

**BEACH CREEK
HYDROLOGY STUDY**

for

Qualicum Beach Streamkeepers
221 Elizabeth Avenue
Qualicum Beach, B.C.

submitted by

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January, 2001

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1.0 INTRODUCTION

At the request of the Qualicum Beach Streamkeepers, a hydrology study was conducted on Beach Creek to determine the opportunities for water storage in the watershed to increase surface water flow for fish habitat enhancement.

Urban development in the Beach Creek watershed has increased stress on this creek by re-directing surface water and groundwater flow. Subsequently, surface water flows have decreased in various reaches of the creek limiting fish spawning and rearing habitat.

With assistance from Ministry of Environment's Urban Salmon Habitat Program (USHP), the Qualicum Beach Streamkeepers have enhanced fish habitat from the mouth upstream for 500 m. Installation of root wad and large woody debris structures has provided additional cover and refuge in addition to increasing pool frequency. These in-stream structures have enhanced fish habitat although water supply is still a limiting factor for further enhancement opportunities.

The project objective is to complete a hydrology assessment of the Beach Creek watershed above the mouth and for the upper part of the watershed above Garden Road where fisheries flow requirements are most critical. Specific tasks to meet this objective are outlined in the Terms of Reference and are summarized in three parts below:

Part 1 - Water storage

- To determine how much water is required to provide a minimum of 10% of the mean annual discharge (MAD) to Beach Creek during low flow periods
- To identify and map water storage locations in the watershed to provide the 10% MAD
- To identify costs and considerations associated with water storage development in the watershed

Part 2 – Ground Water

- To identify and map existing groundwater wells and aquifers which could provide 10% MAD
- To identify costs associated with groundwater resource development

Part 3 – Glengarry Golf Course/Town of Qualicum Beach

- To explore partnership options with the Glengarry Golf Course and Town of Qualicum Beach for provision of 10% MAD to Beach Creek during low flow periods

2.0 PHYSICAL DESCRIPTION

Beach Creek (625 ha) is a small urbanized stream located in the Town of Qualicum Beach (Figure 1). The creek begins its life in a wetland area to the south of Qualicum Beach. Beach Creek flows from the headwaters area through a ditchline before returning to a natural state through, what is locally known as, the Brown Property. It continues to flow north through Memorial Golf Course before returning to a developed state through ditches and culverts, and into Qualicum Bay.

Elevation ranges from sea level at the mouth to approximately 100 m in the headwaters area. Topography is gentle with undulating terrain. Residential housing, golf course development, farmland and forested areas characterize the watershed.

The watershed above Garden Road has a drainage area of 319 ha, 214 ha of which are covered by the Glengarry Golf Course (GCC) watershed.

This stream has the potential to provide summer rearing and spawning habitat if adequate flows could be maintained during the low runoff July – September season. At present the stream invariably dries in the reaches above Garden Road during the summer months.

3.0 METHODS

A field visit was completed in the Beach Creek watershed on August 9, 2000. Qualicum Beach Streamkeeper members Faye Smith, Barbara Joughlin and Doug Taylor accompanied Kelly Eakins and Don Reksten. Access to locations in the watershed was by truck and on foot.

Additional information collected included a number of photographs taken to provide visual reference.

3.1 Water Storage

Mean annual discharge was calculated by using data available from the Ministry of Environment Lands and Parks (MELP) French Creek Water Allocation Plan (1994). From this baseline value, the amount of water required to maintain a flow equal to 10% of the mean annual discharge at the mouth and at Garden Road was calculated in addition to determining the water storage volume required.

The watershed area was based on the boundary reported in the USHP Inventory.

3.2 Groundwater

Groundwater records and aquifer maps were researched using the Water Well Database available on the Groundwater Section website. Additional information was obtained from the Town of Qualicum Beach.

3.2 Coordination

A meeting was held with Glengarry Golf Course (GCC) and the Town of Qualicum Beach at GCC on January 5, 2001. Attendance at the meeting included:

Barry McWha	Glengarry Golf Course
Bob Weir	Town of Qualicum Beach
Faye Smith	Qualicum Beach Streamkeepers
Barbara Joughlin	Qualicum Beach Streamkeepers
Dave Clough	D.R. Clough Consulting
Don Reksten	D.E. Reksten Hydrologic Engineer
Kelly Eakins	Eakins Hydrological Consulting

4.0 RESULTS

4.1 Water storage and fisheries flow requirements

Beach Creek at Garden Road

Using the unit runoff (L/s/km²) amounts in the Water Allocation Plan, the MAD at Garden Road is 0.085 m³/s. The minimum fisheries flow requirement, or 10% of MAD, is 0.0085 m³/s or 8.5 L/s. During the July to September low period when monthly streamflow is less than 60% of the MAD, 51.2 dam³ would be required to be released to maintain the flow of 8.5 L/s as shown in the table below.

	Monthly mean discharge	Flow requirement		Volume requirement
		L/s	gpm	dam ³
May	38.3	0	0	0
June	12.8	0	0	0
July	3.2	5.3	70.0	14.2
Aug	0	8.5	112	22.8
Sept	3.2	5.3	70.0	14.2
Oct	19.1	0	0	0
Total				51.2

The catchment area required to fill one pond with a capacity of 51.2 dam³ over the November-April period is 6.5 ha. The pond area required will depend on the depth of storage available. Assuming a pond depth of 3.0 m, 51.2 dam³ would be equivalent to an area 131 m x 131 m (1.7 ha).

Beach Creek at the mouth

From the Water Allocation Plan, the mean annual discharge of Beach Creek was estimated at 0.171 m³/s. The minimum fisheries flow requirement, or 10% of MAD, is 0.0171 m³/s or 17 L/s. During the July to September low period when monthly streamflow is less than 60% of the MAD, 104 dam³ would be required to be released to maintain the flow of 17 L/s as shown in the table below.

	Monthly mean discharge	Flow requirement		Volume requirement
	L/s	L/s	gpm	dam ³
May	75	0	0	0
June	25	0	0	0
July	6	11	145	29.5
Aug	0	17	224	45.5
Sept	6	11	145	29.5
Oct	38	0	0	0
Total				104.5

The catchment area required to fill one pond with a capacity of 104 dam³ over the November-April period is 13 ha. The pond area required will depend on the depth of storage available. Assuming a pond depth of 3.0 m, 104 dam³ would be equivalent to an area 186 m x 186 m (3.5 ha).

The location of such a pond relative to Beach Creek is important. If the storage is located some distance from the lower reaches of Beach Creek, transmission losses would have to be added which could increase the requirement by 15% to 120 dam³.

4.2 Groundwater

A search of groundwater records found twenty four wells within the Beach Creek watershed (Figure 2). Well records are provided on a voluntary basis under the Voluntary Well Reporting Program and only four were obtained from the website (Appendix A). As a result, information available on well records is varied and usually limited.

Alan Cameron (Town of Qualicum Beach) located twenty additional wells and 16 lots that likely had wells were identified from a cadastral map. If each lot has a well, this would bring the total to 40 wells within the watershed.

Wells operated by the Town of Qualicum Beach have the best information. The MELP observation well #295 has a yield in the order of 300 gpm or 23 L/s. A well with a yield

of this order would satisfy fisheries flow requirements at Garden Road and at the mouth and would only be needed during summer months.

Other wells in the area yield between 5 and 40 gpm or 0.40 to 3.1 L/s. Wells with these low yields would not provide the fisheries flow requirements needed to sustain surface flows in Beach Creek.

The Beach Creek watershed is located within the Qualicum Beach aquifer (Figure 3). This is a sand and gravel aquifer dominated by the Quadra Sands formation. The Groundwater Section Water Management Branch (MELP) has classified the aquifer as 1B (14) under the Aquifer Classification System. This classification indicates the level of development and vulnerability to surface water contamination with an overall ranking. The Qualicum Beach aquifer is heavily developed with moderate vulnerability.

4.3 Glengarry Golf Course

The Glengarry Golf Course has expressed an interest in working with the Qualicum Beach Streamkeepers to assist in increasing surface flow to Beach Creek. This is dependent on their own irrigation requirements and continued development of the golf course.

Glengarry Golf Course (GGC) catchment area above the outlet pond (Hole #9) is about 214 ha. The golf course is irrigated by pumping water from a drilled well (located just outside the catchment area near the Pro Shop) into the pond and pumping from the pond to the irrigation system. The pond currently has a capacity of 750,000 gallons or 3410m³. 500,000 gallons can be pumped from the well in about 9 hours (925gpm) to maintain the pond capacity. May to October irrigation demand is from 20,000,000 to 33,000,000 gal (90 to 150 dam³, or an average flow of 5.6 to 9.6 L/s, or 74 to 126 gpm). Currently, overflow from the pond during the wet winter season occurs through a culvert in the access road embankment and is uncontrolled.

Glengarry Golf Course has proposed development as shown on the "Golf Links Reformation" plan, August 2000, and explained by Barry McWha on January 5, 2001. The proposed work will result in 8 ponds with a total area of about 2.9 ha or 7.1 acres, interconnected by underground pipes. If the depth of the ponds averages 2.5 m, total storage capacity is about 70 dam³. If Glengarry continues to obtain irrigation water by pumping from the groundwater well, and is willing to operate the pond system in such a way that water is stored in the ponds and released during the summer, about 70% of the fisheries requirement at the mouth would be satisfied. At Garden Road this pond storage is more than adequate for fisheries requirements (51.2 dam³).

Based on rough estimates of monthly irrigation demand during May to October, and assuming that 70 dam³ of pond storage are in place on May 1, it is estimated that after providing releases for fisheries purposes from July to September at Garden Road it would not be necessary to use the groundwater source for irrigation until mid-August. Up to

that time there is adequate storage and runoff to satisfy both demands. This is for average runoff conditions and would differ during a low runoff year.

If surface water is required at the mouth, there would be a shortfall of 34 dam³ which would have to be provided from additional storage ponds and/or groundwater sources in the watershed.

Potential surface water storage sites are two wetlands located on Weyerhaeuser property in the south part of the watershed adjacent to the golf course. With surface areas of 3.6 and 2.4 ha they could be developed to store about 73 and 49 dam³, assuming a pond depth of 2 m, which would be more than enough to satisfy the additional 34 dam³ required. For the Garden Road fisheries requirements, this storage would likely be enough to eliminate the need for groundwater use for GGC irrigation in an average summer.

Recharging of the Beach Creek aquifer from surface water sources to the south of the watershed near the GGC is being tested by the Town of Qualicum Beach to determine the feasibility of maintaining higher groundwater levels for Qualicum Beach water supply. The quantitative impact of this recharge on Beach Creek streamflow is not known, but the effect should be positive.

Costs

Rough costs are provided for both surface water and groundwater development. These costs are rough estimates only and will vary dependent on factors including surficial materials.

Surface water

Costs to develop surface water storage are based on a per cubic metre cost unit. On the basis of \$5/m³ to excavate ponds with a volume of 120,000 m³:

$$120,000\text{m}^3 @ \$5/\text{m}^3 = \$600,000$$

Groundwater

Drilling is based on a per foot cost unit plus additional costs for completion of the well unit, installation of pumps and well testing. Rough estimates from drillers familiar with the Qualicum area are below:

Drilling and installation of casing	\$ 30/ft
Screen assembly	\$1000
Drive shoe	\$ 100
Pump (varies)	\$2000-5000
Mobilization charge	\$ 300
Well testing	hourly rate

Annual hydro and pumping costs will be contingent on the well developed.

5.0 CONCLUSIONS

It must be noted that the hydrology estimates are based on monthly mean runoff estimates contained in the French Creek Water Allocation Plan. No discharge measurements have been obtained on Beach Creek.

GCC proposed pond capacities were based on assumed depths and a map provided by GCC, not on any detailed plans or drainage design which are expected to be available in the near future. Irrigation use data were provided by GCC.

The hydrology assessment for the Beach Creek watershed to ascertain water storage requirements to enhance fish habitat is summarized below in point form:

Beach Creek at Garden Road

- fisheries flow requirement or 10% of MAD is estimated at 8.5 L/s
- surface water storage requirement to service the 8.5 L/s is 51.2 dam³
- Glengarry Golf Course watershed and the proposed ponds have the potential to provide 100% of fisheries flow requirements

Beach Creek at mouth

- fisheries flow requirement or 10% of MAD was estimated at 17 L/s
 - surface water storage requirements to service the 17 L/s is 104 dam³
 - Glengarry Golf Course has the potential to provide 70% of fisheries flow requirements at the mouth.
-
- Groundwater records indicate groundwater development potential
 - Development of wetland areas adjacent to GGC for storage of water could provide the shortfall in GGC storage to eliminate groundwater use for irrigation and satisfy fisheries needs at Garden Road.

In order to facilitate discussions regarding storage operations to benefit fisheries and GGC irrigation, further analysis of monthly supply and demands should be carried out. It would be useful to determine the difference in water supply for GCC.

The Town of Qualicum Beach does not encourage future development of groundwater due to the existing development of this resource.

Water quality should be addressed to ensure that source water meets fisheries standards.

6.0 RECOMMENDATIONS

The findings of the hydrology assessment for the Beach Creek watershed indicate that utilizing storage potentially available in Glengarry Golf Course ponds is the best solution to enhance fisheries flows. The following recommendations outline the options to provide surface water to Beach Creek:

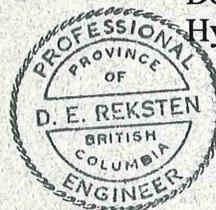
- To continue the association with Glengarry Golf Course in developing use of surface water storage
- To obtain any water use agreements with Glengarry Golf Course in writing
- To ensure that source water from Glengarry Golf Course meets fisheries standards through the establishment of a water quality monitoring program
- To assist Glengarry Golf Course with any annual hydro and pumping costs related to the golf course drainage plan that would supply surface water to Beach Creek
- To increase riparian vegetation around ponds that would contribute to downstream fish habitat (eg. increase shade, lower water temperatures)
- To obtain surface discharge measurements during the low flow season at critical reaches (eg Garden Road) to confirm low flow estimates from the Water Allocation Plan
- Once the drainage plan has been completed for GCC, a detailed water balance analysis for Beach Creek should be conducted to determine the best operation plan to satisfy irrigation and fisheries needs
- To initiate discussion with Weyerhaeuser regarding their development plans and to explore the possibility of utilizing the wetlands for additional water storage if required

Respectfully submitted,

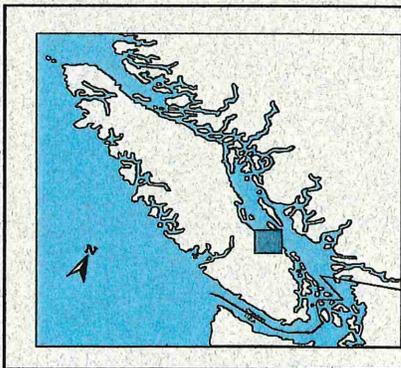
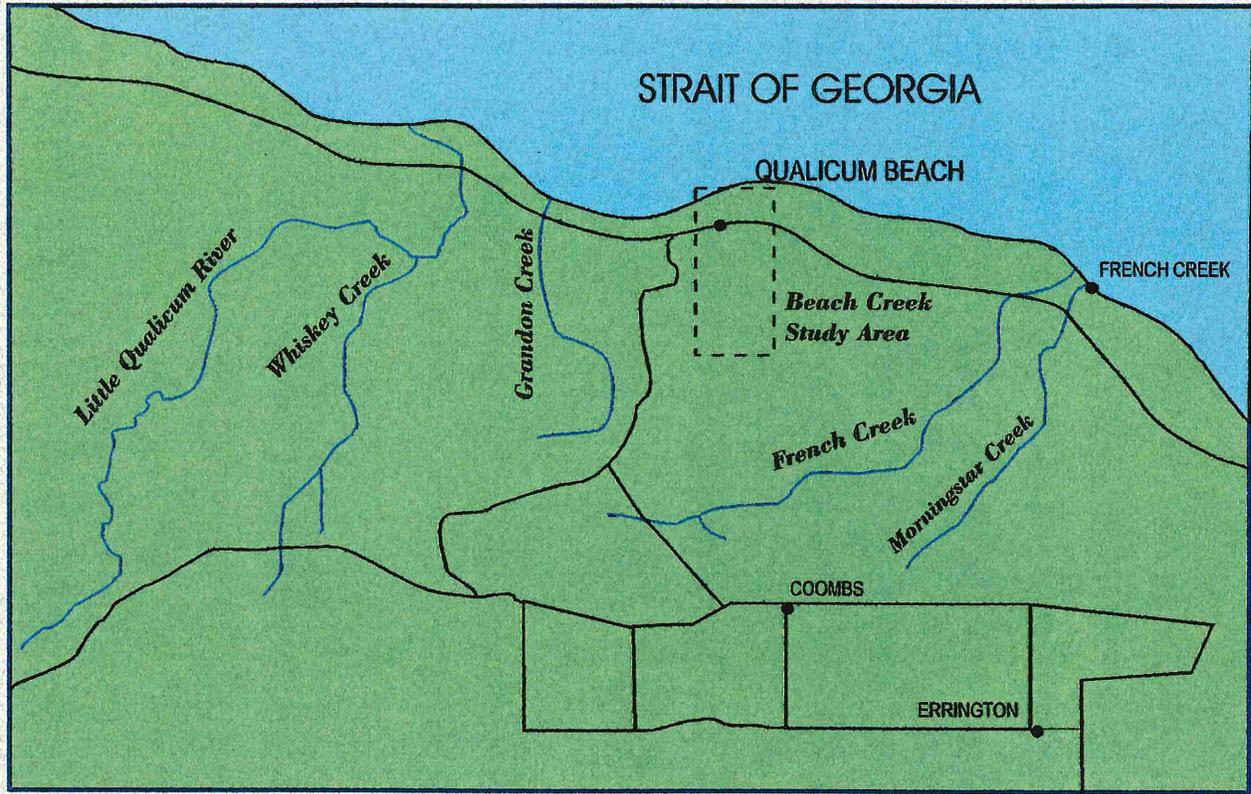


Kelly Eakins, M.Sc.
Hydrologist


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Hydrologic Engineer



FIGURES

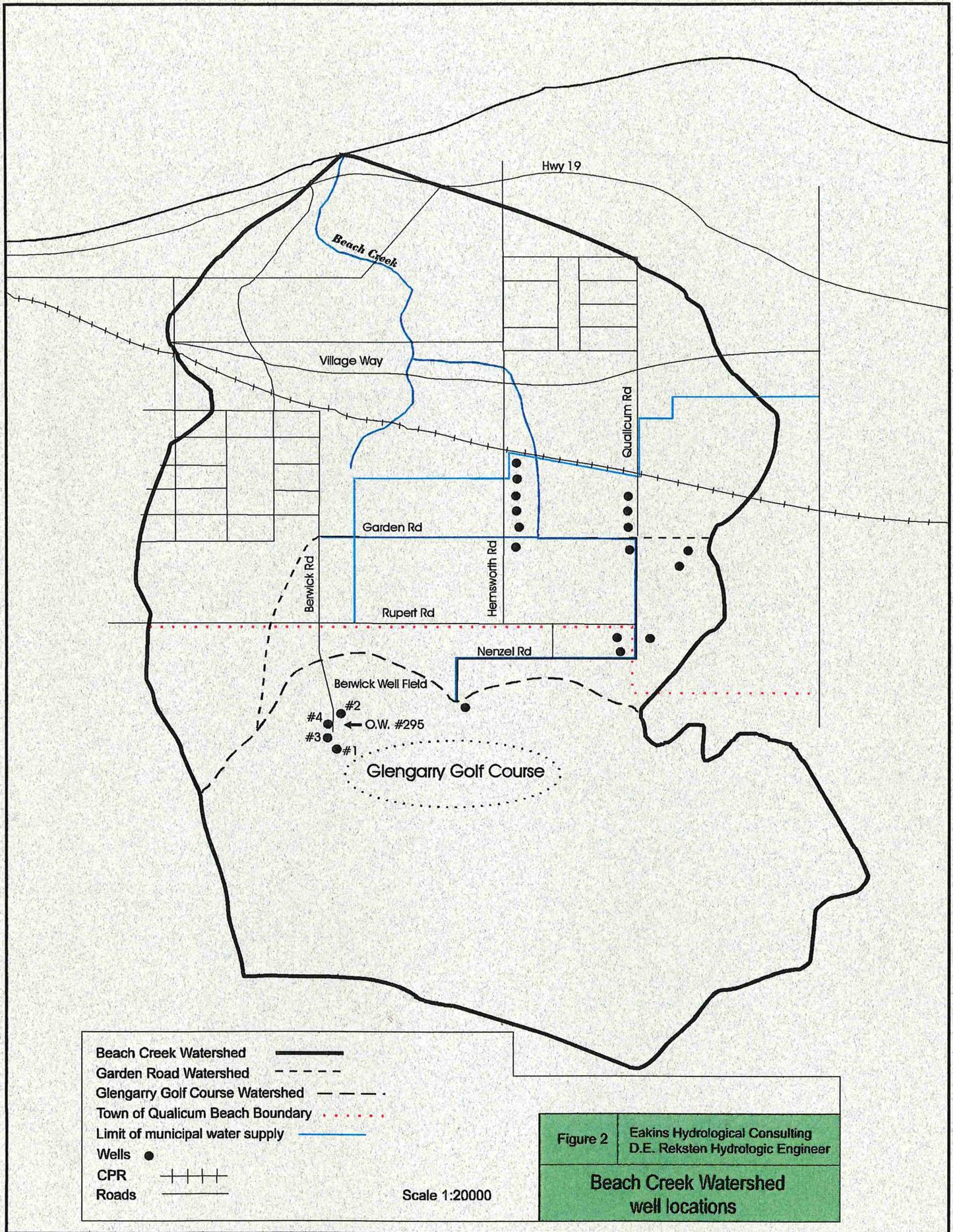


Qualicum Beach

Figure 1

Eakins Hydrological Consulting
D.E. Reksten Hydrologic Engineer

Beach Creek Study Area



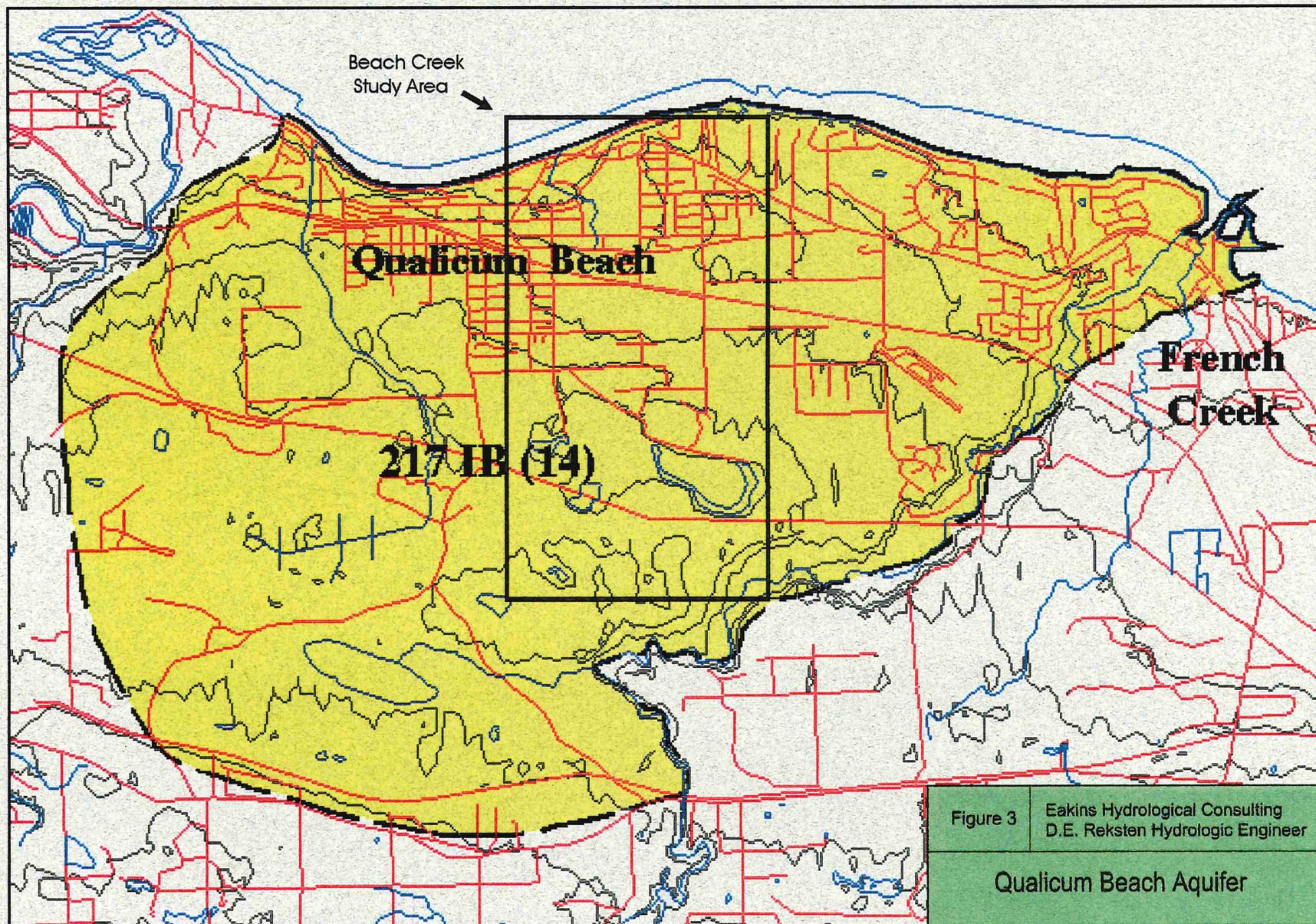


Figure 3 Eakins Hydrological Consulting
D.E. Reksten Hydrologic Engineer

Quaticum Beach Aquifer

APPENDIX A



<p>Well Tag Number 000000000805</p> <p>Owner: VILLAGE OF QUALICUM</p> <p>Address: BERWICK RD</p> <p>Area:</p> <p>WELL LOCATION: NEWCASTLE Land District District Lot Plan Lot Township Section Range Indian Reserve Meridian Block Quarter Island BCGS Number (NAD 27) 092F038243 Well 1</p> <p>Well Use Unknown Well Use Construction Method Unknown Constru Diameter 16 inches Well Depth 90 feet Elevation 0 Bedrock Depth UNK feet Screen from 65 to 85 feet Slot Size 1 Slot Size 2 Slot Size 3 Slot Size 4</p>	<p>Construction Date</p> <p>Driller Unknown License Number</p> <p>PRODUCTION DATA AT TIME OF DRILLING Well Yield 1 GPM Artesian Flow Static Level 38 feet</p> <p>Water Utility Lithology Info Flag Y Pump Test Info Flag Y File Info Flag Sieve Info Flag Screen Info Flag Water Chemistry Info Flag Field Chemistry Info Flag Site Info (SEAM) Other Info Flag</p>
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GENERAL REMARKS:

From	0	To	3 Ft.	Soil
From	3	To	8 Ft.	Clay
From	8	To	18 Ft.	Silt
From	18	To	24 Ft.	Sandy silt
From	24	To	38 Ft.	Till
From	38	To	53 Ft.	Sand and gravel, water-bearing
From	53	To	54 Ft.	Clay with stones
From	54	To	73 Ft.	Sand and gravel, water-bearing
From	73	To	77 Ft.	Till
From	77	To	85 Ft.	Sand and gravel, water-bearing
From	85	To	90 Ft.	Pebbly clay
From	90	To	0 Ft.	Quadra sand

12 rows selected.

Information Disclaimer:

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Date entered to WELL



<p>Well Tag Number 000000000803</p> <p>Owner: VILLAGE OF QUALICUM</p> <p>Address: BERWICK RD</p> <p>Area:</p> <p>WELL LOCATION: NEWCASTLE Land District District Lot Plan Lot Township Section Range Indian Reserve Meridian Block Quarter Island BCGS Number (NAD 27) 092F038243 Well 2</p> <p>Well Use Unknown Well Use Construction Method Unknown Constru Diameter 16 inches Well Depth 81 feet Elevation 0 Bedrock Depth UNK feet Screen from 69 to 81 feet Slot Size 1 Slot Size 2 Slot Size 3 Slot Size 4</p>	<p>Construction Date</p> <p>Driller Unknown License Number</p> <p>PRODUCTION DATA AT TIME OF DRILLING Well Yield 263 IGM Artesian Flow Static Level 36 feet</p> <p>Water Utility Lithology Info Flag Y Pump Test Info Flag Y File Info Flag Sieve Info Flag Screen Info Flag Water Chemistry Info Flag Field Chemistry Info Flag Site Info (SEAM) Other Info Flag</p>
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GENERAL REMARKS:

From 0 To 2 Ft. Soil
From 2 To 15 Ft. Stoney clay
From 15 To 18 Ft. Till
From 18 To 49 Ft. Clay
From 49 To 81 Ft. Silty sand and gravel, water-bearing

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Date entered to WELL



<p>Well Tag Number 000000003158</p> <p>Owner: QUALICUM VILLAGE</p> <p>Address:</p> <p>Area:</p> <p>WELL LOCATION: NEWCASTLE Land District District Lot 78 Plan 11091 Lot Township Section Range Indian Reserve Meridian Block Quarter Island</p> <p>BCGS Number (NAD 27) 092F038243 Well 4</p> <p>Well Use Municipal Construction Method Drilled Diameter 6 inches Well Depth 135 feet Elevation 0 Bedrock Depth 133 feet Screen from 0 to 0 feet Slot Size 1 0 Slot Size 2 0 Slot Size 3 0 Slot Size 4 0</p>	<p>Construction Date 19490101</p> <p>Driller INTERNATIONAL WATER SUPPLY License Number</p> <p>PRODUCTION DATA AT TIME OF DRILLING: Well Yield 0 Artesian Flow 0 Static Level 54 feet</p> <p>Water Utility Lithology Info Flag Y Pump Test Info Flag File Info Flag Sieve Info Flag Screen Info Flag Water Chemistry Info Flag Field Chemistry Info Flag Site Info (SEAM) Other Info Flag</p>
<p>GENERAL REMARKS:</p> <p>no rows selected</p>	

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Date entered to WELL

