty (iron,) yellow	44	D, S	Sufficient supply.
31	NW.	22	"	"	"	Dug	105	2,316	- 45	2,271	85	2,231	Glacial gravel	Hard, iron, "alkaline" yellow	44	D, S	Sufficient supply.
32	NE.	23	"	"	"	Bored	70	2,320	- 50	2,270	70	2,250	Glacial quick-sand	Hard, clear, "alkaline" iron	45	D, S	Sufficient supply; 20-foot well, only few inches of water.
33	NW.	24	"	"	"	Bored	100	2,330	- 20	2,310	100	2,230	Glacial sand	Hard, clear, iron, "alka-line"	44	S	Sufficient supply; 20-foot well, 6 feet water for drinking.
34	SE.	25	"	"	"	Drilled	374	2,300	-200	2,100	374	1,926	Belly River sand	Hard, clear, "alkaline" iron	40	N	Insufficient supply; quicksand plugs up supply at times.
35	SW.	25	"	"	"	Dug	24	2,325	- 18	2,307	24	2,301	Glacial gravel	Hard, clear, "alkaline"	48	D, S	Intermittent supply.
36	SE.	27	"	"	"	Bored	70	2,300	- 30	2,270	70	2,230	Glacial sand	Hard, iron, "alkaline"	45	D, S	Sufficient supply.
37	NW.	28	"	"	"	Bored	69	2,310	- 14	2,296	69	2,241	Glacial gravel	Hard	44	D, S	Sufficient supply.
38	SE.	31	"	"	"	Bored	125	2,320	- 75	2,245	100	2,220	Glacial gravel	Hard, iron, "alkaline"	44	S	Sufficient supply.
39	SE.	31	"	"	"	Bored	28	2,321	- 20	2,301	20	2,301	Glacial sand	Hard, iron	47	D	Sufficient supply.
40	NW.	31	"	"	"	Dug	60	2,340	- 45	2,295			Glacial drift	Hard, iron, "alkaline"	45	S	Sufficient supply; a 20-foot well with soft water.
41	SW.	32	"	"	"	Bored	75	2,324	- 60	2,264	75	2,249	Glacial drift	Hard, iron, "alkaline"	44	S	Sufficient supply; a 75-foot well, used for house.
42	NE.	33	"	"	"	Bored	59	2,307	- 56	2,251	56	2,251	Glacial drift	Hard, iron, "alkaline"	45	D, S	Insufficient supply.
43	SE.	34	"	"	"	Bored	75	2,268	- 45	2,223	75	2,293	Glacial sand	Hard, iron, "alkaline"	45	S	Sufficient supply.

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

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

WELL RECORDS—Rural Municipality of HAPPYLAND NO. 231, SASKATCHEWAN

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
44	SE.	35	20	26	3	Bored	120	2,230	-110	2,120	110	2,120	Glacial sand	Hard, iron, "alkaline"	43	D, S	Sufficient supply.
45	SW.	35	"	"	"	Bored	80	2,286	- 60	2,226	60	2,226	Glacial sand	Hard, "alkaline"	44	D, S	Sufficient supply; a 90-foot well with hard, "alkaline" water.
46	NE.	36	"	"	"	Bored	200	2,330	-100	2,230	100	2,230	Glacial sand	Hard, iron, "alkaline"	42	S	Sufficient supply; a 20-foot well, soft water for house.
1	NE.	1	20	27	3	Bored	108	2,510	-100	2,410	100	2,410	Glacial quick-sand	Hard, iron, "alkaline"	44	S	Insufficient intermittent supply; a 30-foot well, similar.
2	SW.	2	"	"	"	Bored	80	2,510	- 75	2,435	75	2,435	Glacial drift	Hard, iron, "alkaline"	44	S	Insufficient supply, laxative. A 16-foot well for house.
3	NW.	2	"	"	"	Drilled	475	2,580	-375	2,205	475	2,105	Belly River	Hard, iron, "alkaline"	44	S	Sufficient supply; not fit for house.
4	SW.	3	"	"	"	Bored	75	2,485	- 65	2,420	75	2,410	Glacial quick-sand	Hard, iron	44	D, S	Insufficient supply; a 80-foot dry hole also.
5	NE.	3	"	"	"	Dug	12	2,552	0	2,552	0	2,552	Glacial gravel	Hard, clear	48	D, S	Sufficient supply; a similar well.
6	SW.	4	"	"	"	Bored	66	2,485	- 4	2,481	4	2,481	Glacial drift	Hard, iron	44	D, S	Insufficient supply; a 20-foot well, soft water used for house.
7	NE.	4	"	"	"	Bored	140	2,550									Dry hole in glacial drift; 3 other dry holes 130 feet, 135 feet and 120 feet deep.
8	SE.	5	"	"	"	Dug	25	2,415	- 22	2,393	22	2,393	Glacial drift	Soft, clear	47	D, S	Intermittent supply; a 12-foot well also.
9	NE.	5	"	"	"	Dug	25	2,525	- 21	2,504	21	2,504	Glacial gravel	Soft, clear	47	D, S	Sufficient supply.
10	SW.	6	"	"	"	Bored	42	2,425	- 21	2,404	42	2,383	Glacial sand	Hard, iron	45	S	Sufficient supply; a 28-foot well, hard water for house use.
11	NW.	7	"	"	"	Bored	30	2,515	- 26	2,489	26	2,489	Glacial sand	Soft, "alkaline"	47	D, S	Insufficient supply.
12	SW.	8	"	"	"	Dug	20	2,470	- 18	2,452	18	2,452	Glacial drift	Soft	47	D, S	Insufficient supply; a 40-foot well, also soft water.
13	NE.	9	"	"	"	Drilled	335	2,550	-185	2,365	335	2,215	Glacial sand	Hard, iron, "alkaline"	48	S	Sufficient supply.
14	SE.	10	"	"	"	Bored	130	2,496	-100	2,396	100	2,396	Glacial gravel	Hard, iron, yellow	45	S	Sufficient supply; a 24-foot well, soft water; used in house.
15	SW.	12	"	"	"	Dug	13	2,480	- 10	2,470	10	2,470	Glacial sand	Salt	49	D, S	Insufficient supply; a 21-foot well; also 100-foot dry hole.
16	SE.	13	"	"	"	Dug	20	2,410	- 10	2,400	20	2,390	Glacial sand	Hard	47	D, S	Sufficient supply.
17	NW.	14	"	"	"	Drilled	425	2,478	-175	2,303	425	2,053	Belly River	Hard, iron, "alkaline"		S	Sufficient supply; laxative; a 20-foot well for house use.
18	SE.	15	"	"	"	Dug	22	2,480	- 19	2,461	19	2,461	Glacial drift	Soft	48	D, S	Insufficient supply; a 22-foot similar well; also 120-foot dry hole.
19	NE.	15	"	"	"	Bored	120	2,475	-118	2,357	118	2,357	Glacial drift	Hard, iron, "alkaline"	44	S	Intermittent supply; several dry holes from 16 to 138 feet in glacial drift.
20	NW.	15	"	"	"	Bored	108	2,440									Dry hole in glacial drift; a 90-foot dry hole also.
21	SE.	16	"	"	"	Dug	20	2,515	- 15	2,500	15	2,500	Glacial sand	Soft	47	D, S	Intermittent supply; a 20-foot similar well.
22	NE.	16	"	"	"	Drilled	435	2,470	-135	2,335	435	2,035	Belly River	Hard, iron, "alkaline"	48	S	Sufficient supply; laxative; a 20-foot well, soft water for house.
23	SE.	17	"	"	"	Bored	100	2,513	- 70	2,443	99	2,414	Glacial sand	Hard, iron, yellow	44	S	Sufficient supply; a 20-foot well, soft water for house.
24	NE.	17	"	"	"	Bored	99	2,510	- 79	2,431	99	2,411	Glacial sand	Hard, iron, yellow	44	S	Insufficient supply; another well 25 foot deep; soft water for house.

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(#) Sample taken for analysis.

WELL RECORDS—Rural Municipality of HAPPYLAND NO.231, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
25	S.W.	18	20	27	3	Bored	90	2,510	- 15	2,495	90	2,420	Glacial sand	Soft, "alkaline"	44	D, S	Sufficient supply.
26	NE.	18	"	"	"	Dug	24	2,470	- 17	2,453	17	2,453	Glacial sand	Soft	46	D, S	Sufficient supply.
27	SE.	19	"	"	"	Bored	68	2,420									Dry hole in glacial drift.
28	S.W.	20	"	"	"	Drilled	378	2,420	-178	2,242	378	2,042	Belly River	Hard, iron, "alkaline"	48	S	Sufficient supply.
29	NW.	20	"	"	"	Bored	80	2,435	- 60	2,375	80	2,355	Glacial drift	Hard, iron, yellow	44	D, S	Sufficient supply.
30	N.W.	21	"	"	"	Bored	65	2,400	- 17	2,383	60	2,340	Glacial gravel	Hard, iron	46	S	Sufficient supply; a 20-foot well, soft water for house.
31	S.W.	22	"	"	"	Bored	84	2,400	- 64	2,336	64	2,336	Glacial sand	Hard, iron, "alkaline"	45	D, S	Sufficient supply.
32	SE.	23	"	"	"	Dug	74	2,372	- 32	2,340	74	2,298	Glacial drift	Hard, iron, "alkaline"	46	S	Sufficient supply; a 20-foot well, soft water for house.
33	SE.	24	"	"	"	Dug	80	2,383	- 60	2,323	80	2,303	Glacial drift	Hard, iron	44	S	Sufficient supply.
34	NE.	24	"	"	"	Bored	85	2,370	- 35	2,335	85	2,265	Glacial sand	Hard, iron	45	D, S	Sufficient supply; a similar well.
35	N.W.	26	"	"	"	Dug	100	2,348	- 50	2,298	100	2,248	Glacial drift	Hard, iron, "alkaline"	44	S	Sufficient supply; a 120-foot similar well; haul drinking water.
36	NE.	27	"	"	"	Bored	112	2,350	- 37	2,313	112	2,238	Glacial sand	Hard, iron	44	D, S	Sufficient supply.
37	SE.	28	"	"	"	Bored	40	2,360	- 14	2,346	40	2,320	Glacial gravel	Hard, iron, yellow	44	S	Sufficient supply.
38	NE.	28	"	"	"	Dug	40	2,368	- 37	2,331	37	2,331	Glacial drift	Hard, iron, yellow	44	S	Insufficient supply.
39	S.W.	30	"	"	"	Bored	10	2,375					Glacial sand	Hard, iron, "alkaline" yellow	44	D, S	Sufficient supply.
40	NE.	31	"	"	"	Dug	18	2,320	- 13	2,307	13	2,307	Glacial sand	Hard, "alkaline"	47	D, S	Sufficient supply; 3 similar wells.
41	S.W.	33	"	"	"	Bored	76	2,380	- 41	2,339	75	2,305	Glacial sand	Hard, iron	44	D, S	Sufficient supply; a 15-foot well for house with soft water; a 40-foot dry hole.
42	NE.	33	"	"	"	Dug	18	2,350	- 13	2,237	13	2,237	Glacial sand	Hard, "alkaline"		D, S	Sufficient supply.
43	S.W.	34	"	"	"	Dug	30	2,358	- 18	2,340	30	2,328	Glacial drift	Hard	46	D, S	Sufficient supply.
44	NE.	34	"	"	"	Bored	52	2,510	- 48	2,462	48	2,462	Glacial quicksand	Hard	45	D, S	Insufficient supply.
45	NW.	35	"	"	"	Bored	75	2,353	- 69	2,284	75	2,278	Glacial quicksand	Hard, iron, "alkaline"	46	S	Sufficient supply; unfit for house.
46	NW.	36	"	"	"	Bored	85	2,330	- 65	2,265	85	2,245	Glacial quicksand	Hard, iron, "alkaline"	44	S	Sufficient supply; unfit for house; a 20-foot well, hard, "alkaline" water for house.
47	NE.	36	"	"	"	Bored	65	2,350	- 35	2,315	65	2,285	Glacial sand	Hard, iron, "alkaline"	45	S	Sufficient supply; haul water for drinking.
1	NW.	1	21	25	3	Drilled	239	2,308	-150	2,158	239	2,069	Belly River	Hard, "alkaline"	44	D, S	Sufficient supply.
2	SE.	2	"	"	"	Dug	25	2,368	- 24	2,344	24	2,344	Glacial drift	Soft	44	D, S	Insufficient supply.
3	NE.	3	"	"	"	Drilled	386	2,295	-150	2,145	386	1,909	Belly River sand	Hard	44	D, S	Sufficient supply.

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

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

WELL RECORDS—Rural Municipality of HAPPYLAND NO.231, SASKATCHEWAN

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
4	SE.	4	21	25	3	Dug	24	2,300	- 21	2,279	21	2,279	Glacial gravel	Hard	44	D, S	Sufficient supply.
5	SW.	4	"	"	"	Drilled	666	2,380			666	1,714	Belly River sand	Hard,iron, "alkaline"	44	S	Sufficient supply.
6	NE.	5	"	"	"	Drilled	240	2,300	-110	2,190	240	2,060	Belly River	Hard	44	D, S	Sufficient supply.
7	NW.	5	"	"	"	Dug	35	2,325	- 32	2,293	32	2,293	Glacial sand	Hard	44	D	Sufficient supply.
8	SE.	6	"	"	"	Bored	56	2,340	- 45	2,295	45	2,295	Glacial sand	Hard	44	D	Sufficient supply.
9	SE.	6	"	"	"	Drilled	369	2,340	-120	2,220	369	11971	Belly River sand	Hard,iron	44	S	Sufficient supply.
10	NW.	6	"	"	"	Drilled	330	2,325	-110	2,215	330	1,995	Belly River sand	Hard,iron	44	S	Insufficient supply.
11	NW.	9	"	"	"	Dug	30	2,250	- 22	2,228	22	2,228	Glacial sand	Hard	44	D, S	Sufficient supply.
12	NW.	10	"	"	"	Drilled	265	2,252	-175	2,077	265	1,987	Belly River sand	Hard,"alkaline"	44	D, S	Sufficient supply.
13	SW.	10	"	"	"	Dug	32	2,245	- 28	2,217	28	2,217	Glacial sand	Soft	44	D, S	Sufficient supply.
14	SW.	11	"	"	"	Dug	37	2,295	- 35	2,260	35	2,260	Glacial sand	Hard	44	D, S	Sufficient supply.
15	NW.	12	"	"	"	Drilled	260	2,320	-110	2,210	260	2,060	Belly River	Hard,"alkaline"	44	D, S	Sufficient supply.
16	SW.	13	"	"	"	Bored	200	2,320	-175	2,145	200	2,120	Glacial sand	Hard	44	D, S	Sufficient supply.
17	SE.	15	"	"	"	Dug	26	2,270	- 22	2,248	22	2,248	Glacial sand	Hard	44	D, S	Sufficient supply.
18	NE.	15	"	"	"	Drilled	340	2,315	-280	2,035	340	1,975	Belly River sand	Hard,"alkaline"	44	D, S	Sufficient supply.
19	SE.	16	"	"	"	Dug	30	2,268	- 27	2,241	27	2,241	Glacial sand	Soft,clear	44	D, S	Sufficient supply.
20	NE.	16	"	"	"	Dug	27	2,288	- 21	2,267	21	2,267	Glacial sand	Hard	44	D, S	Sufficient supply.
21	SW.	16	"	"	"	Dug	24	2,245	- 17	2,228	17	2,228	Glacial sand	Hard	44	D, S	Sufficient supply.
22	SW.	16	"	"	"	Dug	20	2,245	- 10	2,235	10	2,235	Glacial sand	Soft	44	D, S	Sufficient supply.
23	NW.	16	"	"	"	Dug	40	2,260	- 36	2,224	36	2,224	Glacial sand	Hard	44	D, S	Sufficient supply.
24	NE.	18	"	"	"	Dug	45	2,210	- 40	2,170	40	2,170	Glacial sand	Hard	44	D, S	Sufficient supply.
25	SW.	18	"	"	"	Dug	50	2,210	- 40	2,170	40	2,170	Glacial sand	Hard	44	D, S	Sufficient supply.
26	SW.	20	"	"	"	Drilled	250	2,260	- 80	2,180	250	2,010	Belly River sand	Hard	44	D, S	Sufficient supply.
27	NE.	20	"	"	"	Drilled	246	2,310	-146	2,164	246	2,064	Belly River sand	Hard	44	D, S	Sufficient supply; a 500-foot dry hole in Belly River.
28	SE.	22	"	"	"	Bored	184	2,330	-174	2,156	174	2,156	Glacial sand	Hard,iron	44	D, S	Sufficient supply.
29	SE.	23	"	"	"	Dug	152	2,255	-149	2,106	149	2,106	Glacial sand	Soft		D, S	Sufficient supply.
30	NE.	24	"	"	"	Dug	115	2,265	-111	2,154	111	2,154	Glacial sand	Soft		D, S	Sufficient supply.

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

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

WELL RECORDS—Rural Municipality of HAPPYLAND NO. 231, SASKATCHEWAN

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
31	SE.	25	21	25	3	Drilled	318	2,275	-150	2,125	318	1,957	Belly River sand	Hard,"alkaline"		D, S	Sufficient supply.
32	SW.	25	"	"	"	Bored	145	2,240	-133	2,107	133	2,107	Glacial sand	Hard,"alkaline"		D, S	Sufficient supply.
33	SW.	27	"	"	"	Drilled	242	2,270	-140	2,130	240	2,030	Belly River sand	Hard	44	D, S	Sufficient supply.
34	NW.	30	"	"	"	Bored	180	2,270	-105	2,165	105	2,165	Glacial sand	Hard,iron	44	D, S	Sufficient supply.
35	SE.	31	"	"	"	Bored	169	2,220	-100	2,120	169	2,051	Glacial sand	Hard		N	Well abandoned.
36	NW.	33	"	"	"	Drilled	200	2,265	-125	2,140	200	2,065	Glacial sand	Hard	44	D, S	Sufficient supply.
37	SE.	34	"	"	"	Drilled	215	2,288	-125	2,163	215	2,073	Glacial sand	Hard	44	D, S	Sufficient supply.
38	NW.	36	"	"	"	Bored	126	2,230	-122	2,108	122	2,108	Glacial gravel	Hard	44	D, S	Sufficient supply.
1	SE.	1	21	26	3	Dug	25	2,280	- 17	2,263	17	2,263	Glacial quicksand	Soft		D, S	Sufficient supply; a 25-foot well.
2	NW.	2	"	"	"	Bored	163	2,290	- 93	2,197	163	2,127	Glacial gravel	Hard,"alkaline"		D, S	Sufficient supply.
3	NE.	3	"	"	"	Dug	100	2,284	- 79	2,205	79	2,205	Glacial sand	Hard,iron, "alkaline"		D, S	Sufficient supply.
4	NW.	3	"	"	"	Dug	70	2,290	- 60	2,230	70	2,220	Glacial drift	Hard,iron, "alkaline"		D, S	Sufficient supply.
5	SE.	4	"	"	"	Dug	61	2,300	- 56	2,244	56	2,244	Glacial drift	Hard,iron, "alkaline"		D, S	Sufficient supply.
6	NW.	4	"	"	"	Dug	48	2,232	- 33	2,199	48	2,184	Glacial gravel	Hard,iron, "alkaline"		D, S	Sufficient supply.
7	SW.	5	"	"	"	Bored	58	2,310	- 51	2,259	51	2,259	Glacial drift	Hard,iron		S	Sufficient supply; another similar well.
8	NW.	5	"	"	"	Bored	62	2,300	- 56	2,244	56	2,244	Glacial gravel	Hard,"alkaline"		D, S	Sufficient supply; a 16-foot well also.
9	NW.	6	"	"	"	Bored	70	2,330	- 60	2,270	60	2,270	Glacial drift	Hard,"alkaline"		S	Sufficient supply.
10	SE.	7	"	"	"	Dug	70	2,295	- 65	2,230	65	2,230	Glacial drift	Hard,iron		D, S	Sufficient supply.
11	NW.	9	"	"	"	Bored	94	2,270	- 84	2,186	84	2,186	Glacial sand	Hard		S	Sufficient supply.
12	SE.	9	"	"	"	Dug	70	2,264	- 66	2,198	66	2,198	Glacial drift	Hard,iron, "alkaline"		D, S	Sufficient supply.
13	NE.	10	"	"	"	Drilled	344	2,258	-100	2,158	344	1,914	Belly River	Hard,iron, "alkaline" salty		S	Sufficient supply; strong,laxative.
14	NE.	12	"	"	"	Bored	132	2,240	-125	2,115	125	2,115	Glacial drift	Hard,"alkaline"		D, S	Sufficient for 13 head stock.
15	NW.	12	"	"	"	Bored	36	2,230	- 28	2,202	36	2,194	Glacial quicksand	Hard,iron		D, S	Sufficient supply.
16	NW.	13	"	"	"	Dug	24	2,230	- 22	2,208	22	2,208	Glacial sand	Soft		D, S	Insufficient supply; a dry hole 40 feet deep.
17	SE.	14	"	"	"	Dug	28	2,220	- 20	2,200	20	2,200	Glacial drift	Hard		D, S	Insufficient supply.
18	SW.	14	"	"	"	Bored	110	2,252	-100	2,152	100	2,152	Glacial drift	Hard,"alkaline"		D, S	Sufficient supply.

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

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

WELL RECORDS[14] Rural Municipality of HAPPYLAND NO.231, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
19	NE.	15	21	26	3	Dug	110	2,240					Glacial drift	Hard, iron		D, S	Insufficient supply.
20	NW.	15	"	"	"	Bored	22	2,210	- 2	2,208	2	2,208	Glacial drift	Hard, iron, rusty		N	Sufficient supply; harmful to humans.
21	NE.	17	"	"	"	Bored	84	2,192	- 44	2,148	84	2,108	Glacial drift	Hard		D, S	Large supply.
22	NW.	17	"	"	"	Dug	55	2,300	- 49	2,251	49	2,251	Glacial sand	Hard		D, S, I	Sufficient supply.
23	SW.	18	"	"	"	Dug	63	2,195	- 33	2,162	63	2,132	Glacial quick-sand	Hard, iron, red sediment		D, S	Probably sufficient supply.
24	SE.	18	"	"	"	Dug	30	2,215	- 27	2,188	27	2,188	Glacial gravel	Hard, "alka-line"		D, S	Sufficient supply.
25	SE.	20	"	"	"	Bored	100	2,224	- 60	2,164	100	2,124	Glacial sand	Hard, iron, red sediment		D, S	Sufficient supply.
26	SW.	20	"	"	"	Bored	25	2,230	- 15	2,215	25	2,205	Glacial drift	Soft, "alka-line"		D, S	Sufficient supply.
27	NW.	22	"	"	"	Dug	105	2,230	- 98	2,132	98	2,132	Glacial quick-sand	Hard, iron, red sediment		D, S	Sufficient supply.
28	NE.	23	"	"	"	Dug	111	2,228	-100	2,128	111	2,117	Glacial sand	Hard, cloudy, "alkaline"		S	Sufficient supply; laxative.
29	NW.	24	"	"	"	Bored	140	2,215	- 80	2,135	140	2,075	Glacial quick-sand	Hard		D, S	Sufficient supply; a 40-foot well for house use.
30	SW.	25	"	"	"	Drilled	180	2,220									Dry hole in glacial drift; a 160-foot dry hole; 2 seepages wells 30 feet deep for house.
31	SW.	28	"	"	"	Dug	130	2,225	- 95	2,130	130	2,095	Glacial sand	Hard, iron, "alkaline"		D, S	Large supply.
32	NE.	28	"	"	"	Dug	110	2,225	-108	2,117	108	2,117	Glacial sand	Hard		D, S	Sufficient supply.
33	SE.	30	"	"	"	Dug	80	2,230	- 70	2,160	70	2,160	Glacial drift	Hard, iron, "alkaline"		S	Insufficient supply.
34	NE.	30	"	"	"	Drilled	340	2,235	- 90	2,145	340	1,895	Belly River sand	Hard, iron, "alkaline"		S	Intermittent; too "alkaline" for humans.
35	SW.	31	"	"	"	Bored	75	2,220	- 63	2,157	75	2,145	Glacial quick-sand	Hard, iron		D, S	Probably sufficient; a similar well partly caved in.
36	NE.	32	"	"	"	Bored	112	2,200	- 72	2,128	112	2,088	Glacial sand	Hard, iron, red sediment			Sufficient supply.
37	SE.	33	"	"	"	Dug	112	2,195	- 82	2,113			Glacial sand	Hard, iron, red sediment		D, S	Sufficient supply.
38	NE.	34	"	"	"	Bored	118	2,185	- 85	2,100	85	2,100	Glacial drift	Hard, iron, "alkaline" sediment		D, S	Sufficient supply.
39	NE.	35	"	"	"	Bored	127	2,183	-100	2,083	100	2,083	Glacial drift	Hard, iron, red sediment.		D, S	Sufficient for 8 head stock.
40	NE.	36	"	"	"	Bored	160	2,220	-123	2,097	160	2,060	Glacial drift	Hard, "alka-line"		D, S, I	Sufficient supply.
1	NE.	2	21	27	3	Bored	80	2,314	- 50	2,264	80	2,234	Glacial quick-sand	Hard, iron		S	Sufficient supply; a 20-foot well, soft water for house.
2	NW.	5	"	"	"	Bored	80	2,360	- 70	2,290	70	2,290	Glacial drift	Hard, blue colour		S	Insufficient supply.
3	SW.	6	"	"	"	Bored	115	2,378	- 55	2,323	109	2,269	Glacial gravel	Hard, iron		D, S	Sufficient supply.
4	SW.	7	"	"	"	Dug	20	2,350	- 18	2,332	18	2,332	Glacial sand	Soft		D, S	Insufficient; a 20-foot well and supply.

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

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

WELL RECORDS—Rural Municipality of HAPPYLAND NO. 231, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in°F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
5	SW.	8	21	27	3	Dug	23	2,345	- 20	2,325	20	2,325	Glacial sand	Soft		D, S	Insufficient supply.
6	SW.	10	"	"	"	Dug	40	2,325	- 28	2,297	40	2,285	Glacial quick-sand	Hard		D, S	Insufficient supply.
7	NE.	10	"	"	"	Bored	160	2,360	-110	2,250	160	2,200	Glacial quick-sand	Hard, "alka-line"		D, S	Sufficient supply; two 60-foot wells, see-page supply for house.
8	SE.	11	"	"	"	Dug	37	2,342	- 34	2,308	40	2,302	Glacial gravel	Hard, iron		D, S	Sufficient supply for 10 head stock.
9	SE.	12	"	"	"	Bored	50	2,312	- 30	2,282	50	2,262	Glacial gravel	Hard, iron		D, S	Sufficient supply.
10	SE.	15	"	"	"	Bored	103	2,340	- 68	2,272	103	2,237	Glacial gravel	Hard, iron, "alkaline"		D, S	Sufficient supply.
11	SW.	15	"	"	"	Bored	114	2,380	-100	2,280	114	2,266	Glacial drift	Hard, iron, rusty		S	Sufficient for 25 head stock; a 60-foot well also.
12	SE.	16	"	"	"	Dug	61	2,375	- 54	2,321	54	2,321	Glacial quick-sand	Hard, "alka-line"		S	Insufficient supply; another 20-foot well for house.
13	SW.	16	"	"	"	Dug	22	2,360	- 17	2,343	17	2,343	Glacial drift	Soft		D, S	Insufficient supply; a 18-foot well with soft water.
14	SE.	17	"	"	"	Bored	110	2,365	-103	2,262	103	2,262	Gladial drift	Hard		S	Sufficient for 15 head stock; a 17-foot well soft water.
15	SW.	18	"	"	"	Bored	100	2,370	- 70	2,300	100	2,270	Glacial quick-sand	Hard, iron, red on stand-ing		D, S	Sufficient supply.
16	NW.	19	"	"	"	Bored	80	2,365	- 68	2,297	80	2,285	Glacial quick-sand	Hard		S	Sufficient supply; a 14-foot well for house with soft water.
17	NE.	20	"	"	"	Bored	109	2,330	- 101	2,229	109	2,221	Glacial quick-sand	Hard, iron, red sediment		D, S	Sufficient supply.
18	NW.	21	"	"	"	Bored	86	2,330	- 82	2,248	82	2,248	Glacial drift	Hard, iron, rusty		D, S	Sufficient supply; shallow seepage wells supply house water.
19	NE.	21	"	"	"	Dug	108	2,325	- 94	2,231	108	2,217	Glacial gravel	Hard, iron, rusty		D, S	Large supply.
20	SW.	22	"	"	"	Bored	90	2,318	- 78	2,240	78	2,240	Glacial drift	Hard, "alka-line"		D, S	Sufficient supply.
21	SE.	23	"	"	"	Dug	86	2,275	- 71	2,204	71	2,204	Glacial drift	Hard, iron, rusty		D, S	Sufficient supply.
22	NE.	23	"	"	"	Dug	65	2,270	- 58	2,212	58	2,212	Glacial drift	Hard, iron		D, S	Sufficient supply.
23	SE.	24	"	"	"	Dug	30	2,240	- 24	2,216	30	2,210	Glacial gravel and sand	Hard, iron, rusty		D, S	Sufficient supply; also another well in use.
24	SE.	25	"	"	"	Dug	30	2,220	- 22	2,198	25	2,195	Glacial quick-sand	Hard		D, S	Sufficient supply.
25	SW.	25	"	"	"	Dug	20	2,240	- 16	2,224	16	2,224	Glacial sand	Hard		D, S	Sufficient supply; a 53-foot well hard, bitter water, not usable.
26	NW.	25	"	"	"	Dug	19	2,210	- 15	2,195	19	2,191	Glacial quick-sand	Hard, "alka-line"; iron		D, S	Sufficient supply; a 24-foot well.
27	SW.	27	"	"	"	Drilled	360	2,310					Belly River sand	Hard, iron, rusty		S	Sufficient supply; an 83-foot well, hard water for house.
28	NE.	27	"	"	"	Bored	90	2,300	- 82	2,218	90	2,210	Glacial quick-sand	Hard, iron, "alkaline"		D, S	Sufficient supply.
29	SW.	28	"	"	"	Dug	135	2,305	- 75	2,230	135	2,170	Glacial quick-sand	Hard, iron, "alkaline"		D, S	Good supply; dry holes from 72 to 115 feet in glacial drift.
30	SE.	29	"	"	"	Drilled	300	2,340					Belly River	Hard, iron, "alkaline"		D, S	Barely sufficient.

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

WELL RECORDS[16] Rural Municipality of HAPPYLAND NO.231, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in°F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
31	SW.	30	21	27	3	Bored	108	2,365	- 88	2,277	88	2,277	Glacial drift	Hard		D, S	Sufficient supply.
32	SE.	31	"	"	"	Bored	95	2,285	- 83	2,202	95	2,190	Glacial quick-sand	Hard, iron, rusty		S	Sufficient supply; another well for house.
33	NW.	32	"	"	"	Dug	27	2,250	- 24	2,226	24	2,226	Glacial sand	Hard, cloudy		D, S	Insufficient supply; a 23-foot seepage well.
34	NW.	33	"	"	"	Bored	90	2,245	- 75	2,170	90	2,155	Glacial quick-sand	Hard, "alka-line"		D, S	Sufficient supply.
35	SE.	34	"	"	"	Dug	70	2,225					Glacial drift	Hard, iron, "alkaline"		D, S	Sufficient supply.
36	SW.	35	"	"	"	Dug	70	2,274	- 67	2,207	67	2,207	Glacial quick-sand	Hard, "alka-line"		S	Insufficient supply.
37	SE.	36	"	"	"	Dug	69	2,248	- 66	2,182	66	2,182	Glacial sand	Hard, iron		D, S	Sufficient supply.
1	SE.	2	22	25	3	Dug	114	2,265	-109	2,156	114	2,151	Glacial sand	Hard, iron	44	D, S	Sufficient supply.
2	SW.	3	"	"	"	Dug	160	2,270	-100	2,170	160	2,110	Glacial sand	Hard	44	D, S	Sufficient supply.
3	NW.	3	"	"	"	Drilled	360	2,225	-260	1,965	360	1,865	Belly River	Hard, iron	44	D, S	Sufficient supply.
4	NW.	4	"	"	"	Drilled	247	2,288	- 75	2,213	247	2,041	Belly River sand	Hard	44	D, S	Sufficient supply.
5	SE.	6	"	"	"	Bored	140	2,256	-110	2,146	140	2,116	Glacial sand	Hard	44	D, S	Sufficient supply.
6	NW.	6	"	"	"	Bored	160	2,230	-108	2,122	160	2,070	Glacial sand	Hard, iron	44	D, S	Sufficient supply.
7	SE.	7	"	"	"	Drilled	250	2,242	-100	2,142	250	1,992	Belly River sand	Hard, "alka-line"	44	D, S	Sufficient supply.
8	SW.	12	"	"	"	Drilled	228	2,235	-100	2,135	228	2,007	Belly River sand	Hard, iron, "alkaline"	44	D, S	Sufficient supply.
9	NE.	14	"	"	"	Drilled	235	2,240	-180	2,060	235	2,005	Belly River sand	Hard	44	D, S	Sufficient supply.
10	NW.	14	"	"	"	Dug	130	2,200	-120	2,080	120	2,080	Glacial sand	Hard, sulphur	44	D, S	Sufficient supply.
11	SE.	16	"	"	"	Drilled	262	2,225	-110	2,115	262	1,963	Belly River sand	hard	44	D, S	Sufficient supply.
12	SW.	16	"	"	"	Drilled	216	2,225	-110	2,115	216	2,009	Belly River sand	Hard	44	D, S	Sufficient supply.
13	SE.	17	"	"	"	Drilled	280	2,215	-170	2,045	280	1,935	Belly River sand	Hard, "alka-line"	44	D, S	Sufficient supply.
14	SW.	17	"	"	"	Drilled	201	2,208	-150	2,058	201	2,007	Belly River sand	Hard, "alka-line"	44	D, S	Sufficient supply; laxative.
15	NE.	18	"	"	"	Drilled	229	2,208	-129	2,079	229	1,979	Belly River sand	Hard, "alka-line"	44	D, S	Sufficient supply; bad effects on humans and stock.
16	SE.	19	"	"	"	Drilled	210	2,210	-110	2,100	210	2,000	Belly River sand	Hard, "alka-line"	44	D, S	Sufficient supply; laxative.
17	NE.	20	"	"	"	Drilled	265	2,210	-165	2,045	265	1,945	Belly River sand	Hard, iron, soda	44	D, S	Sufficient supply.
18	NE.	24	"	"	"	Dug	35	2,250	- 32	2,218	32	2,218	Glacial sand	Soft	44	D, S	Sufficient supply.
19	NE.	25	"	"	"	Bored	60	2,280	- 48	2,232	60	2,220	Glacial sand	Hard	44	D, S	Sufficient supply.
20	NW.	26	"	"	"	Bored	160	2,170	-110	2,060	160	2,010	Belly River	Hard	44	D, S	Sufficient supply.

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

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

WELL RECORDS[17]—Rural Municipality of HAPPYLAND NO. 231, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
21	SW.	27	22	25	3	Drilled	285	2,210	-170	2,040	285	1,925	Belly River sand	Hard	44	D, S	Sufficient supply.
22	SE.	28	"	"	"	Drilled	245	2,210	-175	2,035	245	1,965	Belly River sand	Hard	44	D, S	Sufficient supply.
23	SW.	29	"	"	"	Drilled	275	2,208	-245	1,963	275	1,933	Belly River sand	Hard, "alkaline"	44	D, S	Sufficient supply.
24	SE.	30	"	"	"	Drilled	230	2,202	-170	2,032	230	1,972	Belly River sand	Hard, iron, "alkaline"		D, S	Sufficient supply; laxative.
25	SE.	31	"	"	"	Drilled	200	2,216	-110	2,106	200	2,016	Glacial gravel	Hard, iron	44	D, S	Sufficient supply.
26	SW.	32	"	"	"	Drilled	212	2,244	-150	2,094	212	2,032	Glacial sand	Hard	44	D, S	Sufficient supply.
27	SW.	34	"	"	"	Bored	120	2,215	-115	2,100	115	2,100	Glacial sand	Hard	44	D, S	Sufficient supply.
28	NW.	34	"	"	"	Drilled	185	2,200	- 65	2,135	185	2,015	Belly River sand	Hard		D, S	Sufficient supply.
29	NW.	35	"	"	"	Drilled	200	2,225	- 80	2,145	200	2,025	Belly River sand	Hard	44	D, S	Sufficient supply.
1	SW.	1	22	26	3	Bored	202	2,235	-166	2,069	202	2,033	Belly River sand	Hard, iron, red sediment		D, S	Insufficient supply.
2	NW.	1	"	"	"	Bored	165	2,205	-145	2,060	165	2,040	Glacial quicksand	Hard, iron, "alkaline"		D, S	Sufficient supply.
3	SW.	2	"	"	"	Bored	155	2,225	-125	2,100	155	2,070	Glacial quicksand	Hard, iron, rusty		D, S	Insufficient supply; another well 160-feet deep with 50 feet water.
4	NW.	3	"	"	"	Drilled	450	2,180	- 80	2,100	450	1,730	Belly River sand	Hard, cloudy, "alkaline"		S	Sufficient supply; laxative.
5	NE.	5	"	"	"	Bored	122	2,180	- 96	2,084	122	2,058	Glacial quicksand	Hard, iron, rusty		D, S	Sufficient for 100 head stock.
6	NW.	7	"	"	"	Drilled	684	2,240	- 50	2,190			Belly River sand	Salty, soft		S	Sufficient supply.
7	SW.	8	"	"	"	Dug	140	2,200					Glacial sand	Hard, iron, "alkaline" rusty		D, S	Sufficient supply.
8	NW.	10	"	"	"	Bored	125	2,175	-100	2,075	125	2,050	Glacial sand	Hard, iron		D, S	Sufficient supply.
9	SE.	10	"	"	"		160	2,175					Glacial quicksand	Hard			Small supply.
10	NE.	12	"	"	"	Drilled	320	2,205	-170	2,035	320	1,885	Belly River quicksand	Hard, iron, "alkaline"		N	Well abandoned.
11	SW.	14	"	"	"	Bored	150	2,200	-130	2,070	150	2,050	Glacial sand	Hard, iron, "alkaline"		D, S	Sufficient supply; a 320-foot well quicksand at 170 feet abandoned.
12	NE.	15	"	"	"	Drilled	340	2,210					Belly River quicksand	Hard, "alkaline"		S	Sufficient supply; laxative.
13	SW.	16	"	"	"	Drilled	350	2,202	-100	2,102			Belly River quicksand	Hard, "alkaline"		S	Large supply.
14	NE.	16	"	"	"	Bored	136	2,200	-106	2,094	136	2,064	Glacial quicksand	Hard, iron, "alkaline"		S	Barely sufficient; laxative.
15	SW.	17	"	"	"	Drilled	730	2,205	-115	2,090	730	1,475	Belly River	Hard, "alkaline"		S	Large supply; haul drinking water.
16	SE.	18	"	"	"	Bored	120	2,210	-110	2,100	110	2,100	Glacial quicksand	Hard, iron, rusty		D, S	Insufficient supply.
17	NW.	18	"	"	"	Bored	125	2,215	-120	2,095	120	2,095	Glacial quicksand	Hard, iron, rusty		D, S	Sufficient for 6 head stock.

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

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

WELL RECORDS—Rural Municipality of HAPPYLAND NO. 231, SASKATCHEWAN

B 4-4
R. 7526

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
18	SE.	21	22	26	3	Drilled	400	2,200	-150	2,050	400	1,800	Belly River sand	Hard, "alkaline"		S	Sufficient supply.
19	NE.	21	"	"	"	Drilled	660	2,215	-180	2,035			Belly River sand	Hard, "alkaline"		N	Large supply.
20	SE.	23	"	"	"	Drilled	160	2,170	- 60	2,110	140	2,030	Glacial quicksand	Hard, iron, "alkaline" cloudy		D, S	Large supply; had a 320-foot well in Belly river quicksand, ruined.
21	SW.	26	"	"	"	Drilled	220	2,180	- 93	2,087	180	2,000	Glacial gravel	Hard, "alkaline"		D, S	Sufficient supply; a 136-foot well filled with quicksand.
22	NE.	26	"	"	"	Drilled	174	2,210	-144	2,066	174	2,036	Glacial quicksand	Hard, iron, rusty		D, S, I	Sufficient supply.
23	NW.	27	"	"	"	Drilled	352	2,190	-100	2,090	352	1,838	Belly River course sand	Hard, iron, soda		S	Large supply.
24	SE.	28	"	"	"	Drilled	480	2,220	- 60	2,160	480	1,740	Belly River sand	Hard		N	
25	NE.	29	"	"	"	Dug	8	2,095	- 2	2,093	8	2,087	Glacial gravel	Hard		D, S	Sufficient supply.
26	SE.	30	"	"	"	Dug	32	2,170	- 25	2,145	32	2,138	Glacial quicksand	Soft		D, S	Sufficient for 20 head stock.
27	S.	31	"	"	"	Dug	21	2,130	- 3	2,127	21	2,109	Glacial quicksand	Hard, "alkaline"		D, S	Insufficient supply; hauls water.
28	NE.	32	"	"	"	Dug	18	2,090	- 16	2,074	16	2,074	Glacial quicksand	Soft		N	Insufficient supply at present.
1	NW.	1	22	27	3	Drilled	125	2,240			125	2,115	Glacial drift	Hard, "alkaline"		D, S	Barely sufficient for 11 head stock.
2	NE.	2	"	"	"	Bored	106	2,230	-101	2,129	101	2,129	Glacial drift	Hard, iron		D, S	Barely sufficient for 14 head stock.
3	NW.	2	"	"	"	Bored	118	2,255			118	2,137	Glacial drift	Hard, iron, rusty		S	Sufficient supply.
4	SW.	3	"	"	"	Bored	119	2,260	-100	2,160	100	2,160	Glacial quicksand	Soft		D, S	Insufficient with two similar wells.
5	NE.	5	"	"	"	Drilled	253	2,275	-203	2,072	253	2,022	Belly River coarse sand	Hard, iron, "alkaline" rusty		S	Sufficient supply; hauls water for house.
6	SE.	7	"	"	"	Drilled	360	2,280	-170	2,110	360	1,920	Belly River quicksand	Hard, iron, rusty		D, S	Sufficient supply.
7	SW.	9	"	"	"	Drilled	360	2,260	-260	2,000	360	1,900	Belly River	Hard, iron, "alkaline" rusty		S	Sufficient supply.
8	SE.	10	"	"	"	Drilled	360	2,250	- 80	2,170			Belly River sand	Hard, iron, "alkaline" rusty		D, S	Sufficient supply.
9	NW.	10	"	"	"	Drilled	437	2,250	- 80	2,170	430	1,820	Belly River quicksand	Hard, iron, "alkaline" rusty, soda		S	Sufficient supply.
10	SE.	12	"	"	"	Dug	133	2,220	-120	2,100	133	2,087	Glacial drift	Hard, iron, red sediment		D, S	Sufficient supply.
11	NE.	12	"	"	"	Bored	130	2,200	-115	2,085	130	2,070	Glacial quicksand	Hard, iron, rusty		D, S	Insufficient supply.
12	NW.	12	"	"	"	Drilled	325	2,205	-140	2,065	325	1,880	Belly River sandstone	Hard, "alkaline"		S	Sufficient supply.
13	NE.	13	"	"	"	Drilled	400	2,230					Belly River	Hard, iron		D, S	Sufficient supply.

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

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

WELL RECORDS—Rural Municipality of 19 HAPPYLAND NO. 231, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
14	NE.	14	22	27	3	Drilled	425	2,260	-225	2,035	417	1,843	Belly River sand	Hard, iron, "alkaline"		S	Large supply.
15	NW.	14	"	"	"	Drilled	380	2,250					Belly River sandstone	Hard, iron, rusty		S	Sufficient; also a shallow well for house.
16	SW.	16	"	"	"	Dug	110	2,260	-105	2,155	105	2,155	Glacial quick-sand	Hard, iron, "alkaline"		S	Sufficient supply.
17	NE.	16	"	"	"	Drilled	330	2,250					Belly River sand	Hard, iron, "alkaline"		S	Haul drinking water.
18	NE.	17	"	"	"	Drilled	330	2,245					Belly River	Hard, iron, "alkaline" rusty		S	Large supply; haul drinking water.
19	SW.	18	"	"	"	Drilled	276	2,265	-266	2,039	276	1,989	Belly River grey sand	Hard, iron, "alkaline" rusty		D, S	
20	SW.	20	"	"	"	Drilled	320	2,260					Belly River	Hard, "alka-line"		S	Sufficient supply; laxative; haul drinking water.
21	SE.	21	"	"	"	Drilled	328	2,245	-260	1,985	328	1,917	Belly River sand	Hard, "alka-line"		S	Sufficient supply.
22	NE.	22	"	"	"	Drilled	400	2,255									Dry hole in Belly River formation.
23	NW.	22	"	"	"	Drilled	340	2,220	-240	1,980	340	1,880	Belly River sand	Hard, "alka-line"		N	Sufficient supply; but filled with quick-sand at present.
24	SE.	24	"	"	"	Drilled	320	2,200	-160	2,404	320	1,880	Belly River blue sand	Hard, iron, "alkaline"		D, S	Large supply.
25	SW.	24	"	"	"	Drilled	406	2,255	-180	2,075	406	1,849	Belly River quicksand	Hard, "alka-line"		D, S	Sufficient supply; well depeened to 1,000 feet as supply was insufficient.
26	NW.	25	"	"	"	Drilled	335	2,215	-170	2,045	335	1,880	Belly River quicksand	Hard, iron, "alkaline"		D, S	Sufficient supply.
27	SW.	27	"	"	"	Drilled	320	2,250			320	1,930	Belly River	Hard, "alka-line"		D, S	Large supply.
28	NE.	27	"	"	"	Dug	125	2,160									Dry hole in glacial drift; also another dry hole; haul water.
29	SE.	30	"	"	"	Drilled	358	2,260	-258	2,002	358	1,902	Belly River sand	Hard, iron, "alkaline" rusty		D, S	Sufficient supply. #
30	NE.	30	"	"	"	Bored	84	2,280	- 77	2,203	77	2,203	Glacial drift	Hard		S	Insufficient supply; a 32-foot seepage well.
31		34	"	"	"	Drilled	315						Belly River sand	Hard			Insufficient supply; also a 212-foot well in glacial drift and a 274-foot dry hole Belly River sand.
32	SE.	35	"	"	"	Dug	12	2,150	- 10	2,140	10	2,140	Glacial quick-sand	Soft		S	Barely sufficient.
33	SW.	35	"	"	"	Dug	16	2,150	- 13	2,137	13	2,137	Glacial sand	Soft		D, S	Insufficient supply.
34	NW.	35	"	"	"	Dug	15	2,150	- 11	2,139	11	2,139	Glacial sand	Hard		D, S	Insufficient supply.
1	SW.	1	23	25	3	Drilled	221	2,204	- 80	2,124	221	2,083	Belly River sand	Hard	44	D, S	Sufficient supply.
2	NE.	2	"	"	"	Drilled	348	2,200	-220	1,980	348	1,852	Belly River sand	Hard	44	D, S	Sufficient supply.
3	SW.	11	"	"	"	Drilled	194	2,205	-110	2,095	194	2,011	Belly River sand	Hard	44	D, S	Sufficient supply.
4	NE.	11	"	"	"	Drilled	450	2,200	-160	2,040	450	1,750	Belly River sand	Hard		D, S	Sufficient supply.

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

WELL RECORDS—Rural Municipality of HAPPYLAND NO.231, SASKATCHEWAN

WELL No.	LOCATION ¼	Sec.	Tp.	Rge.	Mer.	TYPE OF WELL	DEPTH OF WELL	ALTITUDE WELL (above sea level)	HEIGHT TO WHICH WATER WILL RISE: Above (+) Below (−) Surface	Elev.	PRINCIPAL WATER-BEARING BED: Depth	Elev.	Geological Horizon	CHARACTER OF WATER	TEMP. OF WATER (in °F.)	USE TO WHICH WATER IS PUT	YIELD AND REMARKS
1	SE.	2	23	26	3	Drilled	320	2,040	-120	1,920	320	1,720	Belly River quicksand	Hard, iron, rusty			Insufficient supply; a shallow well also used.
2	NE.	3	"	"	"	Dug	12	2,100	- 8	2,092	8	2,092	Glacial sand	Hard, "alkaline"		D, S	Insufficient supply; 5 other wells 10 feet deep.
3	NE.	4	"	"	"	Dug	18	2,110	- 14	2,096	14	2,096	Glacial quicksand	Soft		D, S	Sufficient supply; a similar well.
4	NW.	9	"	"	"	Dug	12	2,120	- 10	2,110	10	2,110	Glacial quicksand	Soft		D, S	Insufficient supply; a similar well.
5	SE.	15	"	"	"	Dug	6	2,070	- 5	2,065	5	2,065	Glacial sand	Soft		S	Steady supply; another well used for house.
6	SW.	15	"	"	"	Dug	12	2,080	- 9	2,071	9	2,071	Glacial quicksand	Soft		S	Good supply.
7	SW.	18	"	"	"	Dug	14	2,100	- 11	2,089	11	2,089	Glacial quicksand	Soft		D, S	Sufficient supply.
1	NW.	1	23	27	3	Dug	60	2,115	- 54	2,061	54	2,061	Glacial quicksand	Hard, "alkaline"		S	Sufficient for 40 head stock; a shallow well soft water for house.
2	NE.	2	"	"	"	Dug	18	2,105	- 15	2,090	15	2,090	Glacial quicksand	Soft		D, S	Just sufficient; a 70-foot well with small supply.
3	NW.	2	"	"	"	Spring	0	2,090					Glacial sand	Soft		S	Intermittent spring; also a 6-foot well.
4	NE.	3	"	"	"	Spring							Glacial drift	Hard			Small supply.
5	SE.	13	"	"	"	Dug	20	2,100	- 18	2,082	18	2,082	Glacial sand	Hard		D	Sufficient supply; another well used for stock
6	SE.	14	"	"	"	Dug	20	2,100	- 13	2,087	13	2,087	Glacial sand	Hard		D, S	Sufficient supply; three other shallow wells, one with soft water.
7	SW.	24	"	"	"	Dug	35	1,900					Glacial gravel	Hard		D, S	Large supply.

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