

PROOF OF WATER FOR THE PROPOSED SUBDIVISION
OF DISTRICT LOT 5682 AND PART OF DISTRICT LOT 6091,
NORTH OF HALFMOON BAY ON THE SECHELT PENINSULA

Prepared for

MR. ROBERT H. STRAIGHT
R.R. 1, 11415 Sunshine Coast Highway
HALFMOON BAY, B.C. VON 1Y0

Prepared by

PACIFIC HYDROLOGY CONSULTANTS LTD.
204 - 1929 West Broadway
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JUNE 23, 1992

PACIFIC HYDROLOGY CONSULTANTS LTD.
CONSULTING GROUNDWATER GEOLOGISTS

June 23, 1992

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Mr. Robert H. Straight
R.R. 1, 11415 Sunshine Coast Highway
HALFMOON BAY, B.C. V0N 1Y0

Subject: Proof of Water for the Proposed Subdivision of District Lot 5862
and Part of District Lot 6091, North of Halfmoon Bay on the
Sechelt Peninsula

Dear Sir:

This letter is further to several telephone discussions between Mr. Robert Straight, Property Owner, and either Ann Badry, Hydrogeologist, or Mr. Ed Livingston, P. Eng., of Pacific Hydrology Consultants Ltd., and to a discussion onsite between Mrs. Straight and Ed. Livingston on June 18, concerning "Proof of Water" for the subject Subdivision, as required by B.C. Ministry of Transportation and Highways, and as outlined in a letter from B.C. Ministry of Transportation and Highways dated April 27, 1992 to Mr. John C. Theed, B.C.L.S. of Sechelt.

1.0 INTRODUCTION

Further to the aforementioned site visit and telephone discussions, and from the documents forwarded with your (Rob Straight) memo' of June 1, 1992, we understand the following concerning the proposed Subdivision:

1. The parcel of land proposed for subdivision is legally described as D.L. 5862 and Block 1, D.L. 6091, Ex. Plan 4782, Group 1, N.W.D.
2. Application has been made to subdivide the subject parcel, more or less in half, along an east/west line, with the existing house and building on the South Lot.

.../2

Mr. Robert H. Straight

Proof of Water for the Proposed Subdivision of District Lot 5862 and Part of
District Lot 6091, North of Halfmoon Bay on the Sechart Peninsula

June 23, 1992 - Page 2

3. The existing house is supplied with water from a dug well located south of the driveway. The Well, which is equipped with a shallow well pump, supplies ample water of good quality, as shown by a November 1983 water analysis by Analytical Service Laboratories Ltd.
4. In 1973, Robinson, Roberts & Brown Ltd. (now Brown, Erdman) carried out a pump test of the existing well and concluded that the existing well has a capacity of at least 0.38 L/sec (5 igpm). This investigation is described in two letters to Mr. H.L. Straight from Robinson, Roberts & Brown, dated June 13 and July 5, 1973.
5. Wells drilled into rock in the Middle Point area have been successful in obtaining water but the chemical quality of the water is often not satisfactory because of a "sulphur" odour - probably H₂S (hydrogen sulphide).
6. There is a domestic water license on Donley Creek which crosses the southeast corner of District Lots 5862 and 6091, with the point of diversion on Lot 6091. The license, which is in good standing, is held by Jack and Lillian Farrell.
7. The neighbours to the north (District Lot 5863) obtain water from a dug well located in the bush at higher elevation south of the house. Examination of this well and surrounding area by Ed Livingston during his site visit of June 18, 1992 showed the following:
 - a. The well is a shallow, open and unlined dug well, excavated in either glacial till or a very stoney phase of the glaciomarine sediments.
 - b. Water is conveyed from the well to the house by a syphon.
 - c. An old abandoned black poly' pipe extends southeastward from the well to an old dug well, also abandoned, which is located several hundred metres upslope through the bush. This old well is located on a "bench" which is wet; the water level in the well was close to surface at the time of Ed Livingston's visit and there is swamp vegetation nearby.

Mr. Robert H. Straight

Proof of Water for the Proposed Subdivision of District Lot 5862 and Part of

District Lot 6091, North of Halfmoon Bay on the Sechelt Peninsula

June 23, 1992 - Page 3

Figure 1 in Appendix A is an area and water well location map; Figure 2 shows the layout and other features of the proposed Straight Subdivision. Appendix B contains a summary table of water wells in the subject area for which records are on file with B.C. Environment.

2.0 GEOLOGY

The subject area is underlain by intrusive rocks of granite/diorite types, of Paleozoic to Tertiary age.

The area of the proposed Straight Subdivision was glaciated several times; the last glacial episode ended about 10,000 years ago, at which time sea level was 100 m (330 ft) or more above present sea level. During the time of high sea level, large volumes of sediment-laden meltwater were being discharged into the sea from melting ice in the uplands. The sediment settled out quite rapidly in the sea to form a "blanket" of glaciomarine sandy silt, with stones over the area which was below sea level. As the land emerged from the sea, marine erosion reworked the glaciomarine sediments to form a thin intermittent cover of sand and gravel on which much of the present soil has developed.

The gently sloping area, which is present on the south side of the existing driveway, through which Donley Creek flows and where the Straight Well is located, may be a raised delta of a former Donley Creek when sea level was higher than at present. At that time, the Creek was much larger than at present and was depositing a delta into the sea. The area is now almost waterlogged by the flow of Donley Creek which disappears into the ground a short distance below the culvert under the driveway. The existing well is dug into the deltaic sediments which are permeable enough to supply the well with ample water for domestic use.

Mr. Robert H. Straight

**Proof of Water for the Proposed Subdivision of District Lot 5862 and Part of
District Lot 6091, North of Halfmoon Bay on the Sechelt Peninsula**

June 23, 1992 - Page 5

than one well. If the water contains H₂S (hydrogen sulphide), as is reported from other wells in the area, relatively inexpensive modern pressure-aeration equipment can be installed to deal with the problem.

A dug well must be located in an area of thick overburden similar to the site of the old abandoned dug well on D.L. 5863 to the north. The capacity of such a well is not likely to be as high as the existing Straight well near the driveway as it is apparently dug in deltaic sediments rather than glacial or glaciomarine deposits. The capacity of dug wells cannot be predicted in advance. A well of this type has minimum capacity in early autumn before the heavy fall precipitation and, therefore, its capacity should be evaluated by a careful pump test at that time. The record which is on file with B.C. Environment for the Well on D.L. 5863 states that the well goes dry in the period August to November, showing the need for careful evaluation of the capacity of such wells at the end of the summer drought. Dug wells such as the existing Straight Well, which is located adjacent to a permanent Creek, are less prone to seasonal fluctuations in capacity.

As mentioned previously, there is a domestic water license on Donley Creek, with a point of diversion upstream of the Straight Property; therefore, diversion of water for the North Lot to be created by the proposed Subdivision would not affect the present license. The first question is whether there is excess flow in the Creek in early autumn before the fall precipitation. If this source is considered, a simple device can be constructed to measure low flows in August and September. It should be possible to direct the entire flow into a length of 50 mm (2") diameter plastic pipe so that the flow can be measured by timing the filling of a container of known volume - probably a 22 litre plastic bucket. Application for a domestic water license can be made at B.C. Environment's Office in Surrey. Use of Donley Creek to supply the North Lot would obviously require an easement from the Creek on the South Lot to the building site on the North Lot.

Mr. Robert H. Straight

**Proof of Water for the Proposed Subdivision of District Lot 5862 and Part of
District Lot 6091, North of Halfmoon Bay on the Sechelt Peninsula**

June 23, 1992 - Page 6

4.0 GROUNDWATER QUALITY

Table 2 in Appendix C contains the results of a 1983 water analysis for the existing Straight Well on the South Lot of the proposed Subdivision. The Table also contains the results of an analysis of groundwater from the Mitchell Well on D.L. 6235 which, as previously discussed, obtains water from a deep fracture zone in rock.

As Table 2 shows, the groundwater from the Mitchell Well is quite highly mineralized. The fact that the static water level in the Well rises 4.6+ m (15+ ft) above sea level shows conclusively that the poor quality water is not due to sea water intrusion, since the static water level would be expected to be close to sea level if the fracture system intersected by the Well were directly connected to the sea; rather, the highly mineralized groundwater, with a chloride content of 362 mg/L, is almost certainly due to a long slow-moving groundwater flow system in the rock. The deeper nearby rock well (D.L. 5864) reportedly flows; therefore, it also cannot be directly connected to the sea. The chloride content of water from the Well on D.L. 5864, which is almost twice as deep as the Well on D.L. 6235, was apparently about three times as high (800 to 900 mg/L). The experience with these two deep rock Wells shows the need to monitor groundwater quality during drilling; in this way, if deeper poor quality groundwater is encountered, drilling can be terminated and the zone of poor quality water sealed off. If such water is encountered and the Well has insufficient good quality water above that depth, a second well can be tried or, alternatively, reverse osmosis could be used to reduce the mineralization.

5.0 SUMMARY

1. Experience shows that the existing shallow dug well on the South Lot to be created by the proposed Straight Subdivision is an adequate source of good quality water.

Mr. Robert H. Straight

Proof of Water for the Proposed Subdivision of District Lot 5862 and Part of
District Lot 6091, North of Halfmoon Bay on the Sechelt Peninsula

June 23, 1992 - Page 7

2. Alternative water sources for the North Lot include a drilled well in rock, a dug well and a license on Donley Creek.
3. Experience shows that drilled wells in the light-coloured intrusive bedrock which underlies the subject area are usually successful in obtaining much more water than required for an individual consumer; however, the presence and/or depth of fractures cannot be predicted and an occasional unsuccessful well may be drilled or, as shown by the nearby Mitchell Well, a deep well may encounter poor quality groundwater at the discharge end of a slow-moving groundwater flow system. On a large lot, more than one well can be drilled if necessary.
4. Under suitable conditions, such as at the existing dug well which supplies the Straight Residence, shallow dug wells can be satisfactory water sources. However, the capacity of such wells should be properly evaluated for capacity at the end of the summer drought period.
5. Similar to dug wells, the flow of Donley Creek is minimum at the end of the summer drought period so measurements of low flow should be taken during this period. Use of Donley Creek requires that a license application be made to B.C. Environment. A license on Donley Creek, provided that low flow measurement shows a license to be feasible, would not interfere with an existing upstream license held by the Farrell's.
6. Available chemical analysis of groundwater from the Straight dug well shows that the quality of water from shallow overburden along Donley Creek is of good quality for domestic consumption. As shown by a water analysis from the nearby Mitchell Well, deep wells in rock may obtain highly mineralized water from the discharge zone of a long slow-moving flow system in rock. Reports of a "sulphur" odour in water from rock wells in the area is probably due to the presence of hydrogen sulphide (H₂S) which can be removed by relatively inexpensive pressure-aeration equipment or other treatment; H₂S is not an health hazard.

Mr. Robert H. Straight

Proof of Water for the Proposed Subdivision of District Lot 5862 and Part of
District Lot 6091, North of Halfmoon Bay on the Sechelt Peninsula

June 23, 1992 - Page 8

We trust that this letter and attachments adequately addresses the concerns of B.C. Ministry of Transportation and Highways with respect to "Reasonable assurance of adequate domestic water supply...". However, please do not hesitate to call if you wish to further discuss any aspect of the contents of this letter or if we can be of further assistance with this matter.

Yours truly,

PACIFIC HYDROLOGY CONSULTANTS LTD.

A handwritten signature in cursive script that reads "Ed Livingston". The signature is written in dark ink and is positioned above the typed name.

Ed Livingston, P. Eng.

Attachments

APPENDIX A

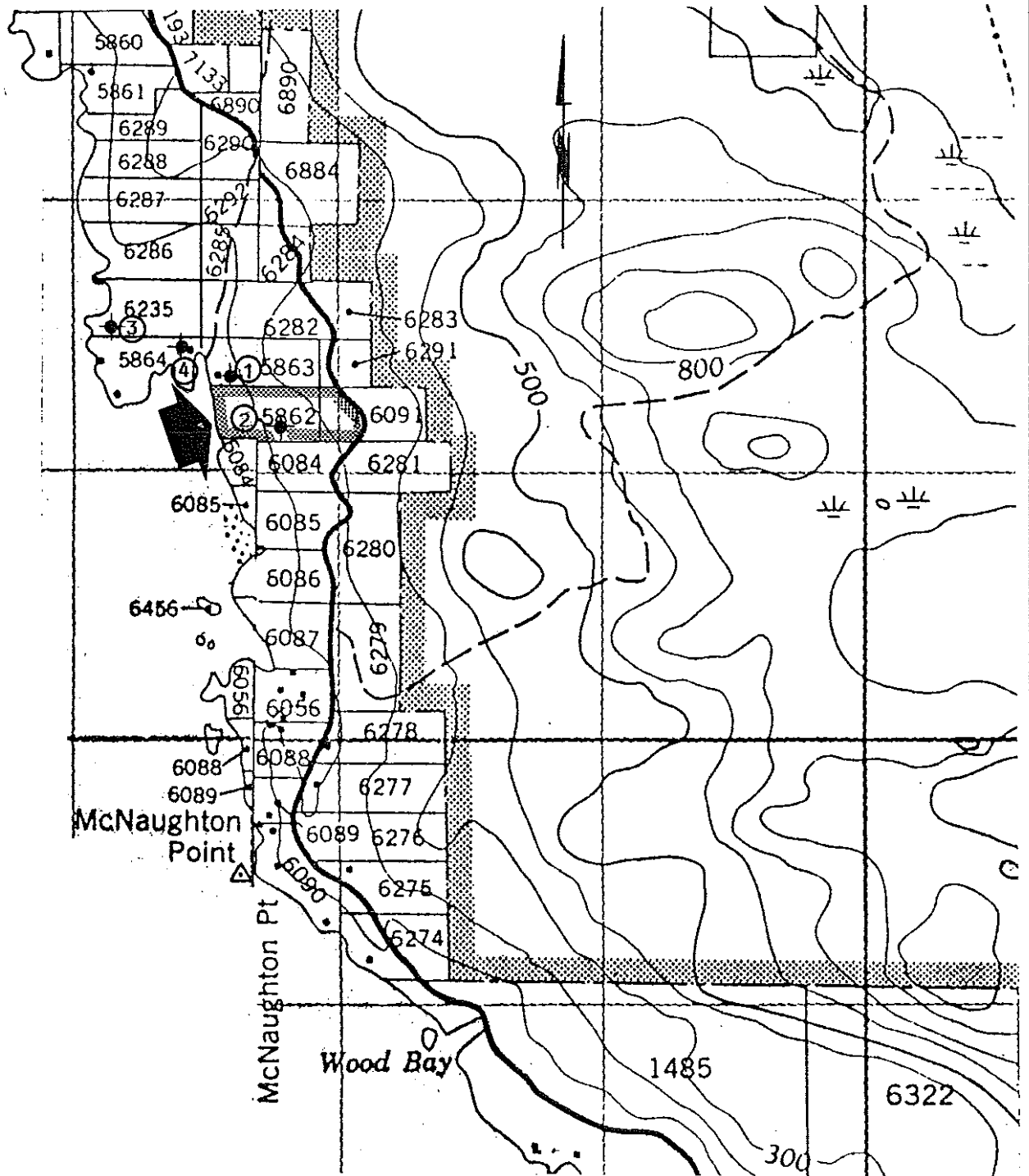
AREA AND WELL LOCATION MAP

AND

PROPOSED SUBDIVISION LAYOUT

FIGURE 1

PROPOSED SUBDIVISION OF STRAIGHT PROPERTY
NORTH OF HALFMOON BAY ON SECHELT PENINSULA



Notes:



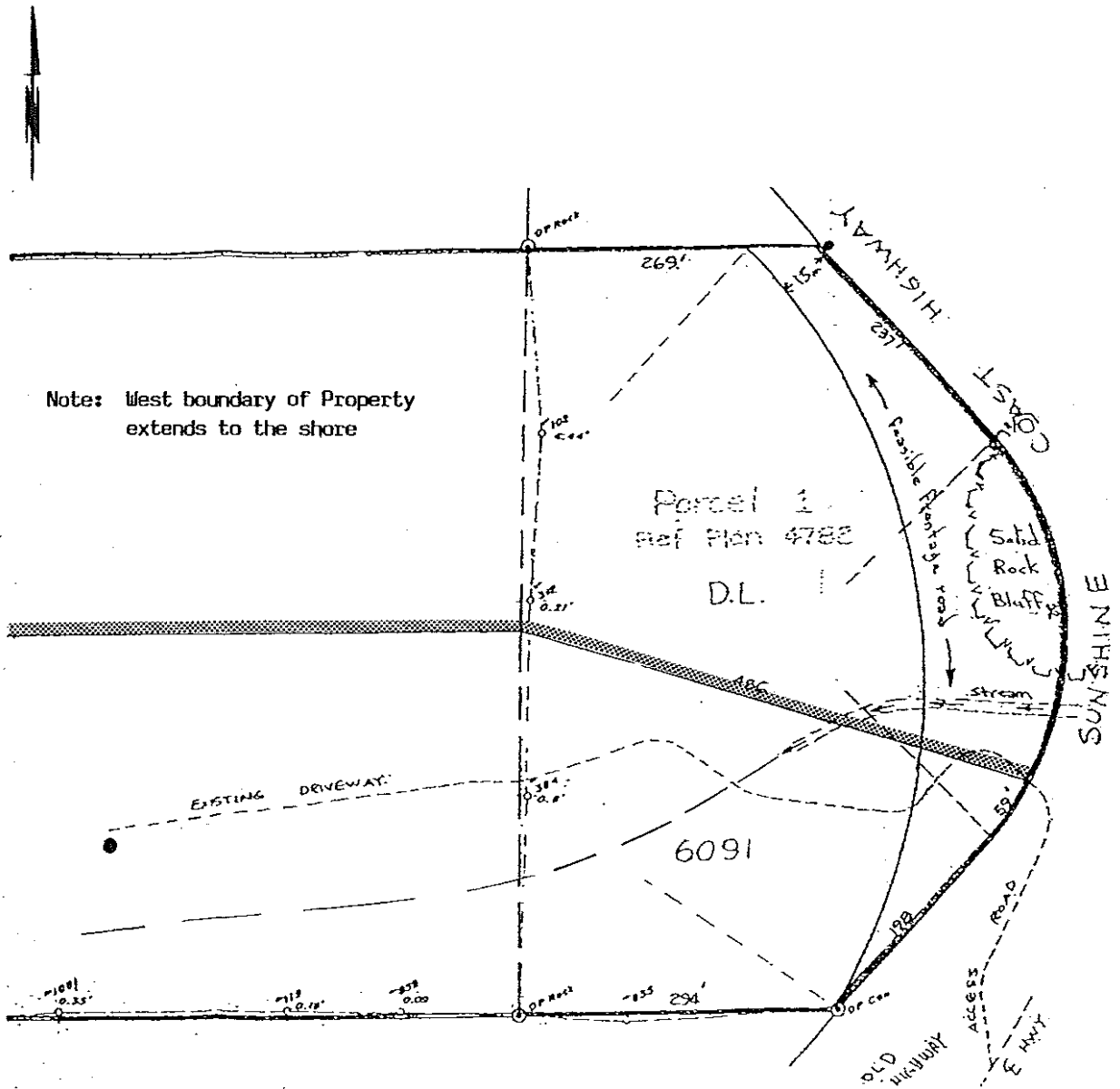

1. The base map is prepared from 1:50,000 scale topographic maps 92F/9, Texada Island, and 92G/12, Sechart Inlet, enlarged to an approximate scale of 1:23,000.
2.  outlines location of proposed Straight Subdivision (see Figure 2, Page A - 2).
3.  indicates approximate location of a water well (see Table 1 in Appendix B).

FIGURE 2

SUBDIVISION PLAN
OF
STRAIGHT PROPERTY NORTH OF HALFMOON BAY



Notes:

1. The scale of the base map is approximately 1:2100.
2.  indicates the proposed north/south subdivision of subject Straight Property.
3. ● indicates approximate location of existing dug well on south lot to be created.

APPENDIX B

SUMMARY OF WATER WELLS

Table 1. Summary of Water Wells in the Area of the Straight Property on the Sechelt Peninsula

Map Ident. No.	Owner [Location]	Well Depth (ft)	Static Water Level (ft)	Driller's Log	Location of Fractures (ft)	Estimated Capacity (gpm)	Remarks
1	J.R. Logan [D.L. 5863]	12	?	Record shows topsoil over clay over hardpan.	n/a	?	A note on the well record states that the well goes dry from August to November.
2	J.R. Logan [Part of D.L. 5862]	8	?		n/a	?	Record states that the well supplies two houses all year and maintains an adequate supply.
3	Joni Mitchell [D.L. 6235]	250	3	0 - 5 ft silty clay 5 - 165 ft diorite bedrock 165 - 250 ft altered diorite with some schists.	25, 90, 170, 250	$\frac{1}{2}$, $\frac{1}{2}$, $1\frac{1}{2}$, 20	6" diameter casing extends to 13 ft; note on record states that Well is located near a swamp, at an elevation about 20 ft amsl.
4	Joni Mitchell [D.L. 5864]	403	+82	0 - 3 ft sand and boulders 3 - 80 ft diorite, very hard with many dykes 80 - 130 ft diorite, soft, many dykes 130 - 200 ft diorite, hard, with high hornblende content 200 - 403 ft diorite, moderately hard, with occasional dykes.	100, 303, 328, 331, 341, 365, 373, 383	$\frac{1}{2}$, $\frac{1}{2}$, -, 1, 2, $2\frac{1}{2}$, 3, 25	6" diameter casing extends to 30 ft; note on record states that the Well is located close to a creek, at an elevation about 10 ft amsl; water below the fracture at 341 ft is reported to be saline.

APPENDIX C

GROUNDWATER QUALITY

Table 2. Groundwater Quality in Area of Straight Property on Sechart Peninsula

TEST		Straight Dug Well (1)	Mitchell Drilled Well (2)	Drinking Water Guidelines (3)
PHYSICAL PARAMETERS				
pH		6.18	8.70	6.5 - 8.5
Conductivity (umhos/cm)		82.5		-
Colour (CU)		<5.0	2.0	15.
Turbidity (NTU)		<1.0	13.9	5.
Suspended Solids (mg/L)		<1.0	26.9	-
Total Dissolved Solids (mg/L)		61.	935.	500.
Hardness (mg/L)	CaCO ₃	29.	13.8	-
DISSOLVED ANIONS (mg/L)				
Alkalinity	CaCO ₃	154.	-	-
	HCO ₃ ⁻	25.7	148.0	-
Chloride	Cl ⁻	5.6	362.0	250.
Fluoride	F ⁻	0.030		1.5
Silicate	SiO ₂	-	11.6	-
Sulphate	SO ₄ ²⁻	4.5	66.4	500.
NUTRIENTS (mg/L)				
Nitrate and nitrite	N	0.18	<0.1	10.0
Phosphate (ortho)	O-PO ₄	<0.003	<0.1	-
DISSOLVED METALS (mg/L)				
Iron	Fe	<0.03	0.10	-
Manganese	Mn	0.43	<0.05	-
TOTAL METALS (mg/L)				
Arsenic	As	-	-	0.05
Barium	Ba	-	-	1.0
Cadmium	Cd	<0.0005	-	0.005
Chromium	Cr	-	-	0.05
Copper	Cu	0.092	<0.01	1.0
Iron	Fe	<0.03	8.2	0.30
Lead	Pb	<0.001	<0.01	0.01
Manganese	Mn	0.043	<0.05	0.05
Zinc	Zn	0.011	<0.01	5.0
Calcium	Ca	11.2	5.5	-
Magnesium	Mg	0.24	<0.1	-
Potassium	K	1.00	0.9	-
Sodium	Na	5.34	332.0	-

Sources of information:

1. Analytical Service Laboratories Ltd. File 608A; November 21, 1983.
2. Can Test Ltd. File No. 2081 A; October 5, 1971
3. Maximum acceptable concentration defined by Health and Welfare Canada 1989.