Earth Sciences Report 79-5

# Hydrogeology of the Peerless Lake Area, Alberta

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## ABSTRACT

The Peerless Lake map area (NTS 84B) is situated in north-central Alberta. The area is sparsely populated and access is poor.

The area is covered by thick surficial deposits, primarily of glacial origin, overlying Cretaceous shales. Yields of up to 38 L/s (500 igpm) may be obtained from glaciofluvial deposits. The greatest yields are available from preglacial sands and gravels located in portions of the Misaw and Atikameg Buried Valleys. In general, the bedrock is a poor aquifer yielding usually less than 0.4 L/s (5 igpm).

Groundwater from surficial deposits is predominantly the calcium/magnesium-bicarbonate type with an average total dissolved solids concentration of 1000 mg/L. Muskeg waters chemically resemble waters from surficial deposits, but total dissolved solids concentration rarely exceeds 250 mg/L. Bedrock groundwaters are the sodium/potassium-chloride type with an average total dissolved solids concentration of over 2000 mg/L.

## INTRODUCTION

The Peerless Lake map area (NTS 84B) is bounded by longitudes 114° and 116° west and latitudes 56° and 57° north. Total area is approximately 13,000 km$^2$ (5000 sq mi).

The population of less than 1000 is distributed in the settlements of Loon Lake, Red Earth, Trout Lake, and Peerless Lake. The major road is Highway 67 which trends north-south through the central portion of the map area. About 70 percent of the area is not accessible by road except in winter.

Petroleum exploration and lumbering are the major industries. The Red Earth and Utikuma Fields are the major oil-producing areas. Two permanent and numerous temporary lumber mills are scattered over the map area.

Little previous work has been done on the near-surface geology and hydrogeology. The bedrock geology was mapped by Green *et al.* (1970). An exploratory soil survey was completed by Lindsay *et al.* (1957). Groundwater investigations have been conducted by the Department of Environment in Loon Lake settlement (Olson, 1975) and in the Peerless Lake settlement. Hydrogeological Consultants Ltd. drilled and pump-tested a well in Red Earth (Clissold, 1974).

Hydrogeologic data are scarce and existing information consists of shallow bored wells around the settlements. Twelve wells are known to have been completed either by oil companies for injection purposes or by the Government of Alberta for water supply. The deepest known water well, located in Lsd 11, Sec 13, Tp 87, R 9, W5, is 250 m (818 ft) deep and is completed in a sand and gravel aquifer located 128 m (422 ft) to 130 m (427 ft) below ground level.

Geophysical information, such as seismic and geophysical well logs, were used to interpret the stratigraphy, to estimate drift thickness, and to assess aquifer characteristics.

A field survey was conducted in the summer of 1976 by truck and helicopter to define and sample areas of natural groundwater discharge and to examine features of geologic importance. Twenty-one shallow testholes were bored using a portable auger drill and five deep testholes were drilled to supplement existing data.

The yields represented on the main map are largely interpretive due to lack of good data. Within any of the designated yield zones the potential yield may vary because of local changes in geology and topography. The data are presented on the hydrogeological map and cross sections according to guidelines established by Badry (1972).

## ACKNOWLEDGMENTS

Shothole logs and seismic information were supplied by Hudson Bay Oil and Gas Corporation and Union Oil Corporation.

Test drilling was carried out by Buffalo Lake Drilling Ltd. of Peace River and field assistance was ably provided by G. Dew.

Alberta Forest Service at Red Earth supplied storage facilities.

The manuscript was critically read by R. Vogwill and G. Ozoray.

## TOPOGRAPHY AND DRAINAGE

The study area is in the Interior Plains physiographic region of Canada (Alberta, Government and University, 1969). Topographically, the Buffalo Head Hills Upland, Utikuma Upland, and Birch Mountains Upland are the higher units, while the Loon River Lowland and the Algar Plain are low-lying.

The topography ranges from less than 488 m (1600 ft) above mean sea level (AMSL) in the floodplain of the Loon River to over 793 m (2600 ft) AMSL at Trout Mountain. The greatest relief is found in the Buffalo Head Hills Upland.

The entire area belongs to the MacKenzie River (Arctic Ocean) drainage system. The area is drained primarily by the Loon and Muskwa Rivers, both flow into the Wabasca River, a tributary of the Peace River. All of the major rivers in the map area have broad meanders indicative of the low gradient in the lowlands. Meander scars, oxbow lakes, and other remnants of meander migration are common in the floodplains.

All lakes found in the map area are of glacial origin. No accurate hydrographic data are available; consequently, lake depth information has been obtained from local residents. Lakes tend to be more numerous, larger, and deeper in the upland areas due to the rolling topography of ground moraine areas. Lakes found in the lowlands, notably Muskwa and Lubicon Lakes, tend to be shallow due to lack of relief on lacustrine plains.

## VEGETATION

The vegetation of the area has been briefly described by Moss (1953).

The map area is covered by aspen forests and treed muskeg (sphagnum moss). The aspen poplar *(Populus tremuloides)* is the most abundant tree species. White spruce *(Picea glauca)* represents the climax species but its growth has been impeded by burning. Numerous other tree varieties are scattered over the map area, including jackpine *(Pinus banksiana)*, balsam poplar *(Populus balsamifera)*, white birch *(Betula papyrifera)*, and water birch *(Betula occidentalis)*.

Peat bogs or muskeg are common and represent the initial stages of a succession through wet meadow to grassland to various wooded communities or bog forest - black spruce *(Picea mariana)* climax. Muskeg predominates in the lower-lying physiographic regions and is sparsely distributed in the plateaus of higher, wooded physiographic regions.

## CLIMATE

The climate of the Peerless Lake map area is designated as microthermal and is characterized by short cool summers (Longley, 1972).

Mean annual precipitation varies from 470 mm (18.5 in) in the Loon River Lowland at Red Earth to more than 508 mm (20 in) in the Birch Mountains Upland. About 75 percent of the total precipitation falls as rain. The isohyets presented in the meteorological side map have been modified from Longley, 1972.

The average annual potential evapotranspiration is about 482 mm (19 in) and exceeds precipitation both annually and in the months of May to September, resulting in a moisture deficiency (Bruce and Weisman, 1967). The mean annual temperature for Red Earth is about -1°C (30°F). The highest mean monthly temperature is 14°C (57°F) in July and the lowest is -21°C (-6°F) in January.

## GEOLOGY

### BEDROCK GEOLOGY

Extensive oil exploration has resulted in various nomenclatures for geologic units of the map area. Two stratigraphic columns, representing the geology in the western and eastern half of the map area, are presented in table 1. In the eastern part of the map area differentiation of Upper Cretaceous units becomes difficult and consequently the units are grouped together as Labiche Formation.

To the depths considered, the primary geological units of the map area are:

*Smoky Group:* A marine unit consisting of shale, silty shale and occasional sandstone lenses. Beds of the Smoky Group subcrop in the northwest corner of the map area. The Bad Heart sandstone, an important aquifer south of the study area, is believed to be absent.

*Dunvegan Formation:* A thin (<15 m or 50 ft) marine sandstone found primarily in the western part of the map area.

*Shaftesbury Formation:* A marine shale composed of two units separated by the 'fish-scale' zone. The lower unit tends to be sandier than the upper.

*Peace River (Viking - Pelican) Formation:* This formation consists of three members, all of marine origin. The Cadotte and Paddy members are sandstones while the Harmon (Joli Fou) member is a shale. The formation thins towards the east and north.

*Spirit River (Grand Rapids) Formation:* A marine silty shale which maintains a fairly uniform thickness of approximately 183 m (600 ft) over the entire map area.

*Basal Cretaceous Sands:* This sandstone unit was formed by erosion at the Paleozoic unconformity. The thickness of Basal Cretaceous Sands is highly variable.

*Paleozoic:* The Paleozoic consists primarily of Mississippian and Devonian carbonates.

Upper Cretaceous shales are the main units which subcrop in the map area. Along the traces of the bedrock channels the Lower Cretaceous Spirit River (Grand Rapids) Formation had been exposed prior to glaciation.

The geology of the area is illustrated in both the geological side map and cross sections. Subsurface geology was determined using information from geophysical well logs and structure testholes.

## SURFICIAL GEOLOGY

No previous work has been done on the surficial geology of the map area. The description of surficial materials is based primarily on air photographic interpretation, field observations, and shallow borehole information.

The thickness of surficial deposits varies significantly: from less than 15 m (50 ft) to over 244 m (800 ft). A preliminary bedrock topography map (Fig. 1) was constructed using well data, geophysical information, and surface topography. The predominant material present in surficial deposits is till in the form of ground and hummocky disintegration moraine. Ground moraine is found primarily on the topographic highs. Hummocky disintegration moraine, characterized by a knob-and-kettle topography, is most well developed in the southwest corner of the map area. Glacial flutings, found in the southeast corner of the map area, suggest dominant ice movement during glaciation was from northeast to southwest.

Extensive thin sheets of glaciolacustrine clays cover lowlands such as the Loon River Lowland and the Algar Plain. Local lenses of clay are found within till over the entire study area.

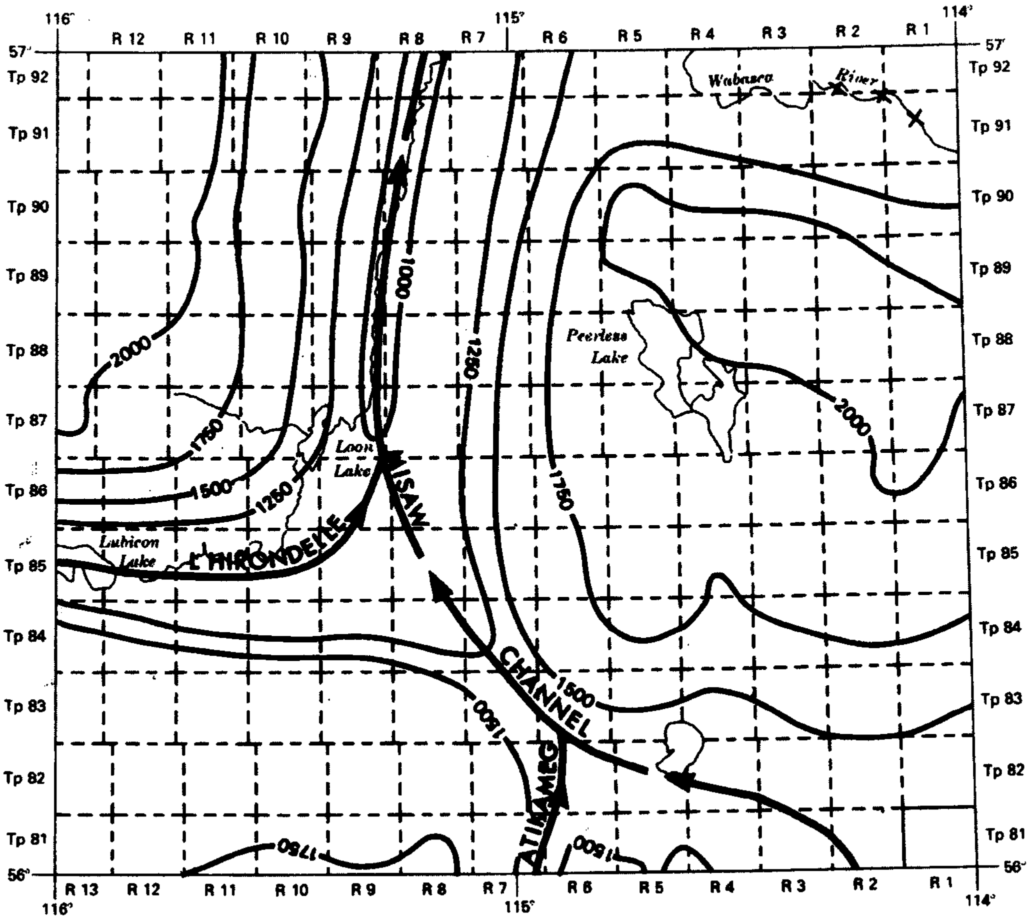
Glaciofluvial deposits of sand and gravel are generally widespread but are thickest in the southwest corner of the study area. Extensive outcrops of outwash sand are noticeable along Highway 67 in the vicinity of Tp 85, R 9. In general, the outwash material consists of poorly sorted sands and gravels, which are angular and varied in lithology. The deposits are commonly found interbedded with till and lacustrine sediments. Test drilling and electric well log analysis have indicated that the deposits are 152 m (500 ft) thick south of Whitefish lookout tower.

An extensive network of preglacial channels, which approximately resembles the present-day drainage system, exists in the study area. The major bedrock channel is here named the Misaw Buried Valley. The thalweg of the channel is coincident with the Muskwa and Loon Rivers. The L'Hirondelle Buried Valley from the west (Borneuf, pers. comm.) and the Atikameg Buried Valley from the south (Vogwill, pers. comm.) are the major tributaries to the Misaw Buried Valley. Deposits in the buried valleys are usually thicker than 152 m (500 ft) and consist predominantly of till interbedded with sand, gravel, and clay. Studies of electric well logs indicate that basal deposits of sand and gravel are present in the Atikameg, L'Hirondelle, and the southern portions of the Misaw buried valleys. The northern part of the Misaw Buried Valley does not contain a well-developed basal unit of sand and gravel as shown by a 249 m (818 ft) testhole in the Red Earth settlement by Clissold (1974).

TABLE 1

Stratigraphic column of formations found in the Peerless Lake area, Alberta

| PERIOD | FORMATION | |
|---|---|---|
| | WEST HALF | EAST HALF |
| Quaternary | Unconsolidated deposits | Unconsolidated deposits |
| Cretaceous | Wapiti Formation<br><br>Smoky Group<br>Dunvegan Formation<br>Shaftesbury Formation<br><br>Peace River Formation<br><br>Spirit River Formation<br><br>Basal Cretaceous Sands | Labiche Formation<br><br>Pelican Formation<br>Joli Fou Formation<br><br>Grand Rapids Formation<br><br>McMurray Formation |
| Mississippian | Rundle Group<br><br>Banff Formation<br>Exshaw Formation | Banff Formation<br>Exshaw Formation |
| Devonian | Wabamun Group<br>Winterburn Group | Wabamun Group<br>Winterburn Group |




**Legend**

x: bedrock outcrop

—1000—: approximate elevation of bedrock surface above sea level (feet)

contour interval: 250 ft

scale: 1:1,000,000

Figure 1. Bedrock topography, NTS 84B

# HYDROGEOLOGY

## GENERAL

Hydrogeological information is scarce and consists of bored or shallow drilled wells in the vicinity of major settlements. Some scattered information is available from oil company injection wells and seismic shotholes.

Since the most important aquifers are found within surficial deposits more emphasis is placed on the hydrogeology of surficial deposits.

## BEDROCK HYDROGEOLOGY

Few wells are completed in bedrock and consequently little information is available. Bedrock yields have been estimated by extrapolating yield information from adjacent map areas (Jones, 1966; Tokarsky, 1972) and from geophysical well log interpretation. All bedrock yields presented on the yield map and cross sections are designated as 'possible' due to lack of data.

The Dunvegan Formation, which is found primarily in the western half of the area, is the best bedrock aquifer. Yields of up to 2 L/s (25 igpm) may be possible in the northwest corner of the map area. The yield probably decreases rapidly eastward due to stratigraphic thinning. Yields obtainable from the Shaftesbury Formation are probably less than 0.1 L/s (1 igpm) due to the low permeability of the shales.

The Peace River (Pelican - Viking) Formation is capable of yielding 0.4 L/s (5 igpm) to 2 L/s (25 igpm) from the Paddy and Cadotte members. Yield decreases to less than 0.1 L/s (1 igpm) in the argillaceous Harmon (Joli Fou) member.

A yield range of 0.1 L/s (1 igpm) to 0.4 L/s (5 igpm) has been assigned to the Spirit River (Grand Rapids) Formation. This yield estimate is based on anticipated large available drawdowns and the existence of some permeability in the siltstone. Paleozoic carbonates may yield over 8 L/s (100 igpm) in places, depending on the frequency and size of fractures and joints. They are not considered important aquifers since the strata are at impractical depths and contain saline groundwater.

## SURFICIAL HYDROGEOLOGY

Basal sand and gravel in the Misaw Buried Valley in the southeastern portion of the map area has the greatest groundwater potential. The assumption that yield is high is based on 1) electric well log information which reveals thick sand and gravel sequences, and 2) several deep wells completed in the tributary Atikameg Buried Valley south of the study area for which 20-year safe yields of over 38 L/s (500 igpm) were obtained (Vogwill, pers. comm.). A high available drawdown is expected since the sand and gravel is confined by less permeable till. In the portion of the Misaw Buried Valley which trends north-south the yield decreases markedly to less than 2 L/s (25 igpm). The decrease is probably due to a decrease in the thickness and permeability of the sands and gravels. In the vicinity of the Red Earth settlement the channel is filled with till containing numerous lenses of sand and gravel. Clissold (1974) conducted a pump test in a sand and gravel lens within the till and obtained a transmissivity and 20-year safe yield of 0.2 $m^2$/d (15 igpd/ft) and 0.6 L/s (8 igpm), respectively.

Geophysical well log information indicates that the L'Hirondelle Buried Valley (Borneuf, pers. comm.) which joins the Misaw Buried Valley from the west contains a basal unit of sand and gravel which may yield 2 L/s (25 igpm) to 8 L/s (100 igpm). High yields are anticipated because of the apparent high permeability of the basal deposits and the expected high available drawdown.

Yields of 8 L/s (100 igpm) to 38 L/s (500 igpm) are possible from glaciofluvial deposits. The deposits are widespread but are most important in the southwest quarter of the map area where they are divided into two major aquifer zones. The depth to a 15-m (50-ft) thick upper zone varies with topography and a 30-m (100-ft) thick lower zone is located 61 to 91 m (200 to 300 ft) below ground level. Both aquifer zones consist of coarse gravel which is varied in lithology, angular, and poorly sorted. Figure 2 shows the two aquifer zones in a testhole in the southwest part of the study area. Alberta Research Council testhole No. 3 (Appendix) partially penetrated the upper aquifer and subsequent bailing tests revealed a yield of more than 8 L/s (100 igpm). Further drilling through the aquifer was difficult due to excessive circulation losses. No wells have been completed in the lower aquifer zone; however, yields over 38 L/s (500 igpm) are suggested from electric well log information.

In areas where surficial deposits are thick and composed primarily of till the yield varies from 0.1 L/s (1 igpm) to 0.4 L/s (5 igpm). The yield is strongly dependent on the fracture permeability of the till and on the presence of sand and gravel lenses within the till.

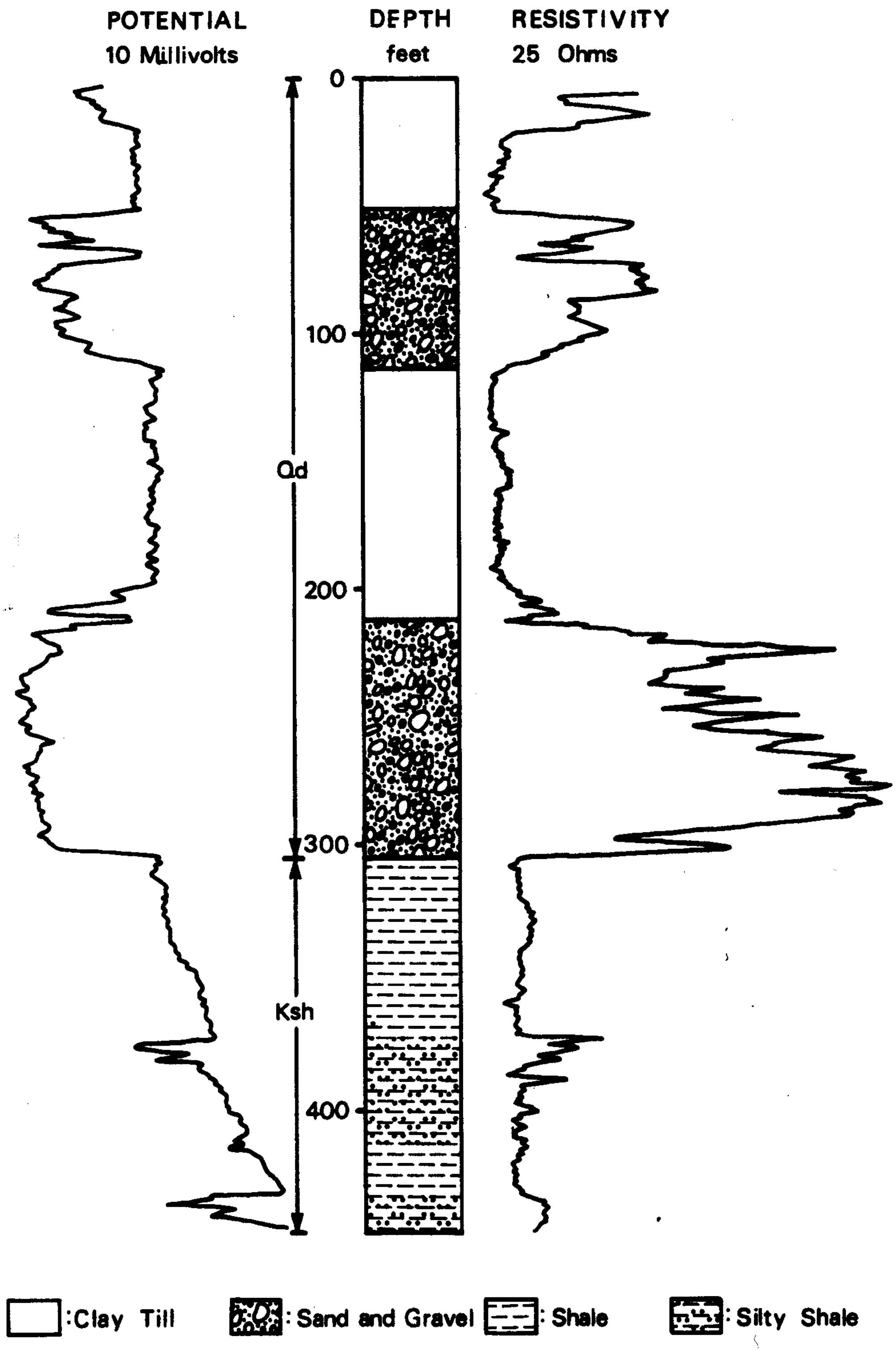



Figure 2. Structure testhole (Lsd 2, Sec 26, Tp 82, R 11, W6M)

## GROUNDWATER MOVEMENT DISTRIBUTION

The direction of groundwater movement has been determined from surface topography and groundwater discharge phenomena such as flowing wells, springs, and seepages. The groundwater table is generally a subdued replica of the topography.

Recharge of the groundwater system takes place primarily in the upland areas. Water from these areas flows down to recharge bedrock and buried valley aquifers.

Local groundwater discharge is present over the entire map area in the form of seasonal discharge features. The major topographic lows, the Loon River Lowland and Algar Plain, are areas of regional discharge (Toth, 1978). In both lowlands groundwater discharge takes place in the form of springs, seepages, or recharge into the Loon and Muskwa Rivers.

The largest spring observed in the map area, flowing from a sand lense-till outcrop at 6 L/s (75 igpm), was found 3 km (2 mi) south of Gods Lake. Numerous contact springs generally flowing at less than 1 L/s (10 igpm), are located in the Wabasca River valley. They are believed to be part of local flow systems since they flow only after snowmelt in spring and after intense rainfall during the summer and fall.

Basal sand and gravel in the bedrock buried valleys is usually confined by till and occasionally flowing artesian conditions result. Uncontrollable flows have been reported from wells completed in the basal unit of the Misaw Buried Valley in the southeastern part of the map area (Vogwill, pers. comm.). In the vicinity of Red Earth settlement the Misaw Buried Valley lacks a well-developed basal sand and gravel unit but flowing artesian conditions are created by the confinement of sand and gravel lenses by less permeable till. Flows are usually less than 0.4 L/s (5 igpm).

The most extensive flowing artesian area is located about 10 km (6 mi) north of Utikuma Lake. Seismic exploration has accurately delineated the flowing artesian area. Many seismic shotholes are flowing at more than 4 L/s (50 igpm). The artesian pressure is probably caused by the confinement of a 15-m (50-ft) thick sand and gravel zone by till. The flowing artesian area is bounded approximately by the 640-m (2100-ft) surface topography contour line and further outlined by natural groundwater discharge features such as seepages. No wells are completed in the 30-m (100-ft) thick basal sand and gravel zone which is found 61 to 91 m (200 to 300 ft) below ground surface. It is expected that a well completed in this lower zone would probably encounter strong flowing conditions due to effective confinement of the permeable deposits.

## HYDROCHEMISTRY

Little hydrochemical information exists for the map area. Approximately 80 water samples of surface water bodies, springs, and flowing shotholes were collected to supplement existing chemical data. Over 90 percent of the existing chemical data are from surficial deposits. Due to lack of bedrock hydrochemical data, only the hydrochemistry of surficial deposits is presented on the hydrochemical side map.

Calcium and magnesium ions constitute over 60 percent of the cations in groundwater from surficial deposits. In deep drift, sodium and potassium ion concentrations become markedly higher, probably due to mixing with bedrock groundwater. Bicarbonate and carbonate are the dominant anions. Sulfate ion predominates locally in the lowlands and is usually associated with a high total dissolved solids concentration. In general, the total dissolved solids concentration varies from less than 500 mg/L in the uplands to over 2000 mg/L in the lowlands.

Groundwaters from surficial deposits usually contain less than 1 mg/L iron except in areas underlain by glaciofluvial deposits. Iron concentrations average about 5 mg/L in the south-central portion of the map area where thick sand and gravel are present.

Muskeg waters, which are widespread over the map area, are the calcium/magnesium-bicarbonate type and usually have a total dissolved solids concentration of less than 250 mg/L.

The hydrochemistry of bedrock groundwaters is not accurately known but can be reasonably inferred from drillstem tests. Sodium and potassium are the dominant cations and chloride the dominant anion. The middle of the Spirit River (Grand Rapids) Formation is approximately the boundary between sodium/potassium-bicarbonate type water above and sodium/potassium-chloride type water below. Total dissolved solids content increases rapidly with depth, indicating slow groundwater movement through the shales.

## CONCLUSIONS

The study area contains potentially large groundwater resources in the surficial deposits. A yield of over 38 L/s (500 igpm) is believed available from basal sand and gravel along portions of the Atikameg and Misaw Buried Valleys. Yields of over 8 L/s (100 igpm) may be obtained from glaciofluvial deposits in the southwest part of the map area.

Till is generally a poor aquifer yielding less than 0.4 L/s (5 igpm); however, the presence of extensive fracturing or sand and gravel lenses may increase the yield to 2 L/s (25 igpm).

The bedrock is a poor aquifer. The Smoky Group and Dunvegan Formation in the northwest part of the map area are assigned a yield range of 0.4 L/s (5 igpm) to 2 L/s (25 igpm) due to the presence of sandstone units. In the remainder of the map area poorly permeable Cretaceous shales and siltstones subcrop.

Flowing artesian conditions exist locally in all major topographic lows. Flows of up to 0.8 L/s (10 igpm) are possible when wells are completed in sand and gravel lenses within till in the buried channels. The most extensive flowing artesian region, caused by confinement of a 15-m (50-ft) thick sand and gravel unit, is located in the south-central portion of the map area. Flows exceeding 8 L/s (100 igpm) have been reported.

In general, groundwater quality is poor. Drift groundwater is primarily the calcium/magnesium-bicarbonate type and has a total dissolved solids concentration which varies from less than 500 mg/L in the uplands to over 2000 mg/L in the lowlands. Little information exists on the quality of bedrock groundwater. Drillstem tests suggest that the water is the sodium/potassium-chloride type and has a total dissolved solids concentration which increases rapidly with depth due to the low permeability of the shales.

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## APPENDIX - ALBERTA RESEARCH COUNCIL TESTHOLES

1. Location: Lsd 8, Sec 1, Tp 90, R 5, W 5th M
   Date Drilled: October 19, 1976

| Depth (feet) | Lithology |
|---|---|
| 0 - 34 | Till, brown, clayey |
| 34 - 36 | Sand, coarse grained |
| 36 - 41 | Till, gray, stony |
| 41 - 58 | Sand, coarse grained; gravel, poorly sorted |
| 58 - 68 | Sand, coarse grained; clay interbeds |
| 68 - 170 | Till, gray, stony |
| 170 - 244 | Till, gray, stony; some boulders |
| 244 - 300 | Shale, gray |

2. Location: Lsd 12, Sec 21, Tp 84, R 9, W 5th M
   Date Drilled: October 20, 1976

| Depth (feet) | Lithology |
|---|---|
| 0 - 35 | Sand, fine grained |
| 35 - 78 | Sand, medium grained; gravel, poorly sorted |
| 78 - 82 | Sand, fine grained |
| 82 - 92 | Sand, fine grained; gravel, poorly sorted |
| 92 - 140 | Till, gray, clayey |

3. Location: Lsd 5, Sec 17, Tp 81, R 10, W 5th M
   Date Drilled: October 20, 1976

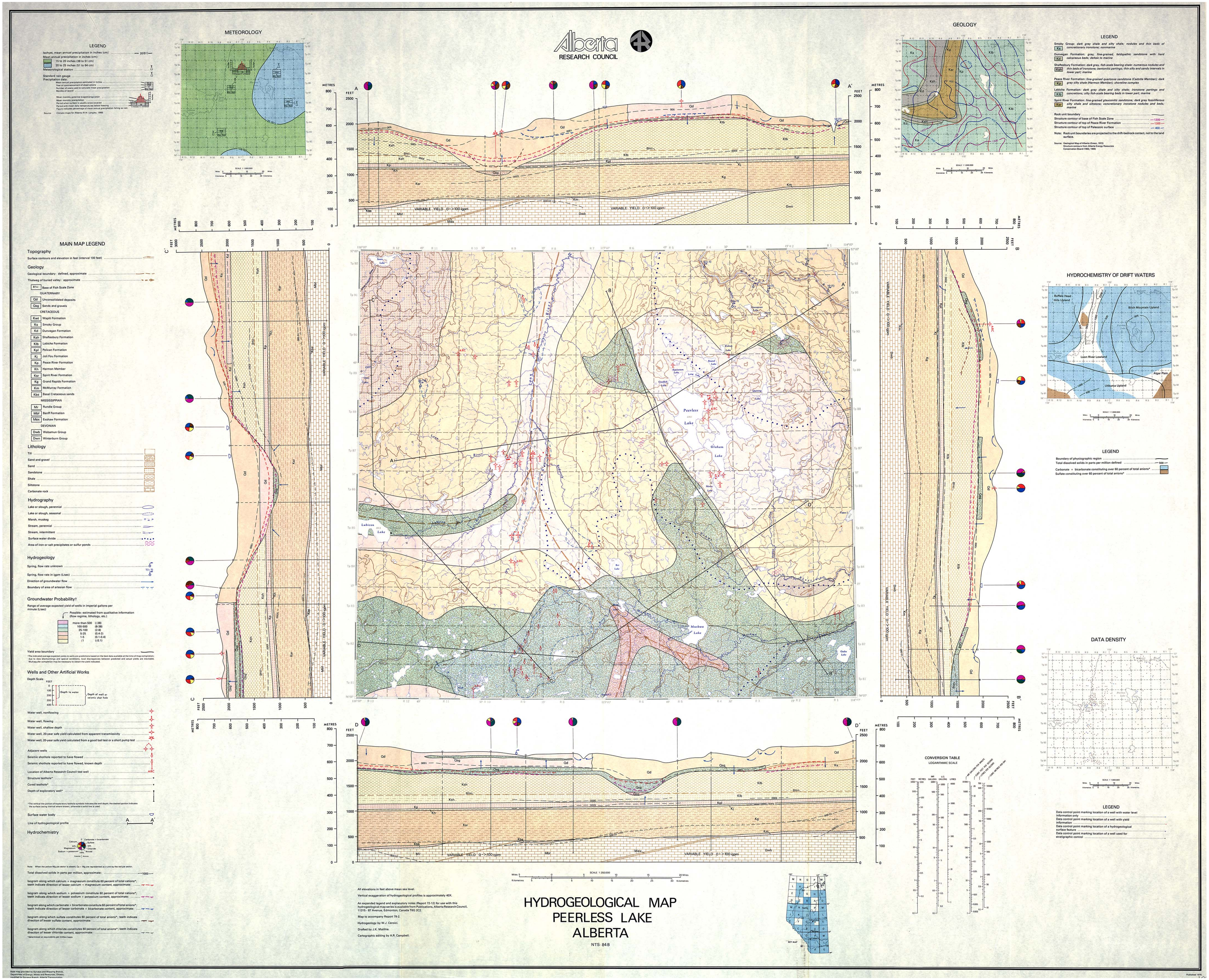
| Depth (feet) | Lithology |
|---|---|
| 0 - 8 | Clay, brown (oxidized) |
| 8 - 34 | Till, brown; minor sand, fine grained |
| 34 - 40 | Till, gray |
| 40 - 51 | Till, brown; sand lenses |
| 51 - 80 | Sand, fine grained |
| 80 - 90 | Sand, coarse grained |
| 90 - 100 | Sand, coarse grained; gravel |
| 100 - 120 | Gravel, coarse, poorly sorted (drilling difficult) |

4. Location: Lsd 4, Sec 21, Tp 88, R 4, W 5th M
   Date Drilled: October 21, 1976

| Depth (feet) | Lithology |
|---|---|
| 0 - 18 | Till, brown, clayey |
| 18 - 85 | Till, gray, clayey |
| 85 - 92 | Till, brown, sandy |
| 92 - 122 | Till, gray, clayey |
| 122 - 125 | Sand, fine grained |
| 125 - 168 | Till, gray, clayey |
| 168 - 176 | Sand, fine grained; gravel, poorly sorted |
| 176 - 190 | Till, gray, clayey |
| 190 - 240 | Till, gray; sand interbeds |
| 240 - 300 | Shale, gray |

5. Location: Lsd 4, Sec 30, Tp 89, R 6, W 5th M
   Date Drilled: October 22, 1976

| Depth (feet) | Lithology |
|---|---|
| 0 - 20 | Till, brown, sandy |
| 20 - 143 | Till, gray, clayey |
| 143 - 180 | Till, gray; sand interbeds |
| 180 - 188 | Sand, medium grained; gravel, poorly sorted |
| 188 - 190 | Clay, gray, clayey |
| 190 - 211 | Sand, medium grained; gravel, poorly sorted (drilling difficult) |


Alberta
RESEARCH COUNCIL
METEOROLOGY
GEOLOGY
MAIN MAP LEGEND
Topography
Surface contours and elevation in feet (interval 100 feet)
Geology
Geological boundary: defined, approximate
Thalweg of buried valley: approximate
Bfsc Base of Fish Scale Zone
QUATERNARY
Qd Unconsolidated deposits
Qsg Sands and gravels
CRETACEOUS
Kwt Wapiti Formation
Ks Smoky Group
Kd Dunvegan Formation
Ksh Shaftesbury Formation
Klb Labiche Formation
Kpl Pelican Formation
Kj Joli Fou Formation
Kp Peace River Formation
Kh Harmon Member
Ksr Spirit River Formation
Kg Grand Rapids Formation
Km McMurray Formation
Kbs Basal Cretaceous sands
MISSISSIPPIAN
Mr Rundle Group
Mbf Banff Formation
Mex Exshaw Formation
DEVONIAN
Dwb Wabamun Group
Dwn Winterburn Group
Lithology
Till
Sand and gravel
Sand
Sandstone
Shale
Siltstone
Carbonate rock
Hydrography
Hydrogeology
Groundwater Probability
Wells and Other Artificial Works
Hydrochemistry
HYDROCHEMISTRY OF DRIFT WATERS
DATA DENSITY
CONVERSION TABLE
Peerless Lake
Graham Lake
Lubicon Lake
VARIABLE YIELD 0->100 igpm
SCALE 1:250,000
All elevations in feet above mean sea level.
Vertical exaggeration of hydrogeological profiles is approximately 40X.
An expanded legend and explanatory notes (Report 72-12) for use with this hydrogeological map series is available from Publications, Alberta Research Council, 11315 - 87 Avenue, Edmonton, Canada T6G 2C2.
Map to accompany Report 79-2.
Hydrogeology by W.J. Ceroici.
Drafted by J.K. Matthie.
Cartographic editing by A.R. Campbell.
HYDROGEOLOGICAL MAP
PEERLESS LAKE
ALBERTA
NTS 84B