Aggregate resources of the Greater Vancouver and Lower Mainland market, B.C., Canada: Problems and future outlook

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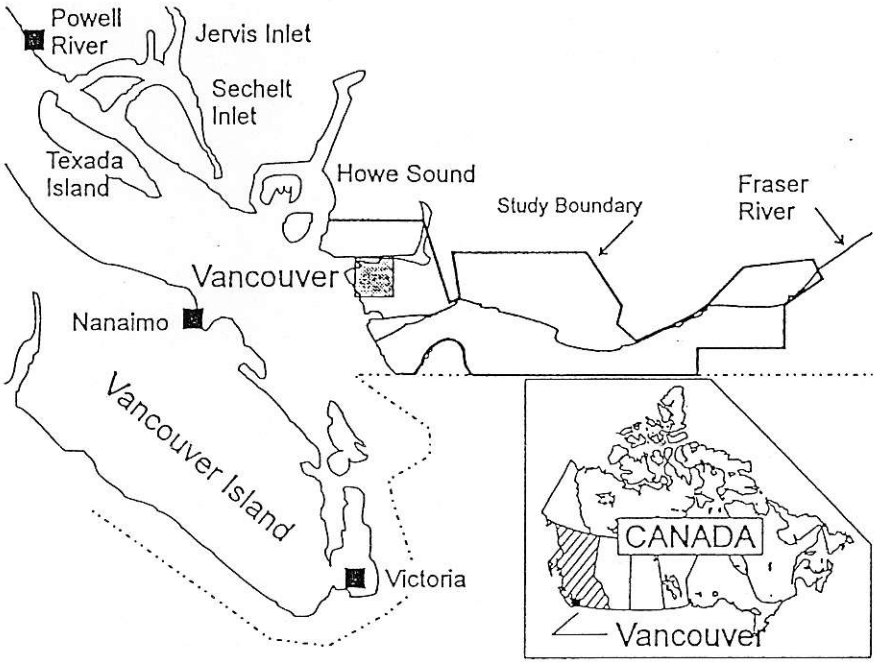

Figure 1. Location of study area, Lower Mainland, British Columbia, Canada.

3 ORIGIN AND DISTRIBUTION OF SAND AND GRAVEL DEPOSITS

Sand and gravel resources of the southern coastal region of British Columbia may be linked to various episodes of Wisconsinan glaciation. The distribution of sand and gravel deposits in the Fraser Lowland and along the coast is controlled by a number of factors. During the Quaternary Period, the province experienced several glacial-interglacial cycles. Major glaciations were accompanied by isostatic and eustatic changes in sea level of up to 200 m. As a result, low-lying areas were, at times, covered by the sea.

Since the Fraser Lowland is bounded to the north and south by high mountain ranges, western glacier margins would have occupied the sea at certain times. During deglaciation, meltwater from the ice produced widespread and extensive deposits of sand and gravel along the coast, throughout the Fraser Lowland and adjacent areas. The interaction of waves and changing sea level positions, resulted in the widespread accumulation of gravely beach deposits up to a few meters thick at elevations between 0-200 m. (Hora & Basham 1981).

For many years Greater Vancouver construction activities have relied on gravel imported from other areas. Since the major production centres in the Fraser Lowland and adjacent areas are distant from the urban core and trucking costs are not always competitive, the industry has developed production units along the coast and is barging aggregate to Greater Vancouver to supply the local construction industry. At the same time, the aggregate producers developed tidewater supply depots in the proximity of Greater Vancouver downtown areas. The shipping companies meanwhile developed self-unloading barges to serve the industry. Some deposits in the Howe Sound area have already been depleted, but about 50% of the deltaic deposits located along the shores of Jervis and Sechelt Inlets have not been explored or developed. An additional area of aggregate potential are the shores of Indian Arm and Pitt Lake. A final possibility includes dredging gravel from the Strait of Georgia.

Over the years, industry has shown a great level of flexibility in adjusting to changing the supply-demand situation with diminishing availability of aggregate from local sources (Figs 5-6, Tables 4-5). Since the 1960's, the major aggregate producers started to develop production centres along the coast to supply the Vancouver market. Capilano raised deltaic deposits are scattered along the mainland coast and, to a minor extent, on Vancouver Island. The thickness observed in some exposures has reached 65 m and the reserves are frequently in order of tens of million tonnes. Producing pits in Capilano sediment deposits that supply the Greater Vancouver

Table 4. Exports and imports of aggregate in tonnes, Lower Mainland, B.C. Source: Natural Resources Canada 1995.

Year	Exports	Imports
1994	327,042	381,524
1993	255,079	446,941
1992	297,402	428,318
1991	316,421	509,283
1985	225,090	864,675

Table 5. Aggregate prices in the Lower Mainland. FOB plant or supply depot source: Industry price lists.

	1978 ($/tonne)	1995 ($/tonne)
Pit run	0.63-1.83	3.25- 4.50
Screened and washed	2.14-4.06	8.50-11.50
Screened and crushed	1.85-3.66	8.00-11.95

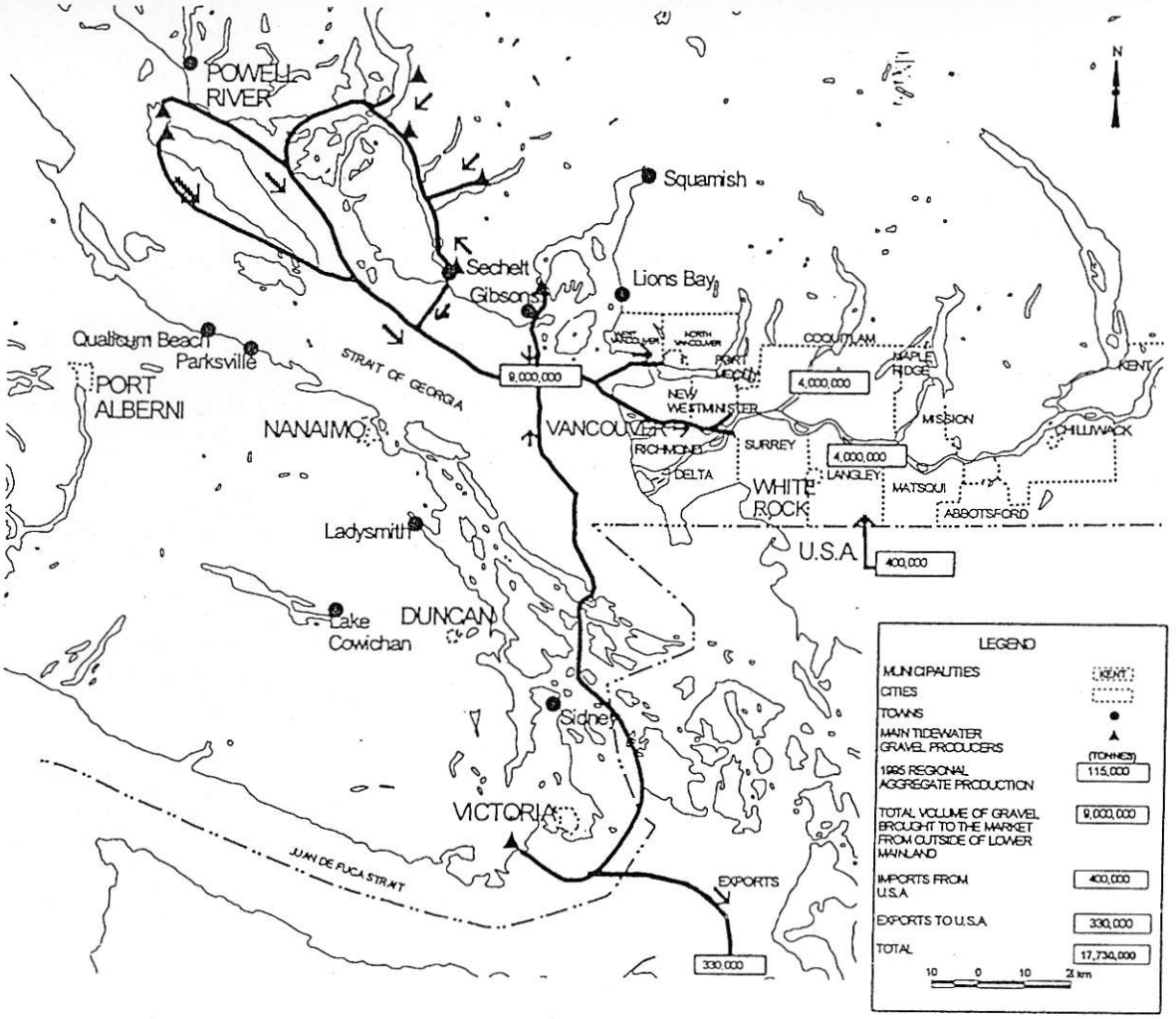

Figure 5. 1980 gravel production and shipments in the Lower Mainland, British Columbia.

market are along Howe Sound (partially depleted already), Jervis and Sechelt Inlets, and at Colwood, near Victoria, on Vancouver Island. Another coastal pit at Friday Harbour, on San Juan Island in Washington State, provided up to one million tonnes annually, most of it shipped to Vancouver until 1985, when this deposit was depleted. Closure of this production centre significantly reduced the aggregate imports from Washington State and opened some export markets for British Columbia producers, namely the Colwood pit on Vancouver Island. The industry sources indicate the transportation cost from Texada Island, for example, to the average downtown Vancouver supply depot in 1978 was $1.00 per tonne of aggregate, in 1995, it is $2.50 per tonne of aggregate. This is still only about 25% of the processed product price quoted for the Lower Mainland FOB plant.

Until 1985, most of British Columbia aggregate imports were shipped by barge, in 1995, imported gravel is shipped by trucks from pits just south of the 49th parallel.

Holnam West Materials Ltd. Limestone Quarry - Texada Island

by

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Limestone has many uses and is an essential raw material in any developed society. The production of basic building materials, such as steel, base metals, pulp, glass, portland cement, and lime, consume large quantities of limestone providing the primary components of any community's physical growth and development.

Pulverized or precipitated white limestone has become an increasingly important industrial mineral filler for many manufactured products such as paint and other coatings, joint cement, drilling muds, plastic pipe, and fine paper.

Other growing markets that are adding to the demand for limestone include waste gas desulphurization, soil conditioning, and acid rock drainage neutralization. The almost galloping pace of environmental regulation and control is doubtless going to provide ever-increasing demands for limestone and lime across a broad range of specifications.

Thus it is common to find limestone mining operations within relatively small economic zones, as it was a century ago when marbleized stone was such an important building material. Then, as now, transportation costs played a very strong role in the location of these operations. unlike deposits of precious and base metals, many high grade limestone properties remain unexploited because of distance from viable markets. It is interesting to see how this relationship has played out in the Pacific Northwest.

Holnam West Materials, and it's predecessor, Ideal Cement Company Ltd., has quarried limestone on Texada island since 1956.

Texada Island is located some sixty miles north of Vancouver, B. C. in the Georgia Strait between Vancouver Island and mainland British Columbia. It is thirty miles long in a northwest, southeast direction and is four to five miles across.

The majority of the limestone is found in the northern third of the island. The portion of this limestone being quarried by Holnam is described as the lower member and possibly part of the middle member of the Triassic marble Bay formation. The strata dip 10 to 12 degrees northeasterly and strike northwesterly. Several faults trending North 10 degrees West have fractured and offset the formation. Dykes trending in the same direction have been intruded during at least two separate periods.

Within the quarry area, dykes appear to occupy nearly vertical fracture zones, particularly those which are 10 to 15 feet thick. These dykes trend North 15 degrees West and are commonly resistant to erosion. Smaller dykes ranging from 1 to 3 feet, either crosscut the larger dykes at about North 45 degrees West or run parallel to them. These dykes erode slightly below the limestone surface and show no indication of past intrusive faulting.

The limestone can be described as medium to dark grey, even textured and cryptocrystalline. Minute irregular veinlets containing minor amount of silica and pyrite are present but are not readily apparent to the eye. This high quality chemical grade limestone is being used by pulp mills, smelters and in the manufacture of cement and high purity chemical grade lime.

Limestone quarries have been a facet of Texada living since the early 1890's, initially for flux for a local copper smelter, subsequently, and still early on, for other shoreline smelters on Vancouver Island pulp and paper mills up and down the Coast. Lime kilns were constructed on Texada Island - originally vertical kilns fired with wood then a rotary kiln fired with oil. Burning of lime locally halted in the mid 50's. Raw, sized stone was then shipped to lime plants in Tacoma and Portland from the Blubber Bay Quarry, now operated by Ash Grove Cement.

B. C. Cement (now Tilbury Cement) supplied their small cement plant on Vancouver Island at Bamberton from a quarry on the north end of Texada near Blubber Bay during the 1930's, 40's and 50's. A new quarry was opened at Cobble Hill and the Texada quarry operation was closed down.

Cement-grade limestone production began on Texada in earnest in 1956 when Lafarge began shipping limestone to a new cement plant in Richmond from the quarry south of Van Anda. Nearby, Imperial Limestone has continued operations since the early 50's, supplying specialty limestone markets. Ideal began shipments to the Grotto Cement plant in Washington State in 1966 and then to it's Seattle cement plant which made it's first cement in March 1967. This amount of cement-grade limestone, some 500,000 tonnes/year, gave the quarry the opportunity to expand.

Increase in demand for rip rap (over 200,000 tonnes in 1968) and other limestone products gave the Company a new credibility in the eyes of senior management. In 1972, a new crushing, screening, conveying, stockpiling, reclaiming, and barge loading facility was approved and commissioned in 1973. It is still operating today.

The present quarry covers an area of approximately 100 acres with a limestone depth potential of over 700 feet where it lies on the Karmutsen volcanic basement. The volcanics have a similar dip and strike generally to the limestone.

Down-the-hole drilling provides the 8-inch boreholes for blasting with ANFO or high explosive. A smaller track-type hydraulic drill is used for pioneering work. Bench heights average 33 feet. Front-end loaders and trucks feed an impact crusher in closed screening circuit at a capacity rate of 800 tonnes per hour to produce a minus three-inch product. This product is stockpiled and shipped to cement plants or to aggregate users in the Lower Mainland. Chemical grade limestone is crushed in the same system with a two-inch minus product being processed further on two 8'x20' double decked screens.

Four crushing plants area used to reduce the blasted rock to customer specifications. Four loading facilities on the west side of Texada Island put the quarry production on the customer's barge. One of these is capable of loading deep sea vessels and is currently used to load coal from the Quinsam Mine near Campbell River. Panamax sized vessels are now being loaded and the capability is there to load Cape sized. Another facility, a ramp, allows the loading of rip rap and the unloading of coal directly by truck to or from barge. Coal is stockpiled on site for shipment overseas.

The million tonne shipping threshold was crossed in 1972, the 2,000,000 in 1987 and the 3,000,000 in 1992.

Current limestone shipments amount to some 2,700,000 tonnes per year, rip rap and construction materials 600,000 tonnes per year, and coal 480,000 tonnes per year. For the last five years, Holnam is also producing white limestone for the Huber's plant in Seattle. Ground product is used for a variety of filler applications. The property has reserves for many years to come and it's strategic location on tide water assures it's future as a raw material supplier and handler of basic commodities.