

PACIFIC HYDROLOGY CONSULTANTS LTD.
CONSULTING GROUNDWATER GEOLOGISTS

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February 20, 1992

Dayton and Knight Ltd.
626 Clyde Avenue
P.O. Box 91247
WEST VANCOUVER, B.C. V7V 3N9

Attention: Mr. Agris Berzins, P. Eng.

Subject: Feasibility of Developing a Groundwater Supply for Irvines Landing
Improvement District

Dear Sirs:

This letter is further to discussions in the field on February 18, 1992, among Mr. Agris Berzins, P. Eng., of Dayton and Knight Ltd., Mr. S.K. Lehmann, Superintendent of Public Works of the Sunshine Coast Regional District, and Ed Livingston, P. Eng., of Pacific Hydrology Consultants Ltd., about possible improvements to the water supply source for Irvines Landing Improvement District.

1.0 INTRODUCTION

From the aforementioned onsite discussions of February 18 among Berzins, Lehmann and Livingston, we understand the following:

1. The Irvines Landing Water System obtains water from Hotel Lake by way of an intake at the west end of the Lake. The intake consists of a pipe hung on supports and extending about 6 m (20 ft) into the Lake where the water is quite shallow. The seasonal fluctuation of the Lake is not more than 0.6 m (2 ft).

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2. Water is pumped by a pump in a small pump house to a concrete reservoir, at elevation about 70 m (213 ft), which is located south of the intake. The system operates by gravity from there.
3. In summer there is an algae bloom in Hotel Lake. Chlorination of water containing algae causes taste and odour problems.
4. Hotel Lake is the only economically feasible source of surface water for Irvines Landing and because of the problems caused by chlorination, a groundwater source is desirable.
5. A source with a capacity about $2\frac{1}{2}$ L/sec (33 igpm) is required.

Information on subsurface conditions in the subject area is sparse and there is no surficial geologic mapping covering the area; therefore, the evaluation of groundwater potential presented in this letter is based solely on geologic interpretation from Ed Livingston's rapid field reconnaissance of February 18.

2.0 GEOLOGY AND HYDROLOGY OF HOTEL LAKE

Hotel Lake, at elevation about 50 m (164 ft) amsl, is surrounded by fairly steep rocky slopes, except for short lengths of shoreline at the west end, at the outlet on the north shore and at the southeast corner of the Lake. The Lake apparently lies in an irregular upland valley system where three valleys have been partially dammed by glacial deposits of the last glacial episode in the area. This is apparent at the three sites mentioned above where the Lake shore is composed of sediments; it is particularly obvious at the west end, where the Irvines Landing Road follows a narrow rock valley leading down to the sea shore.

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Exposures along Irvines Landing Road near the west end of the Lake show compact sandy glacial debris overlain by bouldery slope wash from the steep slope of Pender Hill. The west end of the valley is at the shore southwest of the intersection between Irvines Landing Road and Keelson Road. The bottom of the rock valley at the shore is about one metre below high water.

The surficial geology was probably modified by marine erosion at the end of the last glacial episode about 10,000 years ago when sea level was as much as 100 m above its present elevation. Wave erosion, as the sea level declined, produced a gravelly layer on the ground surface, usually called marine veneer. When sea level was almost constant for short periods, terraces were formed in exposed locations. The gently sloping area below Kammer Road may be such a terrace.

Hotel Lake drains through an uncontrolled outlet northward under Beaumont Road. There is much evidence of subsurface flow from the Lake westward through the glacial debris to the sea. For example, the road ditch on the upper side of Kammer Road carries flow which appears to be perennial. Further, there is an extensive groundwater discharge area south of Lee Road in the area between Irvines Landing Road and Keelson Road. Part of this area (Lot C, Plan 14283) has been cleared of trees and partly filled with gravelly fill and part of it is undisturbed and is covered with second growth cedar trees, groundwater discharge in this area is certainly perennial. At the time of the February 18 visit, the discharge to the sea from a ditch at the south end of Lot C was estimated to be 2 to 3 L/sec (26 to 40 igpm).

The perennial discharge phenomena suggest that leakage from Hotel Lake is the source, but there is probably some groundwater, especially in winter and spring, from the steep slopes on both sides of the valley, along with water from local precipitation flowing down the slope in the marine veneer.

3.0 GROUNDWATER SOURCES

Obviously any new water source for the Irvines Landing Improvement District must be close enough to the existing piping and power to keep the capital cost of connecting the source to the system to a minimum. Another factor to be considered is the availability of land at prospective sites. Since there is no subsurface information in the area, testing must be done to locate a feasible source. We suggest that the following sites have some potential and are worthy of further investigation by shallow test pit digging or deeper drilling:

1. A shallow aquifer close to the Improvement District's pump house at the Lake. In order to allow for effective filtration of lake water through the aquifer, test holes should not be dug closer than the about 10 m from the edge of the Lake. Test holes dug with a backhoe should show whether it is possible to construct a dug well(s) or collector facility at such a location. More than one hole may be required in order to identify the best site.
2. Lot C, Plan 14283, D.L. 1543, between Irvines Landing Road and Keelson Road. The central and southern part of this Lot has been covered with a metre or more of gravel fill. Any digging with a backhoe should penetrate this fill to explore the character of the underlying sediments. The contact between the gravel fill and the underlying sediments will probably be obvious.
3. Irvines Landing Community Hall, southwest of the District's pump house. Investigation of this site requires drilling with some type of water well drill. The objective of exploration by drilling is to determine whether the glacial sediments blocking the valley are permeable, how thick the glacial sediments are and the depth to the water table.

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If the glacial sediments at the pump house site are thicker than can be investigated with a backhoe, drilling may be required. It is also possible to drill or dig at other locations in the Valley between Hotel Lake and the suggested site on Lot C; however, property ownership is likely to limit exploration in that area.

A successful well at a site(s) near Hotel Lake would obviously be more economical than a well at other locations in the Valley, as the capital cost of a low head pump capable of pumping to the reservoir would be less than, for example, a pump at Lot C pumping against main pressure. The power cost for a well on Lot C would also be higher.

4.0 GROUNDWATER EXPLORATION PROGRAM AND COSTS

All things considered, a reasonable groundwater exploration program at Irvines Landing would consist of the following:

1. Investigate the ownership of Lot C, Plan 14283, and other land on the flat between Keelson Road and Irvines Landing Road. Contact the land owner(s) to see whether they would allow test digging and, if successful, an easement for a community well. At the same time, check ownership of the lot on which Irvines Landing Community Hall is located (REF 2384?).
2. Using a small backhoe, which is capable of digging to a depth of 4 m (13 ft), and starting on the parcel of land owned by the Improvement District at the water intake on Hotel lake, dig several test pits. Have on hand a small contractor's pump capable of pumping 3 L/sec (41 igpm) to obtain a rough idea of the capacity of any dug hole which makes water.

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3. If shallow digging shows that shallow groundwater is not available in sufficient quantity to be of interest to the District, consider test-production drilling, starting with a site in the Intake/Community Hall area.

The cost of an initial investigation by digging with a rubber-tired backhoe at the District's Intake, and on Lot C between Keelson Road and Irvines Landing Road, is estimated to be as follows:

1. Move machine to Hotel Lake.	\$ 100.
2. Machine time, 6 hrs @ \$60.	360.
3. Engineering, supervision and reporting.	<u>1,000.</u>
	<u>\$ 1,460.</u>

The outcome of the program outlined above may be one of the following

1. At one of the selected sites, it is feasible to construct a shallow dug well(s) or collector facility with sufficient capacity to meet the District's requirements.
2. A dug well(s) is not feasible but there is a reasonable chance of constructing a drilled well with sufficient capacity to serve the District.
3. It is unlikely that either a shallow or deep groundwater source for the District can be developed at a site close enough to the District's System to be a feasible source.

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We are prepared to proceed with the next phase of the Irvines Landing Project as soon as the Regional District has determined land ownership and other details at the sites suggested in this letter. If you wish to further discuss the contents of this letter, or if additional information concerning the feasibility of developing a groundwater source at Irvines Landing is required, please contact us.

Yours truly,

PACIFIC HYDROLOGY CONSULTANTS LTD.

A handwritten signature in cursive script that reads "Ed Livingston".

Ed Livingston, P. Eng.

Draft letter to B.C. Environment
Requesting a Water Well Inventory of Keats Island near Gibsons

February , 1992

B.C. Environment
Water Management Branch
Parliament Buildings
VICTORIA, B.C. V8V 1X5

Attention: Mr. Alan Kohut, P. Eng.
Acting Head, Groundwater Section

Subject: Water Well Inventory, Keats Island

Dear Sir:

The Sunshine Coast Regional District is investigating the feasibility of improving water supply on Keats Island east of Gibsons. There has been considerable development on the Island in recent years and water supply may become a problem. Part of our investigation will include the issue of groundwater and wells. We understand that there is no Water Well Location Map covering Keats Island, in spite of the fact that there are maps covering Bowen Island and the Gibsons-Sechelt area. The Regional District hereby requests that B.C. Environment carry out a water well inventory and prepare a Water Well Location Map covering Keats Island as soon as possible.

The Sunshine Coast Regional District will cooperate and assist in whatever way possible to expedite this matter. Please let us know as soon as possible what action the Ministry is prepared to take.

Yours truly,

c.c. Hon. John Cashore, Minister
B.C. Environment

Hon. Robin Blencoe
Ministry of Municipal Affairs, Recreation and Housing