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Waterfront land use in Metropolitan Vancouver, British Columbia

Charles N. Forward

GEOGRAPHICAL BRANCH
Department of Energy,
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Ottawa, Ontario

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Vancouver, British Columbia. The industrial waterway of False Creek in the foreground retains several active sawmills with ever-present supply of log booms. Downtown Vancouver and Burrard Inlet are in the background. (Photo: courtesy *British Columbia Dept. of Travel Industry*, No. 8556).

Preface

One result of the rapid growth of modern cities is the increasingly heavy demand for urban and suburban land, a demand which, unless valid priorities are established, will become extremely difficult to satisfy. Without direction and control based on sound planning policies the competitive struggle for desirable land could seriously strangle or distort a city's development. This is particularly true in port cities where the waterfront land so vital to their economy is limited, but where the demand for it is not. In this study of metropolitan Vancouver, Dr. Forward has made an inventory of the city's supply of waterfront land and an analysis of present and future requirements for it. He indicates factors which demand urgent consideration at both municipal and regional levels in order to ensure that future development will not be stifled by the inappropriate apportionment of this valuable public resource. Many of his findings might well be considered in the long-term planning policies of other expanding port cities. The survey on which this report is based was begun in 1965.

J. Keith Fraser,
Acting Director,
Geographical Branch.

J. Keith Fraser — Acting Director, Geographical Branch
Margaret Montgomery Larnder — Editor
Joyce Howes — Associate Editor
Cartography under the supervision of Rolande Trevor

CONTENTS

Page

INTRODUCTION 1

PHYSICAL CHARACTER OF THE REGION 4

PRESENT WATERFRONT LAND USE 8

Agricultural and unused land 8

Recreational land 9

Residential land 10

Land used for government, utilities etc. 10

Land used for commercial etc. 12

Land used for manufacturing requirements 14

FUTURE WATERFRONT LAND USE 20

PROBABLE FUTURE WATERFRONT LAND REQUIREMENTS FOR PORT FACILITIES 21

Shipping trade 21

Vessel design and cargo storage and handling 27

Improvement and expansion of terminal facilities 30

Other bulk commodities 31

Petroleum 32

General cargo 32

Passenger services 33

PROBABLE WATERFRONT LAND REQUIREMENTS FOR MANUFACTURING INDUSTRIES 34

Water oriented industries

fish processing 35

wood industry 35

paper industry 37

metal industries 37

transportation equipment industry 37

non-metallic mineral products industry 37

oil refineries 38

chemical products industry 38

Available waterfront land suitable for industry 38

Page

PROBABLE WATERFRONT LAND REQUIREMENTS FOR RECREATIONAL USE 45

PROBABLE WATERFRONT LAND REQUIREMENTS FOR RESIDENTIAL AND OTHER USES 46

SUMMARY 47

ACKNOWLEDGMENTS 50

REFERENCES 51

BIBLIOGRAPHY 52

ILLUSTRATIONS

		Page
	Aerial view of Vancouver, B.C. ...*Frontispiece*	
Figure 1	Extent of Vancouver waterfront land ..... *facing page*	1
Figure 2	Contour elevations, municipal boundaries, population distribution, Vancouver area, B.C.	3
Figure 3	Waterfront land-use districts of the Vancouver area	4
Figure 4	Surficial geology of the Vancouver waterfront area ..... *facing page*	5
Figure 5	Dyke and railway embankment locations in the Vancouver area	6
Figure 6	Navigation channels and anchorages of the Vancouver waterfront area ..... *facing page*	7
Figure 7	Location and extent of land-use categories, Vancouver waterfront area ..... *facing page*	8
Figure 8	Beach on English Bay, 1962	9
Figure 9	Vancouver skyline (West End high-rise apartments)	11
Figure 10	Ribbons of log booms in Fraser River near New Westminster	13
Figure 11	Vancouver waterfront areas used for log storage	14
Figure 12	Sawmill installations on Fraser River near New Westminster	15
Figure 13	Vancouver deep sea berthing accommodation for various categories of commodities ..... *facing page*	17
Figure 14	Vancouver Harbour, showing Ballantyne and Centennial Piers	17
Figure 14a	Grain loading at Alberta Wheat Pool elevator, Vancouver	19
Figure 15	Summary of cargo tonnage handled in ports of Vancouver, 1964	22
Figure 16	Leading commodities handled in ports of Vancouver, 1963..	23

Page

Figure 17 Summary of cargo tonnage (inward and outward, foreign and domestic) handled in ports of Vancouver, 1955, 1958, 1961 and 1964 24

Figure 18 Leading commodities handled in ports of Vancouver, 1955 to 1964 25

Figure 19 Ferry terminal and yachting base at Horseshoe Bay on Howe Sound 33

Figure 20 Foundation conditions along the Vancouver waterfront ... 41

Figure 21 Market value of Vancouver waterfront land, 1965 .... *facing page* 42

Map *A* Steepness of slope within 500 feet of the shoreline along the Vancouver waterfront ..... *in pocket*

WATERFRONT LAND USE IN METROPOLITAN VANCOUVER, BRITISH COLUMBIA*

*C. N. Forward***

ABSTRACT

Waterfront land varies greatly in quality and suitability depending on its use. In metropolitan Vancouver the nature of the site and topography make it a very limited resource. As a basis for planning waterfront land use it was the aim of this study to determine present use and future demand in terms of the physical qualities of the shoreline zone. Distinctions are made between land that can be served by deep-sea, coastal and small vessel traffic, and land suitable for shipping terminals, manufacturing plants, residences or parks. The forecast of waterfront land requirements for port facilities is based on an investigation of the nature and growth of commodity trade and of trends in vessel and terminal design.

Most port requirements would appear capable of being met by development of facilities in Burrard Inlet. Certain manufacturing industries are strongly water-oriented and, although there appears to be an ample supply of industrial waterfront land on the Fraser-Pitt river system, there is a danger it may be occupied by industries that do not use water transportation. Additional marine parkland developed for swimming is an urgent recreational requirement and the Boundary Bay shoreline seems to offer the only suitable zone for such development.

---

*The study area includes the territory defined as the metropolitan Vancouver area in the Census of Canada, 1961, with the addition of the municipality of Pitt Meadows. Thus it includes West Vancouver, North Vancouver municipality, North Vancouver, Vancouver, Burnaby, New Westminster, Coquitlam, Port Coquitlam, Fraser Mills, Port Moody, Pitt Meadows, Richmond, Delta, Surrey, White Rock, University Endowment Lands and unorganized territory.

**Dr. Forward is Associate Professor, Department of Geography, University of Victoria, Victoria, B.C. While engaged on this research project, which is part of the Urban Characteristics Survey of Vancouver required by the Emergency Measures Organization (EMO), he was employed under contract by the Geographical Branch in 1965.

Residential use of waterfront land such as occurs extensively on the north shore of Burrard Inlet and in limited stretches elsewhere, would seem in most cases to merit only a low priority relative to shipping terminal, industrial and recreational uses. Waterfront land could probably be best developed on a metropolitan basis by an agency entrusted with sufficient power to achieve co-ordinated planning and control of this resource.

RÉSUMÉ

Les terrains en bordure de l'eau varient beaucoup tant en qualité qu'en possibilité d'exploitation; dans la région métropolitaine de Vancouver la nature même du site et sa topographie en limitent la rentabilité. La planification de ces terrains fait l'objet de cette étude dont le but vise à trouver l'utilisation actuelle et future de la zone côtière en tenant compte de ses propriétés physiques. On établit des distinctions entre les terrains qui peuvent être desservis par les océaniques, les caboteurs et les petites embarcations, et les terrains qui conviennent aux entrepôts d'expédition, aux usines de fabrication, aux résidences ou aux parcs. La prévision des besoins de terrains en bordure de la mer pour la construction de ports relève des enquêtes sur la nature et la croissance du commerce comme sur les tendances à innover dans la construction des navires et des ports.

Il semble possible de satisfaire à la plupart des exigences portuaires en aménageant les ressources de l'inlet Burrard. Certaines industries de fabrication doivent être localisées près de l'eau. Bien que le bassin hydrographique Fraser-Pitt ait une quantité considérable de terrains propices à ces industries, un certain danger demeure, celui d'y voir s'installer des industries n'utilisant pas le transport maritime. Il est urgent que l'on aménage de nouveaux parcs munis de plages, et le rivage de la baie Boundary semble être la seule zone qui conviendrait à cette fin.

L'utilisation des terrains en bordure de l'eau à des fins résidentielles — très répandue sur la rive nord de l'inlet Burrard et restreinte ailleurs — devrait en général céder le pas aux exigences portuaires, industrielles ou récréatives. Une agence à laquelle on confierait suffisamment de pouvoirs, pourrait réussir à planifier ces ressources et à établir un contrôle coordonné dans ce domaine et conduirait probablement des terrains en bordure de l'eau de la façon la plus profitable.

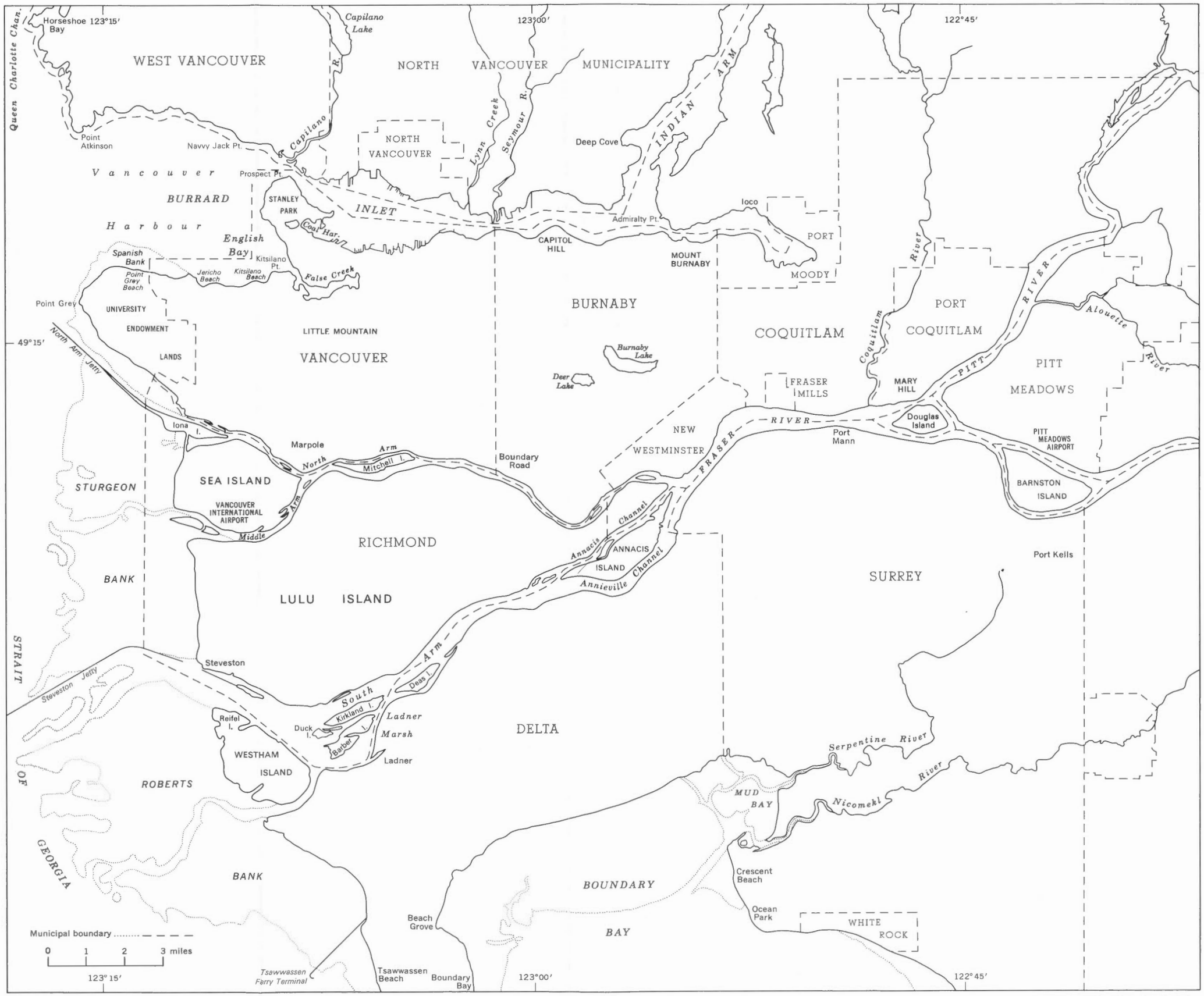


Figure 1. Extent of Vancouver waterfront land.

INTRODUCTION

In most port cities waterfront land is a valuable but limited resource. This is true especially in metropolitan Vancouver, Canada's major Pacific port and third largest urban concentration. The value of the resource is well established by the demand for waterfront property for port facilities or industrial uses. Limitations on the availability of the resource are imposed by the physical features of the landscape.

The formidable barrier of the Coast Mountains so limits access to the Pacific by land routes that, aside from Vancouver, only Prince Rupert and Squamish have developed as Canadian coastal rail terminals. Of these three, metropolitan Vancouver, the nation's key western port, enjoys the most favourable site. The most important transport routes converge on the lower Fraser River and follow its canyon through the mountains to the flat delta lands near Vancouver. At its western end between the United States border and the steep cliffs of Howe Sound north of Queen Charlotte Channel (Figure 1), this corridor to the Pacific is no more than 25 miles wide and within this narrow zone three port areas have developed: Vancouver on Burrard Inlet, New Westminster on the main channel of the Fraser River, and North Arm on the north channel.

Shipping activity is varied and substantial. Among Canadian ports Vancouver is surpassed only by Montreal in total tonnage of cargo handled. On the Pacific coast it handles more dry cargo than any other port, nearly ten times as much as Victoria and nearly twenty times as much as Prince Rupert.

MS submitted May, 1966.

Although its port function is a vital one, metropolitan Vancouver performs many other functions. It is the home of 880,000 people (Figure 2), who are supported by a highly diversified urban economy. Manufacturing, the wholesale and retail trade, transportation and a wide range of service activities offer substantial employment opportunities. Many of the industries have varied and demanding requirements for waterfront sites — some require deep inshore water suitable for ocean-going vessels to berth and load, others require ample water surface for log handling and storage while needing only shallow channels for tugs and barges, still others require extensive, flat building sites of sturdy foundation for heavy structures. The large metropolitan population requires stretches of waterfront for recreation activities, particularly swimming and boating.

It is imperative that the limited extent of waterfront land be used in the best long-term interests of the whole metropolitan community, and careful planning will be required to accommodate wisely the mounting demand for sites. Multiplicity of jurisdictions in the area complicates planning because local interests may often unduly dominate decisions. Metropolitan Vancouver comprises fifteen separate cities or municipalities and several unorganized territories administered by the provincial government. The water bodies fall under several different authorities: Burrard Inlet is controlled by the National Harbours Board, the North Arm of the Fraser River is controlled by the North Fraser Harbour Commissioners, the New Westminister-Pitt River area by the Fraser River Harbour Board and the South Arm* by the provincial government. As a basis for planning, this study attempts to determine present waterfront land use and to suggest best use for the future.

Specifically, the objectives of the study are:

1. To ascertain the condition and present use of water areas and waterfront land.
2. To evaluate waterfront land in terms of the various uses to which it may be devoted; for example, port facilities, manufacturing, commercial, residential and recreational.

---

*This name has not yet been officially approved but is accepted locally as the designation of that branch of the Fraser River which flows along the south shore of Lulu Island.

3. To measure the economic and social requirements of the metropolitan community for waterfront space and to evaluate the relative importance of competing uses.
4. To suggest a possible allocation of waterfront land for major use categories according to established priorities.

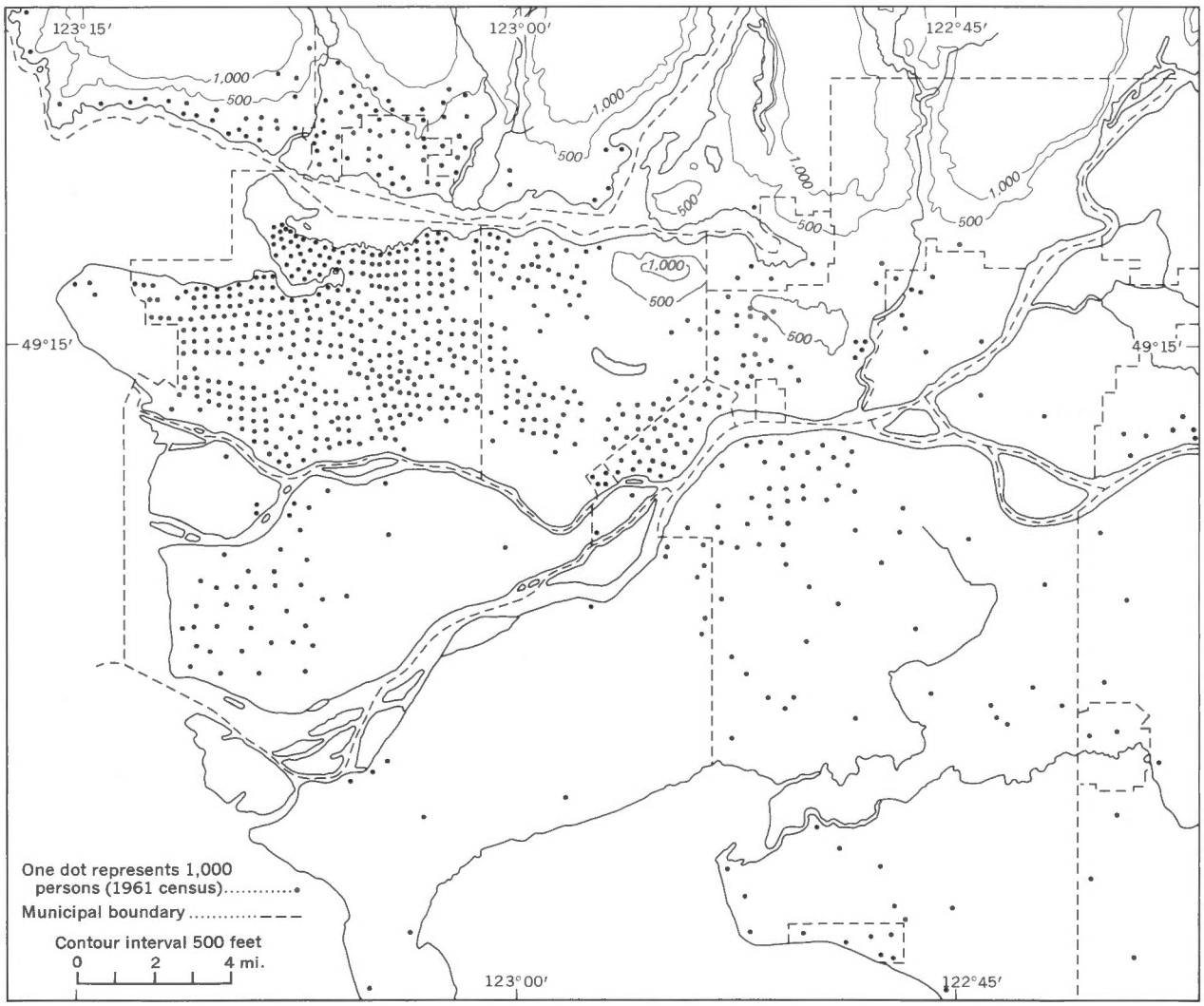


Figure 2. Contour elevations, municipal boundaries and population distribution in the Vancouver area.

PHYSICAL CHARACTER OF THE REGION

The Fraser Lowland, a part of the Georgia Depression, is fringed on the north by the Coast Mountains which rise abruptly to elevations of well over 1,000 feet immediately north of Burrard Inlet and east of Indian Arm (Figure 2). The broad, flat-bottomed valley and delta of the Fraser River is flanked on the south and north by low hills, generally less than 500 feet high, which trend in an east-west direction. Some of these hills are composed of unconsolidated deposits, others, such as Little Mountain, Capitol Hill and Mount Burnaby, have bedrock cores thinly mantled by glacial deposits.

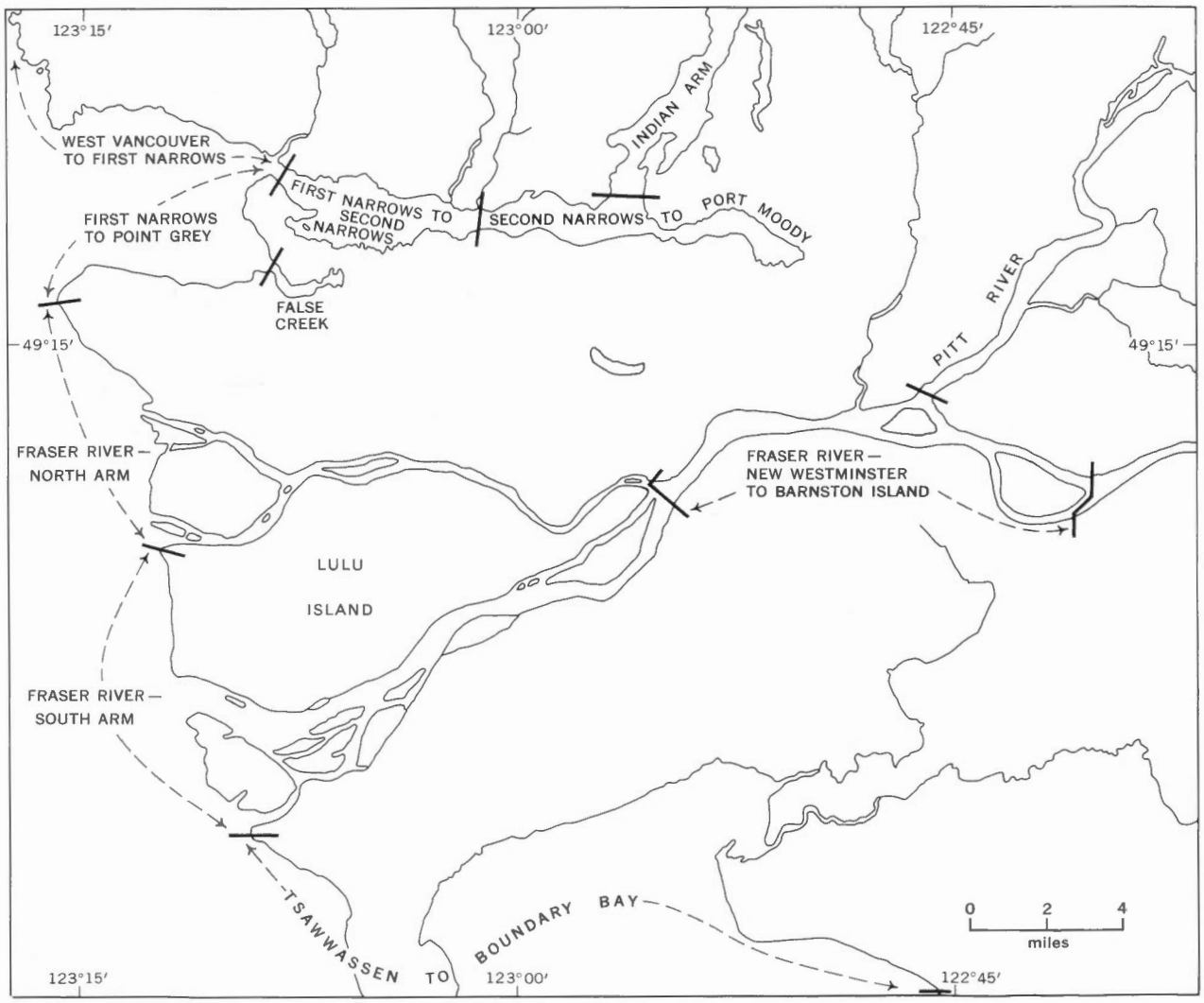


Figure 3. Waterfront land-use districts of the Vancouver area.

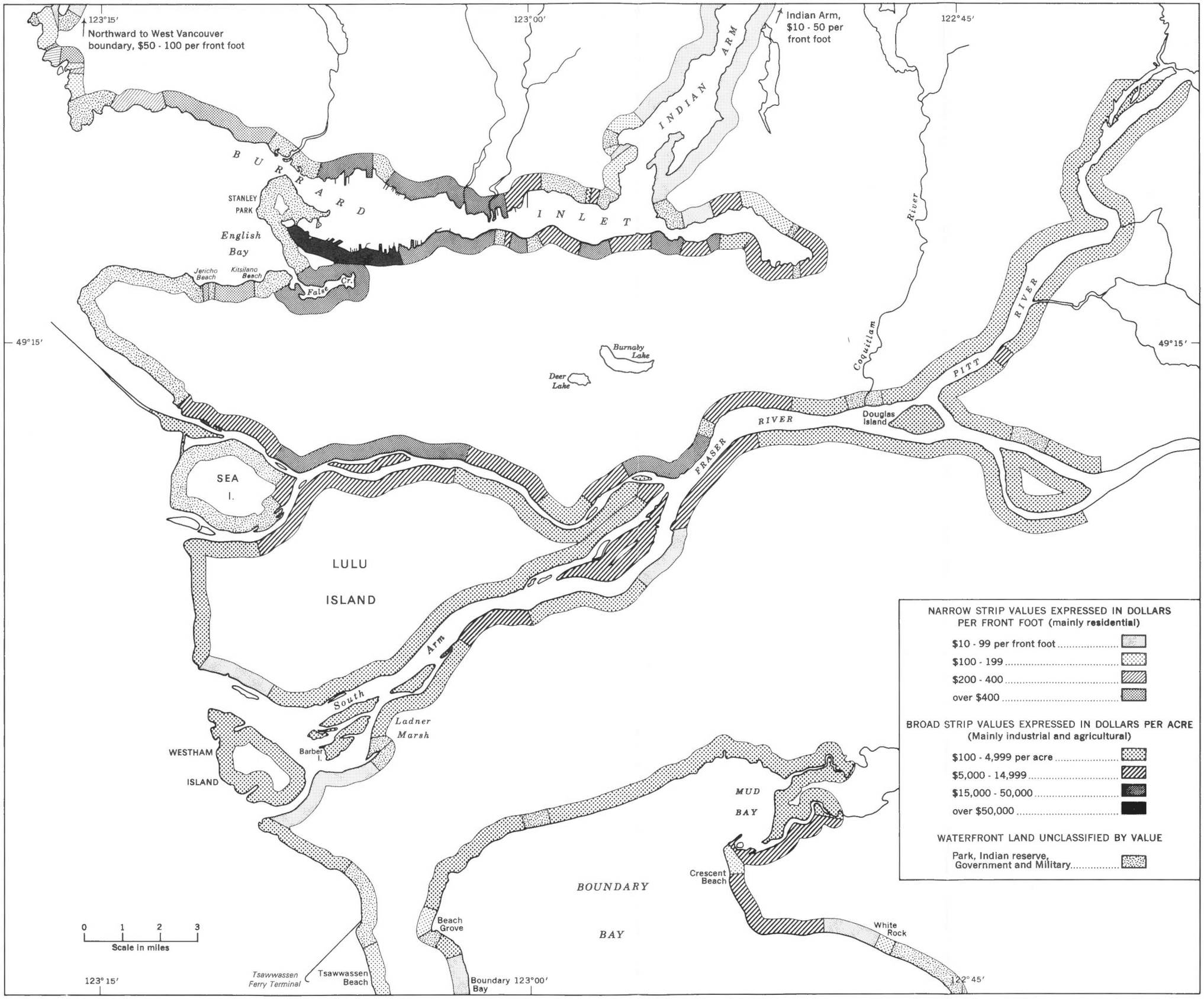


Figure 21. Market value of Vancouver waterfront land, 1965

The wide Fraser-Pitt river valley of the eastern part of the region narrows between the uplands of Surrey and Coquitlam, but widens again in the Fraser delta west of New Westminster. The delta is in process of formation, gradually extending seaward as evidenced by the extensive banks at the river mouth. South of the Fraser River a small parallel valley, occupied by the Nicomekl and Serpentine rivers which flow into Boundary Bay, breaks the continuity of the southern uplands.

The waterfront land-use districts into which the area is divided are shown in Figure 3. The physical characteristics of the shoreline vary considerably between the extremes of precipitous, rocky coast bordering Indian Arm and the flat, peaty shores of certain Fraser River channels (Figure 4). Rock lies at or near the surface along much of the coastline around and north of Queen Charlotte Channel and along much of Burrard Inlet, except for a long stretch on the north shore and for discontinuous strips on the south shore which are characterized by thick deposits of till and outwash. These strips are interrupted at the mouths of Capilano and Seymour rivers by postglacial marine deltas. On the Vancouver and North Vancouver waterfronts, land has been built up by fill in certain localities, most notably around False Creek in connection with wharf construction. Slopes within 500 feet of the shoreline are steepest in Indian Arm where long stretches are over 50 per cent and very little is less than 15 per cent (Map *A*, in pocket). The rock-bound coast of Howe Sound and the prominent cliffs of Point Grey and Prospect Point have slopes exceeding 25 per cent. The central part of Burrard Inlet has, on the whole, a gently sloping coastline.

The Fraser and Pitt rivers are bordered by flat to gently sloping postglacial floodplain and deltaic deposits, with layers of peat of varying thickness in some areas. Short sections of shoreline are composed of till and outwash as at New Westminster, Mary Hill and in the Port Kells area, and bedrock lies near the surface along the upper reaches of Pitt River. Much of the level floodplain and delta region is protected against flooding by a long system of shoreline dykes, and railway lines parallel to the shore constitute protective embankments in some stretches (Figure 5).

The Boundary Bay and Tsawwassen shorelines are varied in character. At the head of Boundary Bay are extensive delta, floodplain and peat deposits.

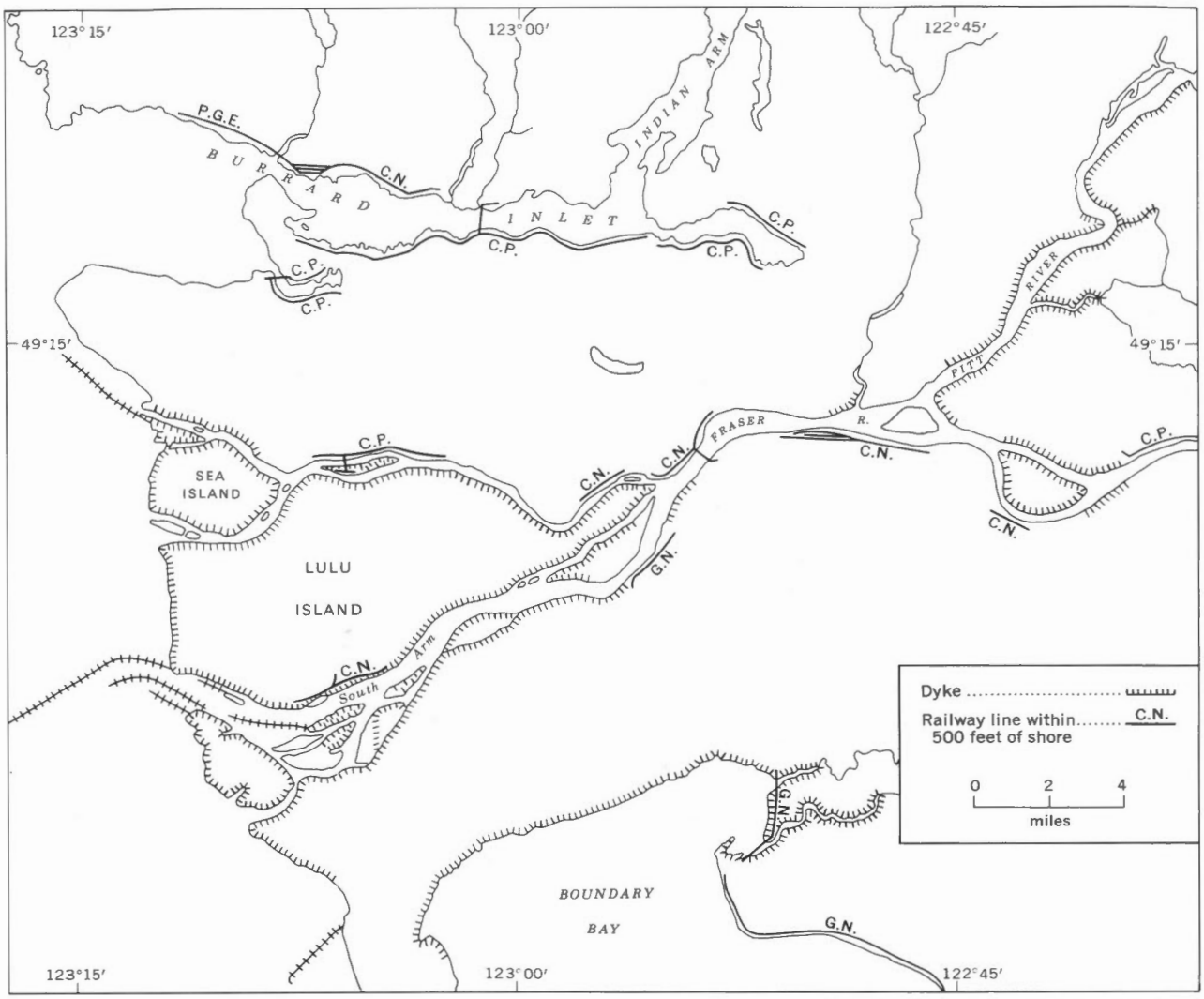


Figure 5. Flood protection afforded by dykes and railway embankments in the Vancouver area.

From the Nicomekl River south to the United States border the shoreline is characterized by alternating strips of gently sloping, postglacial beach deposits and steeper, sandy to silty till. Similar beach deposits fringe the low western shore of Boundary Bay and the central Tsawwassen coast. Near the United States border, the Tsawwassen area has a steep till coastline. Because the Boundary Bay coast is subject to tidal flooding much of the shoreline is protected by dykes (Figure 5).

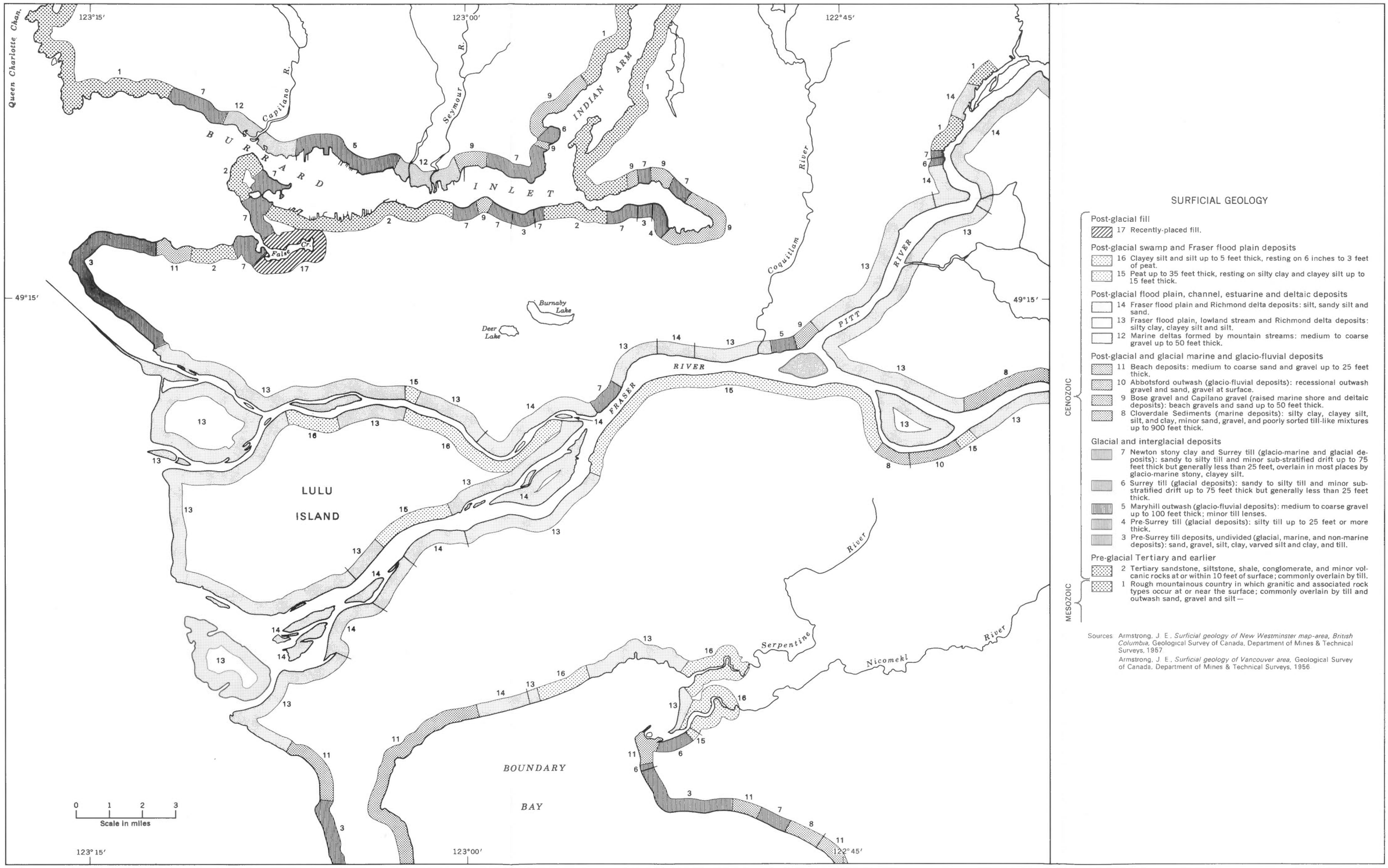


Figure 4. Surficial geology of the Vancouver waterfront area.

Water depth is a controlling factor for navigation (Figure 6). Burrard Inlet inside First Narrows, with a limiting entry depth of 39 feet* is the main deep-sea shipping harbour of the region. The main channel depth from First Narrows to the bulk terminal at Port Moody, including Indian Arm, is over 39 feet and most of the wharves in this area list depths of 30 to 40 feet. The head of Burrard Inlet at Port Moody is very shallow. The broad portion of the inlet west of First Narrows is more exposed and has not been used as a wharfage area, although English Bay is sometimes utilized as an anchorage for ocean vessels. False Creek is a sheltered industrial waterway with a main channel dredged to 15 feet.

The Fraser-Pitt river system consists of a number of industrial waterways and a deep-sea channel via South Arm to Port Mann. The deep-sea channel, giving access to New Westminster, is maintained by dredging to a depth of 28 feet 6 inches with a 12-foot tide at the river mouth. Consequently, larger ships can be accommodated in the Vancouver harbour than in the New Westminster harbour. A program of channel improvement at New Westminster, involving the widening and deepening of Annieville Channel and the diversion of currents by rock walls and groynes to reduce silting, has been undertaken by the Federal Department of Public Works. The project, to be completed by 1970, will allow year-round use of the Fraser-Surrey docks, instead of the present restricted seven or eight months due to silting.

A second entry from the sea lies via North Arm which has depths of 12 to 15 feet. Minor channels 10 feet deep include the Ladner Reach and the Annacis Channel in South Arm, and the Morey Channel in Middle Arm which can be entered from the North Arm. The central section of Middle Arm is devoted exclusively to seaplane use for the Vancouver International Airport, and this prevents its use as a ship entry from the sea. All these channels are maintained at specified depths by the Federal Department of Public Works. Upstream, from the vicinity of Port Mann to Mission, the main channel is self-maintained at a minimum depth of about 20 feet though many stretches are considerably deeper. The Pitt River channel too, is self-maintained at approximately 15 to 20 feet.

*All depths quoted refer to depths at lowest normal tides.

The lower section of the Fraser River is tidal and fluctuates in level seasonally. From a low point during the winter, the water level rises rapidly in May and June owing to the melting of snow in the mountains of its huge drainage basin. The high water mark is reached any time between May 24 and July 16, after which the water recedes during late summer. A normal rise at Langley (east of the limits of Figure 6) is 14 feet, but according to the British Columbia Pilot (1965, v.1, p. 265) records show that a rise of 25 feet has occurred. During high water the upstream navigation is affected by the strong flow. The period from September to November is particularly favourable for river navigation because current velocity is moderate and the water level is still fairly high.

PRESENT WATERFRONT LAND USE

Present waterfront land use was mapped by the author in large scale detail during the summer of 1965. From these maps the footage of waterfront land occupied by significant use of categories was measured and summarized (Figure 7 and Tables 1, 2, 3 and 4). For convenience of analysis the metropolitan area has been divided into shoreline districts on the basis of configuration and character of land and water use.

Agricultural and unused land

Among the categories mapped, this is by far the most extensive. It represents the undeveloped waterfront land available for future urban uses (Table 1). The other categories of land use listed in Table 1 are more typical of present day urban areas and will be discussed under the broad headings of

- Recreational land
- Residential land
- Land used for government, utilities and land transportation requirements
- Land used for commercial, service and construction requirements
- Land used for manufacturing requirements

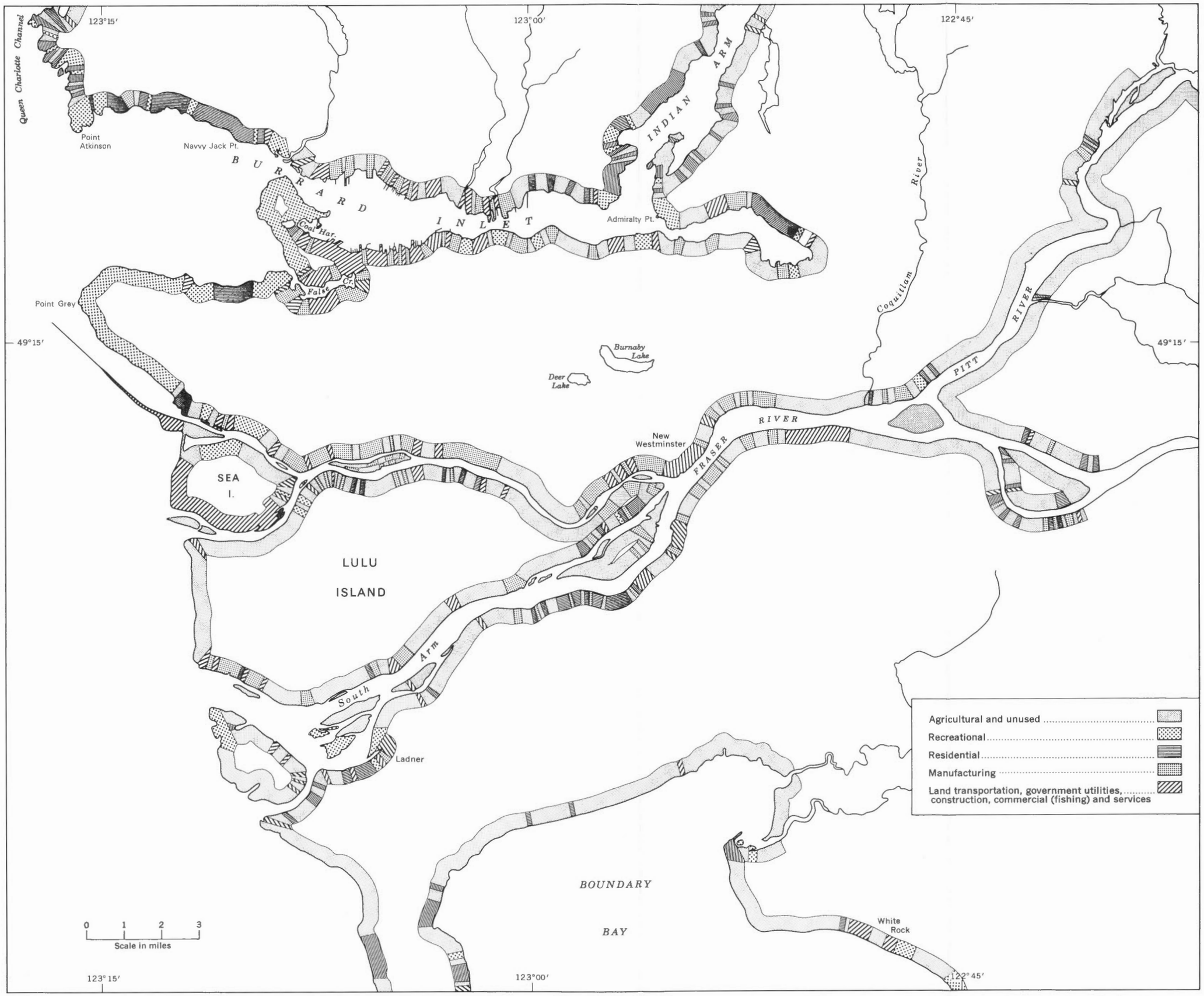


Figure 7. Location and extent of land-use categories, Vancouver area waterfront.

Table 1

METROPOLITAN VANCOUVER WATERFRONT LAND USES SUMMARIZED BY DISTRICT

For each district figures in the first line indicate waterfront footage, figures in second line indicate percentages calculated by districts (underlined) and by land use (in italics)

District	*Agricultural & Unused*	*Recreational*	*Residential*	*Gov't., Utilities & Land Transportation*	*Commercial Service, Retail & Parking*	*Net lofts & Fishboat Mooring*	*Marinas & Marine Service Stations*	*Wholesale & Storage*	*Towing, Dredging & Construction*	*Manufacturing*	*Shipping Terminals*	*Total*
West Vancouver-First Narrows	20,610 1.9 *22.0*	23,505 12.6 *25.1*	42,990 29.9 *45.9*	1,450 1.4 *1.5*			4,480 29.3 *4.8*			630 0.5 *0.7*		93,665 (17.7 miles) 5.3
First Narrows-Second Narrows	12,500 1.2 *16.1*	16,050 8.6 *20.7*	400 0.3 *0.5*	2,940 2.8 *3.8*	920 11.2 *1.2*	390 1.6 *0.5*	1,020 6.7 *1.3*	360 3.8 *0.5*	2,960 21.8 *3.8*	16,380 12.2 *21.1*	23,650 54.8 *30.5*	77,570 (14.7 miles) 4.4
Second Narrows-Port Moody	49,220 4.6 *48.1*	21,030 11.3 *20.5*	9,110 6.3 *8.9*	3,700 3.5 *3.6*		40 0.2 *0.04*	200 1.3 *0.2*		1,460 10.8 *1.4*	4,560 3.4 *4.4*	13,070 30.3 *12.8*	102,390 (19.4 miles) 5.8
Indian Arm	158,750 14.9 *82.1*	2,200 1.2 *1.1*	29,390 20.4 *15.2*	900 0.8 *0.5*	1,300 15.9 *0.7*		750 4.9 *0.4*					193,290 (36.6 miles) 11.1
False Creek	910 0.08 *3.8*			3,880 3.7 *16.2*	480 5.9 *2.0*	1,000 4.2 *4.2*	70 0.4 *0.3*	5,940 62.1 *24.8*	2,200 16.2 *9.2*	9,460 7.0 *39.5*		23,940 (4.5 miles) 1.4
Point Grey-First Narrows		44,300 23.8 *82.0*	6,570 4.6 *12.1*	1,930 1.8 *3.6*			1,230 8.0 *2.3*					54.030 (10.2 miles) 3.2
Fraser River North Arm	152,980 14.4 *46.2*	31,207 16.8 *9.4*	5,368 3.7 *1.6*	68,420 64.6 *20.7*	750 9.1 *0.2*	8,175 34.2 *2.5*	2,822 18.5 *0.8*	740 7.7 *0.2*	6,052 44.6 *1.8*	54,211 40.4 *16.4*		330,725 (62.6 miles) 18.9
Fraser River South Arm	273,495 25.6 *71.4*	41,400 22.3 *10.8*	21,820 15.2 *5.7*	6,640 6.3 *1.7*	50 0.6 *0.01*	12,580 52.6 *3.3*	2,120 13.9 *0.5*	1,450 15.1 *0.4*	100 0.7 *0.03*	21,855 16.3 *5.7*	1,500 3.5 *0.4*	383,010 (72.5 miles) 21.9
N.Westminster-Barnston Island	136,900 12.8 *71.8*		6,665 4.6 *3.5*	14,850 14.0 *7.8*	150 1.8 *0.08*	1,455 6.1 *0.8*	440 2.9 *0.2*	1,080 11.3 *0.6*	580 4.3 *0.3*	23,570 17.6 *12.4*	4,920 11.4 *2.6*	190,610 (36.1 miles) 10.9
Pitt River	120,910 11.3 *94.1*		1,750 1.2 *1.4*	700 0.7 *0.5*		75 0.3 *0.06*	1,430 9.4 *1.1*		200 1.5 *0.1*	3,450 2.6 *2.7*		128,515 (24.3 miles) 7.3
Tsawwassen-Boundary Bay	138,920 13.0 *81.4*	6,000 3.2 *3.5*	19,635 13.7 *11.5*	540 0.5 *0.3*	4,540 55.4 *2.7*	200 0.8 *0.1*	700 4.6 *0.4*					170,535 (32.3 miles) 9.8
Total	1,065,195 (201.7 miles) *60.8*	185,692 (35.2 miles) *10.6*	143,698 (27.2 miles) *8.2*	105,950 (20.1 miles) *6.1*	8,190 (1.5 miles) *1.5*	23,915 (4.5 miles) *1.4*	15,262 (2.9 miles) *0.9*	9,570 (1.8 miles) *0.5*	13,552 (2.6 miles) *0.8*	134,116 (25.4 miles) *7.7*	43,140 (8.2 miles) *2.5*	1,748,280 (331.1 miles) 100%

Table 2

METROPOLITAN VANCOUVER WATERFRONT LAND USE --DETAILS OF SELECTED USES BY DISTRICT

For each district figures in the first line indicate waterfront footage, figures in second line indicate percentages calculated by districts (underlined) and by land use (in italics)

	RESIDENTIAL					*MARINA, YACHT CLUB AND MARINE SERVICE STATION*		
District	*Single family detached*	*Single family detached with fishing shed*	*Apartment*	*Summer cottage*	*Total*	*Marina & Yacht club*	*Marine service station*	*Total*
West Vancouver-First Narrows	41,410 43.5 *96.3*		830 61.5 *1.9*	750 3.6 *1.7*	42,990 29.9	4,480 34.4 *100.0*		4,480 29.4
First Narrows - Second Narrows			400 29.6 *100.0*		400 0.3	1,020 7.8 *100.0*		1,020 6.7
Second Narrows-Port Moody	8,310 8.7 *91.2*	800 3.0 *8.8*			9,110 6.3	200 1.5 *100.0*		200 1.3
Indian Arm	14,270 15.0 *48.6*			15,120 72.3 *51.4*	29,390 20.4	750 5.8 *100.0*		750 4.9
False Creek						70 0.5 *100.0*		70 0.4
Point Grey-First Narrows	6,450 6.8 *98.1*		120 8.9 *1.9*		6,570 4.6	1,230 9.4 *100.0*		1,230 8.0
Fraser River North Arm	5,368 5.6 *100.0*				5,368 3.7	2,362 18.1 *83.7*	460 20.4 *16.3*	2,822 18.5
Fraser River South Arm	945 1.0 *4.3*	20,875 79.2 *95.7*			21,820 15.3	770 5.9 *36.3*	1,350 60.0 *63.7*	2,120 13.9
N.Westminster-Barnston Island	2,145 2.2 *32.2*	4,270 16.2 *64.1*		250 1.2 *3.7*	6,665 4.6		440 19.6 *100.0*	440 2.9
Pitt River	1,000 1.0 *57.1*	400 1.5 *22.8*		350 1.7 *10.1*	1,750 1.2	1,430 11.0 *100.0*		1,430 9.4
Tsawwassen-Boundary Bay	15,203 16.0 *77.4*			4,432 21.2 *22.6*	19,635 13.7	700 5.4 *100.0*		700 4.6
Total	95,101 (18.0) *66.3*	26,345 (5.0) *18.3*	1,350 (0.25) *0.9*	20,902 (3.95) *14.5*	143,698 (27.2) *100%*	13,012 (2.5) *85.2*	2,250 (0.4) *14.8*	15,262 (2.9) 100%

Table 3

METROPOLITAN VANCOUVER WATERFRONT LAND USE - DETAILS OF SELECTED USES BY DISTRICT

For each district figures in the first line indicate waterfront footage, figures in second line indicate percentages calculated by districts (underlined) and by land use (in italics).

	GOVERNMENT, UTILITIES & LAND TRANSPORTATION			*SHIPPING TERMINALS*			
District	*Government*	*Utilities & Land Transportation*	*Total*	*General Cargo & Specialized*	*Grain Elevator*	*Petroleum*	*Total*
West Vancouver-First Narrows	750 6.4 *51.7*	700 0.7 *48.3*	1,450 1.4				
First Narrows-Second Narrows	2,940 25.3 *100.0*		2,940 2.8	15,970 70.4 *67.5*	7,040 82.4 *29.8*	640 5.4 *2.7*	23,650 54.8
Second Narrows-Port Moody		3,700 3.9 *100.0*	3,700 3.5	1,800 7.0 *13.8*		11,270 94.6 *86.2* (connected with refinery-8,800)	13,070 30.3
Indian Arm		900 0.9 *100.01*	900 0.8				
False Creek	490 4.2 *12.6*	3,390 3.6 *87.4*	3,880 3.7				
Point Grey-First Narrows	1,930 16.6 *100.0*		1,930 1.8				
North Arm Fraser River	2,950 25.4 *4.3*	65,470 69.4 *95.7*	68,420 64.6				
South Arm Fraser River	1,730 14.9 *26.1*	4,910 5.2 *73.9*	6,640 6.3		1,500 17.6 *100.0*		1,500 3.5
New Westminster-Barnston Island	480 4.1 *3.2*	14,370 15.2 *96.8*	14,850 14.0	4,920 21.7 *100.0*			4,920 11.4
Pitt River		700 0.7 *100.0*	700 0.7				
Tsawwassen-Boundary Bay	340 2.9 *63.0*	200 0.2 *37.0*	540 0.5				
Total	11,610 (2.2 miles) *11.0*	94,340 (17.9 miles) *89.0*	105,950 (20.1 miles) *100%*	22,690 (4.3 miles) *52.6*	8,540 (1.6 miles) *19.8*	11,910 (2.2 miles) *27.6*	43,140 (8.2 miles) *100.%*

Table 4

METROPOLITAN VANCOUVER WATERFRONT LAND USE - DETAILS OF SELECTED USES BY DISTRICT

For each district figures in the first line indicate waterfront footage, figures in second line indicate percentages calculated by districts (underlined) and by land use (in italics).

	MANUFACTURING								*TOWING, DREDGING, PILE DRIVING & CONSTRUCTION*		
District	*Sawmills & other log converters*	*Wood & paper products*	*Building materials*	*Shipyards & boatworks*	*Metal products & machine shops*	*Chemicals & plastics*	*Food products*	*Total*	*Towing, dredging, & pile-driving*	*Construction*	*Total*
West Vancouver-First Narrows							630 4.4 *100.0*	630 0.5			
First Narrows-Second Narrows	3,900 6.0 *24.0*		3,440 14.7 *21.0*	4,160 42.6 *25.5*	750 9.3 *4.6*	280 4.5 *1.7*	3,850 26.7 *23.5*	16,380 12.2	2,740 25.3 *92.6*	220 8.1 *7.4*	2,960 21.8
Second Narrows-Port Moody	2,370 3.7 *52.0*			380 3.9 *8.3*		1,810 29.0 *39.7*		4,560 3.4	650 6.0 *44.5*	810 29.8 *55.5*	1,460 10.8
Indian Arm											
False Creek	3,270 5.0 *34.6*	600 7.9 *6.3*	1,910 8.2 *20.2*	580 5.9 *6.1*	2,600 32.3 *27.5*	500 8.0 *5.3*		9,460 7.0	1,110 10.2 *50.5*	1,090 40.1 *49.5*	2,200 16.2
Point Grey-First Narrows											
North Arm Fraser River	32,641 50.4 *60.2*	4,850 63.8 *8.9*	7,785 33.3 *14.4*	1,995 20.4 *3.7*	3,390 42.2 *6.2*	2,130 34.1 *3.9*	1,420 9.8 *2.6*	54,211 40.4	5,452 50.3 *90.1*	600 22.0 *9.9*	6,052 44.6
South Arm Fraser River	5,065 7.8 *23.2*	2,150 28.3 *9.8*	3,000 12.8 *13.7*	1,885 19.3 *8.6*	1,145 14.2 *5.2*	1,300 20.8 *5.9*	7,310 50.7 *33.4*	21,855 16.3	100 0.9 *100.0*		100 0.7
New Westminster-Barnston Island	15,610 24.1 *66.2*		5,820 24.9 *24.7*	560 5.7 *2.4*	150 1.9 *0.6*	230 3.7 *1.0*	1,200 8.3 *5.1*	23,570 17.6	580 5.3 *100.0*		580 4.3
Pitt River	1,850 2.8 *53.6*		1,400 6.0 *40.6*	200 2.0 *5.8*				3,450 2.6	200 1.8 *100.0*		200 1.5
Tsawwassen-Boundary Bay											
Total	64,706	7,600	23,355	9,760	8,035	6,250	14,410	134,116	10,832	2,720	13,552
miles	(12.2)	(1.4)	(4.4)	(1.8)	(1.5)	(1.2)	(2.7)	(25.4)	(2.0)	(0.5)	(2.6)
	48.2	*5.7*	*17.4*	*7.3*	*6.0*	*4.7*	*10.7*	*100.0*	*80.0*	*20.0*	*100.0*

Recreational land

Waterfront recreational land,including parks and golf courses,is strongly concentrated in the peninsular area of Vancouver City and Point Grey. The greater part of the shoreline from the mouth of North Arm around Point Grey to the Coal Harbour boundary of Stanley Park is open to the public as recreational land. The Point Grey and Stanley Park sections are wooded and between these extremities are long stretches of sandy beach suitable for swimming (Figure 8). In contrast to many other coastal cities, Vancouver seems to have resisted the temptation to develop this waterfront land for residential or

Figure 8. Beach on English Bay, 1962. The city's ever-increasing population intensifies the need for more such recreational areas. (Photo: courtesy *National Film Board* (T. Grant) No. 64-8274).

commercial purposes. Elsewhere in Burrard Inlet and along the Howe Sound coast are smaller marine parks, some of which offer salt water swimming, such as New Brighton and Cates, while others offer natural wooded terrain, such as Point Atkinson and Admiralty Point. Waterfront parks are few and far between in the river districts, but there are several waterfowl reserves on the islands of South Arm near Ladner. The muddy Fraser is not nearly so attractive for swimming as is the clear ocean. On Boundary Bay a few small but very popular beach parks have been developed, and some stretches of beach that are not constituted as public parks, near White Rock for instance, are used for swimming. In general it appears that the dedication of waterfront land to recreation and public open space in suburban areas has not kept pace with the growth of population outside of Vancouver City.

Residential land

Several distinct types of residential occupancy account for 27 miles of the total shoreline land use (Tables 1 and 2). Single family detached housing of good quality is characteristic along Burrard Inlet, except in the upper part of Indian Arm where summer cottages are numerous. In West Vancouver near Navvy Jack Point some high-rise apartments have been built on waterfront sites formerly occupied by single family dwellings. In contrast, a shoreline strip of public open space has been retained in Vancouver's West End apartment district (Figure 9). Residential use along the Fraser River is chiefly in the form of single detached dwellings, but most of the houses have small fishing sheds or net lofts at the water's edge. The owners are usually fishermen who moor their boats behind their homes. The quality of residence in this area is poor, the houses and sheds often being dilapidated or unpainted and the yards poorly maintained. Generally, residential use cannot compete with industry or transportation uses for waterfront sites in the heart of a port area. In peripheral areas, however, open space for public recreational use is frequently taken over for residential development.

Land used for government, utilities and land transportation requirements

These categories account for more than 28 miles of shoreline (Tables 1 and 3). Vancouver International Airport pre-empts most of the coast of Sea

Figure 9. West End Vancouver skyline of high-rise apartments against the mountain background as seen from English Bay. (Photo: courtesy *National Film Board* (T. Grant) No. 66-7837).

Island and several railway marshalling yards occupy lengthy frontages on the Fraser River and False Creek. The waterfront location of these yards was unnecessary but was convenient because the grades were suitable and the railway pattern of the region tended to follow coastlines and river banks. Electric power, natural gas, sewage and water supply installations occupy waterfront sites at crossings or other key points in the service networks. Various government installations such as the Federal Fisheries Station are also situated along the coast. Shipping terminals are concentrated in the

heart of the Vancouver and New Westminster port areas, particularly on the south side of First Narrows-Second Narrows district, but shipping terminals do not represent all the port facilities because wharves or berths that are part of a manufacturing enterprise have been mapped under the appropriate manufacturing category.

Land used for commercial, service and construction requirements

Although they occupy relatively limited stretches of waterfront land a number of the commercial, service and construction uses are of considerable economic importance to the region. Commercial fishermen are served by company fishing stations, government fishermen's terminals, and small public or private wharves and floats. Small net lofts or storage sheds are found almost everywhere in the area and the larger terminals offer boat repair and warehouse facilities. The great majority of fishing boats are moored and serviced in the North Arm and South Arm areas of the Fraser River, stretches which offer the fresh water mooring in well-protected areas desirable for wooden hulls, as well as easy access both to fishing grounds and to the processing plants at Steveston. The quality of use varies from the few neat, well-maintained terminals to the many cluttered, decaying establishments. Marinas have become numerous in recent years, owing to the great popularity of boating (Tables 1 and 2), and tend to be situated in the western part of the region most accessible to the Gulf Islands cruising grounds in the Strait of Georgia. The typical marina is a commercial enterprise offering mooring floats and shelters, marine gas and oil, provisions, minor repair services, and car parking lots. Some of the more elaborate complexes include motorboat sales offices and restaurants. Yacht clubs have similar boat mooring facilities but place less emphasis upon the ancillary commercial establishments. Marine service stations are connected with marinas except in the Fraser River districts where fishing boats and other commercial vessels are numerous. Both fishing and pleasure craft create a great deal of traffic in the harbour entrances, but this has not yet reached the stage of serious congestion, even at peak periods. Several motels, hotels, and restaurants have waterfront locations, and two of the eight restaurants are actually housed on remodelled old vessels still afloat.

Over 60 per cent of the wholesale and storage frontage is at False Creek where this function is gaining in importance at the expense of manufacturing. The area has the advantage of a central location, well served by rail and street networks, where rental values are not excessively high. Most establishments here depend chiefly on truck and rail transport, use of the waterfront for shipping being incidental.

The towing, dredging and pile-driving industry (Tables 1 and 4) is centred mainly in the North Arm and Vancouver harbours where intensive port and manufacturing development generates most of the business. Log towing and handling is the principal activity in North Arm (Figure 10). The relatively few construction companies with waterfront sites occasionally use scows to move sand, gravel and heavy equipment.

Figure 10. Ribbons of log booms water-stored in the Fraser River near New Westminster. (Photo: courtesy *B.C. Department of Travel Industry*, No. 8038)

Land used for manufacturing requirements

This is one of the most important waterfront uses, occupying more than 25 miles of shoreline (Tables 1 and 4). Nearly three-quarters of this frontage is in the Fraser River districts. Here manufacturers find relatively flat, dyked land at moderate price and shipping channels that can handle coastal or medium-sized deep-sea vessels. As these conditions are less attractive to residential and shipping terminal needs, competition for these waterfront sites is minimized. Of the large number of industrial types here represented, relatively few really require waterfront locations although these are the categories, as listed in Table 4, that tend to dominate.

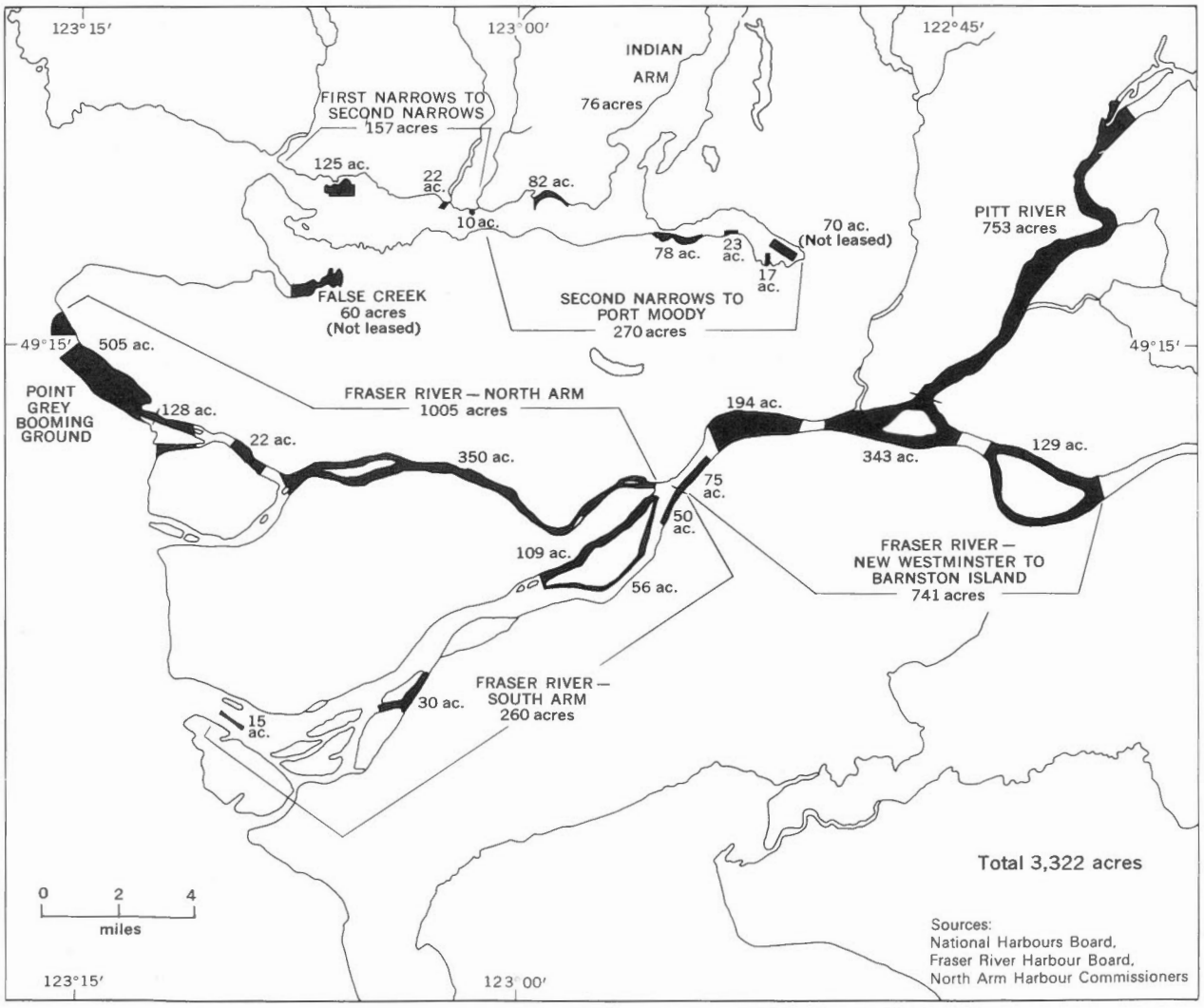


Figure 11. Areas of the Vancouver waterfront used for log storage.

Figure 12. Stretch of the Fraser River near New Westminster showing numerous sawmill installations. (Photo: courtesy *British Columbia Department of Travel Industry*. No. 3216)

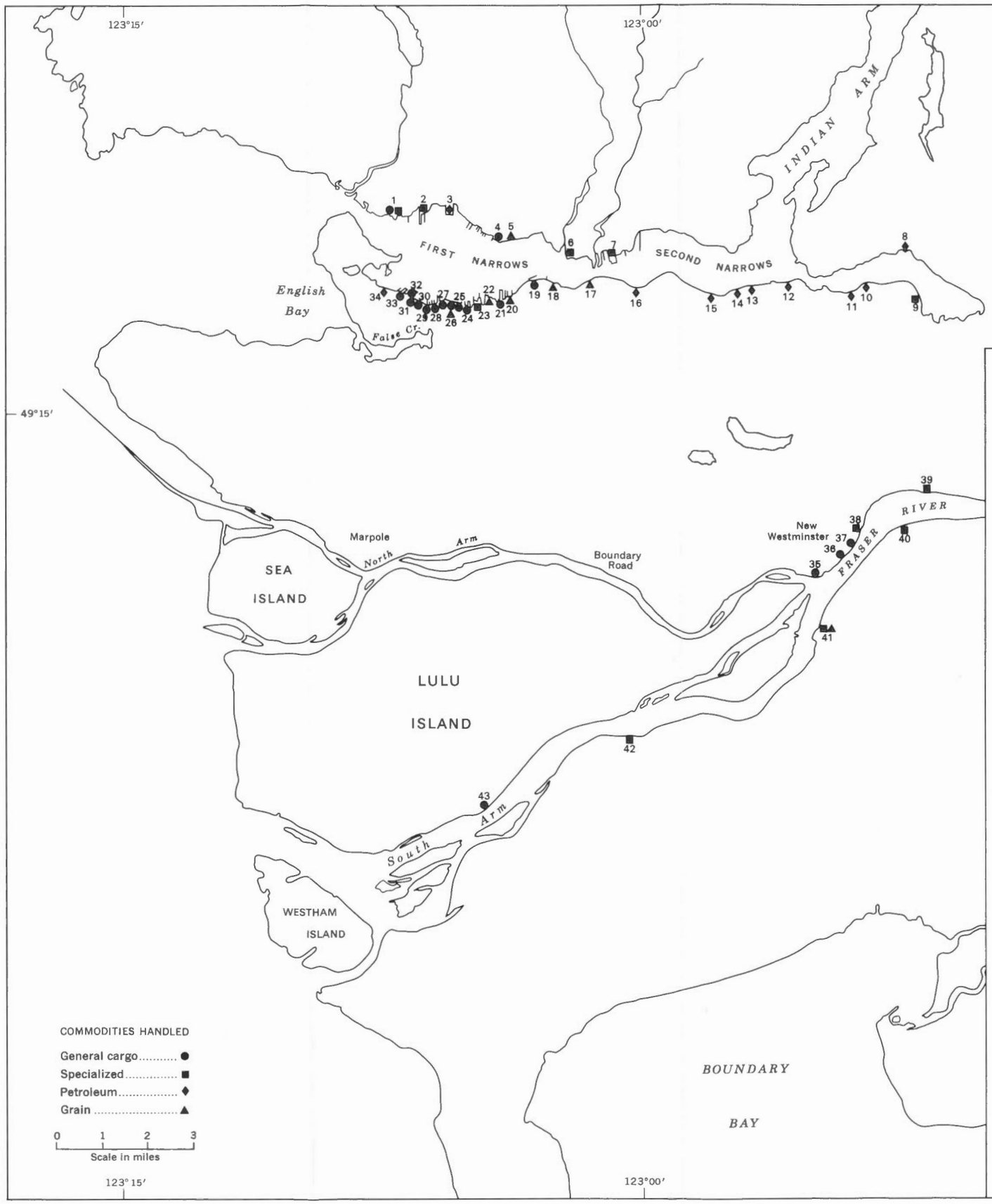
Nearly half of the industrial shoreline is used by log converters and includes sawmills, plywood mills and pole mills. Log transport, storage and handling in water is a practice considered indispensable to the economic operation of log converting industries in the area and is a major use of the water bodies, especially in the river districts (Figure 11). Water depths need not be great to permit log and barge movement by tugboat. The North Arm has the greatest concentration of log converting industries which here occupy 60 per cent of the local industrial waterfront (Figure 12). Logs are stored in narrow booms along both sides of the river channels, normally within the harbour headline, and foreshore areas are leased from the harbour commissioners

for this purpose. Fresh water storage is favoured to protect the logs against marine borer damage. The mills require ample storage space in order to maintain a working inventory of varied dimensions and species that will carry them through supply interruptions. In the Fraser River area it is customary for the mills to store full inventories upstream from their plant sites before the freshet begins in order to avoid the necessity of towing logs against the current. The Point Grey booming grounds at the mouth of North Arm constitute a spacious storage area where logs from Howe Sound and other coastal collection points can be held and sorted for later movement upstream. Of the river districts only the South Arm is relatively unimportant for log storage, mainly because as yet few mills are situated in this area.

Among other manufacturing industries building materials and food products rank next in importance to log converters in terms of shoreline frontage occupied. Building materials plants, situated mostly in river districts, utilize tug and barge transport to move sand, gravel and some of their heavy finished products. Fish processing plants make up the bulk of the food products group. The Steveston waterfront boasts the greatest concentration of fish plants, mainly salmon canneries, because this location is most accessible to the fishing grounds and the industry thus gains efficiency through centralization of production facilities.

Shipyards and boatworks range in size from Burrard Dry Dock Company, the major shipbuilder, through medium-sized yards building steel or wooden vessels, to small boatworks producing pleasure craft and fishing boats. The First Narrows-Second Narrows district, the centre of shipping activity, has the greatest number and variety of shipyards, most of which engage in considerable repair work in addition to their shipbuilding. Locally-owned fleets of tug boats, barges and fishing boats, as well as larger vessels, contribute greatly to this maintenance business. In fact, some of the fishing, towing and manufacturing companies own and operate their own shipyards. Machine shops frequently are situated near shipyards or boatworks and specialize in marine engines and equipment.

With the exception of the chemical plants, most of the other industry groups represented by waterfront sites (*see* Table 4) do not use water transport in handling raw materials or finished products and could apparently



DEEP SEA BERTHING-ACCOMMODATION

Piers	No. of Berths	Berthing Length	Low water Depth	Commodities Handled
1. Vancouver Wharves	4	2430′	35′	general cargo, potash, phosphate rock, lumber, wood chips, ore concentrates, sulphur.
2. Domtar Chemicals-Canada Creosoting Div.	1	75′	35′	creosote oils, creosoted railway ties.
3. Home Oil Distributors	1	700′	30′	petroleum.
4. National Harbours Board — West Indies Wharf	2	800′	30′	general cargo, asbestos, ore concentrates.
5. Burrard Terminals	1	500′	35′	grain (cap 1,500,000 bu.)
6. Lynn Terminals	3	2000′	30′	lumber, general cargo.
7. Hooker Chemical Wharf	1	500′	35′	rock salt, chemicals.
8. Imperial Oil Company	1	700′	30′	petroleum.
9. Pacific Coast Bulk Terminals	2	1350′	35′	coal, sulphur, wood chips, ore concentrates.
10. British American Oil Dock (Barnet-eastern)	1	140′		petroleum.
11. British American Oil Dock (Barnet-western)	1	193′		petroleum.
12. Texaco Canada	1	350′	30′	petroleum.
13. Trans Mountain Oil Pipeline Company, No. 2 Terminal	1	300′	40′	petroleum.
14. Trans Mountain Oil Pipeline Company, Westridge Terminal	1	150′	45′	petroleum.
15. Shell Oil Company	1	400′	41′	petroleum.
16. Standard Oil of British Columbia	1	400′	40′	petroleum.
17. Alberta Wheat Pool-Terminal Elevator	2	1450′	35′ w. end 30′ e. end	grain (cap. 7,150,000 bu.)
18. National Harbours Board No. 4 Elevator (Alberta Pacific Grain Co.)	1	560′	35′	grain (cap. 600,000 bu.)
19. Terminal Dock and Warehouse Company	4	1559′	32′	general cargo, lumber, flour.
20. National Harbours Board Grain	2	1365′	35′w. end	grain (cap. 4,824,500 bu.)
Jetty No. 1, (Alberta Pacific Grain & Pacific Elevators			28′ e. end	general cargo.
21. National Harbours Board Lapointe Pier	4	2224′	35′	general cargo, grain, fish and animal oils.
22. National Harbours Board Grain Jetty No. 3, (United Grain Growers)	2	1000′	30′	grain (cap. 3,764,000 bu.)
23. British Columbia Sugar Refinery Dock	1	425′	30′	sugar, general cargo.
24. British Columbia Packers Dock	1	670′	28′	general cargo, lumber.
25. Great Northern Railway Dock	1	465′	30′	general cargo, newsprint.
26. National Harbours Board — Ballantyne Pier & No. 2 Elevator (Saskatchewan Wheat Pool)	4	2269′	35′-40′	general cargo, grain (cap. 1,650,000 bu.)
27. National Harbours Board — Centennial Pier	5	3300′	35′-40′	general cargo, lumber, logs, automobiles.
28. Canadian National Railways Pier	2	1000′	25′-35′	general cargo, pulp.
29. Ocean Wharves	2	1100′	30′-38′	general cargo, pulp.
30. Canadian Pacific Railway Pier "H"	1	650′	21′-41′	general cargo, salt.
31. Canadian Pacific Railway Quay Wharf	2	1305′	20′-30′	general cargo, lumber, logs.
32. Canadian Pacific Railway Pier "B-C"	2	1050′	30′-36′	general cargo, passengers (Pacific & Orient Lines)
33. Canadian Pacific Railway Pier "A"	2	1504′	30′	general cargo, lumber.
34. British American Oil Company	1	300′	40′	petroleum.
35. Pacific Coast Terminals	4	2160′	30′	general cargo, lumber, lead, zinc, fertilizers.
36. Pacific Coast Terminals	1	500′	30′	general cargo.
37. Overseas Transport Company Dock No. 4	1	500′	34′	general cargo.
38. Overseas Transport Company Docks 5, 6 & 7	3	1560′	60′	general, lumber.
39. Crown Zellerbach Building Materials	2	1300′	30′	lumber, general cargo.
40. Domtar Construction Materials	1	610′	27′	gypsum, creosote oil, lime.
41. Fraser Surrey Docks (Pacific Elevators)	2	1139′	30′	lumber, wood chips, grain (cap. 750,000 bu.), general cargo.
42. Dow Chemical of Canada	1	450′	35′	chemicals.
43. Canada Rice Mills	1	400′	30′	general cargo, food products.

Sources: National Harbours Board
Fraser River Harbour Board

Figure 13. Vancouver deep-sea berthing accommodation for various categories of commodities.

operate as satisfactorily on inland sites, all other factors of industrial location being equal. Some prefer shoreline locations in order to have the option of using water transport if it ever becomes necessary or desirable, while others merely consider waterfront sites as good investments.

Of the 63.4 miles of waterfront land not included in the agricultural and unused, recreational or residential categories,about 90 per cent actually is used for shipping purposes (Table 5). Intensity and quality of use vary greatly, from large,modern shipping terminals almost constantly busy to small manufacturing or commercial establishments where scow slips may be used only occasionally. As shown in Figure 13 those sections used most intensively for shipping are the First Narrows-Second Narrows reach, particularly along the south shore (Figures 14 and 14a),the New Westminster waterfront,and the north side of North

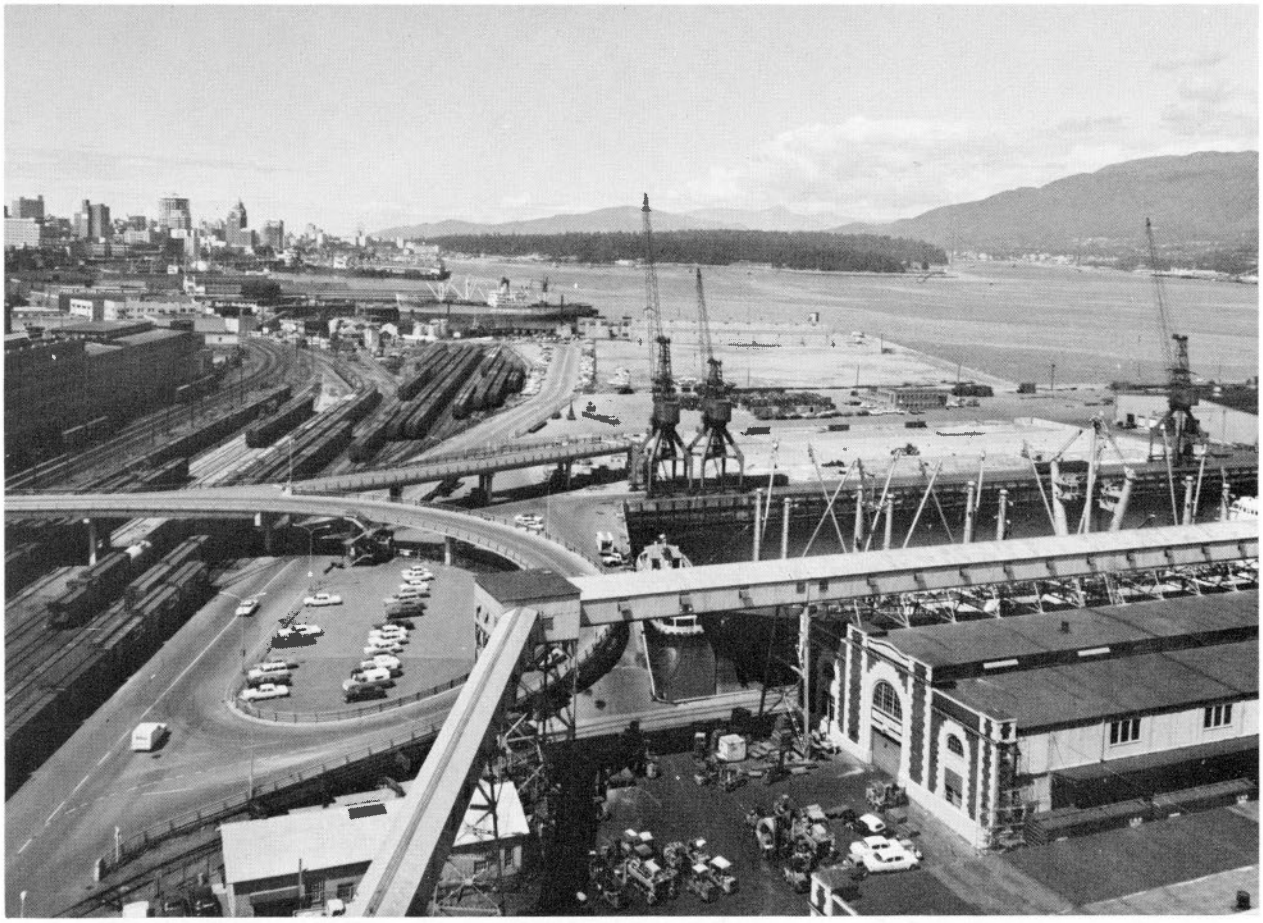


Figure 14. Vancouver Harbour, showing Ballantyne and Centennial piers. Grain conveyor gallery in foreground connects National Harbours Board No.2 Elevator to Ballantyne Pier loading facilities.(Photo: courtesy *B.C. Dept. of Travel Industry*. No. 9327).

Table 5

SHORELINE USE FOR SHIPPING PURPOSES

For each district figures in the first line indicate waterfront footage, figures in second line indicate percentages calculated by districts (underlined) and by shipping use or non-use (italics)

MANUFACTURING, TERMINAL, COMMERCIAL AND GOVERNMENT USES
(all uses except parks and golf courses, residential, agricultural and unused)

Industrial and Commercial Districts	*Deep sea shipping (use)*		*Coastal shipping (use)*		*Waterfront for shipping (non-use)*		*Total*
First Narrows-		21,560		26,120		940	48,620 (9.2 miles)
Second Narrows	47.7	*44.3*	10.2	*53.7*	2.7	*2.0*	14.5
Second Narrows-		11,370		8,590		3,070	23,030 (4.4 miles)
Port Moody	25.2	*49.4*	3.3	*37.3*	9.0	*13.3*	6.9
False Creek				17,240		5,790	23,030 (4.4 miles)
			6.7	*74.8*	16.9	*25.2*	6.9
Fraser River				129,350		11,820	141,170(26.7 miles)
North Arm			50.6	*91.6*	34.5	*8.4*	42.1
Fraser River		2,550		40,565		3,180	46,295 (8.8 miles)
South Arm	5.6	*5.5*	15.9	*87.6*	9.3	*6.9*	13.8
N.Westminster-		9,670		27,935		9,440	47,045 (8.9 miles)
Barnston Island	21.4	*20.5*	10.9	*59.4*	27.6	*20.1*	14.0
Pitt River				5,885			5,885 (1.1 miles)
			2.3	*100.0*			1.7
Total		45,150		255,655		34,240	335,045
	(8.5 miles)		(48.4 miles)		(6.5 miles)		(63.4 miles)
		13.5		*76.3*		*10.2*	*100%*

Arm from Marpole to Boundary Road, the Vancouver-Burnaby boundary. The quality of use is highly variable even within any one district, making generalization very difficult. High quality new wharves and structures often are flanked by decaying or poor quality facilities and this is true in the case of both shipping terminals and manufacturer's wharves. A few new shipping terminals have been built during recent years, including Centennial Pier (No. 27) and Vancouver Wharves (No. 1), but most of the port facilities are relatively old.

The greater part of the shoreline used for activities connected with shipping is oriented to coastal movement rather than to deep-sea. While First Narrows-Second Narrows has half of the developed deep-sea frontage, North Arm has half of the coastal. The percentage of waterfront land occupiers who do

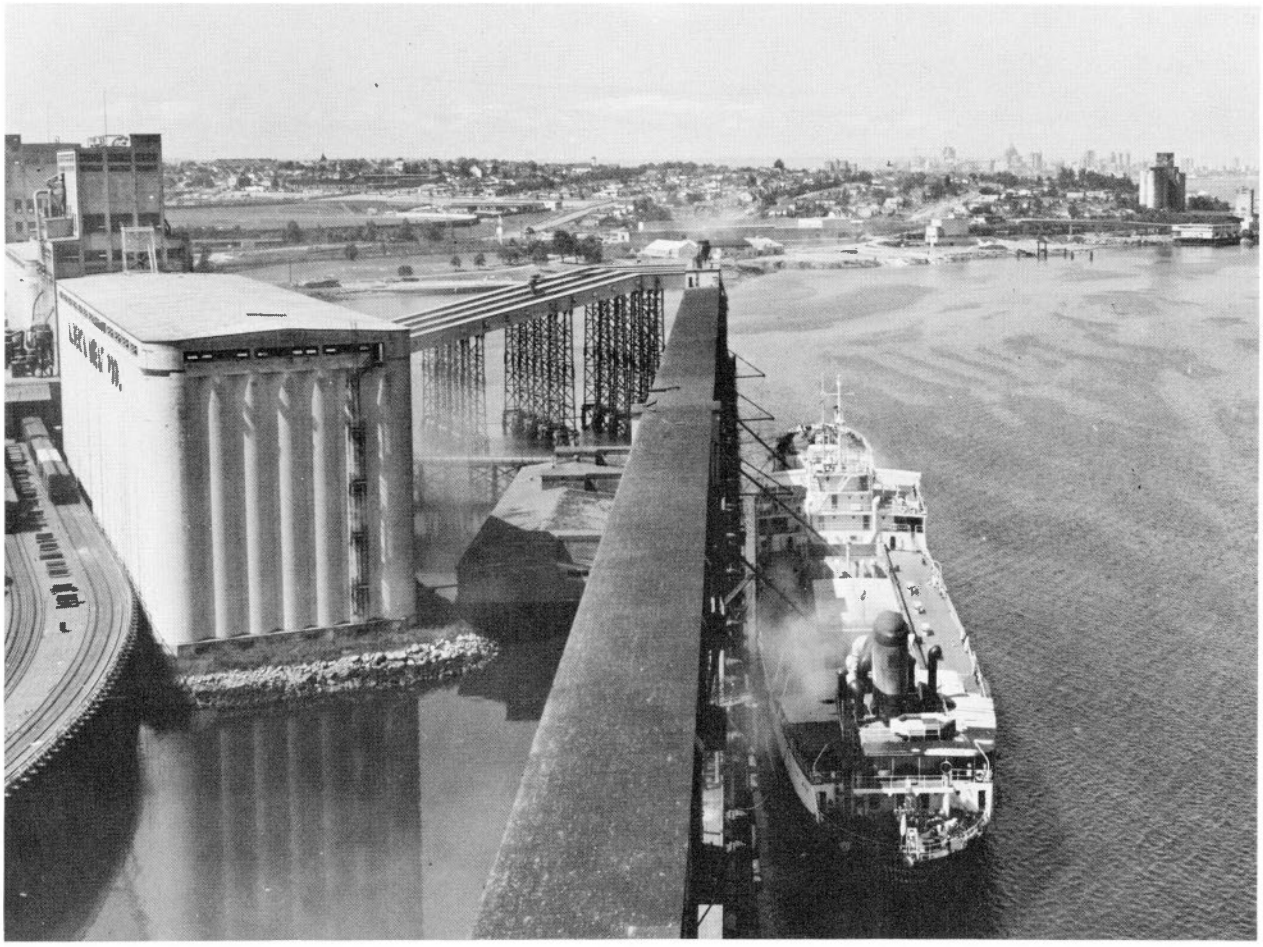


Figure 14a. Grain loading at Alberta Wheat Pool elevator, Vancouver. Note the disparity in shoreline docking facilities. (Photo: courtesy *B.C. Dept. of Travel Industry*. No. 9325).

not use their frontage for shipping is highest in False Creek, 25 per cent,and lowest in the First Narrows-Second Narrows section, 2 per cent. Furthermore, the intensity of use is far lower in False Creek than in Vancouver Harbour. South Arm and North Arm are next lowest in percentage of non-shipping users, South Arm specializing in fish processing and North Arm in log converting, both of them water-oriented industries. Ideally, the occupiers of waterfront land should either make use of the shipping potential or locate their industry elsewhere, releasing the sites to those who can use them more fully.

FUTURE WATERFRONT LAND USE

An attempt to forecast future demand for waterfront land and to suggest best use must be based on a sound evaluation of the economic and social requirements of the whole metropolitan area. It is apparent that metropolitan Vancouver enjoys a commanding position in the trade and industry of British Columbia. A large part of western Canada ships its products of farm, mine and factory to world markets through its port. Within the port hinterland natural resource industries such as potash, copper, molybdenum, and asbestos mines, and pulp and paper mills, to mention but a few of the new developments, are expanding rapidly and the port function is destined to assume increasing significance. Although the first-stage processing of local raw materials, such as logs, fish and dairy products, has long been the bulwark of manufacturing industries, the recent trend is toward greater diversification. With metropolitan and provincial markets expanding rapidly, Vancouver can look forward to steady manufacturing growth in coming years.

It is the rate of growth, therefore, that remains a matter of speculation. The forecast is that in 1981 metropolitan Vancouver will contain nearly as many people as were living in the whole province of British Columbia in 1956 (Table 6). The implication is that the present residential,commercial, industrial, institutional and recreational facilities of the metropolitan area must be virtually doubled during the next fifteen to twenty years. The actual built-up area is not likely to double because increasing intensity of land use will occur. The demand for waterfront land, however, will increase greatly, but redevelopment of inefficiently used frontage will parallel the occupation of shorelines not yet committed to urban use.

Table 6

POPULATION OF METROPOLITAN VANCOUVER AND BRITISH COLUMBIA

	1956	1961	1981 estimate*
Metropolitan Vancouver	665,017	790,165	1,300,000
British Columbia	1,398,464	1,629,082	2,912,000

**Vancouver's Changing Population*, Vancouver Planning Department, Vancouver, June 1964, p. 13.

Among the various waterfront uses requiring port facilities, public recreation and certain types of manufacturing industries should probably be accorded the highest priority. Fortunately, shorelines suited to recreational development are generally undesirable for industrial and shipping uses. Certain commercial uses, such as marinas, marine service stations and resort hotels, are truly water-oriented enterprises, but their space and location requirements are not very demanding. Residential use of the immediate shoreline is not desirable because the unobstructed view of the water from the shoreline routes and the ease of public access to the waterfront are extremely valuable urban assets.

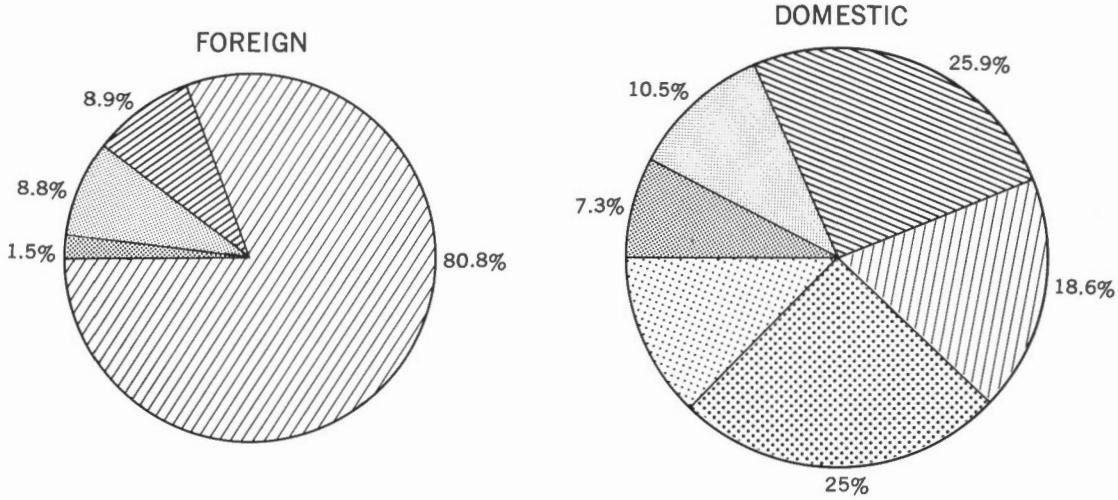
PROBABLE FUTURE WATERFRONT LAND REQUIREMENTS FOR PORT FACILITIES

The future demand for port facilities can only be met by continuing modernization and expansion of existing facilities and construction of new installations. Considerable evidence indicates that Burrard Inlet can accommodate most of the required shipping terminals in the foreseeable future. It offers a spacious, deep harbour inside First Narrows and the entrance can be dredged to provide minimum depths exceeding the present 39 feet. Factors that have a direct bearing on port facilities requirements include the nature and growth of the shipping trade; trends in vessel design, size and equipment; and in cargo storage and handling techniques.

Shipping trade

The total cargo tonnage handled by the three ports of metropolitan Vancouver for which statistics are collected, *i.e.*, Vancouver, New Westminster

and North Arm, is shown in Figure 15. Vancouver shares the foreign trade 90 per cent to 10 per cent with New Westminster and handles nearly half of the domestic cargo tonnage. Foreign trade is remarkably unbalanced with the outward cargo tonnage being about eight times the inward tonnage. Fundamentally, Vancouver is an outlet for heavy bulky commodities such as grain, wood and mineral products, including petroleum, moving from hinterland points in the Prairie Provinces and British Columbia to world markets (Figure 16). It is not an importer to rival



FOREIGN

	Inward	Outward	Total
VANCOUVER	1,193,376	10,839,589	12,032,965
NEW WESTMINSTER	195,171	1,179,879	1,375,050
	1,388,547	12,019,477	13,408,015

DOMESTIC

VANCOUVER	4,518,018	3,242,827	7,760,845
NEW WESTMINSTER	1,277,680	1,832,989	3,110,669
NORTH ARM FRASER RIVER	4,352,207	2,213,443	6,565,650
	10,147,905	7,289,259	17,437,164

Sources: National Harbours Board, Annual Report,
Fraser River Harbour Commissioners, Annual Report,
North Fraser Harbour Commissioners, Annual Report

Figure 15. Summary of cargo tonnage handled in the ports of metropolitan Vancouver, 1964.

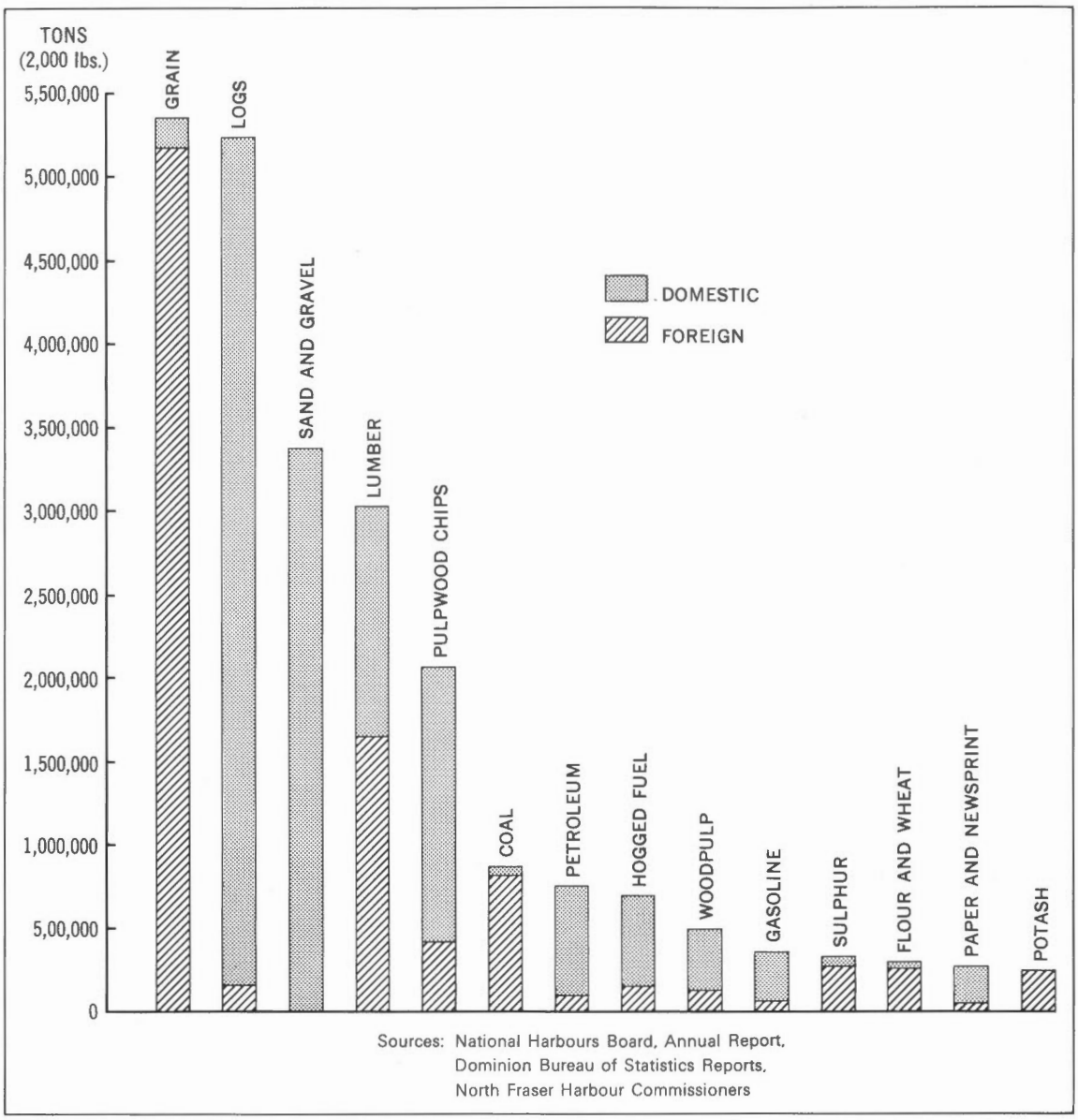
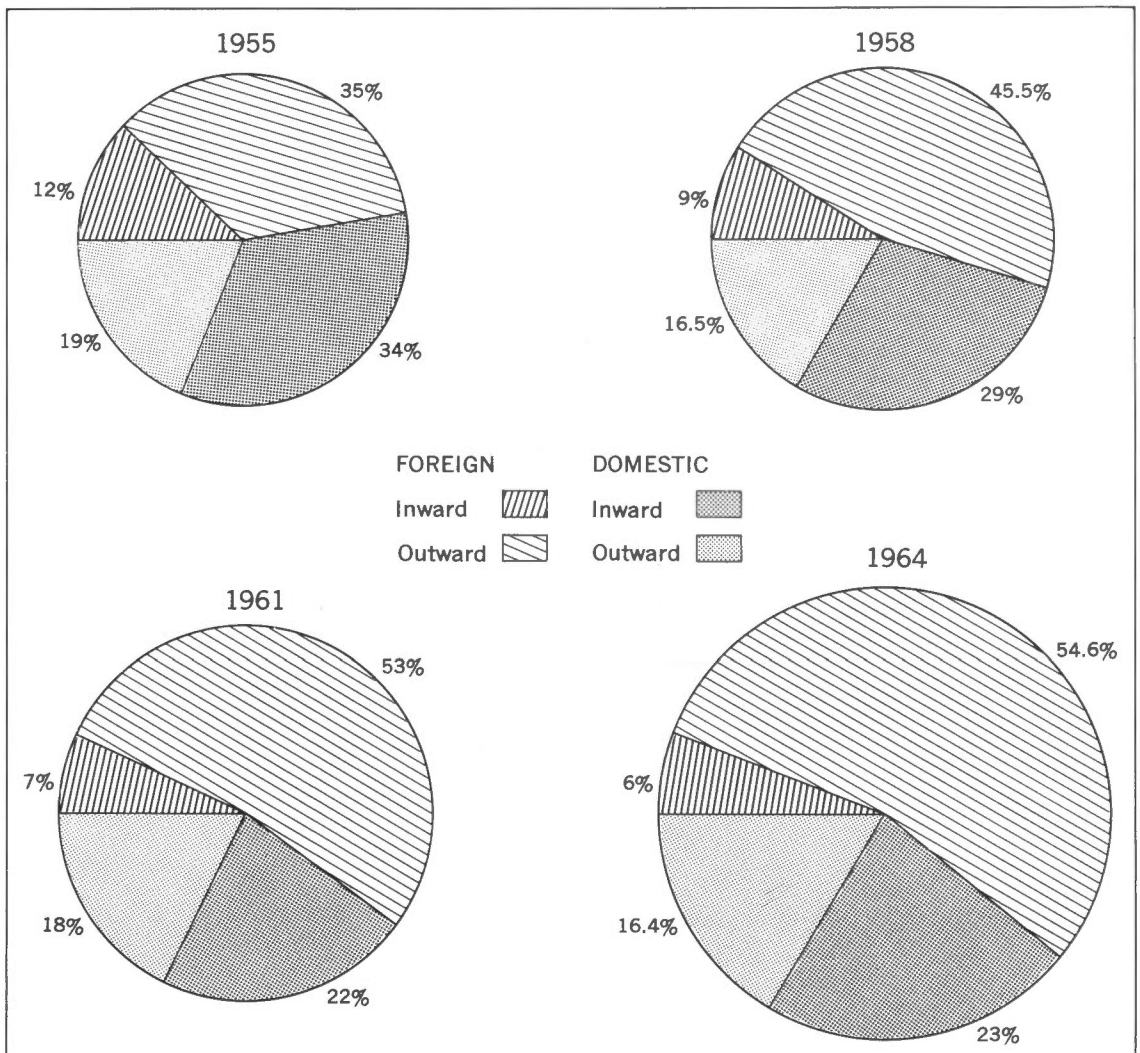


Figure 16. Leading commodities handled in the ports of metropolitan Vancouver, 1963.

eastern ports like Montreal and Halifax, though it surpasses both of these in export tonnage. Canada's imports of general cargo are predominantly manufactured goods from Europe and the major markets are located in eastern Canada. The more balanced domestic trade tonnage of the Vancouver waterfront is dominated by the movement of raw materials, chiefly logs, sand and gravel



	1955			1958		
	Inward	Outward	Total	Inward	Outward	Total
FOREIGN	1,296,580	3,835,817	5,132,397	1,020,507	5,280,253	6,300,760
DOMESTIC	3,821,188	2,031,427	5,852,615	3,388,647	1,940,224	5,328,871
			10,985,012			11,629,631

	1961			1964		
	Inward	Outward	Total	Inward	Outward	Total
FOREIGN	1,018,789	7,411,180	8,429,969	1,193,376	10,839,589	12,032,965
DOMESTIC	3,196,783	2,413,594	5,610,377	4,518,018	3,242,827	7,760,845
			14,040,346			19,793,810

Tons — by weight (2000 lbs.) or by measurement (40 cu. ft.)

Sources: National Harbours Board, Annual Reports

Figure 17. Summary of cargo tonnage (both inward and outward, foreign and domestic) handled in the ports of Metropolitan Vancouver in the years 1955, 1958, 1961 and 1964.

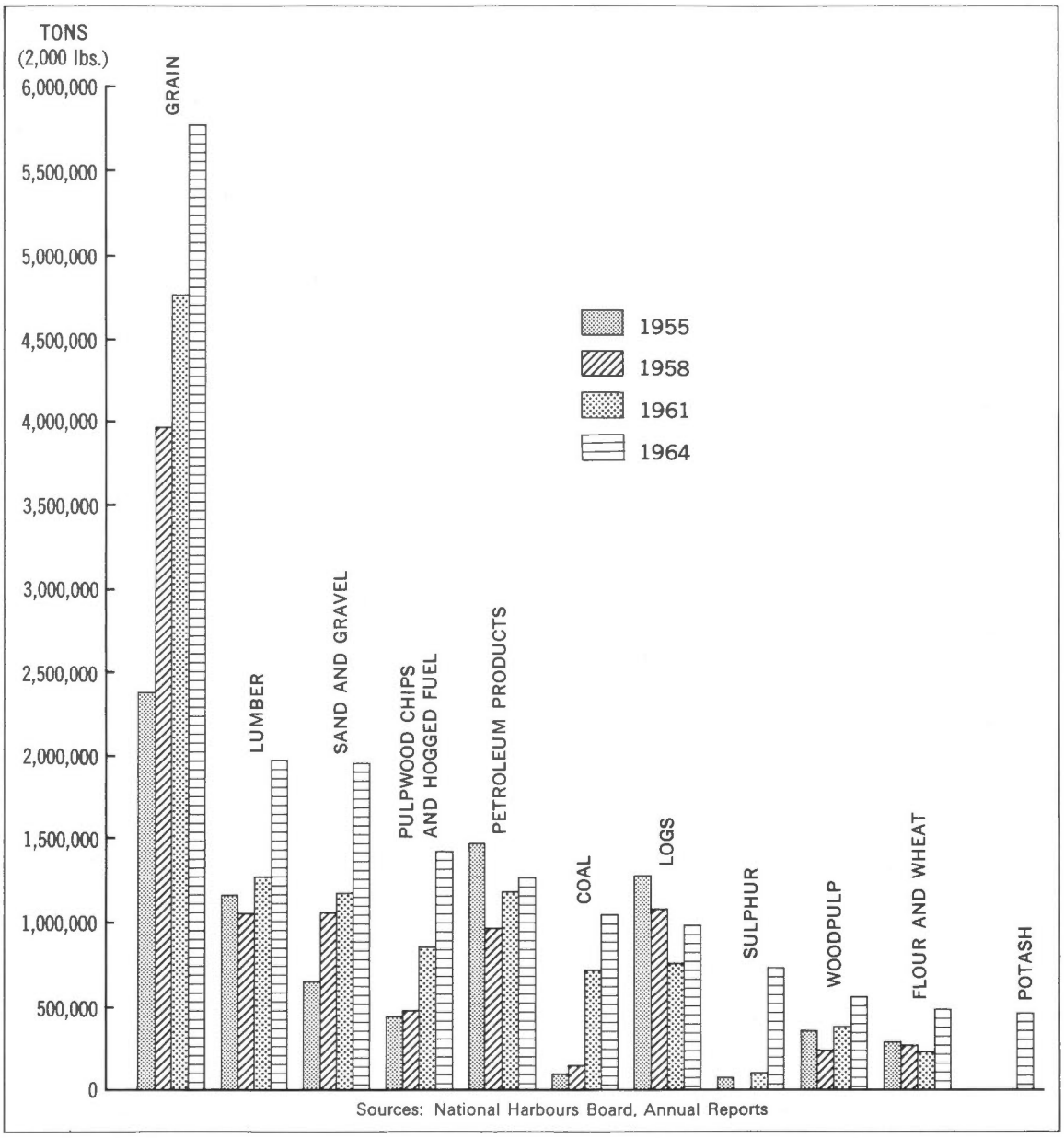


Figure 18. Leading commodities handled in the ports of metropolitan Vancouver during the period 1955 to 1964.

inward and of pulpwood chips,outward. North Arm harbour with its many sawmills is the main destination of the logs and the main source of wood chips. Commodities such as lumber, wood pulp and newsprint paper,manufactured at various coastal points,move coastwise to the Vancouver and New Westminster deep-sea docks for export. As British Columbia's principal refining centre, Vancouver supplies petroleum products to Vancouver Island and the mainland coastal markets.

The shipping trade, particularly the outbound trade, has increased greatly during the past decade and gives promise of continued growth (Figures 17 and 18).

Metropolitan Vancouver has become the principal outlet for Canada's grain, handling 40 per cent of the nation's export in 1964-65 crop year, or more than three times as much as any other Canadian port. The lower ocean freight rate structure introduced in 1958 has been a major factor in causing the export grain divide on the Prairies to shift farther eastward. Prior to 1958 Montreal possessed a cost advantage for shipment of grain from western Saskatchewan to Great Britain, but since that date Vancouver has enjoyed the advantage (Slack, 1964). A return to higher ocean freight rates resulting from a shortage of world shipping capacity, would harm Vancouver's competitive position in the grain trade. On the other hand, the huge wheat sales of recent years to the U.S.S.R., China and Japan have proved the importance of trans-Pacific grain movement relative to the traditional trans-Atlantic pattern. The prospect that densely populated eastern Asia will continue to import large quantities of Canadian grain as long as favourable loan and credit arrangements are available appears certain and this grain will probably be shipped through Vancouver.

The movement of coking coal from the Crows Nest Pass area to steel mills in Japan may double or triple in volume within the next few years, if production and transportation costs can be lowered sufficiently to allow producers to expand their output considerably and so dispense with the present Canadian government subsidy paid on a maximum of 800,000 tons a year from all western mines. Contracts for at least two million tons a year have been offered by Japanese buyers and the possibilities of reducing costs are favourable through possible greater mechanization and lowered rail freight rates. The potash mining boom in Saskatchewan has thrust that province into the forefront of world producers and created a steadily expanding export pattern. A large part of this export movement is handled through Vancouver and promises to expand considerably in the near future. The present principal markets are in Europe, the United States and Japan. Vancouver is situated about as far from central Saskatchewan as is Fort William-Port Arthur, but it has several advantages over the lake ports, particularly for Asian and United States shipments: it is an ice-free port,it possesses specialized potash handling equipment,and it has developed a return cargo trade with east coast United States ports.

Sulphur is another product originating east of the Rockies that may experience an expanding export trend as the rising demand on the world market

has raised the price recently, thus creating favourable conditions for Canadian exports. As a by-product of "sour" natural gas processing in Alberta, sulphur is reasonably abundant, and Vancouver being the port closest to production centres is assured of the sulphur export trade. One of the largest producers, *Shell Canada Limited*, is investigating the possibility of building a pipeline for the transport of sulphur from southern Alberta to the west coast.

A significant export of propane to Japan began in 1966. According to *Industrial Expansion in British Columbia (1965)*, a recent agreement between British American Oil Company and a Japanese firm provides for the export of 28 million barrels during the next ten years.

The tremendous expansion of the pulp and paper industry that is now under way in British Columbia is bound to result in greatly increased exports. Metropolitan Vancouver will be the chief port for shipment of newsprint, kraft and other grades of pulp produced by inland mills. At least six new plants are either already under construction or slated for early construction in the interior of the province.

Inbound cargo volume may be expected to increase more slowly than outbound although a gradual growth of inbound shipments may occur to supply the varied requirements of a steadily expanding population and the industrial need for raw materials. A recent example of increasing raw material demand is the establishment of a regular trade in phosphate rock from Florida that is destined for a fertilizer plant at Fort Saskatchewan, Alberta. At least 100,000 tons a year will be imported via Vancouver and the ships will carry potash to eastern United States ports on their return voyages. Various manufacturing industries in the metropolitan area depend on water-borne supplies of raw materials, notably wood products, building materials, fish processing and chemicals. The chemical industry, which brings in such materials as salt by water, is likely to grow considerably in response to the demand for chemicals by the mushrooming pulp and paper industry.

Vessel design and cargo storage and handling

Deep-sea cargo ships are becoming larger and more automated year by year. Though general cargo vessels still predominate, specialized types such as tankers and bulk carriers are becoming more numerous today. Most of the latter, usually 20,000 tons or over, are considerably larger than general cargo

freighters. The bulk carrier *Argyle*, about 40,000 gross tons, is the largest cargo ship that calls regularly at the port of Vancouver. It carries salt from the west coast of Mexico to the Hooker Chemical plant (Figure 13, wharf No.7) on the north shore east of the Second Narrows Bridge. The record of deep-sea vessel arrivals during the four-year period from 1960 to 1964 shows an increase in average tonnage from 4,600 in 1960 to 5,300 in 1964 (Table 7). A continuation of this trend will further emphasize the necessity of providing longer berths and deeper water to accommodate the larger cargo vessels of 700 feet or more in length.

The premium placed on speed and efficiency is forcing modernization of antiquated facilities. More rapid and more efficient methods of cargo handling becomes increasingly vital as ships increase in size and are being introduced in major ports throughout the world. Among these methods is the use of containers, pallets, and unit handling techniques. The use of new cargo handling equipment brings with it the need for greater transit shed and open storage space on piers, as well as improved truck access.

A container system of cargo movement has been introduced by the White Pass and Yukon Corporation which operates a ship and train services from its docks in North Vancouver to Whitehorse, Yukon. The specially designed *Frank H. Brown*, 6,000 tons, carries most of its cargo in steel and aluminum containers of varied sizes that can be transported easily on highway trailers or railway flatcars (*Canada Month*, 1966 pp. 24-25). A variety of cargoes can be accommodated by the containers, some sealed and some vented, some refrigerated and some heated. General cargo is carried outbound to the Yukon and the containers return loaded with asbestos and mineral concentrates. Fundamentally, a container system is best adapted to the movement of general cargo in a regular service where transfer from water to land transportation must be facilitated. Perhaps some of the shipping services besides the White Pass and Yukon Corporation may be able to adopt this system profitably, but as a general rule the Vancouver trade with its emphasis on the handling of bulk commodities, is not well suited to the use of containers.

Unit handling of lumber and use of pallets for many products is becoming quite common. Lumber is stacked in compact units of uniform board lengths, that take up less space in freight holds than bulk lumber or uneven

Table 7

*VESSEL ARRIVALS AT PORT OF VANCOUVER, 1960-64**

Year	*Number of deep sea vessels*	*Net registered tonnage†*	*Average tonnage‡ deep sea vessels*	*Number of coastal vessels*	*Net registered tonnage†*	*Average tonnage‡ coastal vessels*	*Total number of vessels*	*Total net registered tonnage†*
1960	1,771	8,141,297	4,597	27,021	13,433,040	497	28,792	21,574,337
1961	1,839	8,763,207	4,765	22,696	13,172,228	580	24,535	21,935,435
1962	1,891	9,243,574	4,888	22,316	11,341,941	508	24,207	20,585,515
1963	1,853	9,630,143	5,197	19,325	8,049,280	417	21,178	17,679,423
1964	1,924	10,186,962	5,295	19,538	8,483,913	434	21,462	18,670,875

*National Harbours Board, Annual Reports, 1960-64, Ottawa.
†Short ton, 2,000 lbs.

stacks. Pallets facilitate the handling of a wide range of bagged goods and food products such as the apples from the Okanagan Valley.

Bulk handling facilities are highly mechanized to achieve maximum loading and unloading speed. An example is the bucket-crane conveyor-belt system installed at Vancouver Wharves to unload phosphate rock from ship's hold to storage silo at a rate of 1,000 tons per hour. The use of integral trains operating direct from a production site to a bulk loading terminal is another technique that may be introduced. Crows Nest Industries has proposed that its coal movement could profit from the economy and efficiency of hauling 65-car trains from mine to wharf.

Improvement and expansion of terminal facilities

Grain - Grain terminal facilities require enlargement of capacity and modernization of equipment in order to cope with the huge grain carriers of the present day. Recent high levels of wheat exports have placed a great strain on elevator capacity and rail transportation systems. Grain elevator capacity in metropolitan Vancouver stands at just over 20,000,000 bushels (for individual elevator capacities *see* Figure 13). Most of the elevators date from the 1920's, though some have additions constructed since that period. In many cases improved car dumping, cleaning and conveying equipment is required. Effective capacities of the elevators are reduced today from former levels because, in addition to the high grades of northern wheat that once were more dominant, present demand requires the stocking of various other types of grain, such as durum, oats, barley, flaxseed and rapeseed. The small size of some elevators, notably the National Harbours Board No. 4, with a 600,000-bushel capacity, is a disadvantage today because some of the grain carriers can take aboard in one load more than the elevator holds. A highly automated grain elevator with a capacity of 5,500,000 bushels is under construction by the Saskatchewan Wheat Pool on the north shore one and one-half miles west of the Second Narrows Bridge. When this is completed, the metropolitan storage capacity will be nearly 26 million bushels and Vancouver will replace Montreal as second to Fort William-Port Arthur in grain elevator storage capacity.

During the last quarter of 1965 and early in 1966 there were persistent delays in grain loading. Though elevators were accused of being incapable of

handling the shipping bottleneck, the elevator companies reported that their storage and loading facilities operated at less than two-thirds of capacity and that insufficient supplies were being moved from the Prairie Provinces. Railway delivery problems may have been partly responsible for the shipping delays, but also elevator handling facilities and procedures were also probably inadequate to the task. More complete drying and cleaning of the grain before shipment from the Prairies would simplify the transfer and storage functions of the elevators.

A proposal to combine export terminal operations is under investigation. A single organization rather than the individual grain companies would route the railway cars to elevators, achieving benefits of speed and efficiency. One obvious benefit would be the possibility of concentrating different grains in different elevators instead of the present system of maintaining a balanced stock in the properties of each individual company. It appears that grain elevator capacity will be sufficient for some time to come if maximum efficiency of operation can be achieved.

Other bulk commodities

Most of the items expected to generate greatly increased shipping traffic are bulk commodities, such as potash, sulphur, coal and pulp. At present there are two bulk terminals, Vancouver Wharves and Pacific Coast Bulk Terminals, both engaged in substantial expansion programs. Vancouver Wharves (Figure 13, No. 1), situated on the north shore of Burrard Inlet immediately east of the First Narrows Bridge, is served directly by the Pacific Great Eastern Railway and the Canadian National Railways. Pacific Coast Bulk Terminals (Figure 13, No.9) occupies a site on the south side of Burrard Inlet at Port Moody, on the main line of the Canadian Pacific Railway. The expansion being undertaken in both cases involves the addition of better cargo handling equipment and more space. These improved facilities should meet the demands of the immediate future although it is possible that a new bulk terminal will be required within five or six years. A suitable site would be the National Harbours Board property, District Lot 272, on the north shore about a mile west of the Second Narrows Bridge. Sufficient space would be available here with good rail access to deep water frontage. The replacement of the old Second Narrows Bridge with

a higher level lift span will greatly enhance the north shore for shipping terminal development, as well as reduce the railway congestion on the south shore. Now under construction, the project includes a two and one-half mile tunnel approach from the Canadian National Railways main line to the south. This will eliminate the present circuitous approach route along the Vancouver waterfront and the bridge will permit a wider navigation channel between the piers than does the present span. Bulk handling facilities additional to these could be situated on reclaimed land on the north side east of the bridge. Any bulk terminal situated on the south shore should be placed east of Second Narrows in order to reserve the section between the bridges as the principal general cargo zone.

Petroleum

The major petroleum terminals are suitably situated on the south shore of Burrard Inlet east of Second Narrows, most of them being connected with refineries (Figure 13). It is in this area that Trans Mountain Oil Pipeline Company is building a special terminal for propane export. With the addition of propane shipping facilities the present petroleum docks should be adequate for some time to come. Their function was more vital before the pipeline from Alberta was built in the 1950's because crude oil at that time was imported by tanker. In future, however, any large scale development of petroleum refining and associated petrochemical industries might require a more spacious site than is available on Burrard Inlet.

General cargo

The terminals that handle general cargo, lumber and other commodities are concentrated on the Vancouver waterfront between the bridges and at New Westminster (Figure 13). With the exception of Centennial Pier, built in 1959, most of the docks are over 35 years old. A few are derelict or virtually unused. Some new construction is under way, for example, the Centennial Pier expansion and a wharf renewal project in New Westminster. A continuing renewal program of outmoded deep-sea terminal facilities is needed and it would seem advisable that a large part of this investment should be confined to the inter-bridge section of Vancouver. This is the best waterfront zone for general cargo handling and its full potentialities should, therefore, be exploited.

Passenger services

Both coastal and trans-ocean passenger services are established at Vancouver. Coastal, passenger and motor vehicle traffic is handled chiefly by the Canadian Pacific Railway Nanaimo Ferry dock in Vancouver, and the British Columbia Ferry Authority docks at Tsawwassen and Horseshoe Bay (Figure 19).

Figure 19. Ferry terminal and yachting base at Horseshoe Bay on Howe Sound (Photo: courtesy *British Columbia Department of Travel Industry*, No. 7285).

Alaska cruise ships operate from the Canadian National Railways pier. P and O-Orient Lines is the only trans-ocean service which includes Vancouver as a port of call. These ships, the largest being 45,000 tons, berth at Pier"B-C" (Figure 13, no. 32), recently acquired by the National Harbours Board from the Canadian Pacific Railway as a result of settlement of a long-standing ownership dispute. This waterfront section near Stanley Park is the most favourable location for a passenger terminal because tidal currents have minimal effect here. The National Harbours Board is planning to renovate Pier "B-C" and will continue to serve the P and O-Orient Lines vessels despite the increasing freight business also being handled at this pier. The building of a new passenger terminal in this area has been proposed, but the present twenty calls a year by passenger liners probably is insufficient traffic to warrant early construction

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Burrard Inlet will likely accommodate most of the future port facilities requirements. The First Narrows-Second Narrows district should be considered the vital heart of the deep-sea port with the south shore devoted to general cargo, grain and passenger terminals and the north shore to bulk, grain and general cargo terminals as well as a major shipyard. A worthwhile goal would be to reserve this district as much as possible for waterfront uses that generate heavy deep-sea shipping traffic, not only because it is closest to the open ocean, but also because the channel at Second Narrows is slightly restricted by two bridges, one of them a lift span. The Second Narrows-Port Moody district would be suitable for deep-sea petroleum and other specialized terminals, as well as coastal facilities. A small part of the demand for waterfront land could be met by limited expansion and improvement of docks in New Westminster.

PROBABLE WATERFRONT LAND REQUIREMENTS FOR MANUFACTURING INDUSTRIES

The Fraser-Pitt river system provides the principal stock of waterfront land for future industrial development, although Burrard Inlet still has many sites available. The river districts offer a variety of sites on channel depths ranging from 10 to more than 30 feet. Competition will be keenest for large parcels of land on deep-sea frontage. The present deep water areas of the Fraser River and Burrard Inlet should provide most of the deep-sea

waterfront required in the foreseeable future, but eventual deepening of the river or development of the coastal banks may be necessary. The specific requirements of industry depend on the nature of the metropolitan industrial structure, and this is changing significantly at present. According to census data, three of the largest industries, wood, metal and transportation equipment (chiefly shipyards), registered declines in their respective percentages of the manufacturing labour force between 1951 and 1961 (Table 8). On the other hand, percentage gains were reported in most of the other categories, for example, paper, chemical and electrical industries. It is necessary to examine carefully the growth prospects of each major water-oriented industry in order to estimate future waterfront demand.

Water-oriented Industries

The fish-processing industry faces resource limitations and its production facilities have recently undergone a phase of consolidation. A number of salmon canneries along the Fraser River have closed down or have been converted to net lofts and fishing stations. Many of them were old plants of small capacity that became uneconomic to operate. Production is increasingly concentrated at Steveston where greater efficiency has been achieved through economies of scale and the use of modern equipment. As a result, the fish processing industry in future may occupy less water frontage than formerly.

The wood industry is becoming less dominant in the metropolitan economy as the supply of logs on the coast is definitely limited. Great changes have taken place recently in the organization of the industry and products manufactured. Many small sawmills have been eliminated while the capacity and output of some of the larger ones have been increased. The relative importance of products other than lumber has risen greatly — plywood, veneer, particle board and laminated beams are examples. Sawmill operations have become concentrated in North Arm district, tending to shift away from Burrard Inlet, because North Arm offered good industrial sites and favourable conditions for water storage of logs. Many of the older sawmills on Burrard Inlet, especially those on False Creek, have closed down or relocated because renewal and enlargement of plant facilities became essential while at the same time site limitations, conflict with other uses, and restriction of log storage areas militated against expansion or rebuilding there. The recent evolution of

Table 8

*LABOUR FORCE ENGAGED IN MANUFACTURING IN METROPOLITAN VANCOUVER IN 1951 AND 1961**

	1951		*1961*	
Industry Group	*No. of persons*	*% of population*	*No. of persons*	*% of population*
Food & beverage industry	9,243	17.2	11,461	19.9
Tobacco products	3	-	11	-
Rubber industry	38	0.1	156	0.3
Leather industry	817	1.5	286	0.5
Textile products	2,701	5.0	2,859	5.0
Wood industry	17,491	32.6	16,472	28.6
Paper & allied industries	1,998	3.7	3,727	6.5
Printing, publishing & allied industries	3,818	7.1	4,691	8.1
Metal industries	8,212	15.3	8,532	14.8
Transportation equipment industries	4,968	9.3	2,974	5.2
Electrical products industries	762	1.4	1,343	2.3
Non-metallic mineral products	619	1.2	1,128	2.0
Petroleum & coal products	1,077	2.0	1,156	2.0
Chemical & chemical products	756	1.4	1,290	2.2
Miscellaneous manufacturing	1,170	2.2	1,499	2.6
Total	53,773	100.0	57,585	100.0

*Census of Canada, 1951 and 1961, as quoted in *Vancouver's Changing Population*, Table 26.

larger but fewer mills and the limited availability of logs on the coast suggest that the wood industries probably will not require much additional waterfront space.

The paper industry on the other hand has expanded rapidly, producing mainly tissues, paperboard and fine papers for the western Canadian market. Proximity to supplies of wood and pulp is an advantage that Vancouver offers. Future expansion will likely be in the pulp and paper converting field rather than log converting, thereby reducing the necessity for shoreline location. However, the recently established fine paper mill occupies a deep-sea frontage site on Annacis Island, using the shoreline only for a water intake installation. On the whole, the waterfront demand of this group will be relatively small.

Metal industries as a group are not strongly water-oriented. Primarily they are engaged in metal fabricating and machinery production, although steel is produced from scrap and pig iron at Western Canada Steel on Mitchell Island. The diversification of manufacturing and the growth of the western market is bound to stimulate expansion in the metal products group. Some of the new producers such as Trojan Steel and Wire, recently established on North Arm, will favour waterfront sites, with the expectation that they may want to move bulky or heavy items by water.

Transportation equipment industry is dominated by shipbuilding which accounts for about three-quarters of the total employment in this category. Owing to high production costs, the market for these shipyards is almost entirely local. The level of activity in large, ocean-going ship construction will depend greatly upon national policies regarding naval and merchant ship requirements, as well as subsidies. On the other hand, the building and servicing of coastal vessels, tugboats, barges and pleasure craft should continue to flourish in future. Waterfront space requirements for small yards are not very extensive.

The non-metallic mineral products industry often finds availability of water transport essential to its operations because the raw materials and many of the finished products, chiefly the building materials, are bulky and heavy. Supplies of most of the raw materials are readily available and this industry has experienced rapid growth in recent years. Labour cost as a proportion of

total product cost is very low. On the other hand, large storage areas associated with the production facilities are common. As a result, the rather modest employment total for the metropolitan area is not a fair indication of the significance of the industry in terms of waterfront use. Markets are almost entirely local. Most producers are satisfied with shallow waterway locations although a few, with broader markets or more distant raw material sources, require deep-sea sites. This industry group certainly is one which will wish to occupy considerably more waterfront space in future.

The oil refineries that account for most of the employment in the petroleum and coal products group, must have deep-sea docking facilities in order to supply fuel to ships and to serve their British Columbia coastal markets by tanker. Labour cost is a very small part of total cost and land requirements are high. Growth of the petroleum products industry is closely tied to population growth in the market area. In addition, new demand for chemicals may enlarge the petroleum market through establishment of petrochemical industries in the area. The Imperial Oil Company, for example, is constructing a new petrochemical plant at its Ioco refinery to produce toluene. Undoubtedly, enlargement of capacity at present refinery locations will satisfy demand for some time, but eventually it may be necessary to develop new refinery capacity elsewhere. A possible location would be the potential reclamation area of Sturgeon Bank off the west end of Lulu Island which has access to deep water and ample space that could be devoted to associated petrochemical industries.

The chemical products industry is growing faster than most of the others largely as a result of a boom in the pulp and paper industry. The demand for pulp bleaching chemicals is expected to rise very rapidly. Large chemical industries usually require deep-sea water frontage because many important raw materials, such as salt, are imported. With the introduction of petrochemical as well as other chemical industries it appears that requirements of this group for waterfront land will be considerable.

Available waterfront land suitable for industry

Several districts can be considered as unsuitable for industrial development, while others vary in suitability, depending upon the different

industry requirements. The West Vancouver-First Narrows and Point Grey-First Narrows areas are already mainly developed for residential and park use. The Tsawwassen-Boundary Bay area is characterized by extensive tidal flats that could be reclaimed for industrial use but are probably better suited to recreational use. Indian Arm is virtually unoccupied and offers deep water throughout, but its extremely steep slopes preclude industrial development. This leaves False Creek, the First Narrows-Second Narrows and Second Narrows-Port Moody areas and the Fraser-Pitt river system as suitable for industry. In terms of availability of waterfront land for manufacturing use the important distinction must be made between land served by deep-sea or potential deep-sea channels and that served by shallow waterways.

At present unused land or land in agricultural use constitutes the main supply of potential industrial sites (Table 9). Redevelopment for industry of land now taken up for other uses will contribute a very small proportion of the total. The usefulness of land for manufacturing is governed by many limiting factors besides water depth. Among these are slope of waterfront land (Map *A* in back pocket), foundation conditions for heavy industrial structures, accessibility and land value. A general determination of costs involved in obtaining good bearings for heavy industrial structures was made by the Lower Mainland Regional Planning Board of British Columbia in 1961 (Figure 20). Estimates of market value of waterfront land (Figure 21) were obtained in 1965 from assessment officials in the fifteen municipal governments and from the provincial government which administers unorganized territories.

False Creek with its 15-foot channel and central location has many advantages for light manufacturing industries that do not need extensive sites. At present the area suffers from industrial blight and many waterfront occupiers make little or no use of the shipping potential. Plans for redevelopment by the City of Vancouver are well advanced and include the following goals: rationalization of land ownership pattern, establishment of a long-term leasehold policy, replacement of the Kitsilano trestle, construction of a new perimeter road and improvement of street and lot subdivision. Ownership of this valuable property is largely in the hands of the Canadian Pacific Railway and the three levels of government — federal, provincial and city.

Table 9

CHARACTERISTICS FOR POTENTIAL INDUSTRIAL WATERFRONT USE OF PRESENT "AGRICULTURAL AND UNUSED LAND"
(FIGURES IN MILES)

District	*Slope of land within 500 feet of shore*			*Foundation conditions for heavy industrial structures*			*Inaccessible Island shorelines*	*Total Agricultural and Unused*
	0-15%	*16-25%*	*over 25%*	*No extra cost involved*	*Moderate extra cost*	*High extra cost*		
DEEP SEA WATER FRONTAGE								
First Narrows-Second Narrows	2.1	0.2	-	2.3	-	-	-	2.3
Second Narrows-Port Moody	2.1	4.2	1.3	6.4	-	1.2	-	7.6
South Arm	20.7	0.9	-	5.9	12.4	3.3	3.0 (Rose, Kirk, Don, Lion & Steveston)	21.6
New Westminster-Barnston Island	5.2	-	-	2.2	-	3.0	-	5.2
Total deep sea water frontage	*30.1*	*5.3*	*1.3*	*16.8*	*12.4*	*7.5*	*3.0*	*36.7*
POTENTIAL DEEP SEA WATER FRONTAGE								
Port Moody & Douglas Island to Barnston Island	10.0	1.2	-	2.6	5.3	3.3	1.6 (Douglas)	11.2
INDUSTRIAL WATER FRONTAGE (12'-20')								
False Creek (15')	0.2	-	-	0.2	-	-	-	0.2
North Arm (12'-15')	21.2	-	-	2.7	13.0	5.5	1.2 (Poplar)	21.2
New Westminster to Barnston Island (12'-20')	10.9	-	0.3	2.9	4.1	4.2	2.6 (Tree and Douglas)	11.2
Pitt River (15'-20')	22.1	0.6	0.2	1.8	21.1	-	-	22.9
Total industrial water frontage	*54.4*	*0.6*	*0.5*	*7.6*	*38.2*	*9.7*	*3.8*	*55.5*
SHALLOW WATER FRONTAGE (less than 12')								
North Arm (Middle Arm, McDonald Slough, (Tree Island Slough)	7.7	-	-	0.4	6.6	0.7	-	7.7
South Arm (Annacis Channel 10', Sea Reach and Ladner Reach 10', Deas Slough, Canoe Pass, west shores of Lulu Island and Chatham Island)	30.2	-	-	4.0	25.9	0.3	1.1 (Don and Lion)	30.2
Total shallow water frontage	*37.9*	-	-	*4.4*	*32.5*	*1.0*	*1.1*	*37.9*
Total non-deep sea water frontage	*102.3*	*1.8*	*0.5*	*14.6*	*75.0*	*14.0*	*6.5*	*104.6*
Total deep sea and non-deep sea water frontage	*132.4*	*7.1*	*1.8*	*31.4*	*88.4*	*21.5*	*9.5*	*141.3*

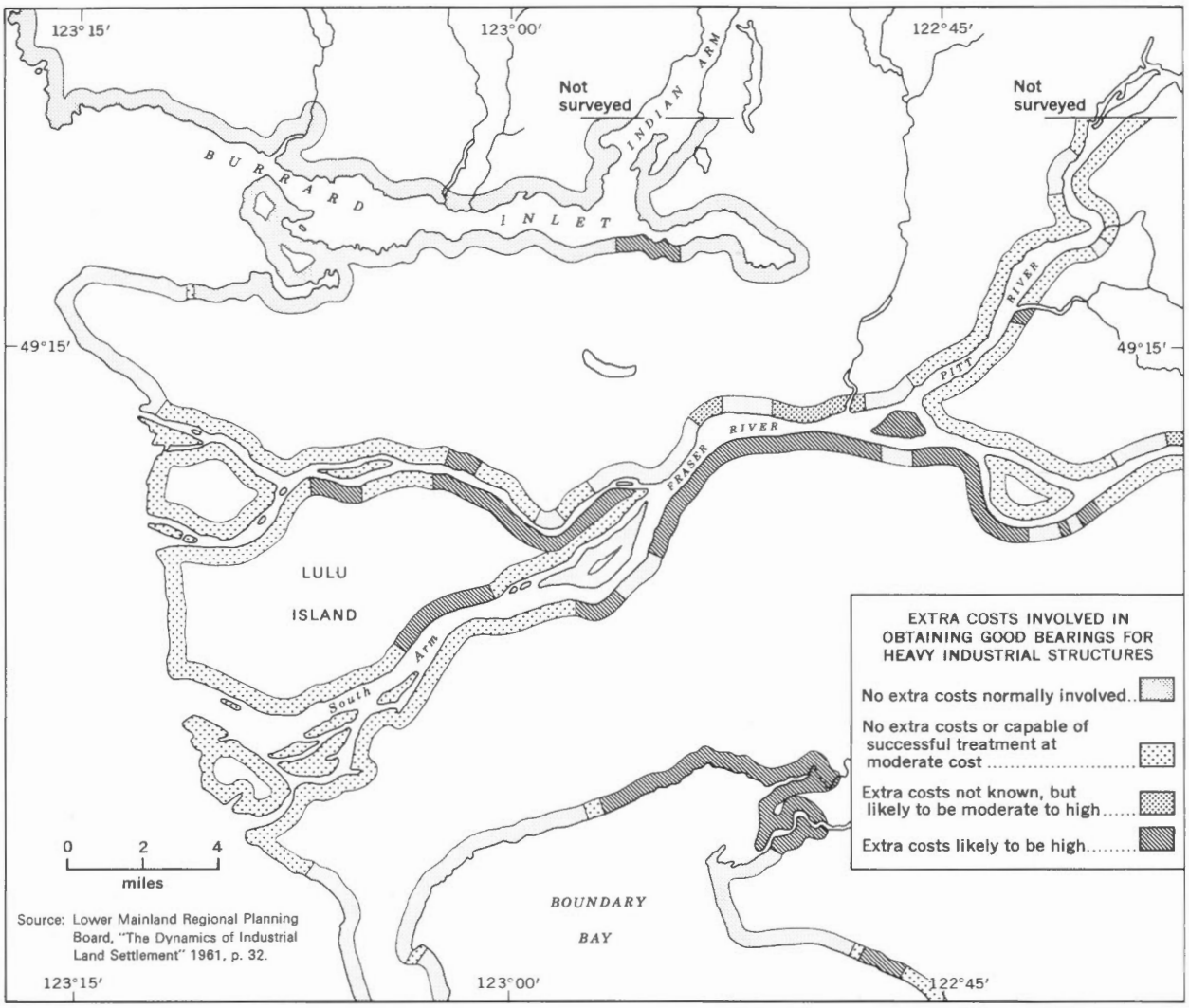

Figure 20. Foundation conditions along the Vancouver waterfront.

It is thought that long-term leases instead of the present short ones would foster better quality of land use. The present Kitsilano railway trestle is a navigation hazard because its opening is very narrow and out of line with the channel. As in the First Narrows-Second Narrows stretch it would seem that the sawmills should be eliminated because water space is too limited to be devoted to log storage and handling. Also, emphasis could be placed on facilitating barge and small boat traffic and on encouraging certain building material producers and water-oriented industries such as boatworks, to become established there. It seems very regrettable that extensive areas of shoreline should be used merely for automobile storage as is the case at present.

The First Narrows-Second Narrows area has nearly two and one-half miles of unused shoreline, however, it is suggested that this district should be reserved for deep-sea shipping terminals. Among manufacturing industries already there, the sawmills can be looked upon as constituting undesirable uses of land in the prime port area and every encouragement should be given to have them relocate elsewhere. The elimination of sawmill operations throughout Burrard Inlet would be a goal to work toward because the water handling of logs essential to these operations is incompatible with deep-sea shipping activity.

From *Second Narrows to Port Moody* there remains some seven and one-half miles of unused deep-sea shoreline, but three-quarters of this is over 15 per cent slope within 500 feet of the shore and a lengthy stretch rates as poor foundation condition because of the existence of a bedrock slide area. Expensive reclamation would be necessary to utilize parts of the north shore. Land values vary considerably but are lower here than west of Second Narrows because of the physical conditions mentioned and because of the increased distance from the city centre. All this shoreline is served or can be served by rail except for the steep section between Ioco and Indian Arm. It is felt that highest priority in this district should be given to deep-sea terminals, although manufacturing industries that generate substantial deep-sea shipping traffic but do not require much space could also be acceptable occupiers. It would seem advisable that sufficient water frontage should be reserved on the north shore east of Second Narrows for eventual development of large scale bulk terminal facilities. The head of the Inlet is shallow but could be dredged to produce a deep-sea channel and turning basin that would create additional deep-sea frontage.

The Fraser-Pitt river-system offers the principal supply of potential waterfront land for industry in the future. Major disadvantages, however, are that the deep-sea channel is limited at its entry to a low water depth of 28 feet 6 inches and that most of the waterfront is river floodplain. A recent study suggests that a disastrous flood of the magnitude of the one in 1948 could be expected about once in 60 years (Sewell, 1965, p. 29). The danger of flooding can be minimized by filling development sites with sand to the

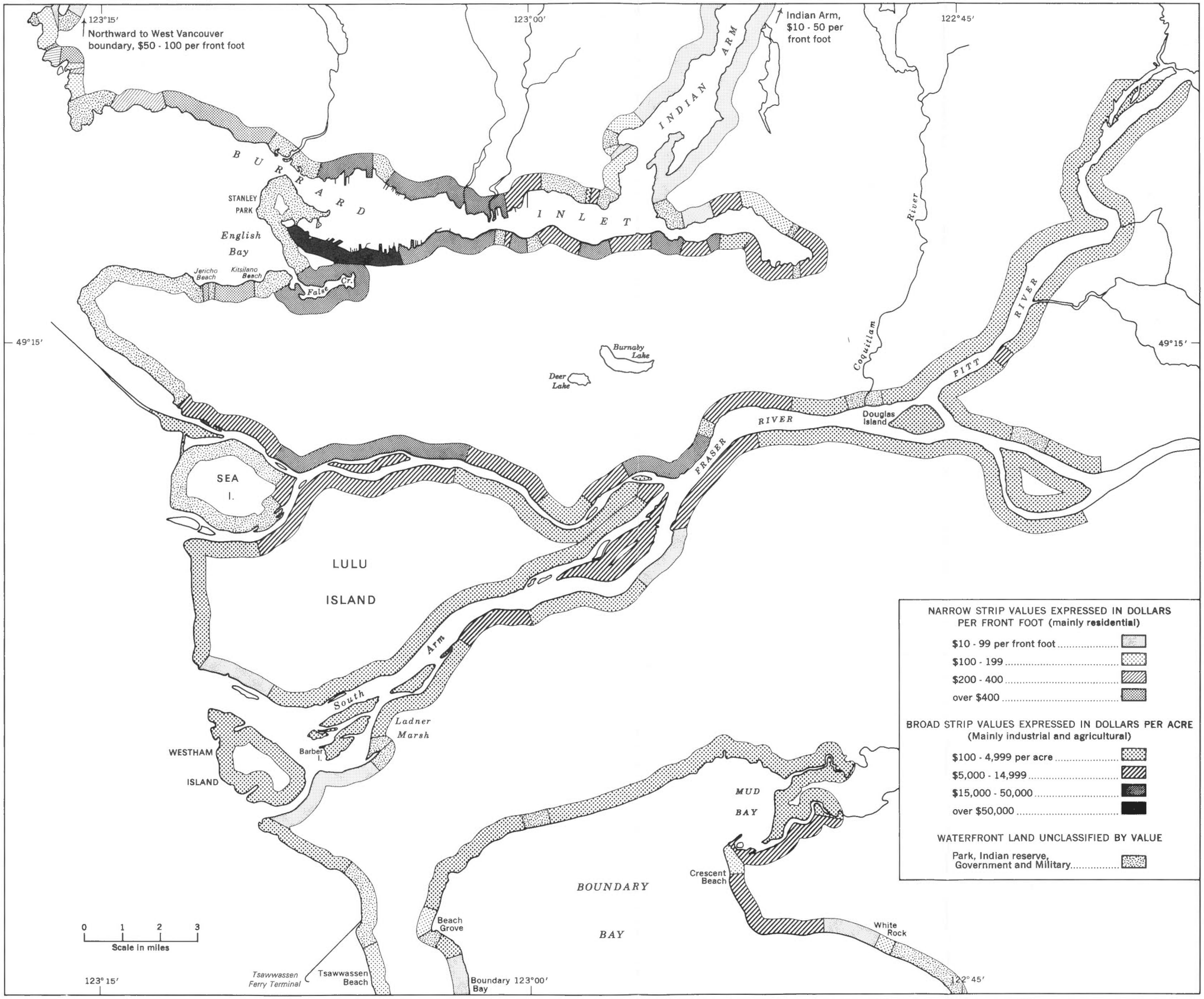

Figure 21. Market value of Vancouver waterfront land, 1965

height of dyke summit level. This fill is obtained by dredging the river bed and pumping the sediment by pipeline onto the land. Unfortunately, relatively few industries have protected themselves in this manner.

Along the existing deep-sea channel land slope is not a problem, but foundation conditions for heavy industrial structures are unfavourable in many places. Those sections characterized by peat deposits (Figure 4) involve extra site preparation costs that are likely to be high, perhaps $17,000 per acre or more, according to the findings published by the Lower Regional Mainland Planning Board (1961). Even the silts and clays of the Fraser floodplain may pose foundation problems involving extra expenses because these materials are often subject to deformation when loaded. About 27 miles of this deep-sea shoreline is classed as agricultural and unused land, but of this, only a little over six miles is known to be of good foundation, readily served by rail and not too steep. This land has a higher value than the other sections where costs of site preparation are involved. In fact, none of the deep-sea waterfront stretches can qualify as cheap land for industry if properly developed for flood protection.

Although there is no shortage of deep-sea sites on the Fraser River now, shortages may develop as a result of extensive occupancy of non-water-oriented industries. Most of the recently established plants which fall into this category, such as those on Annacis Island, make little use of the deep-sea shipping potential of their sites. A continuation of this trend could accelerate the demand for expensive public works to increase the supply of deep-sea frontage through dredging and reclamation. In future the deep-sea channel could be extended east of Douglas Island by dredging to open up the shorelines of Pitt Meadows and Barnston Island to industrial use. Also the presence of a seaplane base on the main channel at the new Pitt Meadows Airport might become a source of conflict with shipping. Reclamation projects could be undertaken on Roberts Bank or, preferably, Sturgeon Bank to provide land for industries, possibly a large oil refinery with associated petro-chemical producers. Advantages of Sturgeon Bank are that it is reasonably close to Vancouver, that it could be served by rail extension from Lulu Island and that it would have access to deep water. Boundary Bay Terminals Limited has proposed a similar project for Boundary Bay that would include

shipping terminal, commercial and residential uses as well as industrial uses. Because of the unique advantages of Boundary Bay for recreational use and the fact that other potential industrial areas such as Sturgeon Bank are available, this proposal does not appear too desirable.

Unoccupied waterfront land on channels of 20-foot depth or less exists in abundant supply. Within the region about 55 miles of shoreline borders channels of 12 to 20 feet, mainly in North Arm and Pitt River. Another 37 miles of shoreline fronts a shallow channel less than 12 feet deep. Both the value of the land and the costs of development vary greatly throughout the area. North Arm is the most intensively developed of the waterways, but considerable space is still available on the south side and in the eastern sections. Several narrow bridges that pose hazards to navigation may be replaced in future. The airport bridge that crosses Middle Arm restricts this channel to use by very small boats, mainly pleasure craft. The shores of Pitt River, almost totally unused, constitute a zone of relatively cheap waterfront land for future industry.

Increased development of waterfront land for industry is bound to result in a reduction of water space available for log storage. Most of the large log-using companies make a practice of buying waterfront land to protect their foreshore log storage leases. This practice will likely continue for many years until demand for shoreline sites by water-oriented industries becomes far greater than it is now.

In the foreseeable future it is the moderately priced, large acreage parcel of deep-sea industrial land that will become scarce. Nevertheless, the Fraser-Pitt river system likely will satisfy demand for some time, though development costs will be high in some areas. South Arm, with its variety of site types and land values, probably offers the best possibilities for deep-sea industrial development. One advantage is the fact that this district is little used for log storage; its proximity to the open sea is another. As was suggested for Burrard Inlet, it would seem logical to concentrate deep-sea shipping traffic in the section nearest the ocean, especially as the railway bridge at New Westminster is a minor hazard to be negotiated by ships moving east of this point.

PROBABLE WATERFRONT LAND REQUIREMENTS FOR RECREATIONAL USE

Recreation is assuming an increasingly important role in modern society as a result of industrial automation and shorter working hours,and the community is being expected to provide recreational facilities to satisfy the growing demand. A number of recreational activities are focused on waterfront and water areas of the region. However, the community is also expected to meet the needs created by rapid population growth and waterfront parkland is of immense urban value whether or not it caters to specific recreational activities. The urban environment is more attractive when the waterfront is bordered by open space that offers the public an unhindered view of the shoreline and free access to it. Vancouver is fortunate in having open space, public access and recreational facilities along more than ten miles of shoreline from Stanley Park to Point Grey.

The sandy beach is the type of recreational shoreline most desired by the public. Vancouver beaches at Stanley Park, English Bay, Kitsilano, Jericho and Spanish Bank are well developed for swimming and are used to capacity each summer week-end, with possibly as many as 50,000 to 100,000 people on a fine afternoon. Other sandy beaches within the metropolitan area are important locally even if their extent is limited. The New Brighton beach park, sandwiched between a grain elevator and a gypsum plant is evidence that limited recreational zones can exist in conjunction with industrial uses.

Only Boundary Bay, a shallow, sandy embayment, reasonably free of the fine silt and clay sediments of the Fraser River that have produced a muddy shoreline in the delta area, possesses the physical advantages required for a major expansion of waterfront parkland that would include the extensive beaches considered essential to meet future recreational demands. Already the Boundary Bay waterfront has a resort character with limited beach areas at White Rock, Crescent Beach, Beach Grove and Boundary Bay. Other potential reclamation areas can satisfactorily accommodate the demand for shipping terminals and industrial frontage.

Development of Boundary Bay as a regional or provincial park could be undertaken in stages, but it would seem advisable that the whole shoreline be acquired as soon as possible and dedicated to park use under the management

of an appropriate public agency. Full development likely would involve the construction of groynes or other marine engineering works to provide foreshore characteristics satisfactory for swimming. Another recreational asset is the presence of large numbers of waterfowl that winter here, particularly in Mud Bay where the Canadian Wildlife Service has proposed the establishment of a bird sanctuary in conjunction with a plan to control the flooding of the Nicomekl River.

It would also be desirable that other coastal areas important for waterfowl conservation, such as the Westham Island-Tsawwassen coastline and the Barber Island-Ladner Marsh area be preserved in their natural state as recreational assets. Thus any large scale industrial reclamation projects that may be undertaken might better be confined to Sturgeon Bank than to Roberts Bank. The beach between the Tsawwassen causeway and the United States' border, already in use by local residents, has a great potential for swimming and boating facilities. The municipality of Delta has proposed the establishment here of a large marina behind a breakwater built at right angles to the causeway.

Protected channels and coves unsuitable for other shipping use often constitute favourable locales for marinas. To minimize conflict with ocean shipping, it would be preferable to locate marinas outside the busiest portion of Vancouver Harbour, especially along the western coast most accessible to the Gulf of Georgia cruising grounds. The West Vancouver shore, False Creek and many channels on the Fraser could accommodate more small craft facilities, and development possibilities at Tsawwassen and Boundary Bay are excellent. Though well inland, Indian Arm is a good location for marinas because it offers sheltered waters for cruising and water skiing and an interesting natural coastline.

PROBABLE WATERFRONT LAND REQUIREMENTS FOR RESIDENTIAL AND OTHER USES

Although residential use of waterfront land is extensive at the present time, this is probably not in the best interests of the metropolitan community, except in certain cases. Residential property in the West End of Vancouver, for example, would be less valuable if the west side of Beach Avenue were lined with private residences or apartment blocks, effectively

blocking public use and enjoyment of the shoreline. It is unfortunate that residential use was permitted along the shoreline from Kitsilano to Jericho beaches on the north side of Point Grey Road, because this break in the parkland continuity could now be mended only at great public expense as land values have skyrocketed to the range of $500 to $600 per front foot. Other residential coastlines that perhaps should have been preserved for public use are those at West Vancouver, Port Moody and Tsawwassen. There is greater justification for residential occupance of rugged coastlines not backed by extensive inland residential development, such as those along the Howe Sound-Queen Charlotte Channel coast of West Vancouver and the shores of Indian Arm.

In the shipping and industrial harbour areas, particularly on the Fraser River, conflict of use has occurred as a result of residential development on the waterfront which, through the complication of titles and the raising of land values, inhibits the acquisition and development of the land for industry. Along the Fraser waterfront dwellings are generally poorly serviced and of very low quality. In most cases redevelopment of the land for industrial use would be desirable.

Other uses, including fishing stations, towing and construction bases, government and utility installations, and commercial establishments, require relatively limited stretches of shoreline. The fishing stations as well as towing, dredging and pile-driving operations normally are closely associated with industrial and shipping activities and will occupy space in the same areas. On the other hand, the location of government and utility installations may be dictated by the water, sewerage, power and other service network requirements for water crossings. Certain commercial uses, such as waterfront hotels and restaurants and wholesale and storage enterprises that use water transport, are suitable occupants of shoreline sites where they do not interfere with the efficient functioning of the port. It is preferable that all of these miscellaneous uses be accommodated outside the zone of concentrated deep-sea shipping traffic.

SUMMARY

Metropolitan Vancouver is fortunate in possessing extensive ocean bays and inlets as well as a multi-channelled river system, but even with its

hundreds of miles of shoreline, it cannot afford to squander its waterfront resources. The available supply of waterfront land suitable to the requirements of many competing uses is very limited not only by economic factors but also by such physical factors as location, water depth, steepness of slope, and surface material. Nevertheless, the nature of the metropolitan economy and its prospective growth indicates a future requirement for waterfront land that can probably be satisfactorily met if careful planning is undertaken.

Some possible guidelines for future development are here indicated:

Management - To achieve the best utilization of waterfront land it would seem that the management and development of this resource should be co-ordinated on a metropolitan basis. Perhaps the establishment of a single metropolitan harbour authority, as suggested by Mr. Norman Bowen of the National Harbours Board is warranted. The harbours of Vancouver, New Westminster, North Arm and South Arm would then no longer be separate competing entities but would become integral parts of a metropolitan Vancouver Harbour. Government development funds could then be assigned to projects in terms of the metropolitan harbour needs which are possibly best evaluated by an agency serving the whole community. For success, such co-ordination of harbour development planning would have to be paralleled by a greater measure of inter-municipal co-operation.

Shipping terminals - A great deal of capital spending by government as well as by private enterprise is urgently required to rejuvenate the harbour. Shipping terminal requirements on the whole could likely be met by expansion and renewal of facilities in Burrard Inlet. The First Narrows-Second Narrows district, handicapped at present by an abundance of obsolete port facilities, could be considered the prime deep-sea port area largely reserved for shipping terminals. In the foreseeable future bulk commodity traffic is expected to expand most rapidly and sites on the north shore could be developed to handle the increased trade. Such development could begin with the National Harbours Board site west of Second Narrows. It is also felt that the gradual elimination of undesirable waterfront users such as sawmills should be a long-term goal for the Burrard Inlet area. In the Second Narrows-Port Moody district deep-sea terminals could be given first priority, followed by certain manufacturing industries that use deep-sea

facilities intensively. Future dredging of shallow areas at Port Moody could be undertaken to extend deep-sea water frontage and produce a turning basin.

Industry - The Fraser-Pitt river system is well suited to accommodate the great majority of the region's water-oriented industries. Everywhere along the river system the ever-present danger of flooding must be taken into account during site preparation for industrial structures. Sufficient fill to raise sites to the dyke summit level would be required. At present there is plenty of unused waterfront land zoned for industry by the Lower Mainland Regional Planning Board in the Official Regional Plan but a future shortage may occur in deep-sea frontage particularly as a result of early appropriation of desirable sites by industries that do no need deep water locations. It would be desirable to reserve some of the waterfront land on deep channels, preferably along South Arm, for industries that now or in the future can and will exploit the shipping potential. This might be done by establishment of a metropolitan authority to purchase waterfront parcels and control their use as parts of more extensive public industrial estates. Eventually, when demand warrants the expense, the main river channel above Douglas Island could be dredged to provide additional deep-sea shoreline, and the potential reclamation area of Sturgeon Bank could be developed for industry.

Parks - There is a definite need for additional marine parkland, especially beach frontage for swimming. The only extensive section of shoreline suitable for such development lies around Boundary Bay. For this reason it would seem in the public interest that the proposal of Boundary Bay Terminals to introduce industrial and shipping facilities should not be accepted, even though recent planning reports of Delta municipality appear to favour limited industrial use. The whole Boundary Bay waterfront could probably be put to better use if devoted to recreational development. As suggested by members of the Canadian Wildlife Service, a bird sanctuary at Mud Bay requiring special marine works to improve the waterfowl habitat could be managed as part of a regional park. Continued development of waterfront parkland, including such recreational facilities as marinas and yacht clubs, could also be carried out along both shores of Burrard Inlet west of First Narrows and along the shores of Indian Arm.

Residences - It is felt that residential use of the immediate shoreline should be discouraged in favour of maintaining a strip of parkland between the shoreline and the first roadway inland. This arrangement would allow public access to the coast and enhance the attractiveness of residential districts. Such a parkland strip would be unnecessary along the steep coastlines of Howe Sound and Indian Arm where the topography limits residential occupance to a narrow waterfront zone.

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