# WATER SUPPLY INVESTIGATION

## KUPER ISLAND INDIAN RESERVE NO. 7

**Penelakut Indian Band**

BY

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and

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## INTRODUCTION

Mr. R. B. Erdman of this office has investigated the water supply on Kuper Island and has carried out the studies required under Project 51114 - Contract No. B.C. 82-83-27. These studies included examination of a spring, a search for an incomplete well and the pump testing of the Village well.

## 1. SPRING

The spring that presently supplies the Village has been enlarged and a berm has been constructed around the area thus forming an open reservoir. While the area around the reservoir has been overgrown with blackberry vines and thistle, it is still possible to observe the water levels in the reservoir from above and slightly to the west of the pump house by standing on the top of an old stump. When the reservoir was observed during the site inspection, there was no overflow. Approximately 20 cm of free board were observed where the reservoir had fallen below any possible overflow point. From the observation point, it is not possible to see the area uphill of the berm, but no inflows of surface water could be observed in the bush above the spring.

The size of the pump and the pressure settings were noted in order to estimate the yield of the spring. Based upon a comparison of this information with the manufacturer's specifications, the present pump has a discharge rated at .60 L/sec. It was noted that the pump was not operating at the time of inspection so the Village demand must be somewhat less than this figure. A water main from the spring supplies the school and the part of the Reserve by the ferry landing.

The spring is situated on or very near to the geological contact between the shales, siltstones and sandstones of the Cedar District Formation and the conglomerates and sandstones of the Decourcy Formation. The bedding of both formations dips at 25 degrees to the west. Recharge to the springs is controlled by the dip of the beds, faulting and fracturing in the area and the topography. There is approximately 40 hectares of area topographically above the springs that can serve as a recharge area.

Precipitation at Chemainus averages 1175 mm per year while the precipitation on Galiano Island averages 873 mm per year. A figure of 1000 mm per year of precipitation has been used to estimate the potential inflow to the spring. The total volume of water falling on the 40 hectares of land each year would be 400,000 $m^3$. If 5% of this water is available to recharge the spring, the estimated average flow would be equivalent to 0.63 L/sec. The maximum flow would take place in the late winter and early spring months. The maximum flow into the spring could be as much as 1 L/sec and the minimum flow in the late summer and early fall could be as low as .30 L/sec.

Inspection of the area around the spring showed very little wet ground. This lack of wet or marshy areas would indicate that the present reservoir intercepts most of the flow from the spring.

The most efficient method of protecting the spring is to leave it in its present condition and to ditch around the uphill side to prevent surface runoff from flowing into the reservoir.

The chemical analysis of the water collected at the pump discharge at the spring is included at the back of the report under Number 2 "Creek Supply." You will note the water has a low pH but meets all the other parameters. The low pH may cause a problem of corrosion in steel piping.

## 2. INCOMPLETE WELL

Several hours were spent searching for the incomplete well but to no avail.

It is recommended that the following procedure be followed to use this well. The 200 mm casing be cleaned out to a depth of 57.6 m and 150 mm casing installed. The 150 mm casing would then be advanced to the bottom of the aquifer which we have estimated to be at a depth of 91 meters. A properly slot-sized well screen would then be selected and installed inside the 150 mm casing. The 150 mm casing would then be pulled back a sufficient distance to expose the well screen to the aquifer. Development would be carried out with surge blocks or by air lifting. At the completion of development, the well would be test pumped for a minimum of 25 hours as required by provincial agencies.

A breakdown of the costs of carrying out the above work is shown on the following page:

| | | |
|---|---|---|
| 1. | Mobilization and demobilization of drilling and testing equipment to and from Kuper Island | $250.00 |
| 2. | Placing 150 mm casing with drive shoe inside existing 200 mm casing to a depth of 57.6 m @ $40/m | $2304.00 |
| 3. | Drill and case 150 mm hole to 91 meters 33.4 m at $79/m | $2638.60 |
| 4. | Well screen 4.88 m @ $328.00/m | $1600.64 |
| 5. | Hourly work to clean 200 mm hole, expose well screen, develop well and perform other authorized work. Estimate 25 hrs @ $125/hr | $3125.00 |
| 6. | Test pumping of well 25 hrs @ $65/hr | $1625.00 |
| 7. | Hydrogeological consulting Brown, Erdman & Associates Ltd. 50 hrs @ $65/hr | 3250.00 |
| TOTAL | | $14793.24* |

*Please use $15000.00 for budgetary purposes.

Not included in this estimate is the cost of pump, controls, wiring and piping.

At the present time, we feel that there is a 95% chance that the existing 200 mm hole can be completed to yield 1.9 L/sec.

## 3. NEW WELL

The faulting and fracturing in the area is such that it may be possible to construct a new well much nearer to the existing tanks than the present incomplete well. The drilling of a new well would involve the setting of approximately 10 meters of 200 mm surface casing which would be cemented into place to protect against possible surface or near surface water contamination. A 150 mm casing would then be telescoped inside the 200 mm casing and advanced to a total depth of approximately 91 m. The well screens would then be set, exposed and developed as outlined above. This is the program that would be used if the same sediments are encountered as those present in the incomplete well. If, however, bedrock is present, then after setting the 200 mm surface casing, a 200 mm open hole would be drilled to the required depth to intersect water-bearing fractures. Information to date from the incomplete well indicates that it may be necessary to case and screen a rock hole so that broken rock from the faults or fractures cannot enter the well.

The cost estimate for a new well in the area of the water tanks follows overleaf:

| | | |
|---|---|---|
| 1. | Mobilization and demobilization of drilling and testing equipment to and from Kuper Island | $250.00 |
| 2. | Drill and case 200 mm surface casing to 10 m and cement in place<br>10 m @ $112/m | $1120.00 |
| 3. | Install 150 mm overlap casing<br>10 m @ $40/m | $400.00 |
| 4. | Drill and case 150 mm to 91 meters<br>81 meters @ $79/m | $6399.00 |
| 5. | Well screen 4.88 m @ $328/m | $1600.64 |
| 6. | Hourly work to expose well screen, develop well and perform other authorized work<br>Estimate 25 hrs @ $125/hr | $3125.00 |
| 7. | Test pumping of well<br>25 hrs @ $65/hr | $1625.00 |
| 8. | Hydrogeological consulting<br>Brown, Erdman & Associates Ltd.<br>70 hrs @ $65/hr | $4450.00 |
| 9. | Final report and chemical analysis | $1500.00 |
| TOTAL | | $20469.64* |

For budgetary purposes, please use $20500.00.

If bedrock is present and the well can be completed without having to set a liner and screen, the estimated cost of the well is as follows:

| | | |
|---|---|---|
| 1. | Mobilization and demobilization of drilling and testing equipment | $250.00 |
| 2. | Drill and case 200 mm surface casing to 10 m and cement in place<br>10 m @ $112/m | $1120.00 |
| 3. | Drill 200 mm open hole to 91 meters<br>81 meters @ $50/m | $4050.00 |
| 4. | Hourly work to develop well<br>5 hrs @ $125/hr | $625.00 |
| 5. | Test pumping of well<br>75 hrs @ $65/hr | $4875.00 |
| 6. | Hydrogeological consulting<br>Brown, Erdman & Associates Ltd.<br>70 hrs @ $65/hr | $4450.00 |
| 7. | Final report and chemical analysis | $1500.00 |
| TOTAL | | $16870.00* |

For budgetary purposes, please use $17000.00.

If bedrock is drilled and it is necessary to set a liner and screen, the estimated cost would be similar to that shown for a 91 m new cased well.

It is estimated that there is an 80% chance of completing a well in the area of the water tanks that will yield 1.9 L/sec.

The differences in the length of the pumping tests should be noted. The provincial government has requested that all rock holes be pumped for 72 hours while overburden wells only have to be pumped for 24 hours.

Before any work is undertaken on the incomplete well or the drilling of a new well, a set of technical specifications should be sent to competent drillers in the area to take advantage of competitive bids.

## 4. VILLAGE WELL

The old submersible pump was removed from the well and the well was sounded to a depth of 83.30 m. This is very close to the original reported depth of 83.66 m. The difference between these depths is most likely caused by the use of different surface measuring points. A 5 Hp submersible test pump was set to a depth of 79.87 m and the well was pumped for 8 hours. The final pumping rate was .50 L/sec with the pumping water level at a depth of 66.07 m. The water level recovery was measured for 100 minutes after the pump was shut down to a recovered water level of 31.15 m. The original static water level in the well was 31.04 m. Upon the completion of recovery readings, the test pump was pulled and the well seal replaced.

At the start of the test, the water was very dirty with an iron-rust colour but very little silt or sand was present. After 35 minutes of pumping, the water started to clear and, by 80 minutes into the test, the water was clear enough to drink. At 290 minutes, the water again became very rust-coloured but, by the end of the test, the water was clear with only a few grains of sand being present. A water sample was collected at the end of the test for chemical and bacteriological analysis.

The plot of the drawdown and recovery measurements indicates a transmissivity of .32 $m^2$/day to 1.6 $m^2$/day. The specific capacity of the well at present is .0144 L/sec/m. With the water pumping level at a depth of 80.5 meters, the yield of the well would be 0.713 L/sec. This pumping rate would not allow for periods of low recharge or further deterioration of the well. When rating wells, it is normal practice to allow at least a 20% safety margin. If a 20% safety margin is applied to this well, then the rated capacity would be 0.57 L/sec. The original rated capacity of the well was 1.14 L/sec with a pumping level of 75 m. If the well is to be used, it is recommended that the bottom of the pump be set at 80.5 meters below the top of the man hole cover.

The appearance of the water during the pumping test and information contained on the chemical analysis indicates that an iron and manganese bacteria has formed on the well screen thereby reducing the flow of water into the well. The most inexpensive method to cure this problem would be to add a product known as "Nu-Well" to the well and backwash; let stand and then pump to waste until the water is clean. As the well is being pumped, the performance can also be checked. It is estimated that it will cost between $1500 and $2000 to

treat the well in this manner. There is, of course, no assurance that this or any other method of cleaning the screen will be successful.

The enclosed chemical analysis on the Village Well shows that the pH of the water is border line. As noted in the summary of the analysis, the water does not meet the drinking water standards for dissolved manganese and has high levels of total iron and total manganese. The well water did not meet the health standards for Fecal-Coliform.

## CONCLUSIONS AND RECOMMENDATIONS

I A swail should be constructed on the uphill side of the spring to prevent surface water from entering the reservoir. No other work should be undertaken in the spring area.

II The spring water meets the "Guidelines for Canadian Drinking Water Quality, 1978" on all parameters tested except pH. A pH of 6.35 is not detrimental to health but may cause corrosion in the distribution system.

III The incomplete well can be completed for an estimated cost of $15,000.00 with an estimated 95% chance of success.

IV A new well can be drilled near the water tank for an estimated $20,500 if conditions are similar to those at the incomplete well (i.e. on the intersection of two faults).

V A new well can be drilled near the water tank for an estimated $17,000 to $20,500 if bedrock is drilled. In each case, the chance of success is considered to be 80%.

VI The water from the Village well does not meet the Canadian Drinking Water Standards.

VII The Village well has deteriorated since it was originally tested in 1969.

VIII By redevelopment, some of the capacity could be regained but it is very doubtful if the well would be capable of producing the original rating of 1.9 L/sec.

IX The problem of the Fecal-Coliform in the Village Well can most likely be corrected by chlorination and the proper installation of the well seal.

If any of the above needs clarification or amplification, please do not hesitate to contact us.

Yours truly,

BROWN, ERDMAN & ASSOCIATES LTD.

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Enclosures