

An Examination of The Role of Local Government in Coastal Zone Management:

The Case of Richmond, B.C.

by

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B.Sc., University of British Columbia, 1989

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF SCIENCE

in

THE FACULTY OF GRADUATE STUDIES
School of Community and Regional Planning

We accept this thesis as conforming
to the required standard

THE UNIVERSITY OF BRITISH COLUMBIA

September 1994

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ABSTRACT

AN EXAMINATION OF THE ROLE OF LOCAL GOVERNMENT IN COASTAL ZONE MANAGEMENT: THE CASE OF RICHMOND, B.C.

The management of the coastal zone is a complex task facing all three levels of Canadian Government. While academic research and public attention tend to focus on federal and provincial agencies, the role of local government has been left largely unexplored. This thesis examines the role of local government in coastal zone management in British Columbia and evaluates local government's contribution to the management of the coastal zone based on the performance of local planning policies in the coastal community of Richmond, B.C.

Coastal zone management (C.Z.M.) is a specialized subset of contemporary resource management models having three hierarchically integrated components representing biophysical, socio-economic and institutional subsystems. A literature review yielded many management issues of which seven were selected to reflect the local government experience in C.Z.M. The seven issues are: Habitat Conservation, Water Quality, Coastal Hazards, Public Access and Aesthetics, Public Input, Water Dependency and Interjurisdictional Coordination.

The evaluation of Richmond's C.Z.M. policies was undertaken using a methodology similar to those employed by Rosentraub (1975) and Jessen *et al.* (1983). A retrospective analysis of Development Permit Application files processed between 1988 and 1991 was employed in the evaluation of existing policies contained within Richmond's Official Community Plan.

While the exact extent of local responsibilities remains poorly defined by existing legislation, local regulatory powers in C.Z.M. were determined to be nonetheless significant. The British Columbia Municipal Act provided a considerable amount of regulatory authority for each of the seven coastal zone management issues, namely in the form of Zoning bylaws, Official Community Plan bylaws and Development Permits.

The findings indicate that Richmond's existing policies displayed limited effectiveness concerning the management of C.Z.M. issues such as Habitat Conservation, Water Quality, Coastal Hazards and Interjurisdictional Coordination. However, the results also suggested that local policies addressing coastal zone issues such as public access and aesthetics were effective. Furthermore, explicit policies for Water Dependency and Public Input were non existent.

Several recommendations were made in this thesis. The first is an expanded recognition of C.Z.M. as a local government concern and responsibility. Further recommendations include increased interjurisdictional involvement, greater public access to waterfront surrounding industrial sites and discouraging the pressure to develop in the floodplain.

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FREQUENTLY USED ABBREVIATIONS

B.O.D.	Biochemical Oxygen Demand
C.C.R.E.M.	Canadian Council of Resource and Environment Ministers
C.Z.M.	Coastal Zone Management
D.F.O.	Department of Fisheries and Oceans
D.P.	Development Permit
D.P.P.	Development Permit Panel
E.S.A.	Environmentally Sensitive Area
F.R.E.M.P.	Fraser River Estuary Management Program
F.R.E.S.	Fraser River Estuary Study
M.H.W.H.	Mean High Water Mark
M.O.E.L.P.	Ministry of Environment, Land and Parks
M.O.L.C.S.	Ministry of Labour and Consumer Services
O.C.P.	Official Community Plan
P.E.P.	Provincial Emergency Program
M.O.T.H.	Ministry of Transportation and Highways

ACKNOWLEDGEMENTS

I am grateful to the many people who generously volunteered their time and efforts towards the preparation of this thesis. I am especially grateful to Tony Dorcey for his considerable contribution to the development of the thesis. The constructive comments and unfailing support offered by Tony were vital to the completion of this study.

I would like to thank Michael McPhee and Dr. Tim McDaniels for their valued comments and assistance with the preparation of the thesis. I am also indebted to Alex Jamieson, David Brownlee, Frank Sciberra and David McClellan at the Richmond Planning Department for their cooperation with the evaluation of Richmond's planning policies undertaken in this thesis.

Perhaps my greatest debt is owed to the people who assisted with word processing, revisions and personal support - thank you Louise, Mom and Dad.

CHAPTER 1

INTRODUCTION

"...Always the edge of the sea remains an elusive and indefinable boundary."

Carson 1955; p.1.

1.1 Introduction

Nowhere is the essence of the coast better captured than in Rachel Carson's words. The physical, chemical and biological interactions that characterize the coastal zone are extremely complex, often ambiguous, and to the casual observer, sometimes profound (Petrillo and Grenell 1985). It has been this very complexity which has complicated efforts to effectively manage the coastal zone.

British Columbia's coastal zone is endowed with spectacular scenery, diverse and abundant wildlife and a wide array of resource opportunities. The interface between land and water creates a complex and dynamic zone of biophysical processes unmatched by any other geographical zone on earth (Bauer 1978). The coast of British Columbia is convoluted by many deep fjords which create a shoreline many thousands of kilometres long. The B.C. coast is further characterized by many islands which create areas of sheltered coastal waters. The B.C. coastline is also punctuated by many rivers and streams resulting in the formation of estuaries. Although occupying but a fraction of the coast, estuaries such as those found in British

Columbia, are considered to be one of the most productive ecosystems in the world (Wilson 1988; Begon *et al.* 1986). Further inland from the land-sea interface, the coastal uplands of British Columbia still contain remnants of the dense temperate rainforests which once dominated this portion of the coast. The combination of climate, geophysical elements and biophysical processes creates a coastal zone which is coveted by society for its intrinsic economic and non-economic values. Forestry, mariculture, fisheries, tourism, transportation, recreation, agriculture and settlement are some of the opportunities available within coastal British Columbia.

1.1.1 Problem Statement.

Due to the host of opportunities provided by both land and sea, the coastal zone has witnessed an ever increasing amount of settlement, recreation and industry over the past century. As the scale of human activity increased, competition over the coast's endowments followed as more and more people vied for the coast's finite resources (Parkes 1980).

In the United States where the pressures of urban development and human activities on the coast are generally more intense than in Canada, the federal government adopted legislation intended to protect the coastal zone. The U.S. Department of the Interior argued before the U.S. Senate Committee on Commerce:

"of the man-made threats to coastal environments described by the Council on Environmental Quality in its first annual report, most have their origin in heavily populated land areas at or near the water's edge. But others can be traced further inland, where eventual impact upon the coastal environment is not so easily recognized. Thus, while pressure becomes most intensive at the point

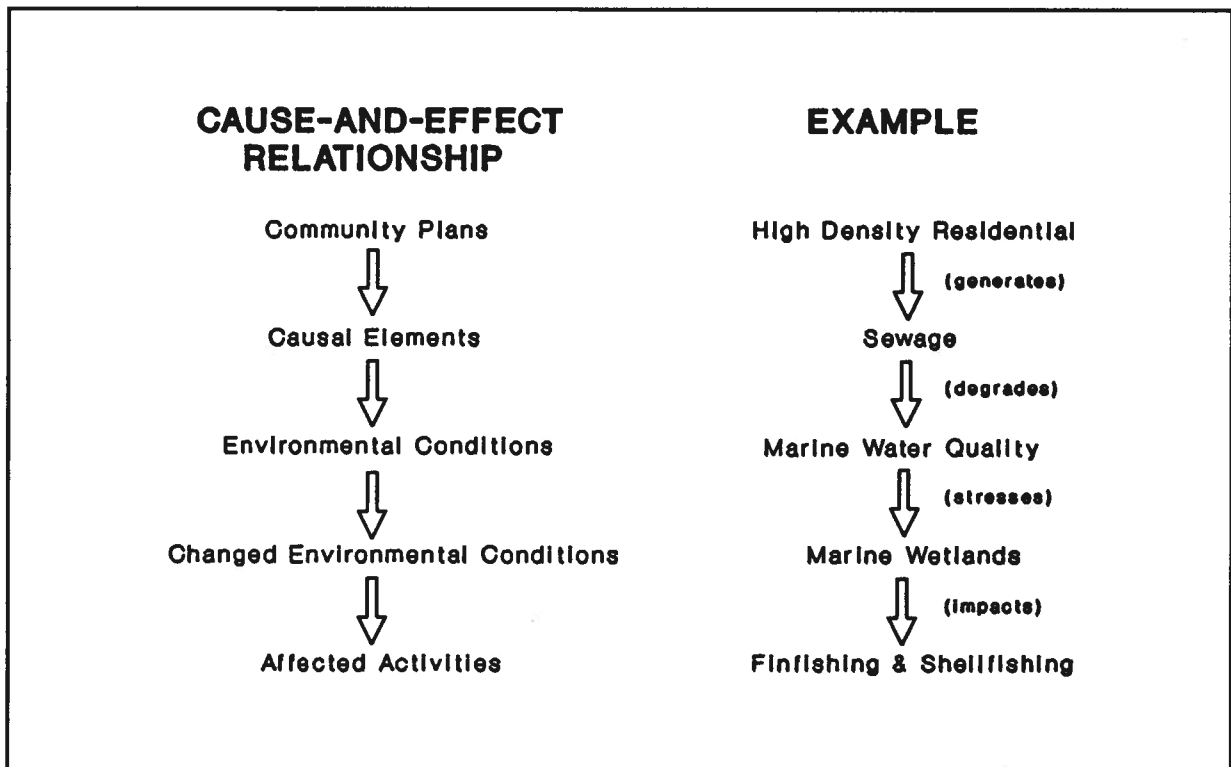
where land meets water, many cannot be alleviated without truly comprehensive planning."

(N.A.C. 1971)

There are many human activities occurring within the domain of local (municipal and regional governments) authority that have a deleterious impact on the vital biophysical processes of the coastal zone. The basis of the local government's authority within the context of Coastal Zone Management is rooted in the ability to regulate land use. Activities such as waste disposal and housing development may also negatively impact a number of other activities that depend on the coast (Nassau-Suffolk 1976; F.R.E.M.P. 1990). Figure 1.1 illustrates the relationship between land-use decisions (causal elements) and impacts on the coastal zone (environmental conditions and affected activities).

When combined with the battery of other inappropriate activities such as over-fishing and insensitive logging methods within the realm of provincial and federal jurisdiction, it becomes increasingly evident that aspects of the coastal zone, for example water quality, have been seriously jeopardized. Current C.Z.M. approaches have had little success ameliorating the ongoing episodes of conflict between competing interests in the coastal zone (Brower and Carol 1984; Canada 1982; Harrison and Parkes 1983; Harrison and Kwamena 1980). Often, accusations of mismanagement have been directed towards local governments for their failure to fully consider the impact of land-use decisions on the coastal zone (Hildebrand 1989; Scott 1981; Grote 1981).

FIGURE 1.1
The Relationship Between Land-use Decisions and the Coastal Zone.
(Adapted from Nassau-Suffolk 1976)



British Columbia, like other provinces involves senior (federal or provincial) and local (municipal or regional) levels of government in the management of the coastal zone. Under the British North America Act of 1867 and the more recent Canadian Constitution Act of 1982 the ownership and regulation of the coastal zone has been essentially divided between the two senior levels of government. It is only by virtue of the Municipal Act, that the province of British Columbia has granted powers to regulate various urban matters, such as land use, to municipal and regional governments (B.C. 1979). Local governments authority to regulate land use is significant considering that the small percentage of intensively used and densely settled coastal

urban areas exhibit all of the resource management problems which could be anticipated in the context of the coastal zone (Hildebrand 1989).

Whereas most of the regulatory power and much of the ownership in coastal zones has been retained by senior governments, the bulk of the responsibility for implementation of coastal zone policies has been left to the local governments and their powers to regulate development impacting the coastal zone (British Columbia 1987a; Brower and Carol 1984). Exercising their regulatory authority over land use, local governments have a great deal of influence in what Hildebrand (1989) characterized as an *ad hoc* management approach which paradoxically attempted to develop and conserve many aspects of the coastal zone. The diversity that exists between the various municipalities and their approaches to coastal zone management makes them attractive from a policy analysis perspective as the municipalities themselves may serve as living laboratories for a vast number of different management approaches.

An extensive review of the literature has revealed a serious lack of understanding regarding the role of local government in effective coastal zone management in Canada. The importance of recognizing the role of local governments in coastal management was established as one of the guiding principles of the Canadian approach to C.Z.M. at the Shore Management Symposium held in Victoria in 1978 (C.C.R.E.M. 1978). Yet, in spite of the conclusions reached at the Canadian Council of Resource and Environment Minister's (C.C.R.E.M.) Shore Management Symposium, surprising little planning and management research attention has focused on local governments.

1.1.2 Objectives of Study.

There are three basic objectives of this study. The first objective is to simply describe the management of the coast from the perspective of local government in British Columbia. To obtain an accurate description of the role of local governments in C.Z.M. in British Columbia it is necessary to address the following:

- What is C.Z.M. in B.C. stated in terms of biophysical, socio-economic and institutional characteristics?
- What are the main coastal management issues which link local government to the overall management of the coastal zone?
- How are local governments empowered to act as managers of coastal zone issues?

Having described the role of local government in the context of general coastal zone management issues, the next step is the evaluation of local efforts (policies) affecting the management of coastal zone issues. Hence, the second objective of this study is to evaluate the performance of local policies relevant to the management of coastal issues. Fulfillment of this objective required the development of an appropriate evaluative methodology and identification of relevant local policies (for the case study community of Richmond, B.C.) affecting coastal zone management issues.

The third objective of this study is to present policy recommendations that will improve the management of coastal zone issues in the case study community of Richmond, B.C.

1.1.3 Organization.

The thesis is presented in seven chapters. Chapter One serves as an introduction and broadly defines the boundaries of this study. Chapter Two introduces a framework for coastal zone management which includes biophysical, socio-economic and institutional components. The chapter identifies many of the coast's biophysical characteristics, highlighting some of the more important resource uses (stakeholders) and overviews current coastal zone management arrangements in British Columbia. Chapter Three focuses specifically on coastal management issues affecting local governments in British Columbia. The coastal management issues are; habitat conservation, water quality, natural coastal hazards, public access and aesthetics, public input, water dependent activities and interjurisdictional coordination. An inventory of regulatory authority granted to local governments through the B.C. Municipal Act is also presented in this chapter. Chapter Four presents a deeper examination of the case study community, Richmond, B.C. The evaluative methodology is developed in Chapter Five. This chapter includes the coastal issue policies selected for evaluation and the evaluative criteria employed in the analysis. Chapter Six presents the results of the analysis of land use decisions and development pressures as revealed through Development Permit and rezoning application files (1988 through 1991). Evaluation of Richmond's policies affecting C.Z.M. are contained within this chapter. The thesis concludes with Chapter Seven which summarizes the findings, presents policy recommendations and suggests future directions for research.

1.2 Scope of Study

1.2.1 The Coastal Zone Defined.

The coastal zone consists of a land component and an adjacent water component with the ecology of the land directly affecting the aquatic ecology and vice versa (Eekman 1975; Ketchum 1972). The water component of a coastal zone may be either fresh, salt or mixed fresh and saltwater as is typically found in estuaries like that of the Fraser River. The typical coastal zone profile includes the following important features: the offshore, the nearshore or foreshore, the shorelands (including backshore and intertidal) and the coastal uplands (Eekman 1975; Sorensen *et al.*, 1984; and British Columbia 1987b). A diagrammatic representation of the coastal zone and its main geophysical subdivisions is given by Figure 1.2. Photographic examples are presented in Figures 1.3 and 1.4 which show the upland and nearshore/offshore components of the coastal zone in Richmond, B.C.

Past experience in both Canada and the United States has revealed that the determination of coastal zone boundaries is a persistent problem in coastal management programmes. Reflecting this experience, a definition of the coastal zone has been adopted which stresses the interdependent ecologies of coastal components of the land and the water. Hence, based on ecological relationships, the coastal zone could vary considerably in width along the entire length of B.C. coast.

FIGURE 1.2
Cross Sections of Typical Coastal Zones.
(Adapted from Gamble 1989)

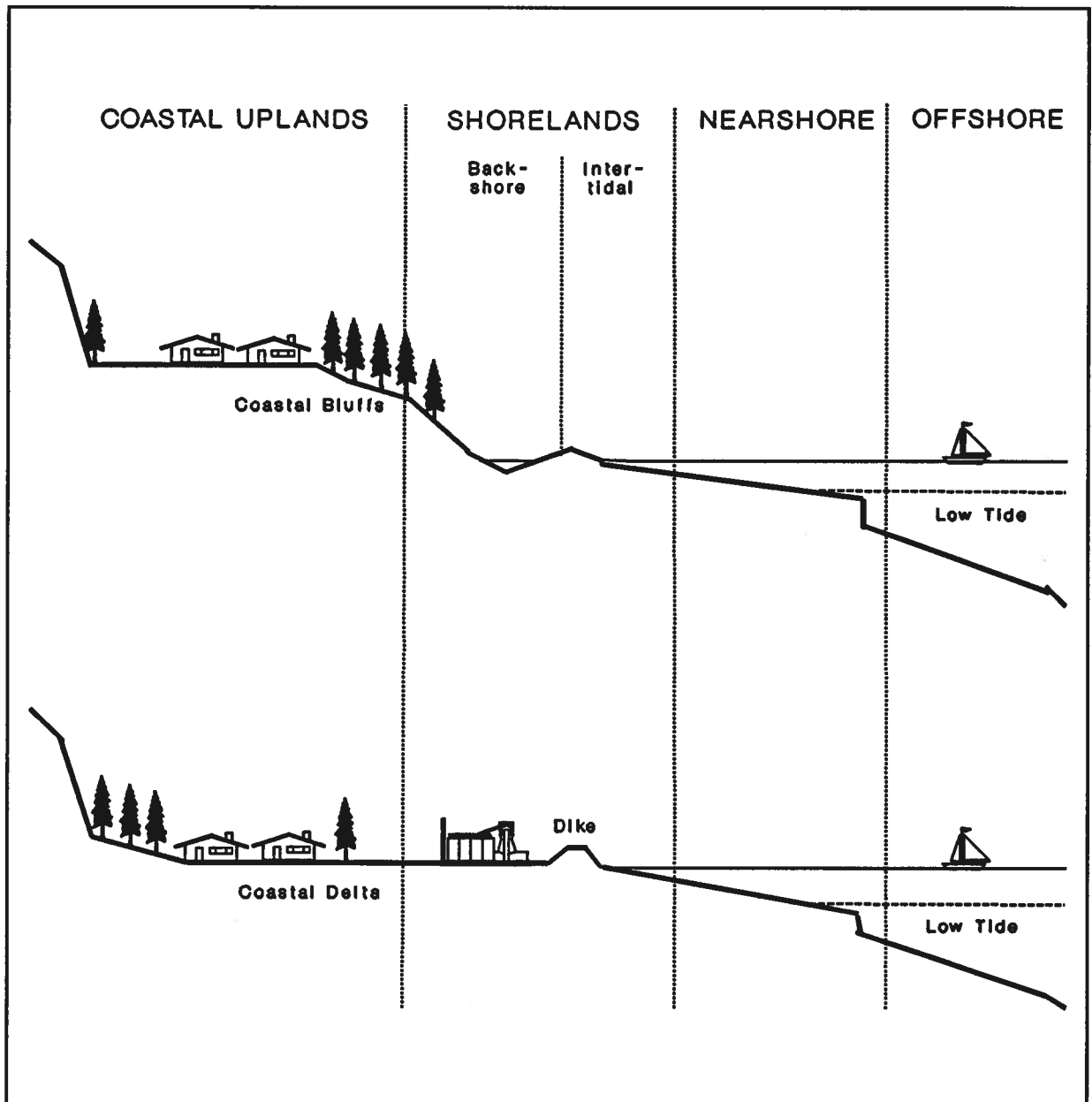


Figure 1.3
Coastal Uplands: South Richmond, B.C.



Figure 1.4
Coastal Shorelands, Nearshore and Offshore: Garry Point (Richmond, B.C.)



Coastal zone boundaries and C.Z.M. have traditionally focused on the seaward side, thus neglecting the landward half of the coastal system. Commenting on the status of C.Z.M in the United Kingdom [Smith 1991:127, emphasis added], stated that:

"landward boundaries are seldom considered, seaward ones always, for reasons to do with the dynamic water column, national jurisdiction and respective administrative limits of land- and sea-based organizations. In the regionalization of environmental management ... it is possible to view the coastal zone as a special case, defined by intensity of use and juxtaposition of land and sea. For both urban and certain rural sea areas characterized by a high intensity of use conflicts and environmental impacts, together with a strong land influence generally, it may be worth extending land use planning seawards."

Employing a coastal zone definition which is founded upon biophysical parameters, permits a more comprehensive management effort. Similar coastal zone definitions have been employed by Smith (1991); Gamble (1989); Eekman (1975) and Bauer (1978).

From both functional and scientific viewpoints, the extent of the coastal zone varies according to the nature of the problem being addressed, hence, policies that regard the coastal zone in its broadest sense may be applied to an area which extends from the upper limits of coastal watersheds to the outer limits of ocean jurisdiction. Defining the coastal zone in such a broad geographic sense presents some difficulties, not the least of which involve a multiplicity of government regulation and a highly complex ownership pattern (especially in the coastal uplands). Obviously, such an expansive boundary presents some serious jurisdictional difficulties for coastal zone policies. The difficulties inherent in coastal boundary definitions have lead many to suggest that the ecological systems of the coastal zone are incompatible with current political and administrative structures which were designed to serve societal needs (Pross

1980; Canada 1982; Johnston *et al.* 1975; and Harrison and Kwamena 1980). From the perspective of the local government's role in coastal zone management efforts, the most relevant components of the coastal zone profile are the uplands, shorelands and to a lesser extent the nearshore. With local regulatory authority essentially confined to the landward and nearshore half of the coastal zone, discussion of local government's role in C.Z.M. primarily centred on questions of land use. However, the impacts of land use may be measurable in the nearshore and offshore areas of the coastal zone.

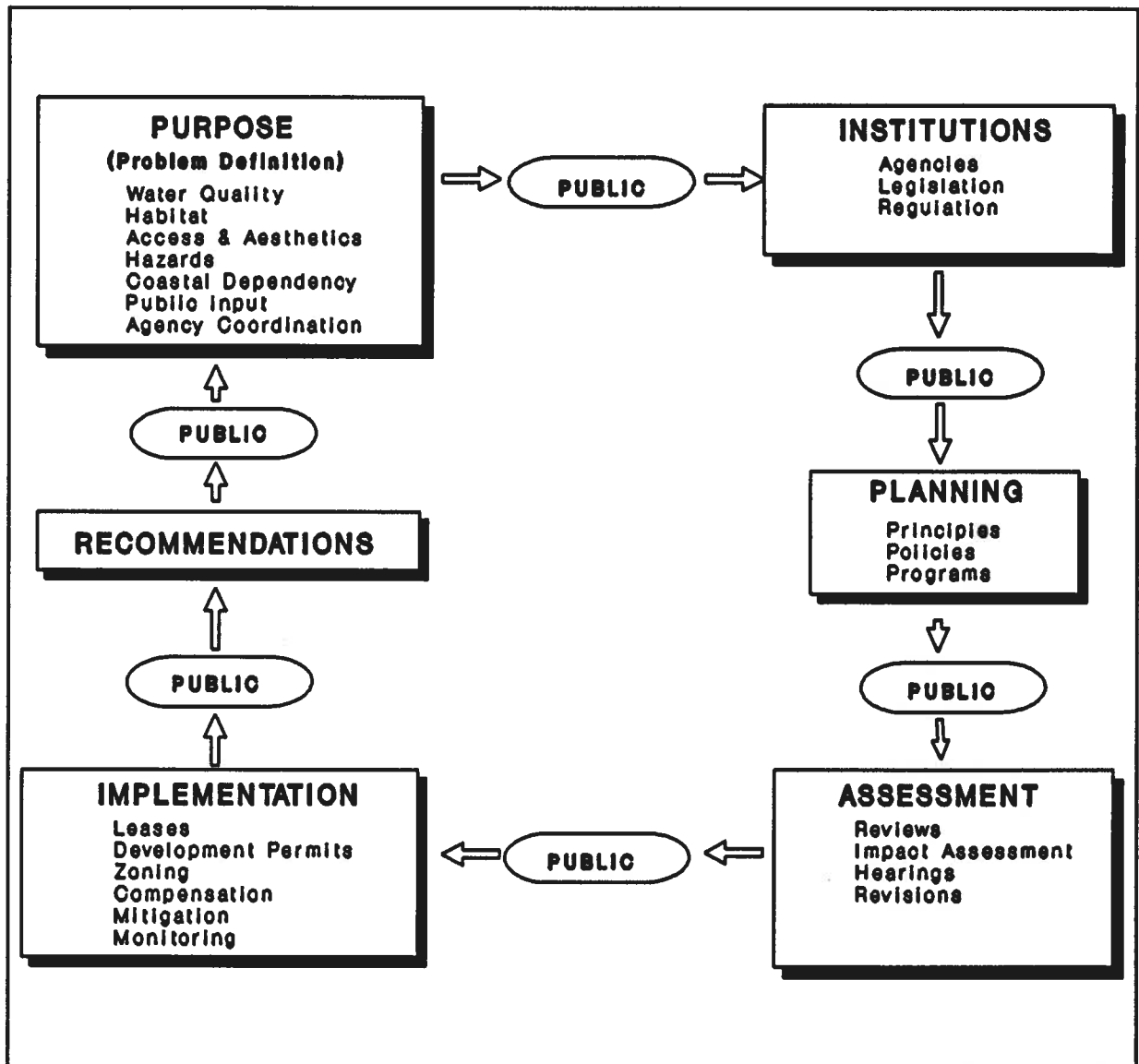
For the purposes of this thesis, the coastal zone is defined by the geomorphological features represented in Figure 1.2. In the case of Richmond, B.C., a low topographical relief has created a community which is entirely situated within the coastal zone.

1.2.2 Coastal Zone Management Defined.

The term coastal zone management has many different pseudonyms in the body of international literature. Thus, the phrase coastal zone management, has become essentially interchangeable with other labels which, among others, include: Coastal zone planning, shore zone management, coastal resource management and integrated resource management. According to Hildebrand (1989), coastal zone management is described as having both a planning component and a management component. The first component, planning, involves an integrated process which specifies the means to balance environmental, social and economic considerations in order to achieve the optimum benefit. The planning approach is characterized by a rational sequence of steps with numerous feedback loops. The second component is the

management aspect itself. Management is a process of implementation for plans created in the planning process. Figure 1.5 outlines a C.Z.M. model which has been modified in a manner that reflects the municipal management perspective. A framework for coastal zone management in British Columbia will be developed over the course of the next two chapters. This will further clarify the **Purpose** (problem definition), **Institutions** and **Planning** aspects of the C.Z.M. model illustrated in Figure 1.5.

FIGURE 1.5
The Rational Comprehensive Model for the Management of Coast Zone Issues.
 (Adapted from Gamble 1989)



Given that a stated objective of the thesis is to evaluate municipal policies affecting the coastal zone, it is useful to clarify what *policy* represents. Pal (1987) defined policy as a course of action or inaction by public (governmental) authorities to address a given problem or

interrelated set of problems. For the purposes of this thesis, the 'policies' evaluated shall include explicit policies stated in the Official Community Plan (O.C.P.) that have a demonstrated relevance to coastal zone management issues.

1.2.3 Sustainable Development and Coastal Zone Management.

Interest in reviving an integrated C.Z.M. approach has grown in recent years due to a resurgence of environmental concern generated by the popularity of the World Commission of Environment and Development's (1987) report, Our Common Future (Rueggeberg and Dorcey 1991). This resurgent environmental movement introduced the world to what many saw as a new way of thinking, sustainable development. First popularized by the report, Our Common Future (W.C.E.D. 1987), sustainable development has operated as an objective in the management of environmentally significant areas in British Columbia such as old growth forests and coastal estuaries (B.C. 1991). In spite of a lack of consensus on what sustainable development actually means, sustainable development has had a tremendous impact on management policies for coastal areas.

Although current trends reveal that sustainable development is becoming a familiar theme in new coastal policies, sustainable development will remain peripheral to the subject matter of this thesis.

1.3 Methodology

1.3.1 The Evaluative Framework and Evaluative Criteria.

The evaluative methodology employed within this study was based on similar approaches used by Jessen *et. al* (1983) and Rosentraub (1975). Both studies utilized a retrospective land use regulation survey to evaluate local C.Z.M. efforts. By modifying these two methodologies, a new evaluative approach was created which appears to be better organized and more comprehensive than either Rosentraub's or Jessen *et al.*'s approaches.

In order to facilitate the evaluation of local coastal zone management policies in an organized manner, an evaluative framework of seven coastal zone issues was synthesized from sources in C.Z.M. literature (Gamble 1989; C.C.R.E.M. 1978; Cote 1989; Kennett and McPhee 1988). These key issues which are reflective of local concerns in the coastal zone are represented as follows:

- 1. Habitat Conservation**
- 2. Water Quality**
- 3. Natural Coastal Hazards**
- 4. Public Access and Aesthetics**
- 5. Public Input**
- 6. Water Dependent Activities**
- 7. Interjurisdictional Coordination.**

The literature from which the seven coastal zone issues were drawn appears to be relatively consistent in the description of coastal concerns. Unfortunately, C.Z.M. sources often ignored issues such as land use economics, political agendas and property rights which are also influential forces that exist in the process of C.Z.M. This study has also elected not to include such significant factors in its list of coastal zone issues. Part of the reason for not considering these other issues involves the difficulty in obtaining relevant information.

Local policies relevant to these coastal issues are selected (from the Official Community Plan) for a case study evaluation of Richmond, B.C. It is crucial to note however, that the evaluations apply only to those policies that existed during the study time frame (1988 to 1991). In instances where no relevant policy exists, a description of land use trends and development pressure is provided with a view to assessing the need for a policy response. The methodology allows for a greater resolution in evaluating exactly where, in terms of the many issues facing coastal zones, local C.Z.M. policies have been effective or ineffective based on the case study findings.

The evaluation of the municipal role in C.Z.M. is what Ritchie (1984) described as a *'semi-quantitative appraisal within the limits of existing knowledge.'* Reflecting this, the judgement criteria for the empirically-based analysis are subjective. Results produced by the retrospective analysis of coastal land use regulation in Richmond were interpreted relative to the intent of the local C.Z.M. policies to yield an evaluation of policy performance. Where

possible, 'benchmark' information such as zoned land supply and current land use patterns were used to compare with observed development pressures and land use decisions.

1.3.2 Case Study: Richmond, B.C.

Richmond, British Columbia functions as a case study in the evaluation of municipal level coastal zone management policies and initiatives. Due to the wide range of coastal issues experienced by Richmond, it would be appropriate to utilize it as a representative case study upon which conclusions concerning local input into C.Z.M. could be confidently based (McPhee, pers. comm. 1991).

Another aspect which makes Richmond an attractive case study is the fact that it is located within one of the best studied estuaries in Canada. Initiated in February, 1977 by the federal Minister of Fisheries and Environment and the provincial Minister of Environment, the Fraser River Estuary Study (F.R.E.S.) conducted detailed research into many aspects of the estuary. The purpose of the F.R.E.S. was to *"develop a management plan which recognized the importance of the estuary both for human activities such as urban-industrial and port development, and for preservation of ecological integrity"* (F.R.E.S.S.C. 1978: p.1). The F.R.E.S. and other studies conducted in conjunction with it, have left a rich legacy of understanding concerning the biophysical, economic and institutional attributes of this estuary.

1.4 Applicability of Study and Findings.

The major emphasis of this thesis involves evaluating local government's policies affecting the management of coastal issues which are a vital component of the overall management of British Columbia's coastal zone. The methodology employed was designed to evaluate existing local coastal zone management policies using explicit and implicit Official Community Plan Objective Statements as judgement criteria. In this study the methodology was applied to existing policies in the Official Community Plan of Richmond, B.C. Furthermore, the observed patterns of development pressures¹ and land use decisions in this study were useful in identifying an imminent need for a pertinent policy. Thus, the methodology proved to be capable of evaluating existing local policies and revealing the need for a policy where none existed previously.

The evaluative framework's list of seven coastal issues was compiled from a broad range of coastal zone management literature covering many other jurisdiction's experiences with coastal problems. Thus, without the need for major modification, the evaluative framework could be applied to other evaluations of local government C.Z.M. policies.

The findings from this thesis could be of general applicability to other situations owing to the universality of the issues and problems being faced by coastal jurisdictions. Of particular

¹Development pressure is a relative term employed to describe the amount of development interest given by the number of development permit applications.

interest to other local governments would be the observed "effectiveness" of policies employed by Richmond.

1.5 Summary

Chapter One introduces the coast as a broadly conceived zone characterized by interacting aquatic and terrestrial ecologies. Within the context of this broad definition of the coastal zone, this study seeks to:

1. Describe local government's role in the management of the coast.
2. Evaluate local policies affecting coastal issues through a case study of Richmond, B.C.
3. Forward policy recommendations designed to improve local efforts, especially in Richmond, to manage coastal issues.

The next chapter explores the coast in terms of biophysical, socio-economic and institutional dimensions in order to arrive at a clearer understanding of the position of local government in Canadian coastal zone management.

CHAPTER 2

A FRAMEWORK FOR COASTAL ZONE MANAGEMENT IN BRITISH COLUMBIA

"Nowhere on the shore is the relation of a creature to its surrounding a matter of a single cause and effect; each living thing is bound to its world by many threads, weaving the intricate design of the fabric of life."

Carson 1955. p.14.

2.1 Introduction

In order to facilitate a systematic review of the many forces and factors present within British Columbia's coastal zone, a framework shall be employed. This framework has been derived from sources such as Brouwer (1987) and Dorsey (1986) and is presented in the specific context of the coastal zone.

2.1.1 Coastal Zone Management: Biophysical, Socio-economic and Institutional Components.

There are three components which constitute a management framework for the coastal zone. The components of this model are; the biophysical, the socio-economic and the institutional. Each component in the framework is characterized by a particular set of processes, subsystems, relationships and laws. This conceptual framework for the coastal zone forms the basis upon which the process of management rests. Walters (1986: p.45) described management models as *"caricatures of nature against which to test and expand experience."* Hence,

management frameworks have become indispensable for assisting decision-makers to understand the nature of conflicts arising within the coastal zone and also to learn from the experience of past policies.

Previous resource management approaches believed that biophysical, socio-economic and institutional components functioned virtually independently of one another. This perception tended to underline the existing beliefs that our socio-economic activities operated in whatever manner they wished with the environment² serving merely as a source of raw materials and a limitless sink for wastes (Rees 1991; Rowe 1989; and Herfindahl and Kneese 1974). This management framework is termed the Horizontal Model Approach (Brouwer 1987). The Horizontal Model Approach is characterized by the interaction between essentially isolated monodisciplinary components (see Figure 2.1b). Within this model, each component is considered equal with respect to conceptual contribution and operationalization. More recently, the Horizontal Model Approach has fallen out of favour with natural resource management theorists, largely due to severe criticism of the assumptions concerning the independence of economics, social systems and the environment (Daly 1989; and Brouwer 1987).

With the recent resurgence in environmental awareness, resource management approaches have favoured the notion of an interdisciplinary and hierarchical approach (Hafkamp 1984;

²Due to the wide array of terms used in the literature to describe biophysical systems, terms such as environment, ecosystem and ecosphere shall be used interchangeably throughout this thesis.

Dorcey 1991; and Walters 1986). Brouwer (1987) has termed this approach as the Vertical Model Approach (see figure 2.1a). According to Brouwer (1987), the vertical model approach is preferable to the traditional horizontal model because it clearly recognizes a hierarchical and mutually dependent relationship between components in the framework. Authors such as Rees (1991), Daly and Cobb (1989) and Sadler (1990) would argue that the biophysical component is the dominant system in the vertically organized management framework. Commenting on the relationship between biophysical and economic systems, Rees (1991: p.460, emphasis added) stated:

"Thus, far from existing in splendid isolation, the human economy is and always has been an inextricably integrated, completely contained, and wholly dependent sub-set of the ecosphere".

The position taken by authors such as Rees has its representation in the approach of this thesis, particularly in the classification of coastal management issues which are dominated by biophysical concerns. Since the Vertical Model is representative of contemporary resource management theory, it will be considered as the theoretical foundation for the analysis and evaluation presented in this study. Consequently, the importance of maintaining the integrity of biophysical systems shall figure heavily in the evaluative process.

A Comparison of Resource Management Frameworks.
(Adapted from Dorcey 1991)

FIGURE 2.1a
The Vertical Model.

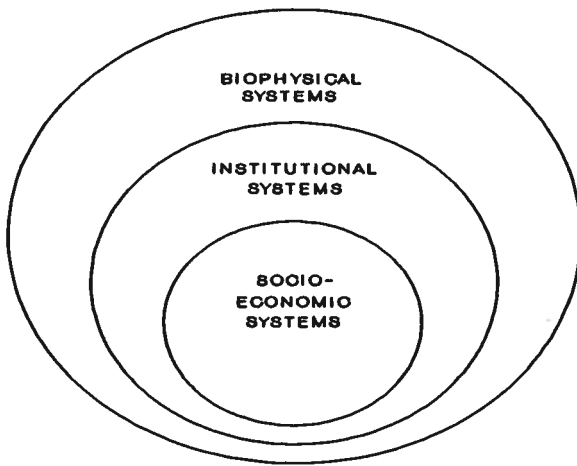
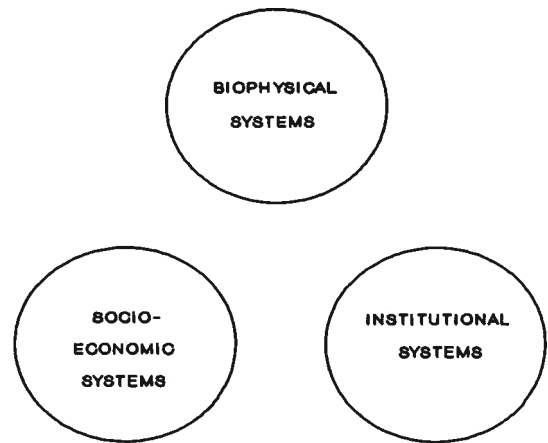


FIGURE 2.1b
The Horizontal Model.



2.2 The Biophysical Component

In the context of C.Z.M., the primary component is the biophysical component. This component includes a vast number of biophysical processes. The degree of understanding of the processes which shape this component varies considerably. In spite of the vast quantity of research conducted to date on the biophysical attributes of the coastal zone, the scope of this

study dictates that only a cursory exploration shall be considered, touching briefly upon Physical and Hydrological attributes, Coastal Zone Ecology and Key Considerations in the Urbanized Coastal Zone (Sections 2.2.1, 2.2.3 and 2.2.4 respectively).

2.2.1 Physical and Hydrological Attributes.

The coastal zone generally consists of a land component and an adjacent ocean component with the ecology of the land directly affecting the aquatic ecology and vice versa (Bauer 1978; Eekman 1975; Ketchum 1972). British Columbia's coastal zone is composed of the saline waters of the Pacific Ocean and the freshwater of local drainage basins. An intermediate third water system may be formed when the geomorphology and fresh water flow are sufficient to create an estuary. The complexity of estuaries is such that the management of estuaries has emerged to become its own discipline (Day *et. al.* 1989; Wilson 1988; and McLusky 1989). Coastal estuaries exhibit a unique pattern of fresh and salt water mixing, called a salinity profile where the lower density, nutrient rich fresh water overlays the denser, nutrient poor ocean water.

The typical coastal zone is defined as having the following important features: the offshore, the foreshore, the backshore and the uplands (refer back to Figure 1.2). Each of these coastal features or coastal subzones are characterized by a distinctive set of biophysical processes and ecologies. Factors such as wind, currents, tidal action, water temperature, water salinity, freshwater discharge and sediment load influence the floral and faunal ecology within coastal

zones (Church and Rubin 1970; Dorcey *et al.* 1983; and Bauer 1978). Table 2.1 lists coastal zone factors and their influence on biophysical systems.

TABLE 2.1
Factors Influencing the Coastal Zone

FACTOR	INFLUENCE ON COASTAL ZONE
Wind and Wave Action	Responsible for accretion/erosion processes along shorelines. Wind and wave activity also responsible for nutrient circulation within the water column.
Tides and Currents	Tides vary the salinity profile of coastal estuaries. Tides also contribute to coast diversity by creating zonation of intertidal flora and fauna. Currents contribute to nutrient cycling within coastal waters.
Water Temperature	Affects dissolved oxygen concentration, stability of the water column and physiological stress for intertidal flora and fauna.
Water Salinity	Affects distribution of salinity sensitive organisms. Also affects the salinity profiles of coastal estuaries.
Freshwater Discharge Rate	Affects the salinity of coastal waters, especially near surface.
Sediment Load	Sediment loads from land run-off and streams affects the dissolved oxygen concentration, turbidity, and photosynthesis rates.

The estuarine ecosystem is one which is locked between marine and riverine environments. Estuarine conditions allow for the formation of an ecosystem at the interface between fresh and salt water creating a zone of tremendous biological productivity (refer to Table 2.2). The high biological productivity of the estuary is particularly impressive when one considers that B.C. coastal estuaries only formed 10,000 years ago following the most recent

retreat of the Cordilleran ice sheet (Barker, 1974). This highly productive ecosystem is based on solar penetration, frequent tidal flushing and nutrient trapping, organic and mineral leaching (Bauer, 1978).

2.2.2 Inputs and Outputs.

Carbon, nitrogen, phosphorus and other critical constituents are continuously introduced into the coastal zone from both the land and the ocean. The organic and inorganic matter that nourishes the coastal zone is delivered by a number of different mechanisms which include:

- ground water containing nutrients;
- tidal flushing;
- faecal deposition from animals and birds;
- detritus deposition from land;
- river and stream sediments;
- wind carried organic matter;
- marine detritus; and
- plankton.

All of these input and outputs to coastal biophysical systems are 'naturally' occurring in that human influence is not considered.

TABLE 2.2
Ecosystem Types and Primary Productivity
 (Source: Whittaker 1975; Begon *et al.* 1986)

ECOSYSTEM TYPE	AREA (10 ⁶ KM ²)	NET PRIMARY PRODUCTIVITY †NORMAL RANGE
Tropical rainforest	17.0	1000-3500
Tropical seasonal forest	7.5	1000-2500
Temperate evergreen forest	5.0	600-2500
Temperate deciduous forest	7.0	600-2500
Boreal forest	12.0	400-2000
Woodland and shrubland	8.5	250-1200
Savanna	15.0	200-2000
Temperate grassland	9.0	200-1500
Tundra and alpine	8.0	10-400
Desert and semidesert-shrub	18.0	10-250
Extreme desert, rock, sand & ice	24.0	0-10
Cultivated land	14.0	100-3500
Swamp and marsh	2.0	800-3500
Lake and stream	2.0	100-1500
Total continental	149	
Open ocean	332.0	2-400
Upwelling zones	0.4	400-1000
Continental shelf	26.6	200-600
Algal beds and reefs	0.6	500-4000
Estuaries	1.4	200-3500
Total marine	361	
Full total	510	

†Per Unit Area (gm⁻²)

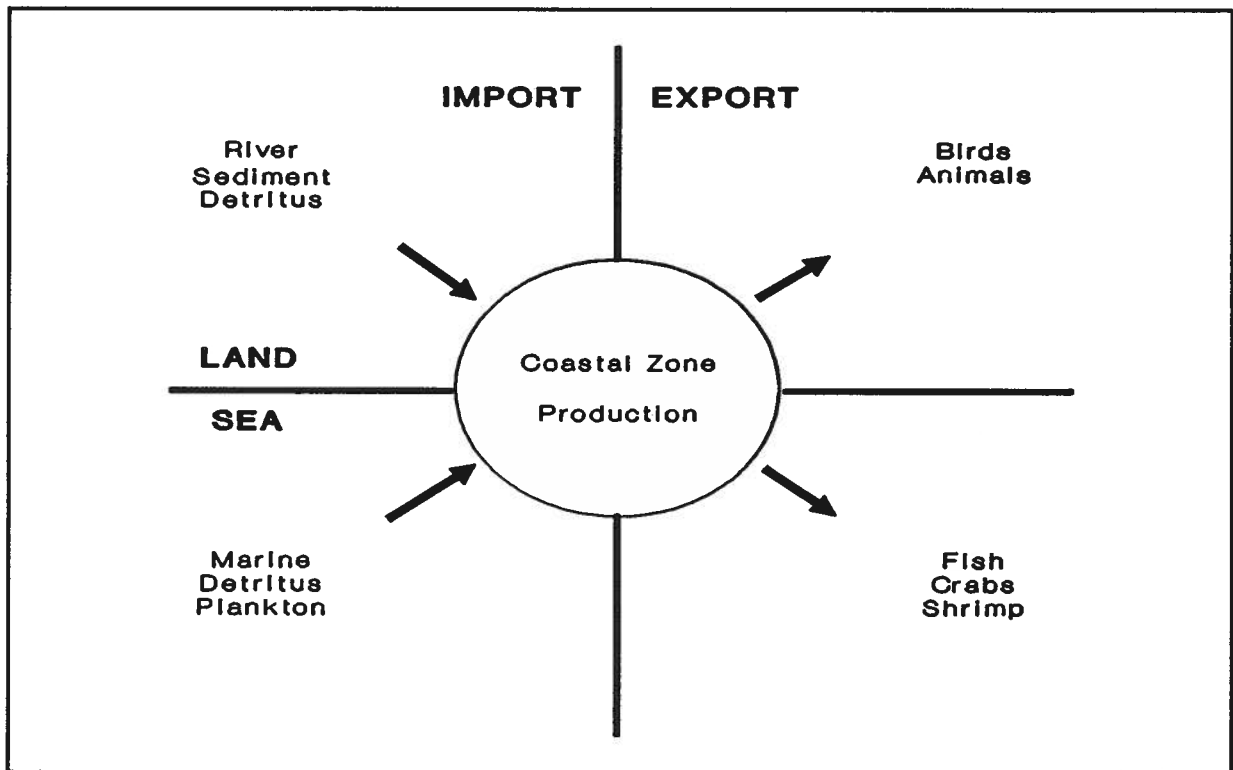
Importation of organic and inorganic nutrients is very important to the overall function of the coastal zone, especially estuaries (McLusky 1989; Postma 1988). In fact, estuarine systems are heavily subsidized in terms of nutrient imports from adjacent ecosystems (offshore and uplands) of the surrounding coastal zone (McLusky 1989).

Organic and inorganic matter are exported out of the coastal zone when organisms that have consumed food within the coastal zone migrate elsewhere. Harvesting organisms that reside within the coastal zone such as crabs or shellfish would also constitute an exportation of organic matter. Figure 2.2 gives a schematic representation of the flow (import and export) of organic matter within the coastal zone. The influence of human activities in the input and output of nutrients to coastal zone systems is addressed separately in sections 2.2.4 and 2.3.

2.2.3 Coastal Zone Ecosystems.

The underlying key to coastal ecosystems is the dynamic nature of the physical components of the coastal zone. Variations in the ecology of the coast exist in both spatial and temporal dimensions. The complicated ecosystem structure observed in coastal zones and coastal estuaries reflects the dynamic and often unpredictable physicochemical factors.

FIGURE 2.2
Nutrient Imports and Exports in the Coastal Zone
(Adapted from Reise 1985)



An overview of coastal zone ecosystems is perhaps best achieved by considering community structure in terms of producers, consumers and decomposers. However, such reductionism must be tempered with a note of caution. Ecosystems must be viewed as far more than a collection of organisms. There exist a number of synergistic, facilitative and predatory interactions between organisms and species that further dictate what we observe as an ecosystem (Begon *et al.* 1986).

2.2.3.1 Producers

The category of producers includes those organisms capable of 'fixing' solar energy by means of photosynthesis. A portion of this 'fixed' energy is respired away by the organism and is lost from the community as respiratory heat. The remainder of 'fixed' energy may be converted into new biomass.

Submergent, emergent and riparian communities of the coastal zone each contribute to the production of new biomass through photosynthesis. Within emergent and riparian communities, there is a considerable array of plant species responsible for the photosynthetic production of biomass, including bog species such as salal and upland tree species such as Western red cedar (Biggs and Hebda 1976; F.R.E.S. 1978)

Producers within submergent coastal communities include phytoplankton (free drifting algae), benthic algae and pelagic algae. In addition to algal species, submergent plant species such as eelgrass (*Zostera sp.*) play an important role in biomass production (F.R.E.S. 1978).

2.2.3.2 Consumers

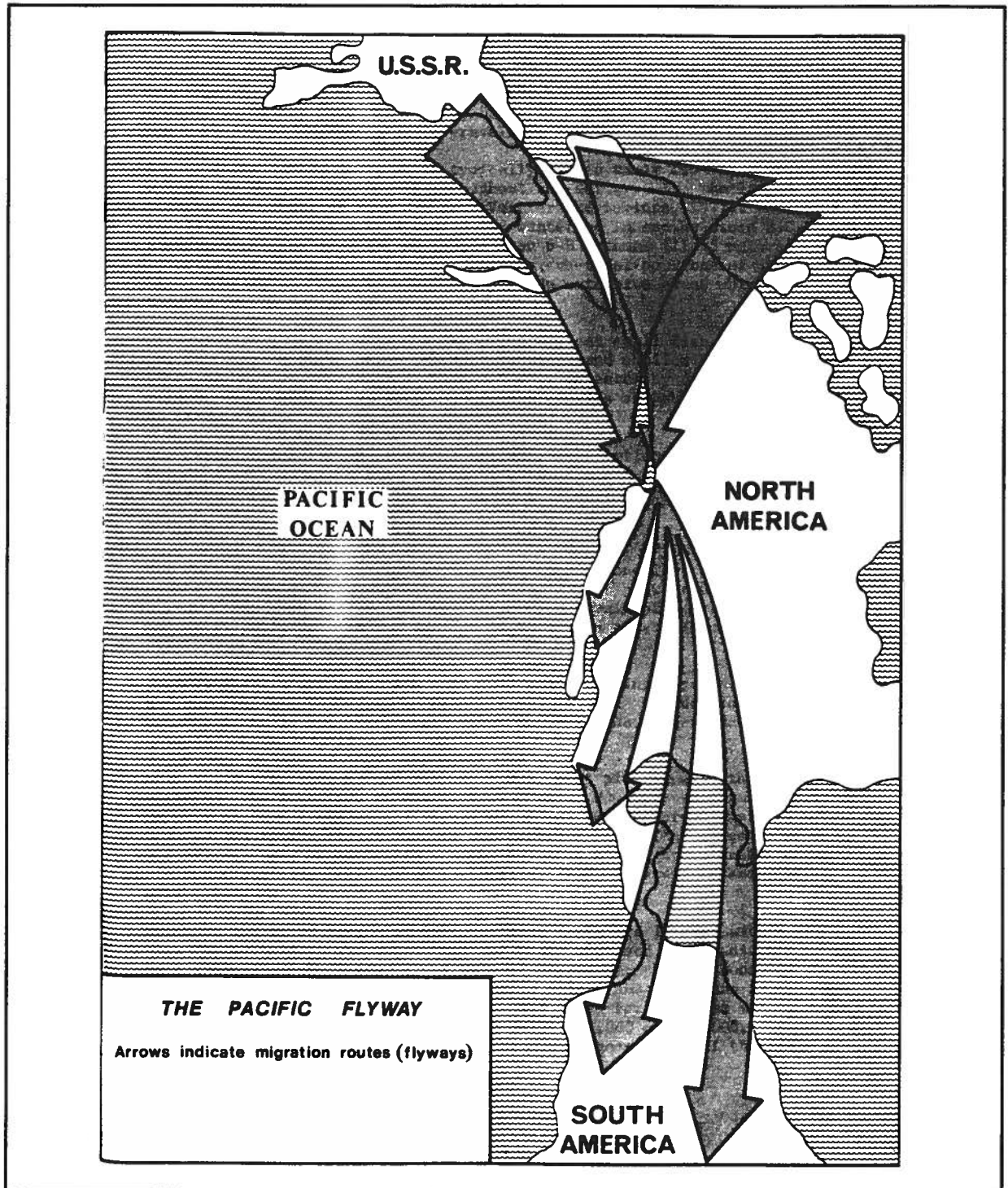
The solar energy assimilated by producers is the biomass upon which consumers feed. Due to reasons of economic and social concern, attention to the coastal zone's consumer species has focused largely on fish and bird populations. British Columbia's coast serves as , 'nurseries of the sea' providing important breeding, rearing and feeding grounds for pelagic fish species at various intervals in their life cycle (Ducsik 1974). Levy *et al.* (1979) and Healey (1982) have

produced some conclusive evidence which suggests that coastal wetlands and estuarine habitats are important temporary residences for juvenile salmon species. The coastal zone of the Lower Mainland, for example, boasts an impressive list of fish species including all salmon species, herring, three spine stickleback, sturgeon, cod and sole (F.R.E.S. 1978).

In addition to pelagic fish populations, several marine mammal species (including orcas) and hundreds of species of benthic invertebrates reside along British Columbia's coast. F.R.E.S. (1978) reported over three hundred species of invertebrates. Commercially important species such as Dungeness Crab, pink shrimp, butter clams and oysters are found in the Lower Mainland's coastal zone, however, harvesting restrictions are in effect as a result of coliform contamination of local waters from urban and industrial sources (F.R.E.S. 1978).

The coastal zone supports hundreds of species of waterbirds, songbirds, marshbirds, birds of prey and game birds (F.R.E.S. 1978; Butler and Campbell 1987). The Fraser Estuary supports the largest population of waterfowl in Canada (Taylor 1974) and is considered to be the single most important aquatic bird habitat in the province (F.R.E.S. 1978). The Lower Mainland region also hosts the second largest seagull population on the West Coast of North America (F.R.E.S. 1978). The convergence of waterfowl from three continents to the Lower Mainland and Vancouver Island make this region a significant stop on the Pacific Flyway (See Figure 2.3).

FIGURE 2.3
The Pacific Flyway
(Source: F.R.E.S. 1978: 101)



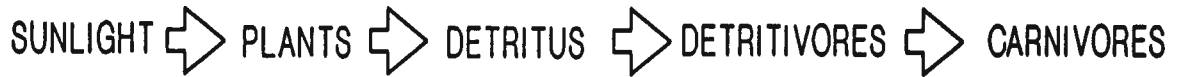
The coastal zone is also utilized by terrestrial species such as sea otters,, muskrats, mink, raccoons and black bears (F.R.E.S. 1978; Kennett and McPhee 1988). These species exploit coastal habitats for purposes of feeding and nesting (F.R.E.S. 1978).

2.2.3.3 Decomposers

Dead biomass or necromass serves as the food source for a number of species classified as decomposers. The role of detritus in coastal estuaries is important because these ecosystems are predominantly detritus-based (Dorcey *et al.* 1983; Ward 1980). Aided by the high availability of nutrients through the action of tidal flushing or land run-off (rivers and streams), decomposition by bacteria, zooplankton and other marine detritivores is relatively rapid (F.R.E.S. 1978). The process of decomposition is similar in the terrestrial component of the coastal zone, however, the rate of decomposition is limited by the availability of nitrogen (Begon *et al.* 1986).

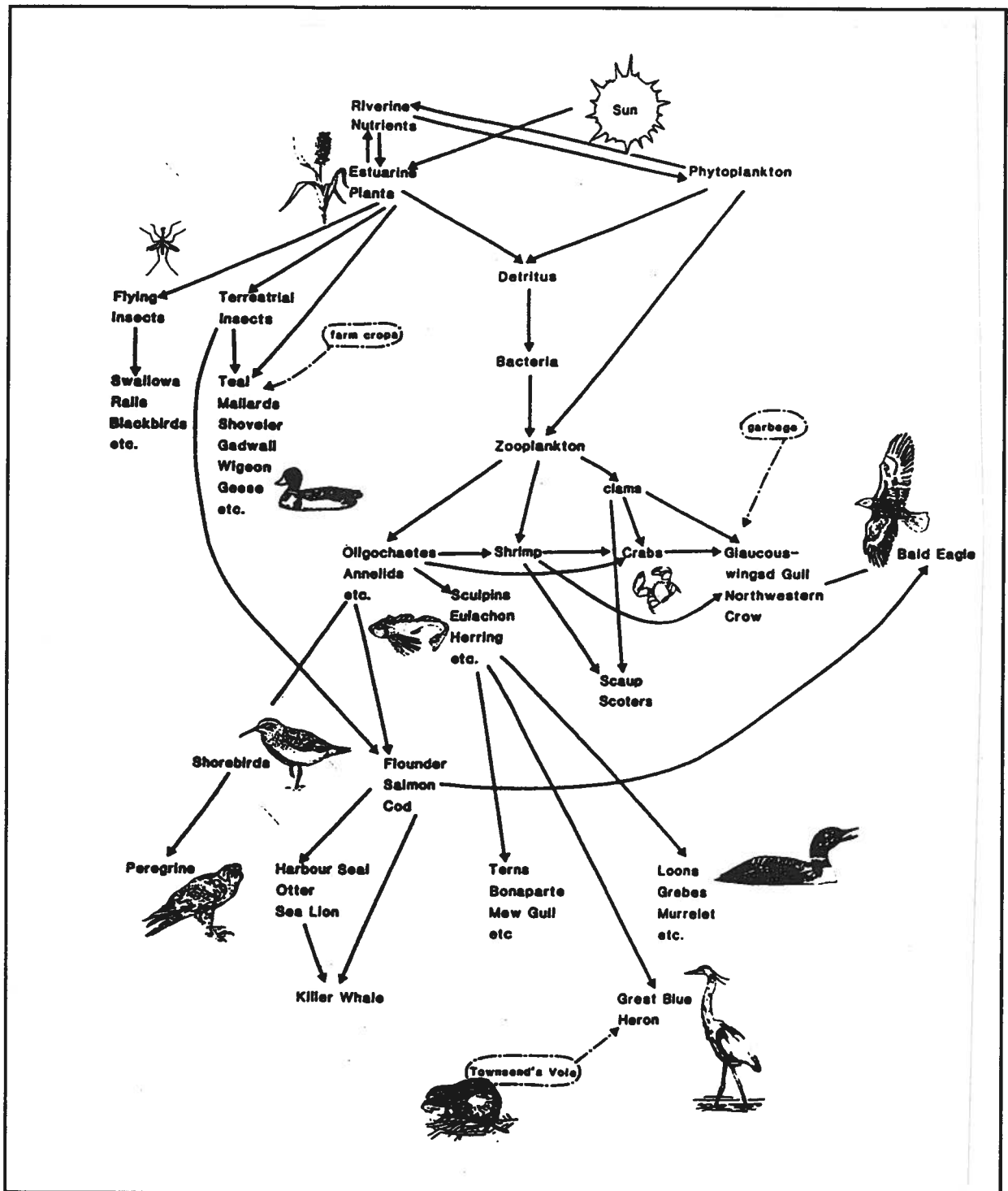
2.2.3.4 Species Interactions

In describing the general architecture of an estuarine food web, Dorcey *et al.* (1983) proposed a hierarchical community structure represented by:



An expansion of this basic model is given by Butler and Campbell (1987) which describes a model foodweb for the Fraser River estuary (see Figure 2.4). The model proposed by Butler and Campbell is also representative of the general structure of coastal ecosystems. The most important observation to be made of this representation involves the intricate manner in which organisms from all components of the coastal zone (offshore, nearshore, backshore, intertidal and uplands) are connected.

FIGURE 2.4
Model for the Fraser River Delta Foodweb
 (Source: Butler and Campbell 1987:12)



2.2.4 Key Considerations in the Urbanized Coastal Zone.

In the United States, the extent of urban development is reflected in the statistic that, although the coastal zone's most productive region, the estuary, accounts for only 15 percent of the land area for coastal and Great Lakes states, it contains over 33 percent of the population (Ketchum, 1972). The situation is even more intense in California where over eighty percent of the state's nearly 30 million people live within thirty miles of the coast (Boyd 1985). The level of urban development in British Columbia is similar to that of California with approximately half of the province's population of three million concentrated in the Fraser River estuary alone. Notably, the majority of the B.C. coast is undeveloped. Ecologists estimate that two-thirds of the global marine populations spend a portion of their life in estuarine regions or are dependent upon other species that do (U.S. Council on Environmental Quality 1970). So it would appear that human beings, as well as other species are drawn to the coastal zone.

The upland component of the coastal zone has been subject to rapidly increasing demands of housing, industry, transportation and recreation (Hildebrand 1989; British Columbia 1987a). Although the primary competitor for coastal upland habitat is housing (Ketchum 1972), research done in Atlantic Canada revealed that developed estuaries are subject to many different land uses (Beanlands 1983). The offshore activities such as fishing and petroleum development which satisfy the demands of coastal urban centres have often over-taxed the capacity of the coastal zone (Todd 1973; Canada 1985a).

Coastal urban centres place various types of stresses on the coastal zone's biophysical components and systems. Wilson (1988) has categorized human stresses on the coastal zone under headings of changes of use, misuse and pollution.

2.2.4.1 Changes of Use

In response to different demands on the coast, physical changes such as residential development or dredge-and-fill operations have initiated a physical, chemical and biological evolution of marine coastal systems (Wilson 1988). The construction of protective seawalls and alteration of land drainage patterns interferes with the input of organic nutrients into coastal waters. Perhaps most importantly, changes in the coastal systems through human activity have led to observed alterations throughout the entire coastal zone food web, particularly on herbivorous and piscivorous birds (Wilson 1988).

Coastal land development practices are capable of producing substantial changes in terrestrial coastal ecosystems. Unfortunately, the impacts associated with coastal habitat alteration due to land use development are usually detrimental in nature (F.R.E.S. 1978). The direct impacts of development may be interpreted in terms of the decreased nesting and foraging capacity of the ecosystem. Factors associated with human activity such as increased predation from domestic animals and increased noise pollution exert a more subtle array of deleterious impacts on coastal ecosystems (F.R.E.S. 1978). The cumulative effects of many small impacts such as urban encroachment are often not observable given the amount of ambient variability in

the coastal zone. The complexity of the coastal zone could mask the indicators of drastic changes in coastal ecology.

Changes in use within the coastal zone have also increased the potential for damages due to natural disasters. For example, the removal of native vegetation along coastal bluffs has been shown to reduce slope stability (VanDine 1991).

2.2.4.2 Misuse

Misuse occurs where the intensity of human activity exceeds the natural capacity of the coastal zone to accommodate such exploitation. Misuse within the coastal zone is much less prevalent than change of use, and the identification of misuse of coastal resources is complicated by the effect of pollution (Wilson 1988). The principal coastal resources to be over-exploited are fish and shellfish (Wilson 1988). The decline in fish species, particularly migratory ones such as salmon may be attributed to over-harvesting, however habitat destruction and bait species over-fishing may represent the most serious threats to commercial fish stocks (Wilson 1988; Simpson 1991). Fragile coastal habitats such as dunes and wetlands are coming under increasing pressure, particularly from leisure activities (Wilson 1988; F.R.E.S. 1978).

2.2.4.3 Pollution

The Joint Group of Experts on the Scientific Aspects of Marine Pollution offer this definition for marine pollution:

"The introduction by man, directly or indirectly, of substances or energy into the marine environment (including estuaries) resulting in such deleterious effects as harm to living resources, hazards to human health, hindrance to marine activities including fishing, impairment of quality of use of sea water and reduction of amenities".

(G.E.S.A.M.P., 1986)

There are five basic classes of contaminants including: organic matter, petroleum products, heavy metals, organochlorines and radioactivity. Organic matter and petroleum products are regarded as the most abundant pollutants, however heavy metals, organochlorines and radioactive pollutants are often the most toxic and persistent in terms of biodegradation (Wilson 1988).

Water pollution from sources such as municipal sewage, industrial effluent, agricultural run-off and acid precipitation is a major threat to the complex food webs that depend upon the aquatic component of the coastal zone. The vast majority of Biochemical Oxygen Demand (B.O.D.), faecal coliforms and trace metals originate from household and other non-industrial sources while radioactive and organochlorines tend to originate from industrial sources (Schreier *et al.* 1991).

The toxic nature of some pollutants and the manner in which vast amounts of pollution are introduced into coastal waters are often detrimental to the coastal zone. These detrimental

impacts may be localized at the end of a sewage outfall or extend far beyond the coastal zone by the movement (export) of organisms that bio-accumulate toxins. Richmond's location at the mouth of the Fraser River is a significant factor in local water quality as it is subject to both river-borne pollutants introduced at points further up stream and ocean pollutants. In addition, two major sewage treatment facilities are located within and adjacent to Richmond's municipal boundaries (Iona and Annacis Island Sewage Treatment facilities respectively). A much smaller third Sewage Treatment facility is located at Lulu Island in Richmond, B.C.

2.3 The Socio-Economic Component

Coastal resources are those naturally occurring resources and systems in the coastal zone that are of value to humans or could be under plausible technological, economic or social circumstances (Dorcey 1986). In the intervening years since the arrival of Europeans in British Columbia in 1774, coastal resource exploitation has evolved considerably (Fisher 1977). Driven by technological advance, exploitation of coastal resources has become more efficient, more intense and has expanded to include an increased number of exploited resource types. The motivation behind the exploitation of coastal resources is largely an economic one.

2.3.1 Nearshore and Offshore Coastal Resource Uses.

2.3.1.1 Fisheries and Mariculture

Between 1978 and 1983 the wholesale value of fish from British Columbia's coastal commercial fisheries sector averaged about five hundred million dollars annually (Dorcey 1986). From 1987 to 1989, the economic value of the B.C. salmon catch alone has averaged \$540

million (Henderson 1991). In addition to commercial fisheries, the salt water sport fisheries have been valued at approximately one hundred and twenty million dollars (Dorcey 1986).

The main species harvested in commercial fisheries include salmon, herring, halibut, other groundfish (including cod, flounder and snapper) and shellfish (including clams, oysters and crabs). Overwhelmingly, salmon is the single most important harvested fisheries resource in British Columbia (Pearse 1982). In the early 1980's, commercial and recreational salmon catches totalled over twenty-three million salmon (Pearse 1982). Recently however, salmon populations in the province's largest salmon-bearing river, the Fraser, have witnessed sharp increases (Northcote and Burwash 1991). For pink (*Oncorhynchus gorbuscha*) and chinook (*Oncorhynchus tshawytscha*) salmon species, a three-fold increase in annual escapements to the Fraser River Basin have been recorded (Northcote and Burwash 1991).

Coastal estuaries and rivers such as the Fraser River system have been shown to be crucial to salmon stocks (Dorcey 1986; Kistritz 1978; Levy and Northcote 1982). These areas are coincident with several British Columbia communities and port/harbour facilities, thus the potential for damage (due to water pollution for example) to offshore and nearshore fisheries resources is very significant.

In recent years, mariculture or fish farming has developed into a significant branch of B.C.'s commercial fishery. Salmon, shellfish and trout are the main species harvested (Canada 1990a). In 1990, production from B.C. fish farms is estimated at \$95 million dollars (fifteen

thousand tonnes) from over one hundred farms (Canada 1990a). Fish farm and shellfish operations have located in the Campbell River/Desolation Sound region, the northwest coast of Vancouver Island and along the coast of Georgia Strait (Canada 1990a).

The financial magnitude of fisheries and mariculture reveal the importance of these coastal resources to the provincial economy. However, for many small communities along the coast of British Columbia, fisheries also represent the main source of income. The village of Steveston (located within Richmond) derives much of its economic health to the commercial and sportsfishing fleet which operates from Steveston harbour.

2.3.1.2 Energy and Petrochemicals

The present extent of energy and petrochemical activity throughout coastal British Columbia is relatively limited (Dorcey 1986). Shipments of oil and gas products, coal and other petrochemicals occur along offshore and nearshore shipping routes. Major port facilities for these products exist at Roberts Bank, Port Moody, Esquimalt, Bella Coola, Kitimat, Prince Rupert and Port Simpson (Canada 1978a).

British Columbia's energy requirements are largely filled by hydroelectric dam projects. Generally, hydroelectric dam projects have not had any significant impacts on major Pacific drainages such as the Fraser River (Dorcey 1986). There have been a number of small hydroelectric developments along coastal streams. An example of such a hydroelectric dam

exists on the Campbell River where the power derived from the dam serves primarily regional needs.

The future prospects within this sector depend much on global economic fortunes, particularly oil prices. During the late seventies energy shortages prompted exploration for oil and natural gas off British Columbia's coast (McPhee 1982). Perhaps a future energy crisis will re-kindle interest in the exploitation of offshore petrochemical resources.

2.3.1.3 Transportation

Shipping activity throughout coastal British Columbia represents an important non-consumptive resource use within the coastal zone. Combined shipping for the entire province of British Columbia totalled over forty-two million metric tonnes of cargo in 1985 (Canada 1985b). The Port of Vancouver alone shipped four million metric tonnes of petroleum products in 1988 (Canada 1990b). In addition to industrial traffic, commercial passenger traffic and ferry traffic utilize coastal waters, especially between Vancouver Island and the mainland. From 1970 to 1980 there has been an annual increase of 16 percent in the volume of passenger cruises along the B.C. coast (Montgomery 1981).

British Columbia's coastal waters are also utilized as a vital transportation link for industrial and commercial sectors of the economy. The ready access to coastal waters for the transportation and storage of logs allows for the exploitation of remote coastal forest resources isolated from road or rail access (Dorcey 1986). Since the early 1980's a shrinking coastal

forest resource base and a shrinking market has seen a decreased use of coastal waters for the transportation and storage of logs (British Columbia 1980). Within Richmond, transportation is a vital economic activity. Richmond is perhaps unique in that all parts of the coastal zone (uplands, shorelands, nearshore and offshore) seem to be involved in transportation activities. Major examples of transportation use within Richmond's coastal zone include Vancouver International Airport and the shipping and pleasure craft traffic along the North Arm and Main Arm of the Fraser River.

2.3.2 Shoreland and Upland Coastal Resource Uses.

2.3.2.1 Forestry

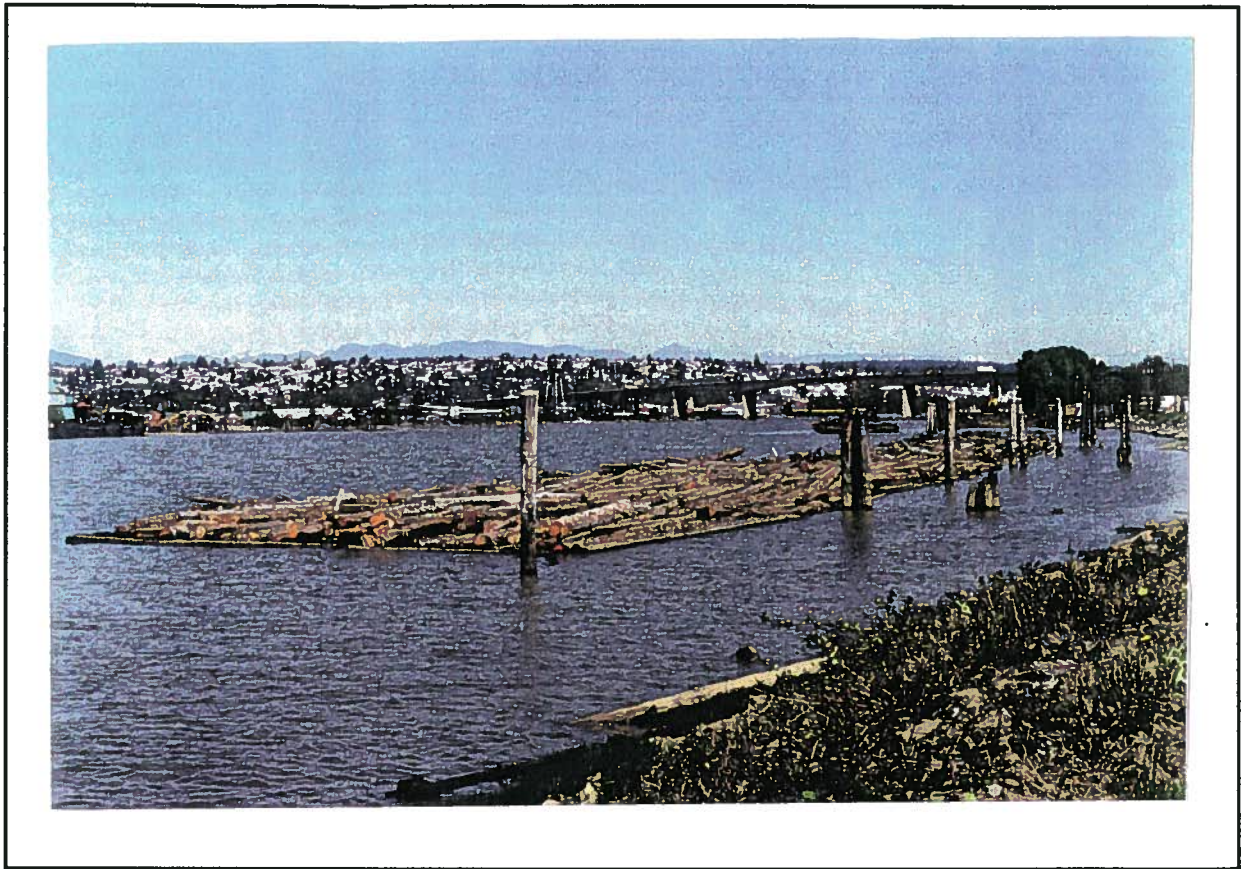
Forestry in British Columbia began along the coast. Coastal tree species such as western red cedar, hemlock, spruce and douglas fir that sustained B.C.'s forest industry since the nineteenth Century began to be replaced by species such as lodgepole pine and jack pine of interior forests. By 1972, interior forests usurped the coastal forest as the leading source of timber in the province's forest industry (B.C. 1980).

In 1990, 78 million cubic metres of timber were cut on crown or private land in British Columbia (British Columbia 1991a). The forest industry in B.C. employs approximately 100,000 workers (British Columbia 1991a). The value of forest products produced in B.C. was \$11.2 billion in 1990 (British Columbia 1991a). The forest industry is the backbone of the provincial economy, accounting for almost fifty percent of the value of provincial exports and

manufacturing shipment (Dorcey 1986). A significant portion of forest industry jobs and timber resources are still located along B.C.'s coast.

Coastal waters serve a very important role in the forestry sector. Coastal areas including the Fraser River Estuary are extensively utilized by the forest industry for log storage, log sorting, wood product transportation, and as a receptacle for waste products. Foreshore areas of the coastal zone are utilized as convenient and practical locations for industrial facilities such as pulp and paper mills. Figure 2.5 portrays log storage activity in Richmond, B.C. on the North Arm of the Fraser River.

Figure 2.5
Log Storage on the North Arm of Fraser River: Richmond, B.C.



2.3.2.2 Mining

Coastal mines were important to the early development of the mining industry in the province, eventually much of the activity relocated further inland (Dorcey 1986). Regardless of the actual location of the mine, more than 90 percent of mining production was shipped out via tidewater (Price Waterhouse 1984).

2.3.2.3 Agriculture

Due to a mild climate, coastal upland areas of British Columbia are often utilized for agriculture. A significant amount of agricultural activity is concentrated in the SouthWest corner of the province in coastal river deltas. In the lower Fraser River region³, there is an estimated 1, 949 farms representing \$1.69 billion in farm capital (Schreier *et al.* 1991). Although, the most intensive concentration of coastal agriculture is found in the lower mainland of British Columbia, the importance of the sector is nonetheless significant given the number of farms and level of investment. The significance of the agricultural sector to Richmond is reflected in local land use patterns in which nearly half of the available land base is allocated to agriculture (Richmond, 1989).

2.3.2.4 Tourism and Recreation

In 1989, the number of non-resident visitors to British Columbia totalled 7.6 million (British Columbia 1991a). Research shows that visitors to the province are attracted to British Columbia's scenic vistas and wild places (British Columbia 1991a). A large proportion of provincial tourism takes place on the coast (Dorcey 1986). Coastal-related activities such as fishing, kayaking, sailing, scuba diving, power boating, swimming and windsurfing are popular attractions for tourists.

³This sample region encompasses the lower mainland of B.C., extending eastward to Hope.

Recently, recreation interest in the coastal zone, particularly in the Lower Mainland has undergone sharp increases (G.V.R.D. 1987). The foreshore also provides the widest range of recreation opportunities found in the region (F.R.E.M.P., 1990). An expansion of foreshore recreation opportunities would be an effective means of:

- satisfying the increased recreation demand due to increased population;
- meeting the specific recreation needs of an aging population;
- achieving ecological protection of sensitive estuarine areas; and
- building a stronger regional perception of the Fraser River estuary.

Recreation demands in the Lower Mainland tend to focus on waterfront activities such as visiting the beach, fishing and boating (G.V.R.D. 1987). The foreshore provides opportunities for these waterfront activities. The foreshore also holds potential for pedestrian paths. Ozborn (1991) revealed that Richmond's trails and dykes have the highest frequency of use of all cultural and recreation facilities in the community. The development of an extensive system of waterfront trails would satisfy the recreation needs of the older portion of the population as well as protect ecologically sensitive areas from more damaging forms of development.

2.3.2.5 Urban Development

The historical pattern of settlement suggests that residential development concentrates on adjacent coastal uplands in proximity to the major employers, such as port facilities, fish

processing plants and sawmills (Kennett and McPhee 1988). Many coastal communities within British Columbia display a distinctive linear pattern of residential development with every home seeking a water view lot. In the lower mainland, many waterfront industrial sites have been redeveloped with higher density, commercial and residential development (Kennett and McPhee 1988). The use of the coastal zone by urban development is not limited to land use, however. Industrial, residential, commercial and agricultural uses rely on the nearshore and offshore waters of the coastal zone to serve as a receptacle for treated wastes⁴.

2.4 The Institutional Component

The conflicts that have arisen over coastal resources have been described by Dorcey (1980) as a "war that society fights with itself as it seeks to both develop and conserve its coastal resources." Key antagonists in this 'war' are found at the three levels of government (federal, provincial and local) as they exercise their regulatory powers in the management of the coastal zone. Dorcey's description of the situation that exists within the coastal zone serves to underline the need for effective management of the coast. Increasingly, attention is focusing on local governments and their powers over land use regulation. This attention is extremely influential in the continuing conflict among all levels of government, First Nations Peoples, industry and interest groups over how best to manage the coastal zone (Simpson 1991).

⁴Some untreated sewage enters receiving waters due to heavy rainfall events and accidental shutdowns (Kennett and McPhee 1988).

In Canada, the rights and responsibilities of government are rooted in the British North America Act (1867). This Act established the fundamental division of rights and responsibilities between the federal and provincial levels of government. There are two features that are key to the management of the coastal zone. The first is that the rights and responsibilities allocated to each government are primarily exclusive. The second feature is that the provincial and federal levels of government are permitted to delegate authority to a 'subordinate body' (Ince 1984). The province of British Columbia has delegated some of its authority to a subordinate body known as Municipal government through the Municipal Act (1979).

Since the British North America Act, the division of federal and provincial powers has become complicated by the new Constitution (1982), various accords and disputes (Dorcey 1986). In fact, the situation has become so complex that nowhere within the coastal zone - upland, backshore, intertidal, nearshore or offshore - is there a clear undisputed basis for one government to be the sole authority (Dorcey 1986).

Who becomes involved in the management of coastal resources is to a large extent determined by the complex pattern of ownership and jurisdiction that exists within the coastal zone (Dorcey 1986). What follows is a brief examination of the fragmented nature of ownership and regulatory jurisdiction present within the coastal zone.

2.4.1 Ownership

The federal government has claimed ownership of the offshore component of British Columbia's coastal zone. Since the prospect of offshore oil, gas and minerals, the provincial government has challenged this federal claim (Dorcey 1986). The provincial government claims ownership of most upland, backshore and intertidal lands and all their resources (Dorcey 1986). The provincial government also contests ownership of nearshore and offshore resources (Dorcey 1986).

Local government has limited ownership in small parcels of coastal upland and coastal shoreland. Typically, municipally owned coastal land is utilized for uses such as infrastructure or parkland. Local governments in British Columbia do not claim ownership of any coastal resources.

A significant portion of coastal upland and coastal backshore is privately owned, usually in what is called a fee simple interest. Crown foreshore leases are available for private ownership also (Roberts 1988). A portion of British Columbia's coastal uplands and backshore is owned (and governed) by First Nations peoples or is subject to land claims. Furthermore, the ownership of coastal zone resources (particularly fish) is disputed between First Nations Peoples and the federal government.

2.4.2 Regulation.

The Canadian approach to C.Z.M. is premised on the adoption and coordination of a number of environmental management policies by those agencies having responsibilities for the coastal zone (Hildebrand 1989). An example of Canadian coastal zone policy is given by the D.F.O.'s recent policy for fish habitat management (Canada 1985a). Policies such as the D.F.O.'s are restricted to fit within narrow departmental mandates. The Canadian approach to C.Z.M. has been to employ the policies of the existing legislative framework in a piecemeal manner in order to deal with coastal zone problems as they arise (Gamble 1989; DOE 1982; and Dorcey 1983). The Canadian approach is far more decentralized than its American counterpart which has descended from federal legislation.

A summary of selected federal and provincial agencies and enabling legislation is presented in Appendix A and B respectively.

2.4.2.1 Federal Government.

Federal jurisdiction is perhaps clearest over the most seaward extent of the coastal zone. Fisheries, shipping, navigation, defense, harbours, international relations and communications are some of the nearshore and offshore activities that fall under federal jurisdiction (Dorcey 1986). Federal agencies involved with the regulation of these activities include: Harbour Commissions, Department of Fisheries and Oceans, Transport Canada, Energy, Mines and Resources Canada and the Department of National Defense.

Federal jurisdiction over activities occurring within the upland, backshore and intertidal portions of the coastal zone is more complicated. Agencies such as Public Works Canada, Environment Canada, Transport Canada and the Department of Fisheries and Oceans may become involved (according to their mandate as detailed by legislation) in matters such as fish habitat protection or dyke maintenance. The federal government retains limited powers stemming from the, "peace, order and good government" clause of the Canadian Constitution (Sec. 5.91(a)) which create federal jurisdiction where air or water pollution transcend provincial or national boundaries (Thompson 1981).

The Six Harbours Agreement passed by a federal Order-in-Council in 1924 grants the federal government jurisdiction over submerged lands in the following B.C. harbours (Roberts, 1988): Victoria, Esquimalt, Port Alberni, Nanaimo, Burrard Inlet and the Fraser River. In addition to control over these major harbours, the federal government has what Roberts (1988) described as essentially "a fee simple interest" in fishing and recreational harbours under a special section of the Land Act. These federally controlled coastal harbours are administered by the Department of Fisheries and Oceans and also by the Oceans Small Craft Harbour Program. Other federal agencies involved with the administration of the submerged portion of the urban coastal zone include: Environment Canada; Energy, Mines and Resources Canada; Transport Canada; the Department of Indian and Northern Affairs and Public Works Canada (Dorcey, 1986). Transport Canada and Public Works Canada are involved in the dredging of waterways, construction of protective breakwaters or jetties and repairing of most dykes throughout coastal British Columbia.

2.4.2.2 Provincial Government.

Due to the provincial government's ownership of most natural resources (Dorcey 1986:43), provincial regulation appears to be spread throughout the coastal zone. The offshore and nearshore aspects of the coastal zone generally fall under the regulatory domain of the provincial Ministry of Environment, Lands and Parks (M.O.E.L.P.), the Ministry of Agriculture, Fisheries and Food (M.O.A.F.F.) and the Ministry of Transportation and Highways (M.O.T.H.). These provincial agencies are responsible for regulating activities such as commercial and sports fisheries, marinas, water pollution and water transportation (Dorcey 1986). Similarly, the upland and shoreland portions of the coastal zone fall under the jurisdiction of these agencies as well as the Ministry of Forests (M.O.F.), the Ministry of Tourism (M.O.T.), Ministry of Agriculture, Fisheries and Food (M.O.A.F.F.), the Ministry of Municipal Affairs, Recreation and Housing (M.O.M.A.R.H.) and the Ministry of Energy, Mines and Petroleum Resources (E.M.P.R.). These latter provincial agencies exercise the responsibility of managing coastal resources such as forests, agriculture and minerals

2.4.2.3 Local Government.

It is recognized that local governments are in relatively weak positions when faced with conflicts between other levels of government (Dorcey 1986). However, the local level of government exercises a considerable amount of control in the field of land use regulation.

Local governments are granted the authority through the Municipal Act to regulate the use of land within the municipality or regional district. Land as defined in the Municipal Act

"includes the surfaces of water", hence municipalities have the ability to zone portions of their aquatic coastal zone (B.C., 1979: Sec.1). In fact, the Ministry of Agriculture, Fisheries and Food encourages coastal municipalities to exercise their zoning authority to protect valuable aquatic habitat from certain types of urban development (British Columbia 1987a). The provincial government has considered delegating control of submerged lands to local governments (Roberts, 1988). However, a similar experiment in the United States under the Coastal Zone Management Act of 1972 revealed that such a delegation of authority was problematic since local governments often lacked the financial resources to handle the increased responsibilities (Mogulof, 1975).

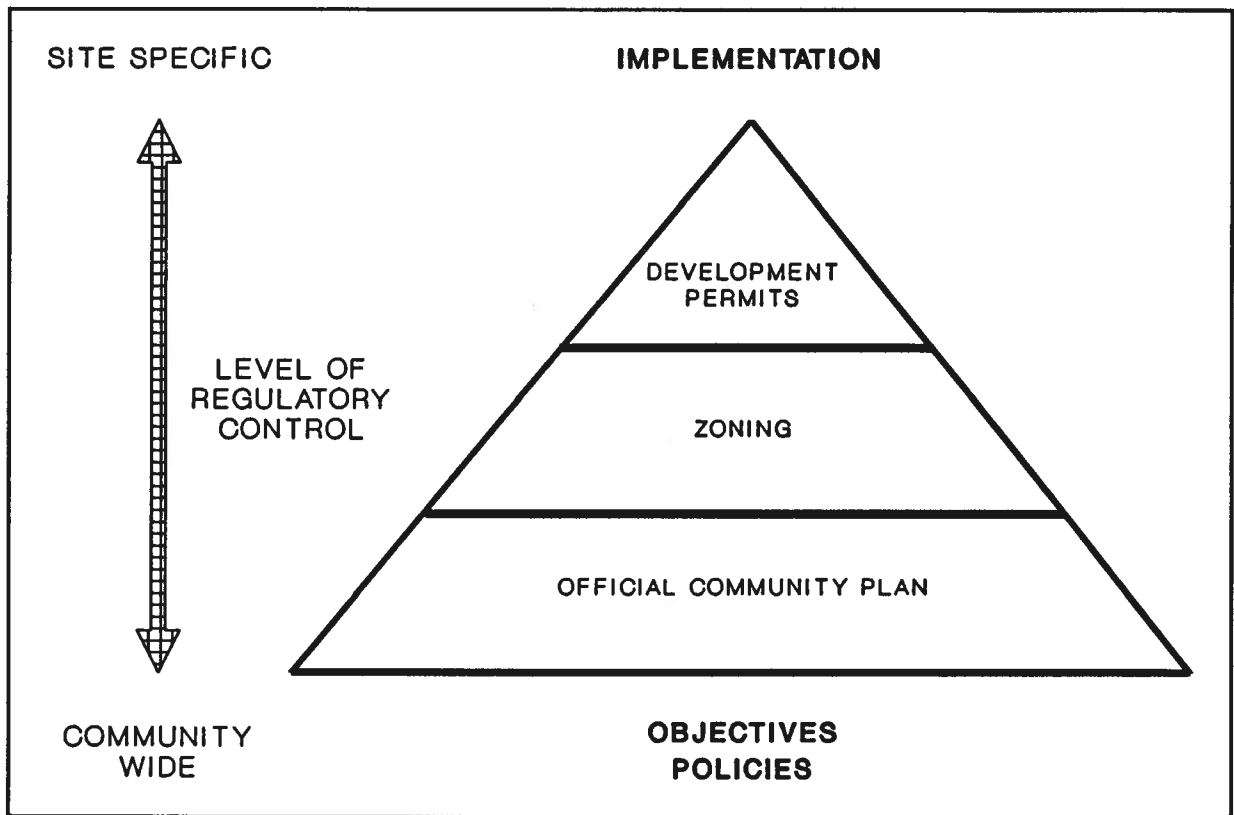
The Municipal Act enables municipal governments to prepare Official Community Plans (O.C.P.) that detail policies and objectives for guiding land use decisions. Implementation of the O.C.P.'s intent is achieved through zoning bylaws which enforce regulations concerning aspects such as size, siting and type of development. In addition to zoning bylaws, municipalities are able to employ a powerful regulatory tool known as a Development Permit in order to implement specific policies contained within the O.C.P. Unlike zoning bylaws, Development Permits act as a more precise control over the nature and design of a proposed development on a site-specific basis. Development Permits also differ from zoning bylaws in that they are unable to prohibit development.

For areas designated in the O.C.P., Development Permits may be required as a means to regulate aspects such as: development in hazard susceptible areas, natural water courses,

development in areas of land above the natural boundary of streams, rivers, lakes or oceans to remain free of development and (as requested by M.O.E.L.P.), the planting of vegetation (British Columbia 1979: sec. 976(5)). Taken together, the O.C.P.'s, zoning bylaws and Development Permits provide a considerable amount of municipal control over the use of coastal upland (Brownlee 1992). This study uses the information recorded in Development Permit Application files to evaluate local initiatives in the management of coastal zone issues.

Given that local regulatory authority within the coastal zone appears to reside primarily in O.C.P.'s, Zoning and Development Permits, it is worthwhile to consider the relationship between each of these three key regulatory tools. Figure 2.6 portrays these regulatory powers in a hierarchical format. Viewed in this relative manner, the O.C.P. provides a community with a foundation of broad objectives and policies while Zoning and Development Permit provide for the implementation of such policies at a more precise level.

Figure 2.6
Local Regulatory Powers: A Hierarchical Relationship



2.4.2.4 F.R.E.M.P.

A unique organizational arrangement exists in the Lower Mainland where the administrative responsibility, normally carried out by separate agencies, is coordinated by a single organization called the Fraser River Estuary Management Program (F.R.E.M.P.). The F.R.E.M.P. offers a unique framework for involving key coastal agencies (see Table 2.3) to "work toward common goals and objectives" on an estuary wide basis (Kennett and McPhee 1988).

TABLE 2.3
Participating Agencies in F.R.E.M.P.

1.	British Columbia Ministry of Environment, Lands and Parks.
2.	Federal Department of Fisheries and Oceans.
3.	Environment Canada.
4.	Fraser River Harbour Commission.
5.	North Fraser Harbour Commission.
6.	Greater Vancouver Regional District.

The F.R.E.M.P. derives its administrative authority from the participating agencies which comprise its management executive. The F.R.E.M.P.'s jurisdiction extends upland to the crest of the dyke (McPhee 1991; Pers. Comm.). For the Township of Richmond which is completely surrounded by dykes, the entire coast to the crest of the dyke is covered by the F.R.E.M.P.

The F.R.E.M.P. plays a significant role in coordinating the planning and management of the zone of land above and below the waterline. The planning and management of this portion of the coastal zone is achieved through a process known as area designation. Similar to municipal zoning, area designations determine what uses are permissible within a given 'management unit' (see Table 2.4). The area designations for the estuary's 85 management units were developed by a task force of 15 agencies who are involved in the management of the estuary (McPhee, 1989). The purpose of the area designations was to *"provide a mechanism for accommodating economic growth while maintaining environmental quality in the estuary"*

while at the same time being flexible enough to respond to changing needs and conditions (McPhee 1989: p.4206).

TABLE 2.4
AREA DESIGNATION DEFINITIONS
(Source: F.R.E.M.P., 1991)

CATEGORY	ABBREV.	DESCRIPTION
Conservation	C	Habitat where the primary 'use' is the maintenance and enhancement of continued biological productivity. Conservation areas may be used for activities which do not impair the continued biological productivity of the area.
Log Storage	L	Primary use is for log storage consistent with the Fraser River Estuary Management Program guidelines for log storage.
Recreation/ Park	R	Areas designated for public open space and recreation.
Port/Terminal	P	Land and water with close proximity to navigation channels, good land transportation connections and sufficient open space for upland development of the terminal. Land and water to be used for the berthing of vessels, the handling and storage of cargoes and/or passengers, in or outbound.
Industry	I	Land and water designated for industries which require water-borne transportation, surface use of the water or use of submerged lands.
Water Oriented Residential/ Commercial	W	Areas of urban residential and commercial activities involving waterfront uses.

2.4.2.5 An Overview of Canadian C.Z.M.

The Canadian approach to the management of the urbanized coastal zone is premised on the adoption and coordination of a number of environmental management policies by those agencies having responsibilities in coastal urban areas (Hildebrand 1989). Unfortunately, the reality in Canadian C.Z.M. has been the piecemeal application of coastal policies to deal with problems in urban coastal regions as they have arisen (Gamble 1989; Canada 1982; and Dorcey 1983).

Despite the numerous failings of Canada's approach to C.Z.M., some contend that the creation of coastal zone 'super agencies' similar to those found in the United States is not the answer either (Sproule-Jones 1978). An improvement in British Columbia's approach to C.Z.M. may be achieved by strengthening the existing decentralized linkages amongst resource agencies (Sproule-Jones 1978). Increasing the coordination among existing agencies may be more cost effective than creating coastal zone 'super agencies' modelled after American C.Z.M. programs.

2.5 Summary

Chapter Two explores a framework for coastal zone management in terms of biophysical, socio-economic and institutional elements. The discussion of the biophysical nature of the coastal zone revealed a highly complex and interdependent set of relationships affecting coastal morphology, biochemistry and ecosystems. The socio-economic component of the C.Z.M. framework identified the key resource uses of the coastal zone. The economic values associated

with these resources and the wide array of resource users suggest the coastal zone represents a significant contribution to both provincial and local economies. The institutional aspect of the C.Z.M. framework described the complex regulatory relationships that exist between federal, provincial and local levels of government. The following chapter builds upon the framework for C.Z.M. by further clarifying the role of local government in seven key coastal zone management issues.

CHAPTER 3

Coastal Zone Management Issues and Local Government Regulatory Authority

3.1 Coastal Zone Management Issues

The identification of coastal zone management issues often requires that the notion of community objectives and significant impacts be re-interpreted in a manner that reflects the intrinsic trans-boundary characteristics of coastal zone processes. Since the definition of the coastal zone is based on the interdependent ecological relationships between terrestrial and aquatic systems, it follows that coastal zone issues shall contain a great deal of biophysical content. The available literature offers a consistent and comprehensive survey of coastal zone issues (Gamble 1989; C.C.R.E.M. 1978; Cote 1989; Kennett and McPhee 1988). These issues have been organized into a list of seven as follows:

- 1. Habitat Conservation;**
- 2. Water Quality;**
- 3. Natural Coastal Hazards;**
- 4. Public Access & Aesthetics;**
- 5. Public Input;**
- 6. Water Dependent Activities; and**
- 7. Interjurisdictional Coordination.**

These seven issues are representative of a number of values, problems and concerns encountered throughout the coastal zone management literature. Within this organizing list of issues, specific

problems such as adequate boat moorage space or maintaining healthy populations of predatory birds may be represented by one or more issues. The seven issues also provide a basis for the identification of relevant local government (Richmond) policies to be later evaluated.

One clear advantage in utilizing a broad scope of issues is that it facilitates an evaluation format capable of assessing C.Z.M. efforts as a holistic, comprehensive and integrated endeavour which Hennessey and Robadue (1987) have described as the "trinity of ecosystem management concepts". Some would suggest that of the seven coastal zone issues presented here, certain issues should be 'ranked' or considered more important than others. The ranking of coastal zone issues relative to one another is not considered here because the evaluative methodology (presented in Chapter Five) was not designed to permit quantitative comparisons between coastal zone issues that ranking is intended to provide. The strength of this evaluative approach lies within its ability to compare results between the same C.Z.M. issues from separate studies. This feature would be particularly useful for comparing between different municipalities in order to assess the performance of different C.Z.M. policies or for evaluating the overall effectiveness and impacts of new C.Z.M. policies by means of a 'before and after' analysis. Issues ranking is best regarded as the next step in the process of allocating planning and management resources to the specific problems and opportunities identified from the findings of this study.

3.2 Habitat Conservation

The protection of sensitive and biologically productive areas such as coastal wetlands is a serious concern for coastal communities throughout Canada and the United States. There is a growing body of evidence to suggest that land use activities are very important factors affecting the health of B.C's salmon stocks (Nassau-Suffolk 1976; Schreier *et al.* 1991 and Simpson 1991). Coastal upland areas are also vital to other wildlife such as species of migratory birds, waterfowl and rare birds of prey (Butler *et al.* 1990; Butler and Campbell 1987).

Within the coastal zone of the Lower Mainland the Fraser River Estuary Study (F.R.E.S. 1978) has identified ten major habitat zones. These habitat zones support numerous species, many of which are highly valued for their commercial, recreational and biological significance (see Table 3.1). The continued alienation of all types of coastal zone habitat ultimately affects the human activities (sport fishing, hunting, bird watching) that depend on these coastal resources. Often the impacts of habitat loss on human activities within the coastal zone are difficult to predict or quantify (Nassau-Suffolk 1976).

TABLE 3.1
Habitat Classifications for the Fraser River Estuary
 (Source: F.R.E.S. 1978)

MAJOR ZONES	DOMINANT VEGETATION	HABITAT CAPABILITY
Sandflats	Benthic Algae	Seals, Shellfish, Crabs, Shrimp, Salmon, Shorebirds
Mudflats	Benthic Algae	Salmon, Seals, Crabs, Shrimp, Shorebirds
Eelgrass Beds	Eelgrass	Salmon, Herring, Crabs, Waterfowl, Raptors
Salt Marsh	Saltwort, Saltgrass, Arrowgrass	Salmon, Raptors, Shorebirds
Bulrush Marsh	Bulrushes	Salmon, Waterfowl, Shorebirds, Raptors
Cattail/Sedge Marsh	Cattail, Sedge	Salmon, Waterfowl, Shorebirds, Raptors,
Freshwater Marsh	Cattail, Sedge, Bulrush	Salmon, Waterfowl, Shorebirds, Raptors, Otter, Mink, Muskrats, Beaver
Riparian	Wet Meadows, Trees, Shrubs	Waterfowl, Otter, Muskrats, Mink, Beaver, Songbirds
Bogs	Spagnum, Labrador Tea	Waterfowl, Raptors, Shorebirds, Otter, Muskrats, Mink, Beaver, Bear, Deer, Coyotes
Agricultural Lands	Crops	Waterfowl, Shorebirds

The conservation of critical natural habitat within municipal and regional political boundaries appears to have evolved much differently than that of provincial and federal level habitat conservation. Unlike senior levels of government which are able to set complete ecosystems aside into ecological reserve status, local governments must work with habitats which are, to varying degrees, already under a human influence. Often, local governments rely on other agencies (such as the Canadian Wildlife Service and B.C. Ministry of Environment, Lands and Parks) and special interest groups (such as Ducks Unlimited and the Western Canada Wilderness Committee) to provide information on environmentally significant areas within municipal or regional boundaries. Despite information and funding limitations, local government should not consider themselves wholly exempt from conservation efforts.

3.2.1 Habitat Conservation: Local Government Regulatory Authority

The British Columbia Municipal Act (B.C. 1979) grants local governments the ability to protect ecologically sensitive coastal habitat by either prohibiting development entirely through zoning or by carefully controlling development so as to ameliorate negative impacts. Specific powers granted to local governments to conserve important habitat are contained under sections 963 (Zoning), 945 (Official Community Plans), 976 (Development Permits) and 952 (Rural Land Use Bylaws) of the B.C. Municipal Act.

Local government's regulation of land use includes "power to prohibit any use or uses in any zone or zones." (B.C. 1979: Sec. 963 (3) and 952 (1)(b{ii})). For local governments,

zoning is a powerful management tool which allows local government considerable control over both the use and conservation of a finite coastal land supply.

Local government powers under Section 945 relating to the content of Official Community Plans include the ability to place "restrictions on the use of land that is subject to hazardous conditions or that is environmentally sensitive to development." (B.C. 1979: Sec. 945 (2)(d)). The *meaningfulness* of policies and objectives that typically constitute an Official Community Plan (O.C.P.) is ensured by Section 949 (2) that states that subsequent bylaws (includes zoning) shall be consistent with the (O.C.P.).

Similarly, the B.C. Municipal Act description of local government powers under Section 976 regarding Development Permits includes the ability to "specify areas of land that are located above the natural boundary of streams, rivers, lakes or the ocean that shall remain free of development." (B.C. 1979: Sec. 976 (5)(d)). Thus, the Development Permit may be used as an effective regulatory device for protecting sensitive habitat in the landward portion of the coastal zone.

3.3 Water Quality

Coastal Communities have traditionally viewed the offshore as a receptacle for domestic and industrial waste water (Schreier, Brown and Hall 1991). In the lower Fraser sub-basin, treated municipal sewage is the largest source of B.O.D., faecal coliforms, suspended solids, nutrients (ammonia and phosphorus) and certain trace metals (copper and zinc). Urban storm

water run-off containing significant quantities of suspended solids, dissolved solids, nutrients, hydrocarbons, coliform bacteria and trace metals further compromise coastal water quality (MacKenzie 1987). Poor water quality has been implicated as the cause of death in 'duck kills' (Butler *et al.* 1990) and 'fish kills' (Moore 1989) which have occurred repeatedly in the Lower Mainland.

Water quality is particularly critical to communities that depend on coastal waters as a key ingredient in their economic and recreational activities. Tourism, mariculture, fisheries, recreation and community aesthetics are impacted by poor water quality. Even property development requires high water quality standards in order to insure the economic viability of waterfront projects (Epstein 1985). The risk to water quality through inappropriate land use practices is illustrated by Figure 3.2 which shows the storage of recycled oil in deteriorating containers and other refuse on the dyke along the North Arm of the Fraser River in Richmond, B.C.

Figure 3.2
Recycled Oil and Refuse On North Arm of Fraser River: Richmond, B.C.



There is considerable evidence to support the conclusion that the type and magnitude of urban development has a direct impact on the quantity and quality of contaminants entering into coastal zone waters (Nassau-Suffolk 1976, Ferguson and Hall 1979; Swain 1982; Barton 1978; Whipple *et al.* 1974; Wanielista *et al.* 1977; Schreier *et al.* 1991). Table 3.2 gives a comparison of land uses and their total contribution to coastal water pollution from the G.V.R.D. Although much attention has been focused on 'point sources' (emanating from a

discrete source such as an outfall pipe) of urban contaminants, studies have shown that 'non-point sources' (emanating from dispersed sources such as wind deposition) constitute a large percentage of the pollutant load entering a water system (Whipple *et al.* 1974; Wanielista *et al.* 1977). Barton (1978) has suggested that non-point urban water pollution is a greater water quality threat than contamination from agricultural sources. In Richmond, British Columbia, it is estimated that the cumulative pollutant loading of storm water run off may equal one half to two times the loading from the Annacis Island Sewage Treatment plant (Richmond 1985c). Given the magnitude of the 'non-point' pollution of coastal waters, discussion of local government's regulatory authority will focus primarily on regulatory powers capable of addressing this pollution source.

TABLE 3.2
Contaminant Loadings from Different Land Uses in the G.V.R.D.
 (Source: Ferguson and Hall 1979)

†CONTAMINANT	LAND USE				
	HOUSING & ROADS	COMMER.	INDUST.	AGRICULT.	PARKS
B.O.D.	9460	540	4160	176	431
Nitrogen	646	48	287	117	146
Phosphorus	274	10.7	87	4.2	16.4
Faecal Coliforms	358	21.3	160	16.6	7.9
Copper	3.24	0.9	7.1	0.2	0.48
Iron	83.7	4.8	37.9	22.9	56
Manganese	7.4	0.9	6.9	1.2	1.2
Nickel	0.64	0.08	0.71	0.05	0.14
Lead	20.6	1.2	8.7	0.18	0.66
Zinc	2.6	1.4	9.7	0.18	1.17

† All values in kg/day, except faecal coliforms which are in (number/day)*10⁴ and Nitrogen and Phosphorus which are in total elements.

3.3.1 Water Quality: Local Government Regulatory Authority

Under certain sections of the Municipal Act, local governments are granted considerable authority over the regulation of land uses that impact coastal water quality. Zoning, Official Community Plans and Development Permits (B.C. 1979: Sec. 963, 945 and 976 respectively) represent some of the local powers that figure prominently in the current status of contaminant loadings enter coastal waters. Utilizing these regulatory powers, local governments are given

the ability to ameliorate some negative impacts of non-point contamination simply by requiring adequate buffers or setbacks to protect coastal waters from polluting uses. Further powers include the ability impose conditions on the timing of the construction phase which may be useful in reducing sedimentation due to runoff (B.C. 1979: Sec. 976 (2)(c)). The British Columbia Municipal Act also exempts "land and improvements adapted or designed and exclusively used for the purpose of abating pollution" from municipal property taxes (B.C. 1979: Sec. 398 (q.1)).

Section 587 (a) of the B.C. Municipal Act grants local governments further powers to protect coastal water quality. Local governments may adopt bylaws that "prohibit a person from fouling, obstruction or impeding the flow of a stream, creek, waterway, watercourse, waterworks, ditch, drain or sewer, whether or not it is situated on private property, and may provide for the imposition of penalties for a contravention of these regulations." Evidently, a number of provisions exist within the B.C. Municipal Act granting local governments regulatory powers and responsibilities in protecting coastal water quality. Section 976 of the B.C. Municipal Act relating to Development Permits is especially significant, allowing local governments a great deal of control over the overall design and siting of development. These powers offer local government many opportunities in the mitigation of deleterious water quality impacts due to development.

The role of local government in establishing and operating sewage treatment facilities is described in Sections 330 and 611 of the B.C. Municipal Act. Although local governments are

assigned authority in the area of 'point-source' water quality control, it is the impact of 'non-point' sources on coastal water quality that is under investigation in this study.

3.4 Natural Coastal Hazards

The coastal zone is subject to a wide range of natural forces which often play key roles in determining the physical appearance of the coast. Three forms of natural coastal hazards are discussed: flooding, erosion/accretion and seismic activity. Of these three, flooding is the most serious resulting in \$177 million in damages throughout the province of B.C. (Hay 1991).

There are three basic types of flooding originating from either atmospheric or geologic (seismic) sources: coastal, river and 'local'. All three types of flooding may have an impact on the coastal zone. River flooding is perhaps the most significant form of natural hazard facing the case study community of Richmond, B.C.

Coastal flooding is principally caused by seismic (resulting in a tsunami) or storm surge events although the susceptibility of coastal areas to these two hazards may vary greatly depending upon location (Hay 1991). The potential for tsunami damage is related to type, frequency and location of seismic or landslide events, coupled with the potential of the adjacent water body to sustain or enhance a tsunami event (Hay 1991). Storm surges are described as increases in water levels exceeding levels normally associated with astronomical tides (Hay 1991). Coastal flooding due to storm surges is caused by a combination of wind driving waters

shoreward and a low pressure system which give rise to elevated sea levels. Coastal land forms such as deltas, spits and backshore areas are most vulnerable to storm surge flooding.

River floods are generally the result of either snow melt events or rainfall events (Hay 1991). Snow melt events tend to occur in the late spring and the magnitude of such flooding is tied directly to the amount of winter snow pack. The coastal deltas of major river systems may experience flooding events lasting days or weeks while smaller coastal drainages typically experience flooding events lasting only a few hours (Hay 1991).

Flooding affecting the coastal zone caused by 'local' flooding is characterized by extreme precipitation events and/or poor drainage capacity. Urbanized areas and agricultural areas are most at risk to local flooding due to poor gravity drainage (Hay 1991).

Foreshore erosion processes are a function of variables such as sediment supply, sediment character, oceanographic conditions of tides, waves , currents and the geomorphic character of the coastline (McConnell 1991). Additional factors affecting erosion processes include ground water conditions, vegetative cover, land use, subsidence and freeze-thaw cycles. Shoreline erosion is subdivided into four categories based on the location of impact: beach/foreshore erosion; upland/backshore erosion; local erosion around structures; and subtidal slope failures (McConnell 1991).

Within the Lower Mainland of British Columbia, municipalities such as Surrey, New Westminster, Burnaby, Maple Ridge, Delta, Coquitlam, Langley, Port Coquitlam, Pitt Meadows and Richmond are located either partially or completely within the 200 Year Floodplain⁵. Richmond is the most populated Canadian community located entirely within a floodplain (Richmond 1985c). Figure 3.3 gives a map of the 200 Year Floodplain in the lower Fraser River estuary. The dyke which is constructed to protect Richmond from flood events up to a one-in-200 year magnitude is pictured in Figure 3.4.

⁵The 200 Year Floodplain refers the area of land that would be covered during a peak flood that has a probability of occurring once in 200 years. The last one-in-200 year flood occurred in 1894 (Kennett and McPhee, 1988).

FIGURE 3.3
The 200 Year Floodplain in the Lower Mainland.
 (Source: Kennett and McPhee 1988: 20)

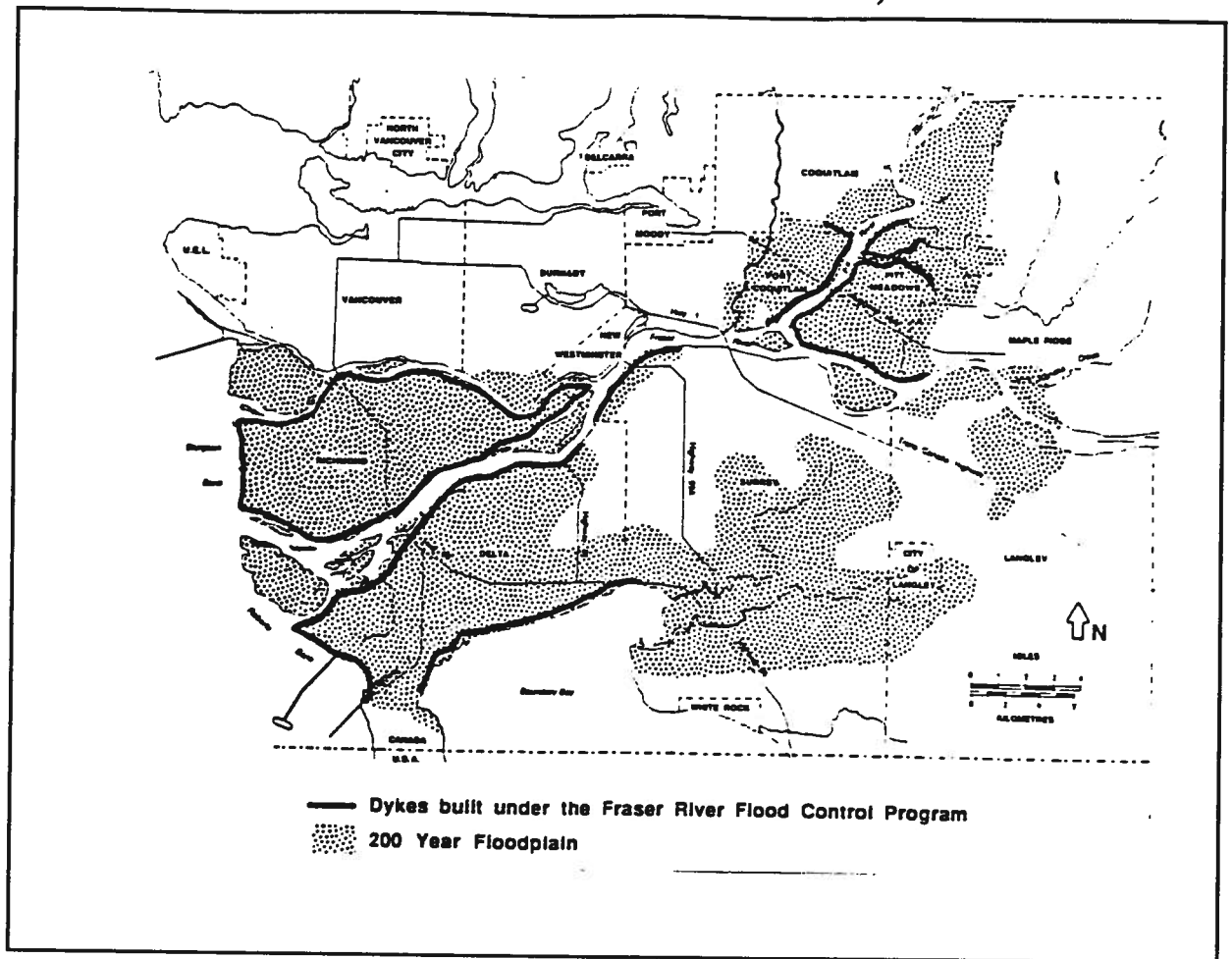
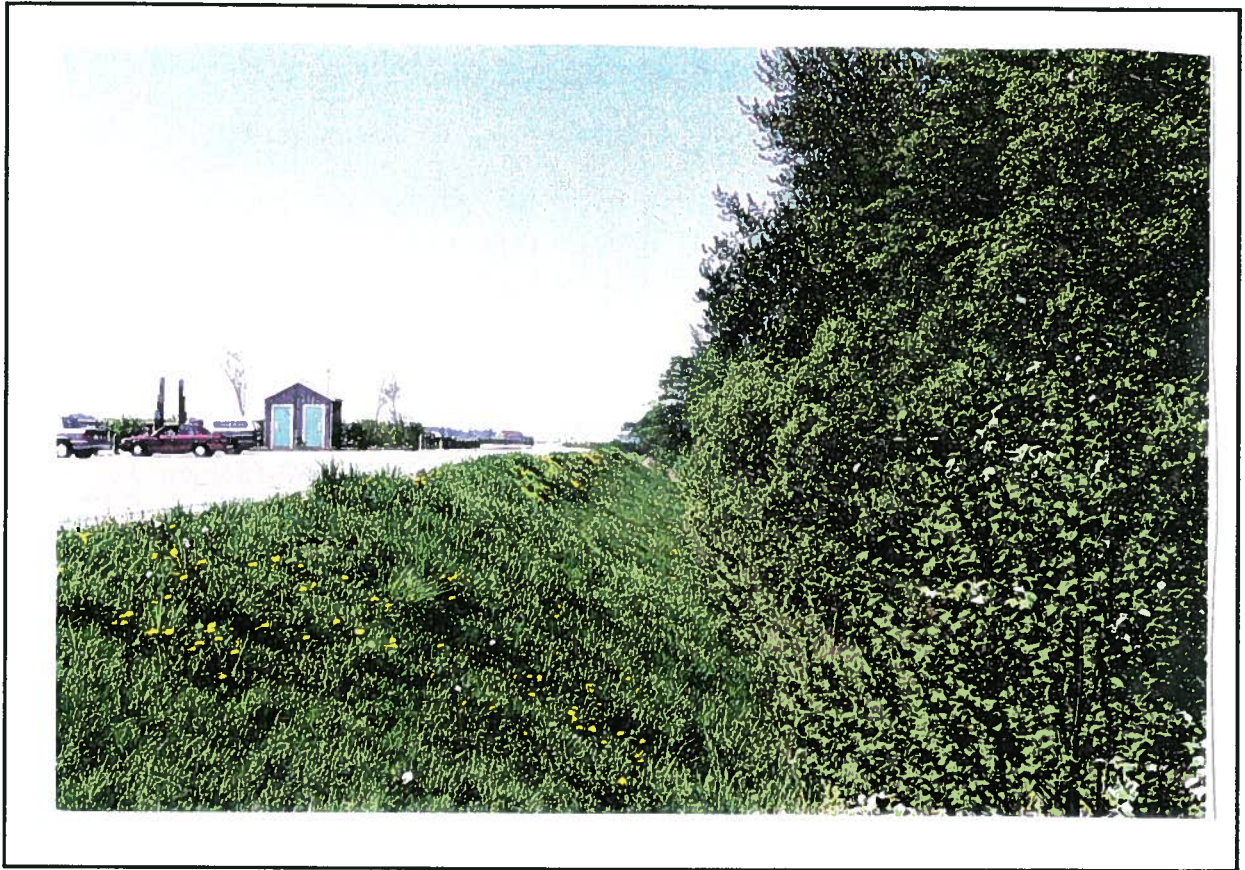


Figure 3.4
View of Protective Dyke: Richmond, B.C.



3.4.1 Natural Coastal Hazards: Local Government Regulatory Authority

Local regulatory powers regarding flood susceptible areas of the coastal zone include the ability to designate such hazard⁶ prone areas, require developers of designated hazard susceptible land to furnish reports written by certified engineers and specify setbacks from watercourses and bodies of water (B.C. 1979: Sec. 969, 734 (2), and 976 (5)(a) respectively).

⁶Hazards specified in the Municipal Act include flooding, mud flows, debris flows, debris torrents, erosion, land slips, rockfalls, subsidence and avalanche.

In addition, local governments may choose to utilize their basic zoning powers to "prohibit any use or uses from any zone or zones" (B.C. 1979: Sec. 963 (3)). Local regulatory powers are somewhat diluted by section 969, subsections 3 and 6 of the B.C. Municipal Act which states that all local government bylaws are superseded by any order of the provincial Minister of Environment, Lands and Parks (formerly Environment and Parks). However, local government are given the power under section 969 (7) of the Municipal Act to enforce "specification of the Minister of Environment [Lands] and Parks as though they were bylaws of the local government".

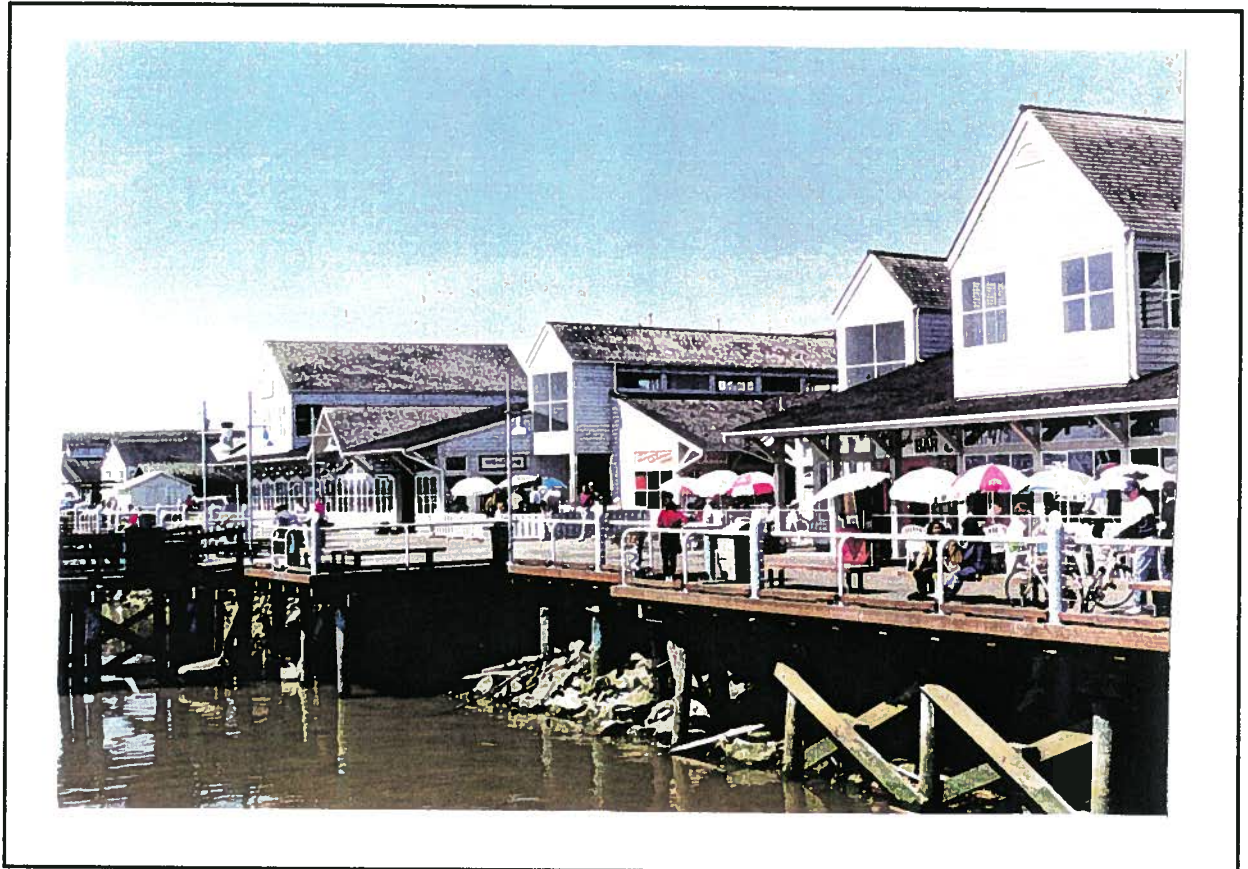
The Municipal Act divides regulatory authority regarding hazard susceptible lands between local and provincial government. Some enforcement powers have been extended to local government, however, the province retains absolute power to supersede local bylaws. The division of powers concerning natural hazards within the Municipal Act points directly to the need for an effective coordination of management efforts among the levels of government.

3.5 Public Access and Aesthetics

Much has been written about the need to reorient waterfront communities towards the waterfront (Matthews and Hall 1988; Hall 1988; and Boyd 1985). Public access to the waterfront either through direct contact with the water or through visual association is a key element in the success to urban waterfront projects (Hotson 1988; Ontario 1987). Given past commitments made by communities such as Vancouver and Richmond to providing a contiguous linear waterfront park, the continued provision of public access is no doubt essential to the future

of these long term plans. Figure 3.5 gives an example of public access for a waterfront commercial project in Steveston (southwest Richmond).

Figure 3.5
Public Waterfront Access: Steveston, B.C.



The urban coast is beginning to earn a more positive aesthetic image due to stricter local governmental controls over both the siting and appearance of new coastal developments. Developers also recognize the importance of well designed waterfront projects in terms of fiscal success. Many coastal communities have witnessed a resurgence of interest in their waterfronts.

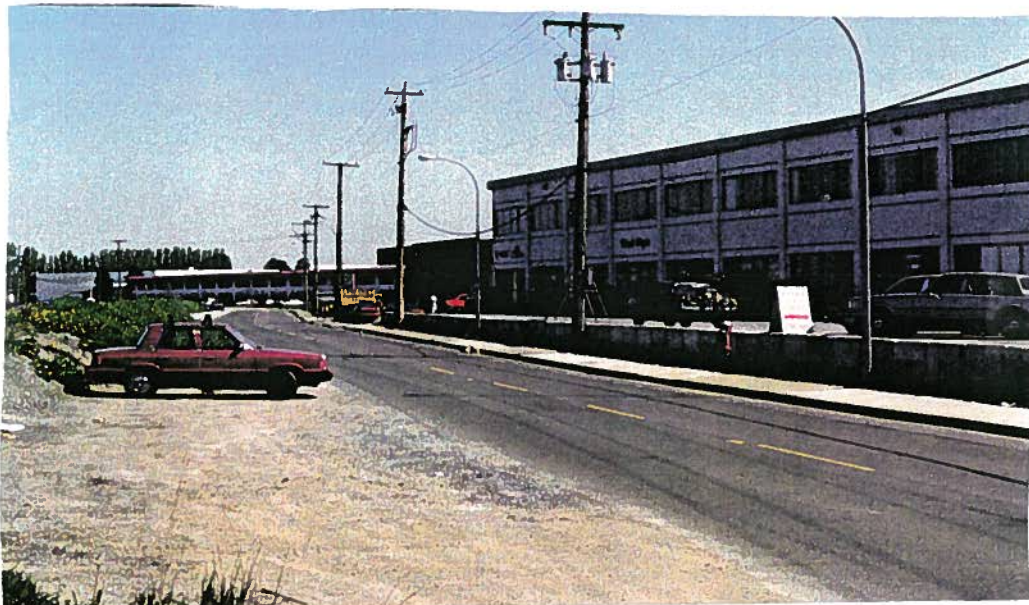
Examples of aesthetically positive and successful waterfront development differs from what Hotson (1988) refers to as a simple gentrification of the waterfront. In successful waterfront developments, current tenants of the waterfront are not necessarily displaced by new development. Moreover, Hotson (1988) identifies tree planting as the most important landscaping element affecting the aesthetic image of the waterfront.

Examples of positive and negative aesthetic images for coastal zone developments in Richmond are pictured in Figure 3.6 and Figure 3.7 respectively. In these contrasting examples, the effect of landscaping is clearly identifiable as a key factor in determining the overall aesthetic image of a given development.

Figure 3.6
Medium Density Housing Adjacent to Dyke: Steveston, B.C.



Figure 3.7
Commercial Development Adjacent to Dyke: North Richmond, B.C.



3.5.1 Public Access and Aesthetics: Local Government Regulatory Authority

Local governments may employ regulatory powers related to Zoning (B.C. 1979: Sec.963) and Development Permits (B.C. 1979: Sec.976) to provide public access to the waterfront. Under Section 963 (zoning) of the B.C. Municipal Act, local governments may regulate the use of land and the siting of buildings and structures within any given zone. Local government may also use Sec. 976 (5(d)) of the B.C. Municipal Act to "specify areas of land that are located above the natural boundary of streams, rivers, lakes or the ocean that shall remain free of development" as a means of creating public access corridors.

Additional opportunities to increase public access to the waterfront derives from Section 992 of the B.C. Municipal Act. Upon subdivision of land, the owner must provide a portion of land (or market value equivalent in cash) to the local government for use as parkland. This portion of land (no less than five percent of the total) may then be dedicated for public use under section 533 of the Municipal Act. Payment in lieu of land may also be used to purchase (in fee simple) property or easements providing access to the waterfront. Hence, subdivided land anywhere within a local government's jurisdiction may be useful in securing a greater degree of public access to the foreshore. It is certainly debatable as to whether or not a five percent gain in public access to the waterfront is worth a net loss of ninety-five percent elsewhere in the coastal uplands for each parcel of subdivided and subsequently developed land.

Section 976 of the B.C. Municipal Act grants local governments a considerable degree of freedom in regulating development through the use of the Development Permit. Development Permits give local government the power to impose requirements "respecting the character of the development including landscaping, and the siting, form, exterior design and finish of buildings and structures." (B.C. 1979: Sec. 976 (6)). Development Permits are only applicable for areas and land uses designated by the local government. For example, the coastal community of Campbell River has specified in its Official Community Plan that all development on foreshore properties and properties abutting watercourses entering the ocean are subject to the controls and regulation of a Development Permit (Campbell River, 1991).

3.6 Public Input

The role of public involvement in C.Z.M., as with any complex management issue, is recognized as being a crucial link in the decision-making process (Harvey *et al.* 1982; Ontario 1987; Warren *et al.* 1972). A well organized public involvement program may greatly enhance the established decision-making process and even provide a forum for addressing conflict (Harvey *et al.* 1982). Often, it is the public through special interest groups that provide the greatest amount of impetus for successful waterfront programs and activities (Ontario 1987).

There are many forms of Public Input which Arnstein represents as a continuum of public power in the decision-making process (Arnstein 1969). No attempt is made in this thesis to identify the most preferable form of public input in the process of C.Z.M. Rather, the

methodology employed in this study is intended to measure the occurrence of any form of public involvement.

3.6.1 Public Input: Local Government Regulatory Authority

The B.C. Municipal Act is specific in stating precisely when and how the public is to be included in local government decisions. Local governments are required to hold a public hearing to allow the public an opportunity to make representations respecting matters contained in a proposed community plan bylaw, rural land use bylaw or zoning bylaw (B.C. 1979: Sec. 956 (1)). The public hearing format allows "all persons who believe that their interest in property is affected by the proposed bylaw" a reasonable opportunity to be heard or to present written submissions (B.C. 1979: Sec. 956 (3)). The Municipal Act forces local government to incorporate public hearings into the very structure of local decision making. In addition to a public hearing requirement for sewage treatment plan bylaws, local governments may also be required to seek the electors assent (through a plebiscite referendum) if there is a public petition to do so (B.C. 1979: Sec. 330(2)).

Public hearings for site-specific zoning applications often gain a great deal of public attention (usually negative). In this format, public input is reactionary, and polarizes pro-development and anti-development lobbies. The public's concern for issues such as the coastal zone is perhaps more effectively introduced into the local government agenda at public hearings for community plan bylaws. In this regard, the public is given an opportunity to fulfil a more proactive role by influencing policy formulation of a community plan.

A further measure for public input is contained within Section 955 of the B.C. Municipal Act. This section allows local governments to establish an 'Advisory Planning Commission' comprised of local residents to "advise council on all matters respecting land use, community planning or proposed bylaws and permits" (B.C. 1979: Sec. 955 (1)).

In Richmond there exists a less formal arrangement for obtaining public input on Development Permits known as a Development Permit Panel (D.P.P.). Unlike the special advisory committee described by Section 955 of the B.C. Municipal Act, the D.P.P. is comprised of employees of the local government. The D.P.P. advertises Development Permit applications and invites public comments on the proposed development.

3.7 Water Dependent Activities

In discussing approaches to coastal zone management Shapiro (1972) distinguished between uses that are **water dependent** and those that are **water related**. Obviously, a third category of waterfront uses exists, that being those that are **water independent**. The definition supported by Shapiro (1972: p.16) for water dependent reads:

"...all uses that cannot logically exist in any location but on the water..."

[and]

"...a use which requires frontage on navigable water to A) provide a transportation service to other industries or to the general public; and B) provide for construction, maintenance, storage and repair of watercraft."

Table 3.3 gives a list of typical water dependent activities. An example of a water dependent activity in Richmond's coastal zone is pictured in Figure 3.8 which shows the commercial fishing fleet harboured at Steveston Harbour.

TABLE 3.3
Summary of Water Dependent Uses
(adapted from Shapiro 1977)

TYPE OF USE	EXAMPLES
Marine Commercial	<ul style="list-style-type: none"> ● Terminal and transfer facilities. ● Moorage and fuelling facilities. ● Industries requiring marine shipped materials. ● Marine construction, repair and dismantling.
Marine Recreation	<ul style="list-style-type: none"> ● Pleasure boat moorage and servicing. ● Boat launch facilities.
Shoreline Recreation	<ul style="list-style-type: none"> ● Parks. ● Bicycle and walking trails. ● Beaches. ● Viewpoints.
Aquaculture	<ul style="list-style-type: none"> ● Fish farms. ● Fishing Piers.
Intakes and Outfalls	<ul style="list-style-type: none"> ● Waste disposal facilities. ● Drainage systems.
Marine Related Research	<ul style="list-style-type: none"> ● Government and academic research facilities.
Floating Homes	<ul style="list-style-type: none"> ● 'Permanent' and mobile floating home moorages.
Protective Structures	<ul style="list-style-type: none"> ● Seawalls, breakwaters, bulkheads etc.

Figure 3.8
Water Dependent Activities: Steveston, B.C.



Conversely, water related uses are defined as those uses which have an economic, but not physical dependence on the water (Shapiro 1977). Condominiums and restaurants are some of the uses that depend on a waterfront location for their economic survival. Water independent activities are those which fail to meet the criteria that define water dependent or water related.

In most communities, increasing waterfront land values (driven by a shortage of desirable waterfront land) have driven many water dependent activities from urban waterfronts. Many coastal communities throughout Canada and the United States have witnessed a replacement of water dependent industries such as shipbuilding by residential and commercial uses (Gallagher 1988; Wrenn 1983). Although these new waterfront tenants may be less of an ecological threat and also provide a greater range of waterfront activities, there are some concerns with this trend. One such concern is the impact to a community's economic health if the working waterfront is permanently replaced by condominiums and public markets (Gallagher 1988). Furthermore, the experience with waterfront re-development in the United States indicates that such re-development has tended to exclude the needs of low income people, minorities, the elderly, the handicapped and the young (United States, no date).

3.7.1 Water Dependent Activities: Local Government Regulatory Authority

Under section 963 (Zoning) of the B.C. Municipal Act, local governments are granted considerable freedom in determining the type of land use for waterfront property. Local governments may regulate the "use of land, buildings and structures" within all zones defined by the local government itself (B.C. 1979, Sec.963 (1)(C)). In effect, local governments determine not only the amount of land zoned for water dependent and water related uses but also where these uses are to be located within the community.

3.8 Interjurisdictional Coordination

Due to the mixture of ownership and jurisdiction within coastal areas, coordination among agencies and their policies is necessary in order to properly manage the coastal zone (C.C.R.E.M. 1978; Hildebrand 1989). Much effort is wasted on coastal policies which contradict or duplicate policies administered by other agencies. The fragmentation of C.Z.M. authority at federal and provincial levels has made local governments reluctant to enter into the complex and often confrontational management *melée* (McClellan; pers. com. 1992). This perception of a fragmented institutional response to C.Z.M. in British Columbia should underline the need for effective coordination of programs and policies among all three levels of government.

3.8.1 Interjurisdictional Coordination: Local Government Regulatory Authority

The B.C. Municipal Act is vague regarding when and where inter-governmental coordination is required and the Municipal Act is silent regarding when and where inter-governmental coordination is advisable to improve the overall management of complex systems such as the coastal zone. At various junctures throughout the Municipal Act, other provincial agencies are identified as having joint or superseding authority in local regulatory matters. In the context of local government involvement in C.Z.M, the provincial government retains a measure of authority including floodplain designations (B.C. 1979: Sec. 969 (3,6)); the protection of fisheries (B.C. 1979: Sec. 976 (5)(e)) and the protection of water courses (B.C. 1979: Sec. 976 (5)(c)). In addition to provincial agencies, federal agencies such as the D.F.O. possess powers which may supersede those of a local government.

The effect of the fragmentation of jurisdiction even within the B.C. Municipal Act serves only to underline the importance of a coordinated management effort as far as the coastal zone is concerned. Nevertheless, the B.C. Municipal Act does grant local governments a great deal of regulatory capability in the form of Zoning, Development Permits and Official Community Plans. Where the B.C. Municipal Act is silent, the decision as to how a local government interacts with the other agencies on individual C.Z.M. issues is often made by the local government.

3.9 Summary

Chapter Three brought the relationship between the seven identified coastal zone management issues and local governments into sharper focus. An analysis of the B.C. Municipal Act revealed that local governments are granted a significant amount of regulatory authority over land use in the coastal uplands, shorelands and nearshore. It was demonstrated that this regulatory authority also empowered local governments to manage many aspects of the seven identified coastal zone issues. The analysis of the B.C. Municipal Act as the legal basis of local government powers in the management of coastal zone issues also revealed that Zoning Bylaws, Official Community Plan Bylaws and Development Permits were prominent aspects of this regulatory authority. The following chapter investigates the case study community Richmond in greater detail in order to provide specific information of the coastal zone issues facing that community. Richmond's land use zoning patterns are also identified in the next chapter as a necessary part of contextual analysis of the case study municipality.

CHAPTER 4

CASE STUDY CONTEXT: RICHMOND, B.C.

4.1 Introduction

An evaluation of local government policies affecting the management of identified coastal zone issues is undertaken using a case study format. Essential background information on the case study community is presented in order to better understand the context in which an evaluation of local coastal zone policies was conducted. This information acts as a benchmark to which results of the analysis of Development Permit Application files are compared to reveal the relative performance of specific policies.

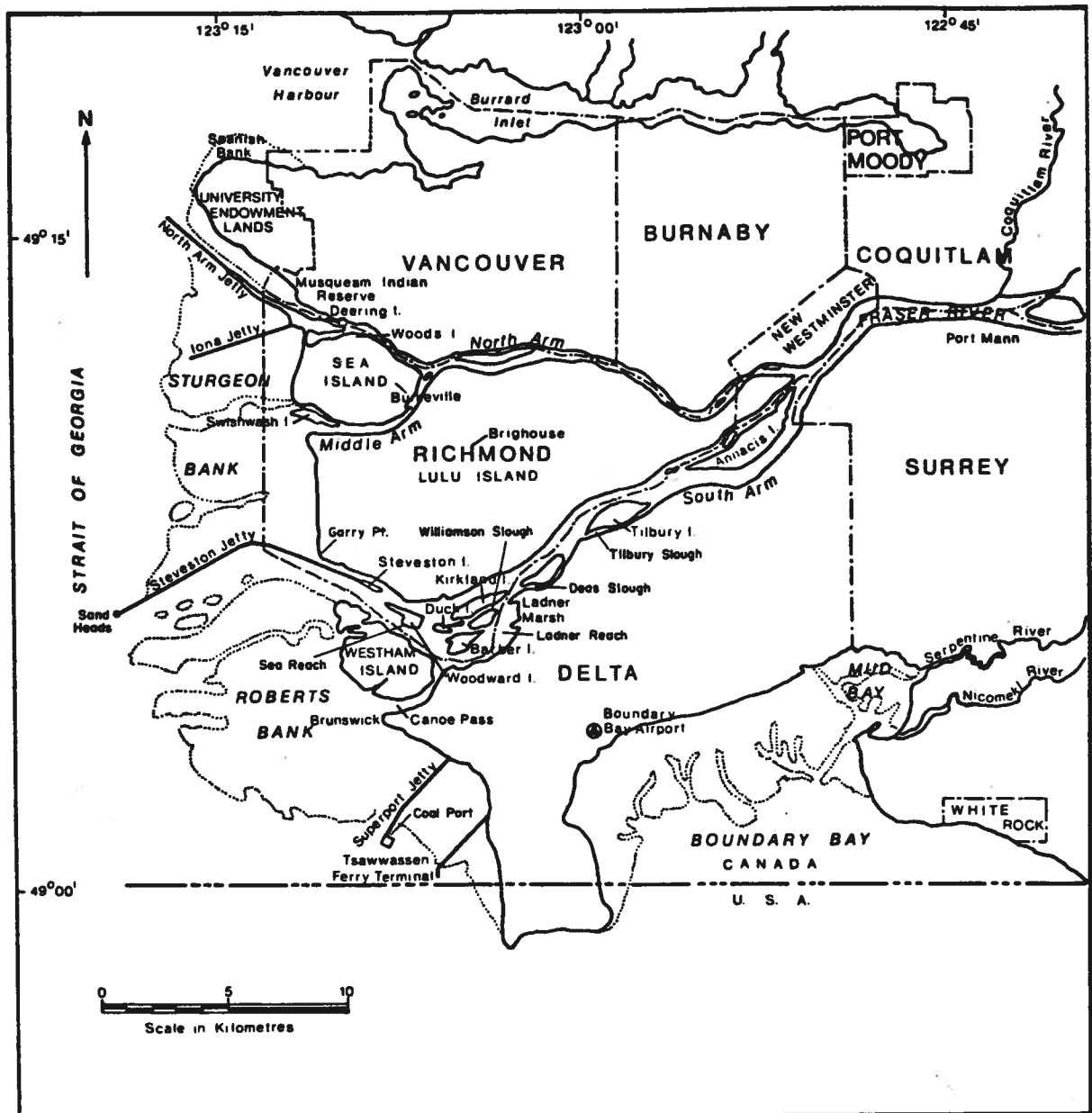
Discussion of case-specific details for Richmond and its coastal zone is organised in a manner reflective of the hierarchical model for a coastal zone management framework described in Chapter Two. Consequently, Chapter Four is divided according to the biophysical, socio-economic and institutional perspectives reflected in the coastal zone management framework. Though not specifically discussed here, aspects of biophysical, socio-political and economic systems are assumed to be hierarchically integrated.

4.2 Richmond, B.C.: Biophysical Context.

The Township of Richmond is located in the southwest corner of British Columbia and is situated on several islands of the Fraser River delta (refer Figure 4.1). The main island, Lulu Island was formed through the gradual process of river borne sediment deposition which started

following the retreat of the last Pleistocene glaciation episode 11,000 years ago . Approximately four thousand years ago Lulu Island attained its current land size (A.I.M. Consultants 1984). Geological evidence suggests that the channels of the Fraser River which surround present day Richmond have remained relatively stable, perhaps due to the evolution of the delta in the deep waters of Georgia Strait (Blunden 1975).

FIGURE 4.1
Map of Richmond, British Columbia



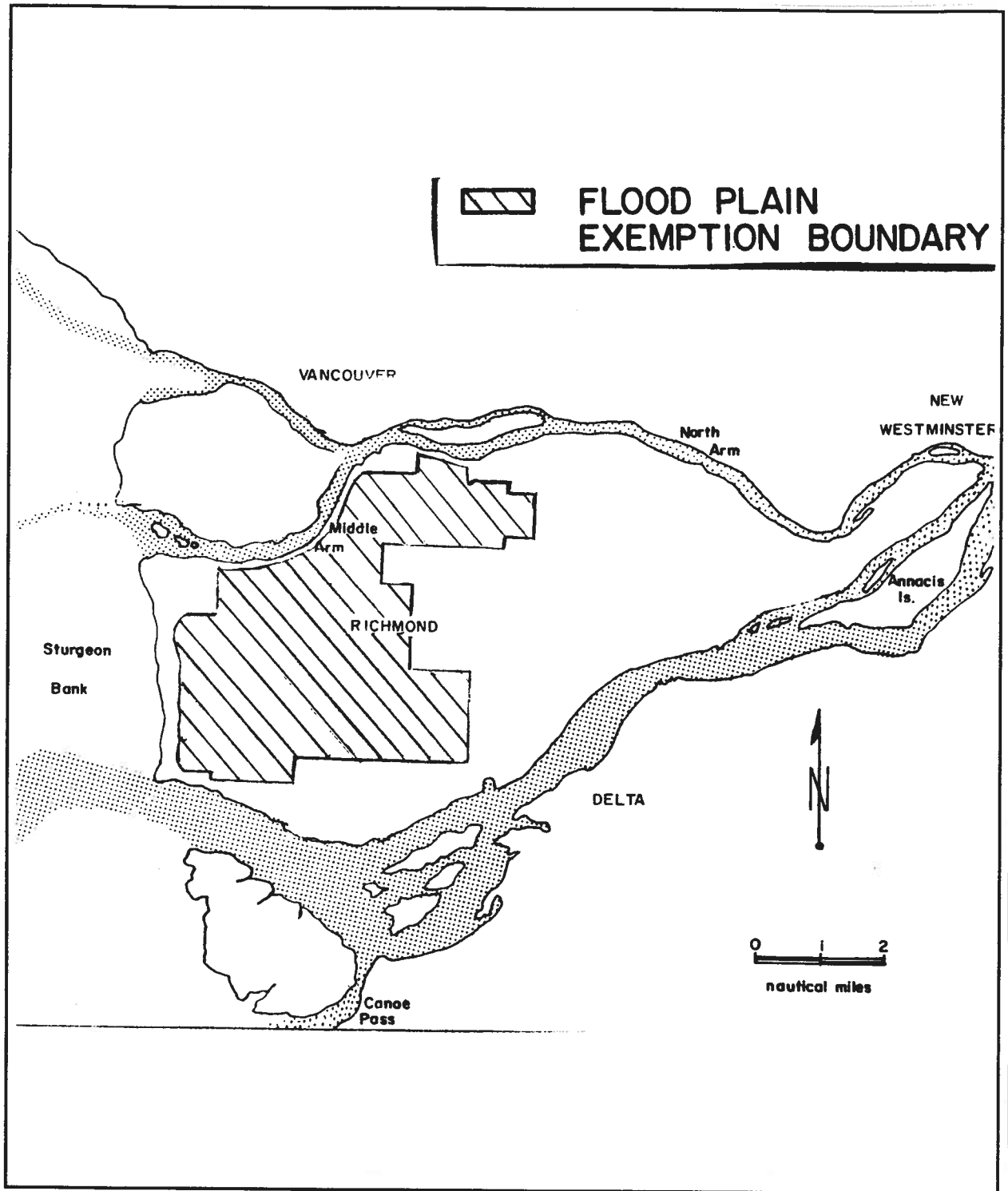
Richmond is situated on the western edge of the Fraser River delta. From the Sturgeon Banks to the Duck, Barber and Woodward Island group complex, all stages of delta landscape development are represented (Richmond 1986). Habitat types still in existence in Richmond's coastal zone include bog ecosystems, riparian communities, intertidal brackish/freshwater marsh and intertidal sand and mudflats (F.R.E.S. 1978). These habitat zones support a number of harvested species such as salmon and waterfowl.

Several hydrological and climatological features have combined to create a coastal estuarine ecosystem which is impressively diverse and biologically productive. The Fraser River Estuary Study reported that primary productivity in the Fraser River estuarine ecosystems were high compared to other estuarine productivity values found in the literature (F.R.E.S. 1978).

Prior to the construction of the many kilometres of dykes and seawalls which protect it, Richmond's former state was that of a "featureless, insect infested and dank" series of shrub covered islands separated by wide shoaling waterways (Blunden, 1975). Consequently, many of present day Richmond's biophysical features are the result of human alterations (F.R.E.S. 1978). One may only speculate as to how fisheries resources and biological productivity have been affected given that the F.R.E.S. (1978) reported that cumulative small scale urban developments within intertidal foreshore and riverine marsh areas can have significant negative impacts.

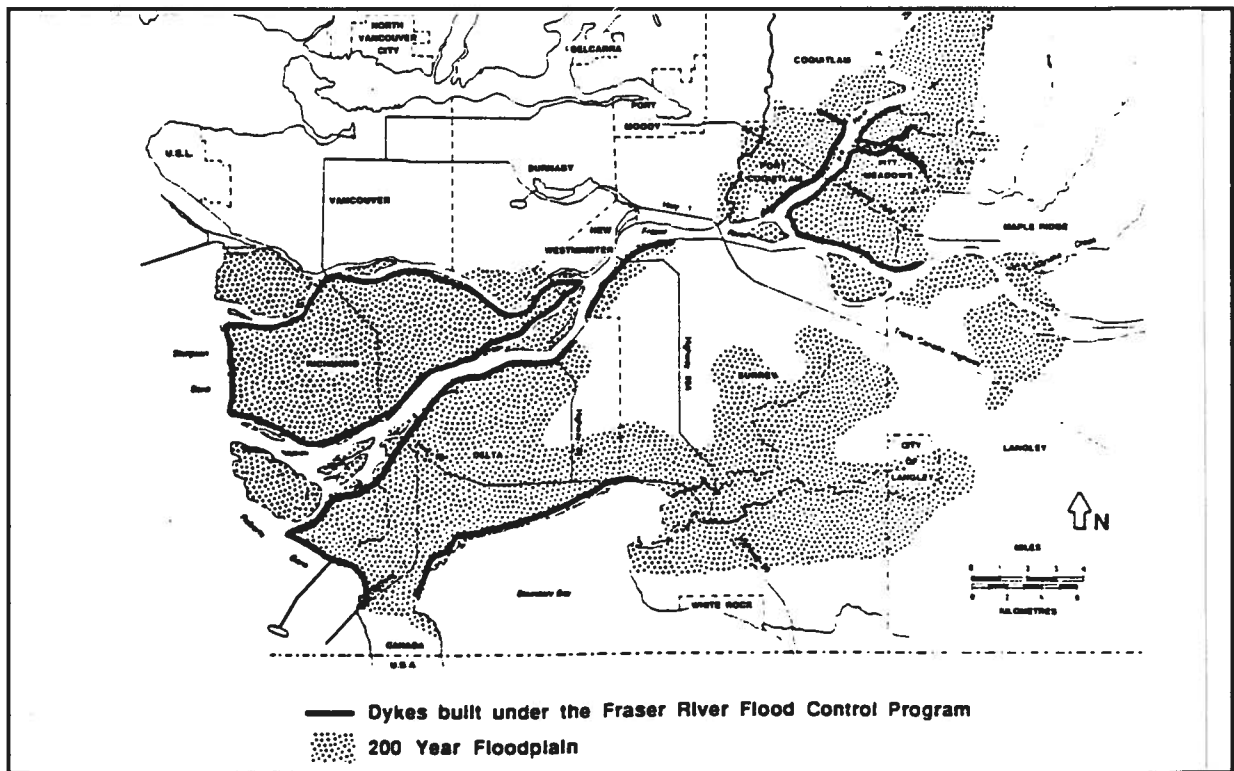
Richmond is almost entirely situated within the Fraser River flood plain. Complementing the protective dykes, a method of controlling development within floodplains was instituted by the provincial and federal levels of government through the Floodplain Mapping Program which commenced in 1987 (Environment Canada 1991). As a consequence of this program and a previous program called the Fraser River Flood Control Program, a Flood Plain Exempt boundary has been created that circumscribes areas within Richmond which do not require ministerial approval for rezoning applications (Richmond 1985a). This exemption boundary includes most urbanized areas in Richmond because the restrictions were not retroactive to pre-existing development (see Figure 4.2). Development in areas outside the Floodplain Exemption Boundary do not require approval from the provincial government.

FIGURE 4.2
The Floodplain Exemption Boundary
(Source: Richmond 1985)



In spite of the attempts to control floodplain development through the use of a Floodplain Exemption Boundary, exempt areas are by no means completely safe from a one-in-200 Year flood event. However the fact that exempt areas are generally located inland provides some degree of flood protection (Sharma 1992: Pers. comm.). Most of the literature indicates that all of Richmond's land area behind the dykes are at risk to a one-in-200 Year flood event (Pearson 1972; Kennett and McPhee 1988; Smith 1991). Figure 4.3 shows the area of Richmond affected by a one-in-200 Year flood event. Since the last major flood occurred in 1948, many of the newer residents of Richmond have little perception of the flood risk (Pearson 1972).

FIGURE 4.3
The One-In-200 Year Floodplain
 (Source: Kennett and McPhee 1988: 20)



4.3 Richmond, B.C.: Socio-economic Context

4.3.1 History and Demographics.

Richmond was incorporated in 1879 at which time most of the thirty homes which housed Richmond's entire population were clustered along the South Arm of the Fraser near Steveston. Since 1879 Richmond has grown to a community of 122,106 people (G.V.R.D. 1991). During the intervening years, Richmond's economic dependence on fishing and agriculture has diminished, being gradually replaced by transportation and manufacturing.

The most dominant feature of Richmond's demographic profile is the aging 'baby boom' generation born in the 1950's (Richmond 1986). Cohort-survival models predict that the average age of Richmond residents will increase from thirty (in 1980) to over 50 by the year 2001 (Richmond 1986; British Columbia 1991b). The number of so-called baby boomers in Richmond is expected to more than double in the next 20 years. This demographic feature will continue to have an impact on housing, health care services, retail spending and recreation within the local community.

4.3.2 Local Economic Context.

Richmond serves an important regional and provincial role as a major transportation hub anchored by the Vancouver International Airport . Due to the presence of the airport, Richmond is often referred to as, "Canada's Gateway to the Pacific" (G.V.R.D. 1991). Future growth in Richmond's economy is expected to be in the commercial services, trade and light industrial sectors, largely as a spinoff of the scheduled expansion of Vancouver International Airport (G.V.R.D. 1991).

Richmond's economy also relies heavily on agriculture, tourism and fishing. As the population and economy continue to expand, the resulting demand for land to facilitate homes, industry and parks is expected to generate considerable conflict with the preservation of the agricultural land base and environmentally sensitive areas (E.S.A.'s) within Richmond.

4.4 Richmond, B.C.: Institutional Context

Much like their federal and provincial counterparts, local governments divide powers and responsibilities between various departments. In Richmond, there are twelve major departments involved in managing local government affairs (see Table 4.1). The departments of Planning, Parks and Leisure Services and Permits and Licenses contribute greatly to the management of issues affecting Richmond's coastal zone.

**TABLE 4.1
THE STRUCTURE OF LOCAL GOVERNMENT IN RICHMOND, B.C.**

Department	Responsibilities
Civic Properties	Civic Building Services.
Computer Services	Computer Systems and G.I.S. System.
Engineering	Roads, Sanitary Sewers, Watermains, Traffic Control and Recycling.
Equal Opportunities	Equal Opportunities and Access.
Health	Environmental Health, Community Care and Home Care Facilities.
Parks and Leisure Services	Parks and Recreation Facilities.
Permits and Licences	Bylaw Enforcement, Permits, Licenses and Building Inspection.
Personnel	Employee Relations.
Planning	Community Planning, Development Applications and Zoning.
Purchasing	Civic Acquisitions.
Taxation	Property Tax Collection.
Public Works	Construction of Civic Projects, Roads and Sidewalks.

Within the context of C.Z.M., Richmond exists within a regulatory structure which includes a number of federal, provincial and regional agencies. Richmond's Official Community Plan acknowledges this with a policy commitment to work with key agencies in the pursuit of community objectives (see Table 4.2). A greater commitment to inter-agency coordination is felt to be a necessary step forward in alleviating some of the redundancies and conflict present in this complex administrative structure (Richmond 1989).

TABLE 4.2
Jurisdictional Involvement in the Implementation
of Richmond's Official Community Plan
 (Source: Richmond 1989)

AGENCY	TASK
North Fraser Harbour Commission	Review proposed foreshore and marine uses on North Arm of Fraser River.
Fraser River Harbour Commission	Review proposed foreshore and marine uses on mainstem of Fraser River.
Department of Fisheries and Oceans	Involved in sensitive foreshore development issues affecting fisheries.
B. C. Ministry of Environment	Involved in air, water and fish and wildlife issues.
Fraser River Estuary Management Program	Involvement in developing environmental policies throughout the Fraser Estuary.
Heritage Conservation Branch/Heritage Trust	Establishes heritage conservation programmes, important to preservation of historic waterfronts like Steveston.
Greater Vancouver Regional District	Involved with regional transportation, services and environmental issues such as park dedication and regional air quality.

4.4.1 Current Land Use Patterns.

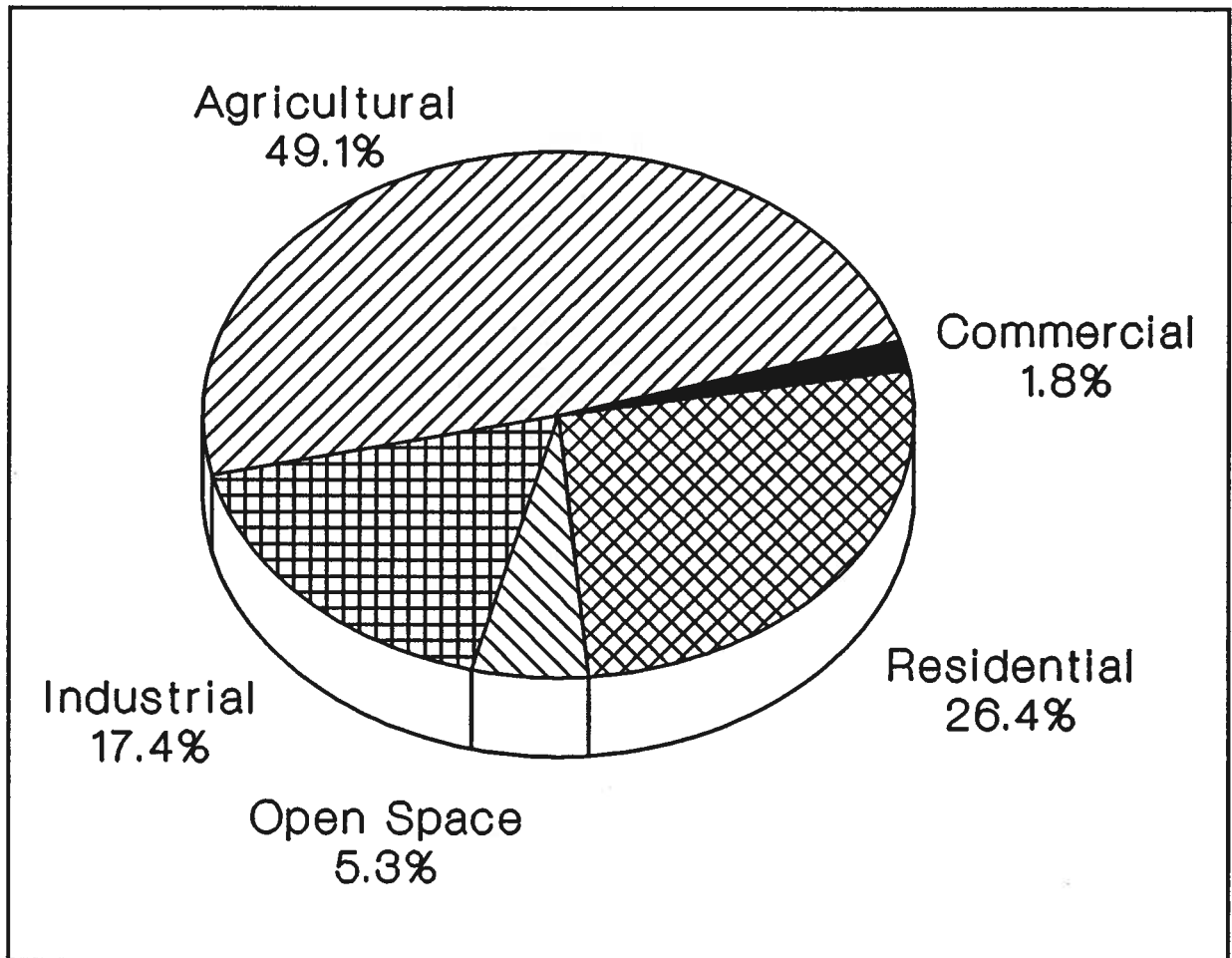
The provision of 'zoning' powers within the B.C. Municipal Act (B.C.1979:Sec 973) grant local governments a great deal of regulatory authority over many aspects of coastal uplands and shorelands. The manner in which 'zoning' authority has been used in the past is often visible in current observed patterns of land use. Furthermore, these patterns of land use are directly linked to specific coastal issues (Nassau-Suffolk 1976; N.A.C. 1971).

A portrait of current patterns of land use in Richmond is given in Figure 4.4 which presents the relative proportions of zoned land supply. In 1985, the three dominant land uses in Richmond were Agricultural (49.1 percent), Residential (26.4 percent) and Industrial (17.4 percent). This portrait of land use in Richmond reveals much about the character of community (agricultural and residential) as well as previous zoning policies. As the total area of Richmond is finite, zoning changes in land use are only at the 'expense' of other uses, however some of this pressure on the land may be relieved through increases in density. Historically, agriculture has given way to residential and industrial development pressures.

In addition to the policies and objectives included in Richmond's O.C.P., there exists a contractual agreement with the various participating parties which comprise the Fraser River Estuary Management Program (F.R.E.M.P 1991). This non-binding agreement is intended to serve three important functions. First, it is intended to document and confirm the understanding of Area Designations for the Fraser River estuary. Second, the agreement is intended to describe

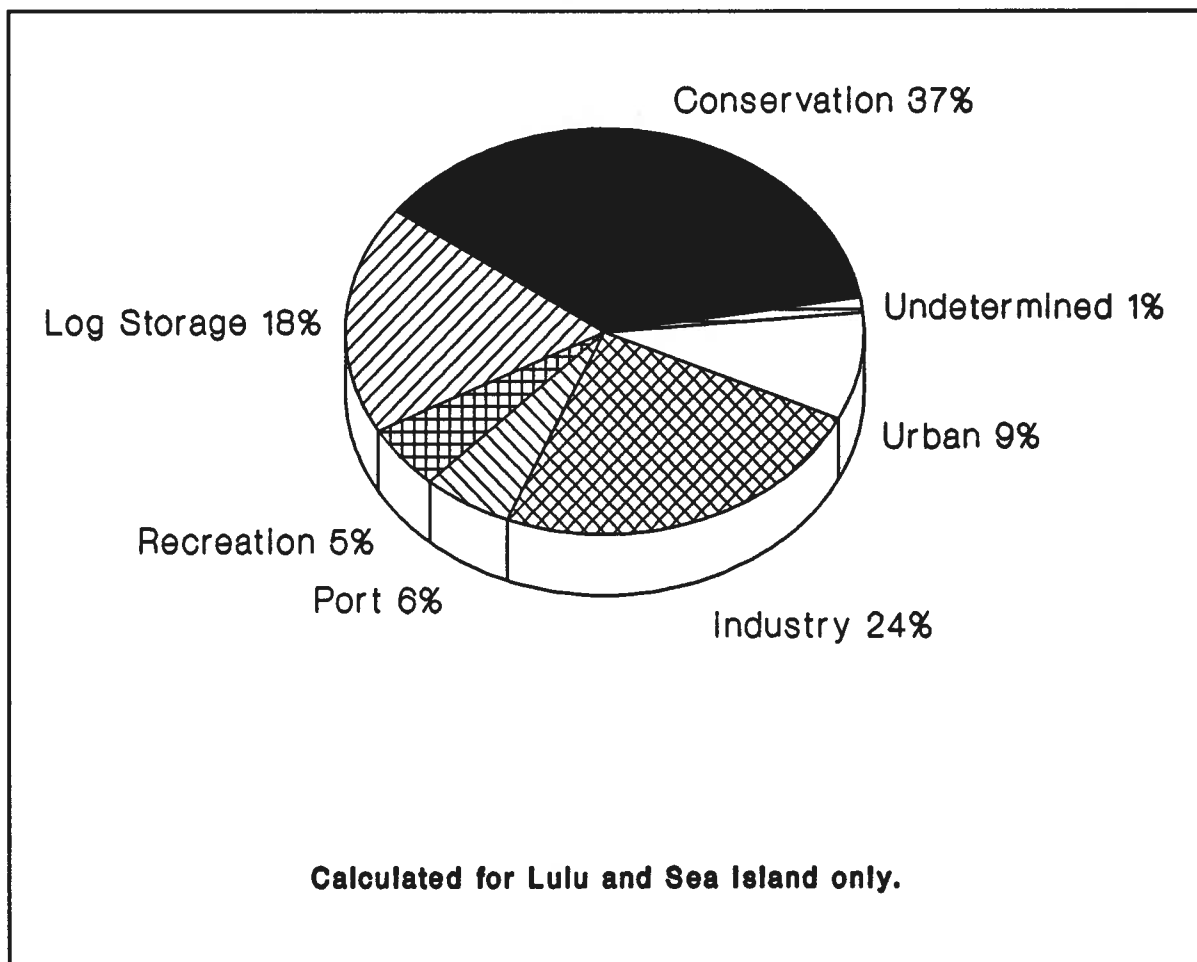
measures to resolve associated barriers to consensus. Third, the agreement provides a framework for helping to coordinate the administrative procedures.

Figure 4.4
Relative Proportion of Zoned Land in Richmond
(Source: Richmond 1989: p.25)



A closer examination of the F.R.E.M.P Area Designations agreement provided some insight into allocated land use patterns for the waterfront portion of Richmond's coastal zone. A pie chart depicting Richmond's Designated waterfront land supply reveals the relative proportion of designated uses for waterfront land (see Figure 4.5). Individually, Conservation

Figure 4.5
Richmond Foreshore Area Designations
(Source: Richmond 1990)



was the largest designated waterfront use at 39.7 percent, however Industrial-type uses (Log Storage, Port and Industry) combined to account for 44.2 percent of designated waterfront. Interestingly, the seven foreshore land designations do not correspond very precisely to Richmond's thirty four zoning categories.

In contrast to Richmond's overall zoned land supply which is dominated by agricultural and residential uses (refer back to Figure 4.4), Richmond's waterfront appears to be reserved primarily for industry and conservation, two uses which are often considered incompatible. The current land use patterns revealed in Figures 4.4 (Zoned Land Supply) and 4.5 (Designated Waterfront Land Supply) reflect past policies and decisions which have seen the concentration of industry along the waterfront and the location of housing and commercial activities further inland. Perhaps the Richmond/ F.R.E.M.P. Foreshore Area Designation Agreement (Richmond 1990) attempts to offset the industrialized waterfront character of Richmond with a nearly equal quantity of designated conservation areas. Regardless, Richmond is left with a legacy of zoned land uses along its waterfront which will undoubtedly have continued impacts in areas such as coastal zone water quality.

4.5 Summary

An analysis of land use patterns in Richmond revealed two important features. Firstly, land use in Richmond is predominantly agricultural and residential in character. Secondly, waterfront land use is predominantly allocated for industrial and conservation purposes. Richmond represents a broad spectrum of issues facing Canadian coastal communities (McPhee

pers. com. 1991). From the commercial fishing fleet harboured at Steveston to the waterfront commercial development at Fraser Point, this municipality is home to many coastal related land uses. Although located further inland, agricultural activity in Richmond has a demonstrated impact on the coastal zone particularly in areas such as water quality (Ferguson and Hall 1979). The combination of uses that depend and affect the coast make Richmond an excellent model upon which to base an evaluation of local coastal zone policies.

CHAPTER 5

The Evaluative Framework

5.1 Introduction

A review of the literature revealed that evaluative methodologies intended for local coastal zone management (C.Z.M.) programs were uncommon. The argument has been made that the infrequency of C.Z.M. program evaluation in Canada is due to the rarity of *bona fide* C.Z.M. programs at any level of government (Jessen *et. al.* 1983). Due to the absence of meaningful or consistent evaluative criteria most of the evaluative frameworks offered by other sources in the literature were considered inappropriate for evaluating municipal coastal zone policies. The desired evaluative methodology would have to be capable of incorporating information relevant to the local government's role in C.Z.M.

Coastal zones typify information problems which are similar to elements of Environmental Impact Assessment (E.I.A.). Evaluative methodologies based on E.I.A. when applied to coastal zone issues have tended to rely heavily on quantitative and empirical knowledge (Ritchie 1984). The main difficulty with specific quantitative data is encountered when one attempts to make macro-scale generalizations based on micro-scale data (Hennessey and Robadue 1987). Furthermore, quantitative information concerning critical aspects of the coastal zone, such as physicochemical processes or trophic relationships may not be readily available, limiting the applicability of this type of evaluative methodology to case studies where a considerable body of research knowledge already exists. The natural complexity that coastal

zones possess has been problematic from an analytical perspective also (Hennessey and Robadue 1987). The coastal zone features which are perhaps the most vexing to impact analysis studies are:

- Coastal ecosystems are connected in a selective fashion (McLusky 1989).
- The impacts of events is not uniform on coastal ecology (Hennessey and Robadue 1987).
- Dramatic changes in ecosystem behaviour is normal, and many of these changes are beyond our ability to predict (Ricker 1963).
- Variability rather than stability is the characteristic of coastal zones which allows them to adjust and therefore persist (Hennessey and Robadue 1987).

Given the difficulties inherent in a highly quantitative evaluative approach similar to that of E.I.A., it follows that an evaluation of the local C.Z.M. policies must reflect the existing, quantitative information while at the same time be cognizant of the limitations in such knowledge. Ritchie (1984) describes the evaluative framework for the coastal zone as a:

"...semi-quantitative appraisal within the limits of existing knowledge and a qualitative estimation which must be more than mere opinion but should be based on comparative judgement."

In the specific context of evaluating policy performance at the local level of government, the evaluative method must also take into account the limitations placed on the local governments

with respect to their jurisdictional authority. This final point is especially important when considering any policy recommendation suggested by the results of the study.

5.2 The Evaluative Framework: Background

The evaluation of local policies relevant to the management of the coastal zone of British Columbia is based on methodologies employed by Rosentraub (1975) and Jessen *et al.* (1983). Each of these studies produced a detailed examination of the roles served by regional levels of government in the management of the coastal zone. Although Rosentraub and Jessen *et al.* utilize similar approaches, the manner in which the results are used for evaluative purposes is somewhat different.

5.2.1 An Evaluative Methodology for the California South Coast Regional Commission

Rosenraub (1975) examined coastal policy development and evaluation of the South Coast Regional Commission in Southern California. His methodology examined many parameters associated with the regulation of coastal zone development including: location, size of development, present use of the land, construction costs, type of development and review procedure utilized. Together, these parameters constituted the foundation of Rosentraub's examination of the South Coast Regional Commission's role in the management of a highly urbanized coast. The relevance of Rosentraub's study to C.Z.M. policy came in the context of agency self-evaluation. Rosentraub's methodology was designed to provide the necessary

information for local agencies to evaluate the performance of their own C.Z.M. policies by analyzing the net result of day to day activities and decisions.

5.2.2 An Evaluative Methodology for Haldimand-Norfolk

Jessen *et al.* (1983) reviewed development applications as a method of evaluating the effect of local land use decisions on the coastal zone. Building on Rosentraub's methodology, Jessen *et al.* (1983) expanded their examination to include parameters such as inter-agency involvement, coastal hazard susceptibility, and length of the decision-making process. Unlike Rosentraub, Jessen *et al.*'s results were used to provide an external evaluation of the performance of coastal land-use policies (existing and inferred).

Rosentraub (1975) and Jessen *et al.* (1983) employed a retrospective survey technique on land use regulation in order to draw conclusions concerning the relative effectiveness of local level policies designed to address the various management issues of the coastal zone. One advantage in using such a retrospective survey of development within the coastal zone is that it provides an empirical record of municipal actions and land-use decisions. Thus, depending upon the type of information sought and the manner in which it is analyzed, it is possible to examine many different facets of local C.Z.M. ranging from inter-agency involvement to development pressures in coastal floodplains as both Rosentraub (1975) and Jessen *et al.* (1983) demonstrated in their respective studies.

5.3 The Evaluative Framework

The evaluative framework consists of three basic components describing basic **C.Z.M.** issues, the policies that are to be evaluated, and criteria required to facilitate the evaluation. These three components are similar to those described by Schaenman (1975) for evaluating land use impacts.

The management issues for the urban coastal zone have been described in Chapter Three along with the regulatory powers available to local governments to these issues. The seven coastal zone management issues are:

- **Habitat Conservation;**
- **Water Quality;**
- **Natural Coastal Hazards;**
- **Public Access and Aesthetics;**
- **Public Input;**
- **Water Dependency; and**
- **Interjurisdictional Coordination.**

The policies and measurement criteria necessary to produce an evaluation are given in the following sections.

5.3.1 Local Policies and C.Z.M Issues: Richmond, B.C.

Richmond's current Official Community Plan (Bylaw 5400) states that the municipality must begin to fulfil a "*stronger role in protecting Richmond's natural resources*" (Richmond 1989). Often the impetus for policy formation is acknowledgement of a current or future problem or concern. Less frequently, policies are created to maintain desirable situations. In the case of Richmond, British Columbia, the local government has acknowledged the importance of ecological resource protection through a number of current and previous policy statements. Many of these local policies are consistent with the principles of C.Z.M. Richmond's Official Community Plan (O.C.P.) does not provide for a separate C.Z.M. program but it does contain a number of objective statements, five of which are considered central to seven key issues for urban coastal zones. Objective statements within Richmond's current O.C.P. and its predecessor (Bylaw 4700) address the following issues:

- **Habitat Protection;**
- **Water Quality;**
- **Waste Management;**
- **Natural Hazard Planning;**
- **Improved Urban Design (Access and Aesthetics); and**
- **Interjurisdictional**

Policies for the planning and management of its coastal areas have developed from these objective statements. The various policies are assumed to be consistent with the intent of these

community objectives. Moreover, the evaluation of a given policy may be determined by how well it serves its objective.

Table 5.1 lists the seven coastal zone management issues and the relevant community objectives and planning policies given by Richmond's (1986b) Official Community Plan Bylaw 4700. The policies selected for evaluation were considered to be the most relevant to C.Z.M. The time frame over which land use data was collected (1988 to 1991) is coincident with the adoption of the policies contained with the O.C.P. Bylaw 4700 was rescinded on April 3, 1989, replaced by an updated O.C.P. (Bylaw 5400) but the policies contained therein were identical. In effect, the evaluation of Richmond's C.Z.M. policies is somewhat historical in that the performance of policies in effect between 1988 and 1991 is considered. In 1991, numerous amendments to Richmond's O.C.P. Bylaw 5400 were added providing more regulatory clout to the O.C.P. policies (Brownlee 1994: pers. comm).

TABLE 5.1
Municipal Objectives and Policies Affecting Richmond's Coastal Zone
 (Source: Richmond 1986b)

Coastal Zone Issue	Objective Statement	Policies to be Evaluated
Habitat Conservation	"To Protect Our Natural Habitats"	Acquire threatened sensitive natural areas. Use Development Permits to mitigate the effects of development near environmentally sensitive areas.
Water Quality	"To Maintain and Improve the Air and Water Quality"	Discourage water polluting industries from locating along the sloughs and estuary.
Coastal Hazards	"To Protect Life and Property from Floods"	Encourage development in areas which are not exempt from floodplain regulations to be constructed in a manner which will provide protection from flood hazard.
Public Access & Aesthetics	"To Encourage Good Urban Design in Richmond"	Maintain significant views from roads, the waterfront and public open spaces. & Promote a safe pedestrian environment. Support the continuing implementation of the Richmond Trails Plan.
Public Input	(Implicit)	N/A
Water Dependency	N/A	N/A
Interjurisdictional Coordination	(Implicit)	Support the F.R.E.M.P.

5.4 C.Z.M. Issues: Policies and Evaluative Criteria

The information necessary to conduct a case study evaluation of local government policies affecting the overall management of the coastal zone was derived from information contained within municipal Development Permit Applications and, to a lesser extent, Rezoning Application files. Consistent with the discussion of local regulatory powers in Chapter Three, Community Plans, Zoning and Development Permits were identified as local government's main tools in exercising its planning and management authority within a larger coastal zone management framework containing many regulating agencies. The Development Permit (B.C. 1979: Sec. 976) is of particular interest from an evaluative standpoint as it permits local governments a considerable degree of control over many elements development on a case-by-case basis. It is often at the level of the Development Permit where local governments must ensure that policies contained within Official Community Plans are respected.

Development Permits are required for most forms of development, including multiple residential, commercial and industrial, in most areas of Richmond (Richmond 1986b). The definition of Development Permit areas means that most development proposals (except single family residential developments) require Development Permits. In addition, Richmond requires all proposed developments located within designated Environmentally Sensitive Areas (E.S.A.'s) to submit Development Permit applications (Richmond 1986: Schedule 1). Thus, most of the development pressure affecting C.Z.M. issues appeared to be covered by Development Permits.

Another argument for selecting Development Permit Files as an appropriate source of information in the evaluation of local C.Z.M. policies involves *richness* of the data contained within these files. Information regarding location, zoning type, site and building design and even external agency contact was contained within these files. Given that the scope of the seven coastal zone management issues range from site specific (Public Access, Aesthetics) to broader land use (Water Quality, Water Dependency) concerns, Development Permit files appear to fulfil the informational requirements rather conveniently. It is important to note that the information contained within Development Permit Application files rather than the Development Permits themselves are the subject of investigation.

The use of detailed, site-specific information contained within Development Permit Applications Files to produce an evaluation of community-wide policies has certain limitations. These include problems in extrapolating conclusions for large-scale issues using small-scale data and the representiveness of the measurements selected for the policy analysis. However, the cumulative use of this site-specific information is one useful *proxi* measurement upon which policy may be evaluated.

The selection of appropriate evaluative criteria involved several considerations. First, the necessary information for each criteria had to be readily available for collection and measurement. Second, the data necessary to analyze each criteria had to be free of large gaps and have sufficient sample sizes to allow confidence in the analysis. Third, and most

importantly, the evaluative criteria must be able to provide accurate and useful insight into the coastal zone issue it was designed to evaluate.

The empirical information was generated from a consecutive four year survey (1988 to 1991) of Development Permit and Rezoning application files in Richmond. A four year time frame was selected because it yielded a manageable database (249 Development Permit application files and 522 Rezoning application files) from which to work. Development Permit and rezoning application data prior to 1988 were not considered due to the immense difficulty involved in retrieving the files from storage. Development Permit and Rezoning application files after 1991 were not considered as most were pending completion.

5.4.1 General Evaluative Criteria.

A number of general evaluative criteria were included as a way to address issues which seemed to be less specific to the coastal zone and linked more closely to local management processes themselves. The criteria are: length of decision-making, magnitude of Development Permit and Rezoning applications and completion rates for applications.

A number of general evaluation criteria are included in the overall examination of local policy effectiveness in C.Z.M. The criteria provide essential information which describes overall trends in coastal land use patterns for Richmond. Specifically, these criteria measure the magnitude of development pressure, the nature of development pressure as indicated by general lands use categories (multiple residential, commercial, industrial, mixed, other etc.),

Development Permit processing times and approval rates for Development Permit applications. Where applicable, the results from these general evaluative criteria are used for comparison purposes in conjunction with policy specific evaluations for each of the other seven coastal zone management issues.

5.4.2 Habitat Conservation.

Policies: ●Acquire threatened sensitive areas

(Richmond 1986: p.37)

●Use Development Permits to mitigate the effects of development near environmentally sensitive areas.

(Richmond 1986: p.37)

Richmond's habitat policies are intended to protect natural habitats. The above policies represent both proactive (acquiring E.S.A.'s) and reactive (mitigation) planning approaches. These policies have the potential to be very effective in achieving the objective of protecting natural habitat.

The evaluation of Richmond's policies regarding habitat conservation is permitted through the analysis of development pressures occurring within areas designated as being environmentally significant (Richmond, 1986b). A key aspect in this analysis is the rate of success (completion) for development applications within and outside E.S.A.'s.

The analysis of development pressures and land use decisions affecting E.S.A.'s should resolve questions of how well E.S.A.'s have been protected in Richmond during the four year survey period. The information generated in the analysis will be capable of addressing this question of E.S.A. protection on a community-wide level.

5.4.3 Water Quality.

Policy: • Discourage water polluting industries from locating along the sloughs and estuaries.

(Richmond 1986: p.38).

Richmond's water quality policies are intended to fulfil the objective of maintaining and improving water quality. This particular policy is interesting from the C.Z.M. perspective as it appears to contradict past land use policies which have promoted the widespread industrialization of Richmond's foreshore. This policy is potentially very effective in controlling the spread of contaminants from non point sources. A key assumption in this evaluation is that certain uses such as industrial uses are more polluting than others and that proximity is a governing factor in the net amount and concentration of contaminants entering a body of water via ground water transport, wind transport and accidental spillage (Ferguson and Hall, 1979; Swain, 1982; Barton, 198; Whipple *et al.* 1974; Wanielista *et al.* 1977). These sources of coastal water pollution are usually not addressed by existing waste collection and treatment infrastructure. Water quality policies in Richmond regarding 'point-source' waste management are not considered in this study.

The evaluation of Richmond's policy concerning water quality was permitted through an analysis of development pressure (by land use type) as a function of distance from the shoreline. Through this type of analysis, it is possible to determine the tendency of industry to locate close to the estuary and sloughs in Richmond. The analysis of development pressures should address the question of whether or not potentially polluting industrial uses continue to locate along the sloughs and waterfront as is observed in current land use patterns in Richmond (refer to Figure 4.5).

5.4.4 Natural Coastal Hazards.

Policy: •Encourage development in areas which are not exempt from floodplain regulations to be constructed in a manner which will provide protection from flood hazard.

(Richmond 1986: p.40).

Richmond's coastal hazard policy is intended to protect life and property from floods. The effectiveness of the policy encouraging construction practices that provides flood protection (also referred to as flood proofing) is ultimately limited by the amount of development taking place in high risk areas of Richmond - these areas closest to the river (Sharma, Pers. Comm). Although flood proofing may reduce some of the risks due to flooding, these risks may not be eliminated entirely.

The evaluation of Richmond coastal flood hazard policy was permitted through the analysis of development patterns within and outside defined floodplain boundaries. The significance of the floodplain exemption boundary from an analytical perspective is that it provides an identifiable division between higher and lower risk areas within Richmond based essentially on the proximity to the Fraser River. Hence, those areas closer to the River (outside the Floodplain Exemption Boundary) are believed to be at greater risk to floods (Sharma, 1992 Pers. comm.). This additional layer of regulation constitutes a tighter level of control over development in the floodplain. Of particular interest to the evaluation was the rate of success for development proposals in areas exempted from provincial approval versus those in areas requiring provincial approval prior to development. The evaluation of this coastal zone management policy differs from the evaluation of other policies in that it is based primarily on an assessment of flood risk due to land use patterns. The analysis of land use patterns within the Richmond floodplain is intended to address the question of whether or not life and property is protected from floods.

5.4.5 Public Access & Aesthetics.

Policy: Public access •Promote a safe pedestrian environment.

(Richmond 1986b: p.33)

***•Support the continuing implementation of the Richmond
Trails Plan***

(Richmond 1986b:p.51).

*Aesthetics • Maintain significant views from roads, the
waterfront and public open spaces.*

(Richmond 1986b: p.45)

Richmond's policies regarding public access to the waterfront are complementary to the long term commitment to realizing a continuous public trail system along the dyke. Guaranteeing public access to the waterfront is an important element in what Richmond perceives as a safe pedestrian environment. Richmond amended it's most recent Official Community Plan Bylaw 5400 in late 1991 with a development guideline that states:

"Public access to the waterfront for the purpose of recreation or education should be designed into each foreshore development in a manner which is consistent with the natural values of the site".

This new policy guideline clearly states that public access to the waterfront is to be included in developments. The evaluation of the two policies may be used later as a way to assess the impact of the addition of the 1991 design guideline on waterfront development (Bylaw 5746).

The evaluation of the public access policy for Richmond was permitted through the analysis of site plans (contained within Development Permit files) for foreshore development proposals. Only site plans with clearly marked public right-of-ways were counted as having public access. The provision of public access was also analyzed with respect to development type. The key question of this analysis was how often public access was permitted for foreshore developments.

Richmond's policy regarding aesthetics is intended to fulfil the goal of good urban design. Although the criteria governing aesthetics and good urban design are highly subjective, it is nonetheless worthwhile to consider the 'maintenance of views' as an essential element of coastal zone aesthetics. Landscaping constituted the minimum level of aesthetic consideration towards the objective of view maintenance. From a practical standpoint, the presence or absence of landscaping was the only measurable criterion for aesthetics. Hence, the evaluation of aesthetics in C.Z.M. was based on the occurrence of landscaping for development proposals. The analysis of landscaping requirements for Development Permit Proposals was intended to provide insight into whether or not Richmond was addressing the aesthetics issue in the coastal zone.

5.4.6 Public Input.

Policy: ●None

Although the commitment to effective public input into the municipal decision working process is not explicit in Richmond's O.C.P. a public input policy is, however, implied by the closing sentence of the O.C.P. which reads;

"The planning process must be on going so that the plan can continue to reflect the values of the community."

(Richmond 1989; P.70).

That the planning process is to reflect community values seems to suggest Richmond's acceptance of public involvement at various phases of decision-making. However, it is important to recall that public hearings are requirements of the Municipal Act for the adoption

of the O.C.P. and Zoning bylaws. Public consultation for Development Permits is left to the discretion of local governments.

An evaluation of the public input dimension (policy not explicit) focuses on the occurrence of public consultation (facilitated through Development Permit Panels) for development proposals over the four year study frame. The occurrence of public input was also considered as a function of development type. Lacking a definitive public input policy necessitates that the evaluation of this aspect of C.Z.M. remain essentially descriptive.

5.4.7 Water Dependency.

Policy: • *None*

Richmond's O.C.P. does not contain a specific policy regarding water dependency. The absence of such a policy may indicate that the issue has not yet been perceived by Richmond as being a concern. Zoning patterns and F.R.E.M.P. foreshore area designations are *defacto* policies affecting the coastal zone management issue of water dependency for they govern the provision of land supply for water dependent, water related and water independent uses.

As with the evaluation of the public input dimension of C.Z.M., the analysis of water dependency issues is essentially descriptive rather than evaluative. A description of trends in foreshore land uses and water dependent activities was permitted through an analysis of the 'level of dependency' (categorized as either water dependent, water related or water independent)

as a function of development type and coastal location. This analysis will permit an empirical assessment of the relative demand for foreshore land in Richmond by water dependent and water related activities.

5.4.8 Interjurisdictional Coordination.

Policy: ● *Support the Fraser River Estuary Management Program*

(Richmond 1986b: p.38)

Richmond's policy to support the F.R.E.M.P. serves an implicit objective of ensuring effective interjurisdictional coordination, particularly for issues involving many layers of government. The issue of interjurisdictional coordination is especially crucial in C.Z.M. due to the amount of jurisdictional overlap accompanying many of the other management issues, notably, water quality. Richmond's policy of support for the F.R.E.M.P. is a potentially very effective means of realizing a high level of interjurisdictional coordination. This is possible through the F.R.E.M.P.'s multi-agency composition which provides a framework for agreement among management agencies operating within the estuary (refer to Section 2.3.2.4). However, as it exists presently, coordination with the F.R.E.M.P. is limited to all developments affecting land seaward from the dyke crest (Jamieson 1994 pers. comm.).

Richmond's policy concerning interjurisdictional coordination was addressed by an analysis of the occurrence of contact with other local, provincial and federal agencies, including the F.R.E.M.P.. Contact was confirmed by the presence of written or faxed correspondence

directly between the municipality and the other agency. Written records of telephone conversations were also included. Contact facilitated by an intermediate (such as letters subsequently forwarded to another agency) was not included. Casual observation revealed that occurrence of this form of third party 'coordination' appeared infrequently in Development Permit files. This analysis should help answer questions on the extent of interjurisdictional coordination for Development Permit applications in Richmond.

5.5 Strengths and Weaknesses of the Evaluative Methodology

In describing a 'systematic approach' towards measuring land use impacts, Schaenman (1976) identified three attributes which were considered essential to any such evaluation: **comprehensiveness, consistency and clarity**. The methodology developed from approaches first applied to coastal management involving local governments in California by Rosentraub (1975) and in Ontario by Jessen *et. al.* (1983) demonstrated attractiveness of such an approach in terms of Schaenman's three key attributes. The strengths and weaknesses of this study's methodological approach were assessed on the basis of three criteria; comprehensiveness, consistency and clarity.

5.5.1 Comprehensiveness:

Sources in the C.Z.M. literature such as C.C.R.E.M (1978) and Gamble (1989) have provided the bulk of the groundwork for development of the comprehensive list of coastal zone issues used as a evaluative framework for this study. The evaluative framework employed by this study succeeds in addressing a full array of values and concerns affecting the biophysical,

socio-political and economic fabric of the coastal zone. Although the methodology succeeds in offering a very comprehensive or broadly based analysis, the methodology has made sacrifices in terms of the 'depth' or detail of analysis. Thus, individual problems and concerns may be masked through their inclusion under broad category headings.

5.5.2 Consistency:

The evaluation of resource management approaches is often complicated by inconsistent evaluative methods (Schaenman 1976). Consistency among evaluative methods is crucial because the evaluative outcome is often heavily influenced by the type of data collected (measurement parameters). The general principles of the methodology employed in this study have remained fairly consistent with its predecessors (Rosentraub 1975; Jessen *et. al.* 1983) and has the potential to be consistent with future evaluations of local government C.Z.M. policies because it is based on the same land use information acquired by municipal and regional governments when processing development and rezoning applications. Barring major changes in land use regulation authority, this methodology could remain useful for local coastal zone policy evaluations for many years. In this capacity, the methodology could be a powerful tool for analyzing the long term effectiveness of C.Z.M. policies or assessing the performance of new policies relative to earlier policies.

5.5.3 Clarity:

Schaenman (1976) describes the clarity of an evaluative approach as a function of the meaningfulness and ease of interpretation of the results. The methodology is appealing since it

is not encumbered by highly technical measurements and jargon which Schaenman (1976) felt often impaired the clarity of a methodology. The methodology produces quantitative results describing land use and development pressures which may easily be used to track the performance of specific land use policies.

However, it is also at the level of *clarity* where the methodology exhibits its main weaknesses in interpreting the results. The difficulties were encountered in reaching definitive conclusions based on the results of the evaluation may be attributed to the complex nature of the management issues and management process. Although, the methodology provides plausible conclusions based on empirical results, the methodology is unable to provide any detailed insight on site-specific impacts on the coastal zone. Hence, the methodology is viewed as a somewhat 'blunt' analytical tool which is capable of assessing local C.Z.M. policies on a community wide basis.

5.6 Summary

Modifying Rosentraub and Jessen *et. al.*'s methodology by incorporating a logical and comprehensive evaluative coastal zone issues framework has resulted in an improved methodology for evaluating local policies affecting the coastal zone. Regarded in the specific context of local level C.Z.M., the methodology has shown itself capable of producing a **comprehensive, consistent and clear** evaluation of local policy impact on a community-wide basis. However, the methodology presents certain limitations in providing definitive conclusions for evaluating local policies affecting the coastal zone.

A review of Richmond's O.C.P. Bylaw 4700 revealed a number of policies closely related to the management of identified coastal zone issues. The C.Z.M. issues **water dependency** and **public input** were not represented by policy in Richmond's O.C.P. The evaluation of existing (and absent) policies based on the criteria developed in this chapter is presented in the following chapter.

CHAPTER 6

COASTAL POLICY EVALUATIONS: RICHMOND, B.C.

6.1 Introduction

What follows is a presentation of the analysis results for the evaluation of coastal zone policies. For convenience, the results and discussion are presented concurrently for each coastal issue. This chapter commences with a discussion of general evaluative criteria and ends with a summary of key findings.

6.2 General Evaluative Criteria: Results

An analysis of the nature and magnitude of Development Permit applications, time required to process applications, the status (completed, closed or pending) of Development Permit applications according to proposed use and the spatial location of Development Permit application was conducted in order to provide information on the overall scope and efficiency of the land use regulation process in Richmond from 1988 to 1991.

The municipality of Richmond received 249 Development Permit applications and 522 rezoning applications from January, 1988 to December, 1991 (Refer to Table 6.1). The average rate of completion (approval by council and Development Permit issued) for Development Permit applications was 63.05 percent, slightly higher than the rate of completion for rezoning applications which was 58.05 percent. Development Permit applications were closed (rejected

by council or withdrawn by applicant) at a more frequent rate than for rezoning (21.29 percent versus 32.18 percent). The balance of rezoning and Development Permit applications were classified as pending⁷ since they were still involved in the application process. For much of the subsequent analysis of landuse patterns and development pressure, files classified as pending are ignored.

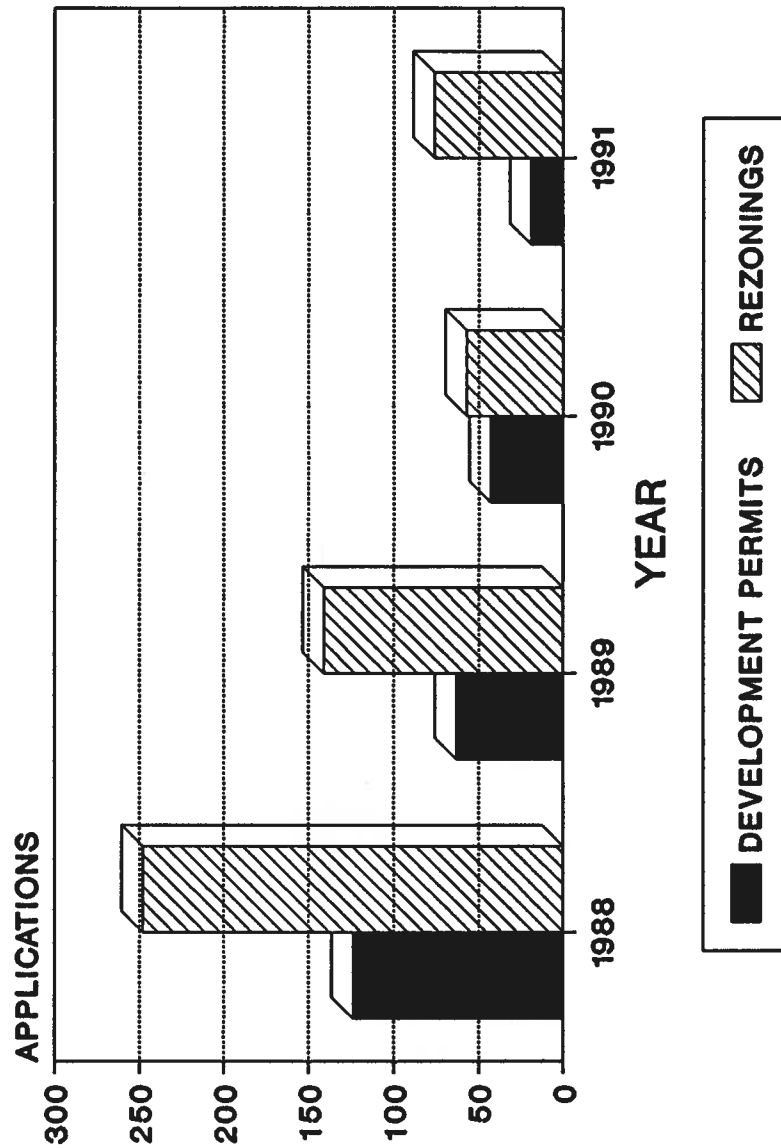
TABLE 6.1
Development Permit and Rezoning Applications in Richmond

YEAR	Development Permits					Rezoning			
	NO.	COMPLETE	CLOSED	PENDING		NO.	COMPLETE	CLOSED	PENDING
1988	124	75.00%	23.39%	1.61%		248	63.31%	34.68%	2.02%
1989	63	52.38%	30.16%	17.46%		141	50.35%	41.84%	7.8%
1990	43	51.16%	11.63%	37.21%		57	57.89%	22.81%	19.30%
1991	19	47.37%	0.0%	52.63%		76	55.26%	13.16%	31.58%
TOTAL	249	63.05%	21.29%	15.66%		522	58.05%	32.18%	9.77%

Figure 6.1 is a graph of the total number of Development Permits and rezoning applications processed by the Richmond Planning Department from 1988 to 1991. This graph shows a clear downward trend in the numbers of rezoning and Development Permit applications, although a modest rebound in the numbers of rezoning applications was observed for 1991.

⁷Application files were considered pending even if they were given council approval but delayed issuance of final permits due to subsequent conditions such as legal or financial complications.

FIGURE 6.1
Magnitude of Development Permit and Rezoning Applications



Nearly half (49.8 percent) of the total number of Development Permit applications were for multiple residential uses. The next largest land use category was commercial accounting for 31.3 percent of the total number of applications. Table 6.2 displays the calculated relative frequencies for the various land use categories. The results presented in Table 6.2 also revealed that Development Permit applications involved over 2,286,134 square metres (2.286 square kilometres) of land. This amount represents approximately less than 1.5 percent of Richmond total land area of 168.1 square kilometres.

TABLE 6.2
Development Applications by Type and Land Area

PROPOSED DEVELOPMENT	AREA m ²	NUMBER	PERCENT
Multiple Residential	1,027,670.0	124	49.8
Commercial	717,614.7	78	31.3
Industrial	273,087.1	17	6.8
Mixed- Commer./Res.	110,461.2	12	4.8
Mixed- Commer./Indust.	1,748.0	1	0.4
Mixed- Commer./Recr.	21,671.0	1	0.4
Mixed- Res./Recr.	52,079.0	1	0.4
Recreation	43,602.5	2	0.8
Public Utility	95.0	1	0.4
Other	38,106.5	12	4.9
TOTAL	† 2,286,134.0	249	100

† Area information was unavailable for 26 Development Permit Application files.

The results of a comparison of the status of Development Permit applications (completed, closed or pending) are presented in Table 6.3. The results revealed a fairly clear pattern of decisions for Development Permit proposals. In general, Development Permits were completed (approved) at a rate three times more frequently than closed (rejected or withdrawn by applicant). These results were consistent between proposed development types.

TABLE 6.3
Development Permit Application Completion Rate by Type

PROPOSED DEVELOPMENT	COMPLETED # (%)	CLOSED # (%)	PENDING # (%)
Multiple Residential	84 (67.74)	21 (16.94)	19 (15.32)
Commercial	46 (58.97)	21 (26.92)	11 (14.11)
Industrial	11 (64.71)	4 (23.53)	2 (11.76)
Mixed- Comm./Res.	6 (50.0)	3 (25.0)	3 (25.0)
Mixed- Comm./Ind.	1 (100.0)	0 (0.0)	0 (0.0)
Mixed- Comm./Recr.	1 (100.0)	0 (0.0)	0 (0.0)
Mixed- Res./Recr.	1 (100.0)	0 (0.0)	0 (0.0)
Recreation	1 (50.0)	1 (50.0)	0 (0.0)
Public Utility	1 (100.0)	0 (0.0)	0 (0.0)
Other	5 (41.67)	3 (25.0)	4 (33.33)
TOTAL	157 (63.05)	53 (21.29)	39 (15.66)

The spacial location of development within the coastal zone was calculated on the basis of the minimum distance of the proposed development site to the Mean High Water Mark

(M.H.W.M.) or High Tide Mark. Table 6.4 displays the number and status of development proposals in relation to the distance from the M.H.W.M. The largest proportion of Development Permit applications, 59.3 percent, was found to occur at distances greater than 1000 metres from the M.H.W.M. Twenty-five (10.2 percent) of the total number of Development Permit applications occurred within 100 metres of the M.H.W.M.

TABLE 6.4
Development Permit Applications and Coastal Location

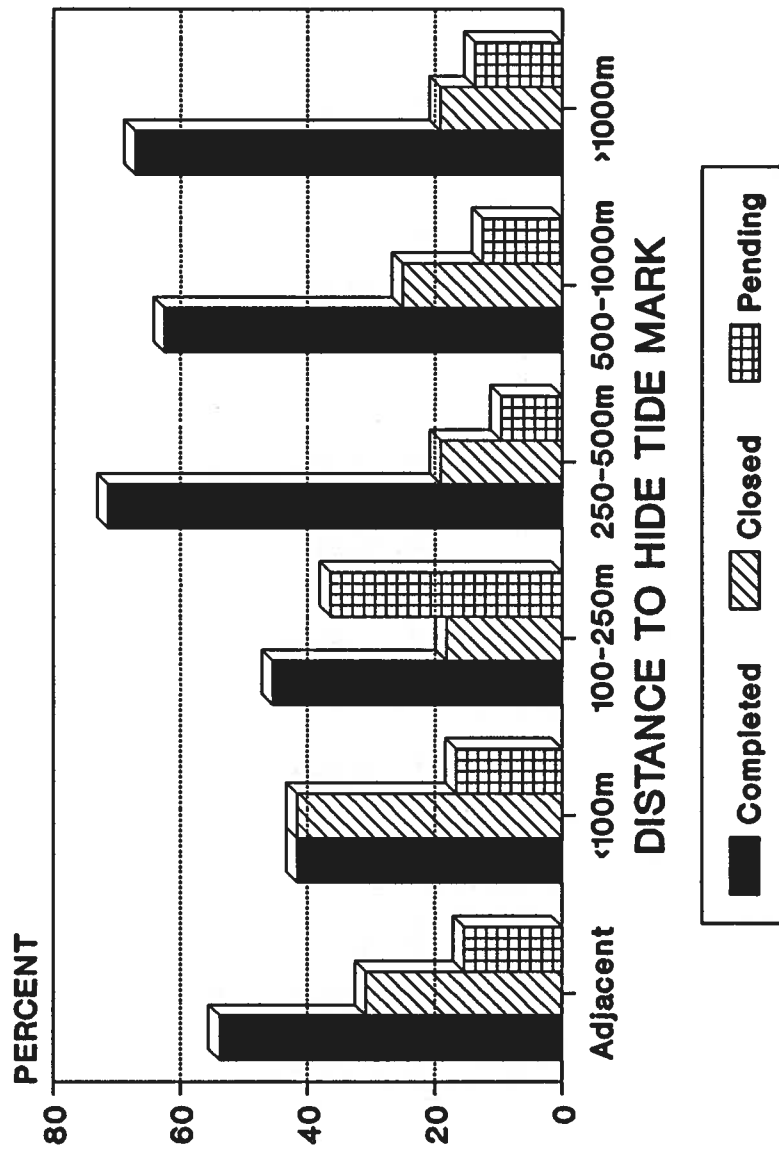
† DISTANCE TO HIGH TIDE MARK	DEVELOPMENT APPLICATIONS	COMPLETED %	CLOSED %	PENDING %
Adjacent	13	53.85	30.77	15.38
less than 100 m	12	41.67	41.67	16.67
100 to 250 m	22	45.45	18.18	36.36
250 to 500 m	21	71.43	19.05	9.52
500 to 1000 m	32	62.5	25.0	12.5
more than 1000 m	146	67.12	19.18	13.7
‡ TOTAL	246	63.01	21.45	15.45

† Distance measurements are estimated to be accurate within 20 meters.

‡ Distance calculations are missing for 3 Development Permit Applications.

The results of a comparison of the status (completed, closed or pending) of Development Permit applications in relation to coastal zone location are presented in Figure 6.2. The results revealed that applications occurring adjacent, within 100 metres and 100 to 250 metres from the M.H.W.M. had noticeably lower completion rates and noticeably higher closed rates compared to the rate of Development Permit applications located at distances greater than 250 metres from the M.H.W.M.

FIGURE 6.2
Development Permit Application Decisions and Coastal Location



The length of application processing time is summarized in Table 6.5. The overall mean for Development Permits was calculated to be 50.67 weeks. Considerable variability was observed in the recorded maximums and minimums for application processing times. Notably, industrial Development Permit applications appeared to be processed on average in fifteen weeks less time than all other Development Permit applications. Pending applications represented 15.7 percent of the total number of applications and were not included in the calculation of mean, maximum or minimum processing times.

TABLE 6.5
Length of Decision for Coastal Development Applications

DEVELOPMENT TYPE	MEAN DECISION TIME (weeks)	MAXIMUM TIME (weeks)	MINIMUM TIME (weeks)	PENDING #
MULTIPLE RESID.	49.67	154	2	19
COMMERCIAL	57.88	197	2	11
INDUSTRIAL	35.93	166	7	2
MIXED-COMM./RES.	36.78	71	20	3
MIXED- COMM./IND.	58.0	58	58	0
MIXED- COMM./REC.	75.0	75	75	0
MIXED- RES./REC.	114.0	114	114	0
RECREATION	57.0	72	42	0
PUBLIC UTILITY	31.0	31	31	0
OTHER	35.75	85	3	4
OVERALL MEAN	50.67	102.30	35.4	39

6.2.1 General Evaluative Criteria: Discussion

The four year survey of land use patterns in Richmond provided information necessary to evaluate aspects of local participation in the multi layered management of coastal issues. As indicated by Development Permit application records, multiple residential and commercial developments are the prevalent land use proposals, both in terms of numbers of applications and in terms of land area. Certainly, the development pressures witnessed in the 1988 to 1991 survey of Development Permit applications indicated no shifts away from Richmond's residential character, however, the magnitude of commercial development pressure appears relatively intense considering that 1.8 percent of Richmond is zoned for commercial uses (refer back to figure 4.4). A continuation of this pattern of development may result in a particular set of effects on the biophysical, social and economic facets of Richmond's coastal zone, some of which may be undesirable. For example, the predominance of residential and commercial growth in Richmond will induce a relative shift in the composition and amount of municipal sewage entering coastal waters due to the fact that these two land uses generate large amounts of B.O.D. and faecal coliforms (Hall 1979; Swain 1982). The resulting impacts on land, water quality and environmental quality may eventually lead to lost economic and recreational opportunities.

The absolute location of development proposals relative to the mean high water mark indicated a relatively low level of development pressure on waterfront land. A large number of Development Permit proposals occurring within 100 metres of the M.H.W.M. appeared to be concentrated in the Steveston area of Richmond (data not shown). Although it is not uncommon

in coastal B.C. communities for there to be a low level of development pressure on waterfront land (Hall, 1988), the situation observed in the Steveston area may be repeated in other areas along the Richmond shoreline.

Overall, Development Permit applications located within 250 metres of the M.H.W.M. experienced a lower 'success rate' compared to applications for development located further inland. The presence of the dyke, the designation of Richmond's foreshore as Environmentally Sensitive (Richmond, 1991) or intended for conservation (F.R.E.M.P. 1991) may have contributed to a stricter development regulation for the foreshore. These aspects of land use regulation may explain the lower rate of success experienced by water front development proposals. The empirical evidence suggests that Richmond's land use mechanisms such as E.S.A. designations may contribute to the protection of foreshore E.S.A.'s through a net reduction in the number of successful development applications.

The analysis of processing time for Development Permit applications revealed considerable variations. All development proposal types experienced processing times far in excess of the turnover time of nine to thirteen weeks as suggested by the Richmond Planning Department (Richmond, no date). These long processing times are probably the result of the large number of applications received in 1988 would have undoubtedly taxed the resources of the Richmond Planning Department. The data also revealed a number of very long processing times which may have skewed the mean processing times recorded in this analysis. The effect

of these long processing times was offset by the presence of short processing times which occurred with a frequency similar to that of the long processing times.

Interestingly, the fastest processing times were observed for industrial and 'other' proposals which were processed approximately fifteen weeks sooner than all other Development Permit applications. Upon further investigation it was determined that these two categories tended to locate close to E.S.A.'s, adjacent to the foreshore or outside the floodplain exempt boundary.

6.3 Habitat Conservation: Results

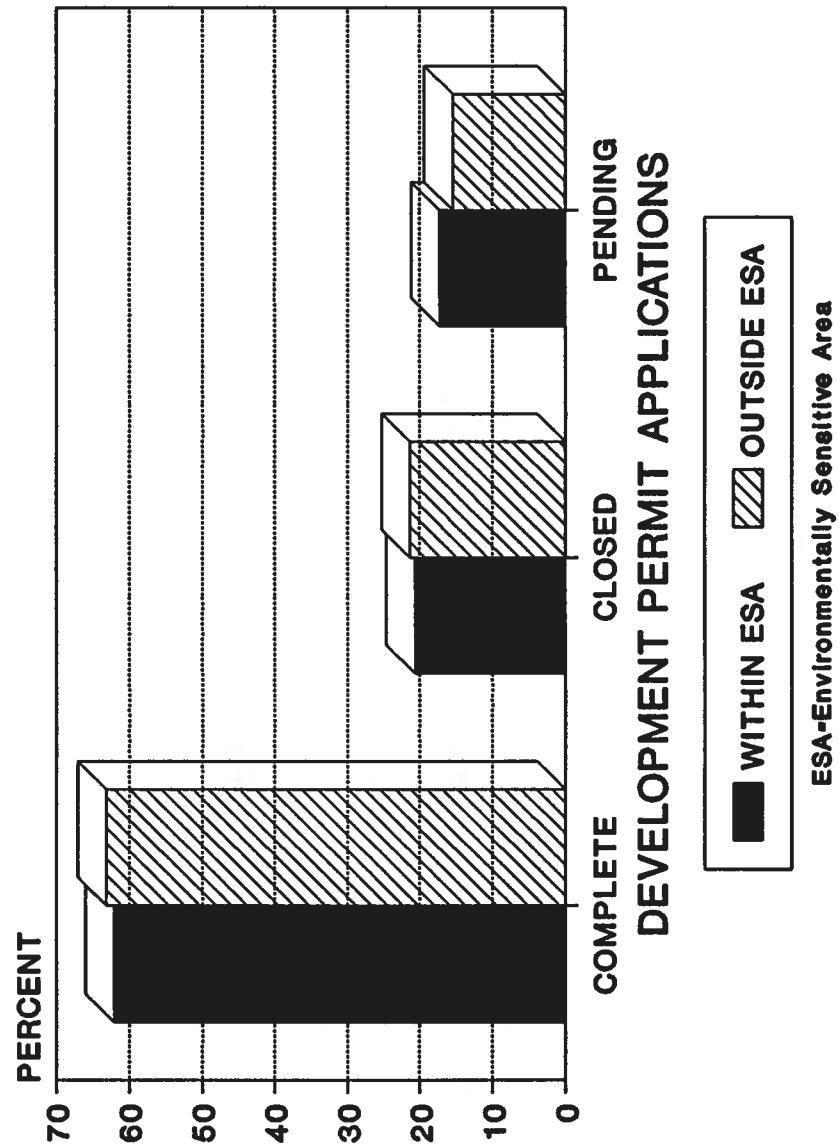
The nature of development pressure on designated E.S.A.'s was carefully analyzed using information available from Development Permit applications. The results presented in Table 6.6 reveal that 29 of 249 (11.6 percent) Development Permit applications were located in E.S.A.'s. Further investigations revealed that commercial and industrial land uses accounted for the majority (62.1 percent) of the development pressures in E.S.A.'s. Moreover, at least half (52.9 percent) of the total number of Development Permits considered as industrial uses were located within E.S.A.'s.

TABLE 6.6
Development Permit Applications and Environmentally Sensitive Areas (E.S.A.'s)

DEVELOPMENT TYPE	No.	Located in E.S.A.			No.	Located outside E.S.A.		
		COMPLE TED	CLOSED	PENDING		COMPLE TED	CLOSED	PENDING
MULTIPLE RES.	5	40.0%	20.0%	40.0%	119	68.91%	16.81%	14.29%
COMMERCIAL	9	66.67%	22.22%	11.11%	69	57.97%	27.54%	14.49%
INDUSTRIAL	9	66.67%	22.22%	11.11%	8	62.5%	25.0%	12.5%
MIXED-COM/RES	1	0%	100.0%	0%	11	54.54%	18.18%	27.27%
MIXED-COM/IND	0	0%	0%	0%	1	100.0%	0%	0%
MIXED-COM/REC	0	0%	0%	0%	1	100.0%	0%	0%
MIXED-RES/REC	1	100.0%	0%	0%	0	0%	0%	0%
RECREATION	0	0%	0%	0%	2	50.0%	50.0%	0%
PUBLIC UTILITY	1	100.0%	0%	0%	0	0%	0%	0%
OTHER	3	66.67%	0%	33.33%	9	33.33%	33.33%	33.33%
TOTAL	29	62.07%	20.69%	17.24%	220	63.18%	21.36%	15.45%

Figure 6.3 compares the status of E.S.A. and non-E.S.A. Development Permit applications. A comparison of the total results revealed that Development Permit applications within E.S.A.'s were successfully completed and rejected (closed) at rates virtually identical to Development Permit applications located outside E.S.A.'s. A comparison of results for each development type was not considered due to the small sample sizes encountered.

FIGURE 6.3
Development Permit Application Decisions and E.S.A.'s



6.3.1 Habitat Conservation: Discussion and Evaluation

Two policies that Richmond has created to protect its natural environment involve the use of Development Permits to mitigate negative ecological impacts of development and acquisition of threatened sensitive areas. The empirical evidence revealed two key findings regarding the nature of development pressure within E.S.A.'s and the rate of success for development proposals located within E.S.A.'s. The four year survey of development proposals revealed that 11.7 percent of all development proposals were located wholly or partially within designated E.S.A.'s. Of this 11.7 percent, industrial and commercial developments represented the majority of proposals located within E.S.A.'s. Industrial developments in particular stood out as being more likely to locate within E.S.A.'s, having more than half of the proposals in that land use category located there. The observed tendency for industrial development proposed and to a lesser extent commercial and 'other' development proposals, to locate within E.S.A. is cause for concern given the generally accepted notion of incompatibility with industrial sites and natural spaces (Canada 1978b).

With recent adoption of Schedule B to Bylaw 5746 which protects E.S.A.'s (Richmond, 1991), Richmond is faced with confronting a clear precedent with the preferred location of industrial development near environmentally sensitive areas. Schedule B to Bylaw 5746 unfortunately takes effect after the time frame of the data collected for this analysis, therefore it would be inappropriate to comment on the impact of this significant policy development. General guideline 3, to Schedule B, Bylaw 5746 states that:

"Potentially polluting activities should be set back and buffered from natural areas. Soil should be protected from pollution or spills including run off from pavement."

(Richmond, 1991).

The observed relationship between industrial uses and E.S.A.'s reinforces the need for a policy response such as Schedule B of Bylaw 5746. Further investigation is needed to determine whether the policy (if properly enforced) is sufficient to protect natural areas from the magnitude and type of development pressure as witnessed from 1988 to 1991.

The value of including an analysis of completion rates for development applications located inside and outside designated E.S.A.'s is two fold. Firstly, the comparison of development application completion rates answers the question of whether or not E.S.A.'s posed any barrier to the development recorded on the survey period. The results indicate that there were no significant differences between E.S.A. and non-E.S.A. development applications. This result was somewhat unexpected as mitigative efforts - those described by existing policies would likely entail additional costs to the developer, thereby increasing the chances of the proponent withdrawing the development proposal. This comparison serves the secondary function of providing the necessary benchmark information to evaluate the impact of new environmental protection policies (such as Schedule B to Bylaw 5746) or the development industry. The E.S.A. policies in effect between 1988 and 1991 in Richmond had no recorded impact on development based on the rate of approval of development permits. The effect on new E.S.A. policies and guidelines in Richmond may be monitored using this baseline information.

Since the findings suggest that Development Permits and E.S.A. designations presented few if any obstacles to the observed development pressure in Richmond and that industrial uses tend to locate adjacent to E.S.A.'s raises questions of the effectiveness of past policies regarding environmental protection.

In late 1991, Richmond amended its current O.C.P. Bylaw 5400 with the adoption of Bylaw 5746 which seeks to prevent the gradual loss of productive and important habitat to development through the general guideline of,

"As far as is practicable, there should be no net loss of natural habitat when development occurs".

(Richmond 1991).

This NO NET LOSS principle is similar to the D.F.O.'s guiding principle of habitat conservation which strives to balance unavoidable habitat loss with habitat replacement on a project-by-project basis (Canada 1986). Criticisms of No Net Loss and remedial mitigation have been raised by Bella (1979:79) who contended that *"natural ecosystems cannot simply be replaced by a succession of construction projects [remedial mitigation], even if they are good"*. Similarly, Brownlee's (1992) analysis of the application of no-net-loss policy identified concerns having to do with the complexity and length of negotiation required to reach agreement between the development proponent and the conservation authorities. Regardless, the results of this analysis reveal that prior to the adoption of a NO NET LOSS policy, the existing habitat protection policies were essentially ineffective as barriers to development in E.S.A.'s. While

Bylaw 5746 has its limitations, it is an important step in the right direction (Jamieson, 1992). A future comparison of the effect of this new policy on land use patterns to the results generated by this study may be an effective way of evaluating the effectiveness of Bylaw 5746.

6.4 Water Quality: Results

The spatial location of development proposals within the coastal zone was calculated for each land use category and the results presented in Table 6.7. The majority of Development Permit applications, 59.3 percent were observed to be located at least 1000 metres from the M.H.W.M. Commercial and industrial land use applications were the most frequent types of waterfront development, accounting for 68.0 percent of all proposals located adjacent or within 100 metres of the M.H.W.M. Commercial proposals located adjacent to the M.H.W.M. were observed to be 7.9 percent of all commercial land use applications processed in the four year survey period. The land use category 'other' also displayed an affinity for waterfront locations with 16.7 percent of all development proposals within this category being located adjacent to the M.H.W.M. Industrial proposals were observed to have the greatest tendency to locate adjacent to the M.H.W.M. with 23.5 percent of all industrial Development Permit applications locating there.

TABLE 6.7
Development Type and Coastal Zone Location

DEVELOPMENT TYPE	Coastal Zone Location					
	ADJACENT	Adjacent to 100 m	100 to 250 m	250 to 500 m	500 to 1000 m	1000 m or more
† MULTIPLE RES.	1	2	4	7	10	99
‡ COMMERCIAL	6	5	13	9	16	27
INDUSTRIAL	4	2	2	1	2	6
MIXED- COMM./RES.	0	1	2	3	1	5
MIXED- COMM./IND.	0	0	0	0	0	1
MIXED-COMM./RECR.	0	0	0	1	0	0
MIXED- RES./RECR.	0	0	0	0	0	1
RECREATION	0	0	0	0	0	2
PUBLIC UTILITY	0	1	0	0	0	0
OTHER	2	1	1	0	3	5
TOTAL	13	12	22	21	32	146

† Missing locational information for one Development Permit Application in this category.

‡ Missing locational information for two Development Permit Applications in this category.

Analysis of Development Permit applications revealed that industrial proposals located within 250 metres of the M.H.W.M. were rejected or withdrawn at rate of 25 percent (analysis not presented). Although this rate of application closure is comparable to the average of 27.66

percent observed for Development Permits located within 250 metres of the M.H.W.M. (refer to Table 6.3).

6.4.1 Water Quality: Discussion and Evaluation

As mentioned in previous sections, the location of development proposal types is a reflection of Richmond's zoning patterns. However, the **magnitude** of development pressure is a function of social and economic conditions beyond the control of local government. Approximately one third of all commercial and one half of all industrial proposals located within 250 metres of the M.H.W.M. The close proximity of industrial and commercial land uses to coastal waters is problematic in terms of the introduction of 'non-point' pollutants into the water. In addition to providing a shorter distance for pollutants to travel to contaminate coastal waters, the development of the foreshore eliminates vegetated riparian zones which are a valuable asset in moderating the spread of pollutants via run-off and wind (Phillips 1989; Canada 1978b).

In light of these findings, Richmond's policy of discouraging water polluting industries from locating along the estuary sloughs appears to be ineffective as the waterfront and municipal zoning continues to attract industrial development. The results do not provide information on the exact nature of water pollution resulting from each proposed industrial use. Additionally, the evaluation of the policy must be viewed in light of the fact that it conflicts with Richmond's zoning bylaw and the F.R.E.M.P. Area Designation agreement which allocate much of the waterfront to industrial uses. It is likely that elements of Richmond zoning bylaw are

confounding the results making a fair evaluation of the water quality policy difficult. Therefore, the ineffectiveness of this policy is only 'apparent'.

In further examining the effectiveness of Richmond's policy of discouraging water polluting industries from locating close to bodies of water, it is useful to reflect on the results presented in Figure 6.2 comparing rates of Development Permit application approval and denial which revealed generally showed lower approval rates for proposals located close to the M.H.W.M. Industrial Development Permit applications located along the waterfront experienced a slightly lower rate of rejection/withdrawal (closure) compared to average values for other land use categories. Evidently, there is little empirical evidence to suggest that industry, polluting or not, is being discouraged from locating along the estuary. In 1989, Richmond amended its zoning Bylaw which restricted heavy industry from locating along the waterfront. Another important aspect of this zoning bylaw amendment is that it prohibits open storage of industrial goods. The analysis unfortunately, does not recognise the impact of this zoning bylaw amendment.

Although the water quality policy neglects to consider water polluting commercial uses, the results showed a significant level of commercial development pressure along the waterfront. A comparison with the foreshore Area Designations of the Richmond/F.R.E.M.P. agreement indicated that nine percent of the foreshore is intended for water related urban/commercial activities. With commercial development proposals accounting for nearly half of the foreshore development pressure, the implications for coastal water quality should not be ignored. Though

the overall toxicity of commercial non-point water pollution may be less than that from industrial sites, the public perception of poor water quality may be far greater due to the occurrence of visible pollution such as litter.

The observed tendency for industrial development to locate close to Richmond's waterfront and the apparent ineffectiveness of Richmond's existing water quality protection policy raises important questions concerning the long term suitability of the waterfront for activities such as recreation and swimming. The Royal Commission on the Future of the Toronto Waterfront concluded that, due to an aging population, pressure to develop the waterfront's large recreation potential will continue to increase (Reid *et al.* 1987). Preserving a suitable level (and public perception) of water quality will ensure that future demands upon the coast are not forsaken.

In 1991, Richmond adopted Bylaw 5746, amending its current Official Community Plan with special development guidelines for foreshore areas. These development guidelines are intended to complement the water quality policy which has been in existence since 1986 with limited success. The guidelines protecting water quality reads:

"Water quality and natural drainage systems should be protected by leaving stream banks intact and by not altering natural slopes and existing vegetation".

(Richmond 1991).

and

"Foreshore developments should dedicate or preserve a natural vegetated strip within the first 30m above the high water mark of the Fraser River and estuary, except where access is essential for water transportation or public use"

(Richmond 1991).

Unlike the water quality policy which was in place during the survey period of this analysis, these development guidelines are specific regulatory tools which may be more easily enforced. Unfortunately, the impact of these new development guidelines on water quality management efforts may only be assessed through future studies.

6.5 Coastal Hazards: Results

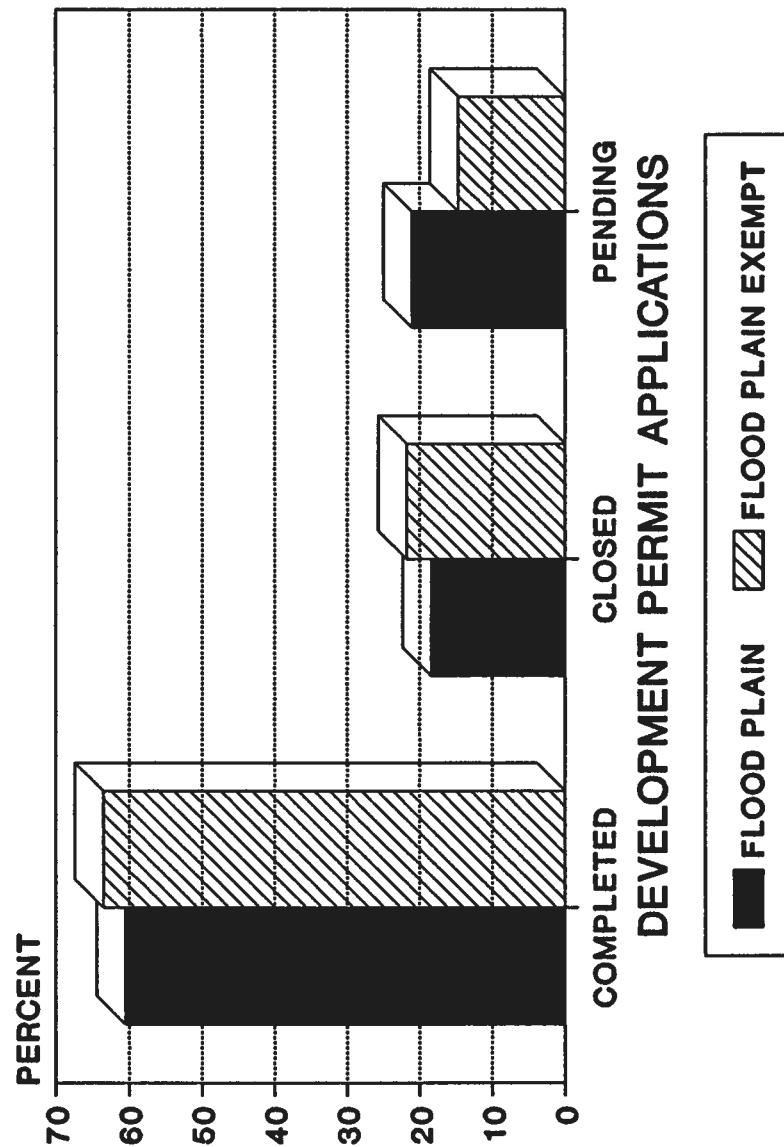
The tendency of Development Permit applications to be located outside the Flood Plain Exemption boundary was calculated and the results presented in Table 6.8. The Richmond Planning Department processed thirty-eight development proposals which were located outside of the Flood Plain Exemption boundary. This represented 15.3 percent of all Development Permit applications. Commercial uses represented the single largest group of non-Flood Plain Exempt land uses (34.2 percent). Although industrial land uses only accounted for 21.0 percent of non-Exempt development proposals (third most frequent after commercial and residential land uses), these proposals represented nearly half (47.1 percent) of the total number of industrial Development Permit applications processed by Richmond between 1988 and 1991.

TABLE 6.8
Development Permit Applications and the Coastal Flood Plain

DEVELOPMENT TYPE	Flood Plain					Flood Plain Exempt			
	No.	COMPLETE	CLOSED	PENDING		No.	COMPLETE	CLOSED	PENDING
Multiple Res.	9	55.5%	11.1%	33.3%		115	68.7%	17.4%	13.9%
Commercial	13	61.5%	23.1%	15.4%		65	58.5%	27.7%	13.8%
Industrial	8	62.5%	25.0%	12.5%		9	66.7%	22.2%	11.1%
Mixed-Comm/Res	0	0%	0%	0%		12	50.0%	25.0%	25.0%
Mixed-Comm/Ind	0	0%	0%	0%		1	100.0%	0%	0%
Mixed-Comm/Recr	1	100.0%	0%	0%		0	0%	0%	0%
Mixed-Res/Recr	1	100.0%	0%	0%		0	0%	0%	0%
Recreation	2	50.0%	50.0%	0%		0	0%	0%	0%
Public Utility	0	0%	0%	0%		1	100.0%	0%	0%
Other	4	50.0%	0%	50.0%		8	37.5%	37.5%	25.0%
TOTAL	38	60.5%	18.4%	21.1%		211	63.5%	21.8%	14.7%

Figure 6.4 displays a comparison of the status (completed, closed or pending) of Development Permit applications inside and outside of exempt areas of the Richmond Floodplain. Development Permit applications were completed and closed with approximately equal probability regardless of location within or outside designated Flood Plain boundaries.

FIGURE 6.4
Development Permit Application Decisions and the Coastal Flood Plain



6.5.1 Coastal Hazards: Discussion and Evaluation

The type of development occurring outside the Floodplain Exempt Boundary over the four year survey period was predominantly commercial and industrial in nature. The fact that nearly half of all industrial development proposals located outside Floodplain exempt boundaries suggests that current zoning and land value patterns are attractive to this form of development. Although residential development has avoided development outside of floodplain exempt boundaries (7.8 percent of residential proposals occurred outside the floodplain exempt boundary) the risk in terms of property damage to industrial and commercial sites is no less severe. A recent analysis of remedial expenses incurred as a result of major floods throughout British Columbia over a three year span from 1989 to 1991, has shown that the average dollar amount for commercial and industrial claims was 44.8 percent higher than private property (residential) claims (Pernu, 1992).

Development within flood prone areas (outside the Flood Plain Exempt boundary) raises some serious questions concerning the role of public agencies in the regulation hazard prone areas. The Federal Emergency Program (E.P.C.) and the Provincial Emergency Program (P.E.P.) are both committed to providing funding for remedial efforts, hence floodplain development is publicly subsidized (Pearson, 1972; Sharma, 1992; pers. comm). Although measures may be taken to mitigate some of the damage caused to structures through flood proofing techniques (F.E.M.A. 1987), damage to the public infrastructure associated with development such as roads and telecommunications is also high. For example, between 1989

and 1991, major floods in the province have resulted in \$38,478,511.00 in remedial expenses, of which 90.33 percent was directed to municipal and provincial government for repairs to public infrastructure such as road repairs, bridge replacement and river bank stabilization (Pernu, 1992). Past experience with the costs involved with flood damage should force municipal governments to consider carefully the logic of piecemeal development within flood prone areas for such development necessitates the provision of infrastructure which has proven to be very costly to repair following flooding. Even with the current system of dyking and discharge, Richmond is not considered floodproof (Richmond 1989). Thus, a continuation of gradual development in higher risk areas within Richmond (outside the Floodplain Exempt Boundary) may actually undermine perceptions of flood hazard and increase pressure to develop within the floodplain.

Unfortunately, a direct evaluation of Richmond's policy of encouraging flood proofing in construction is not possible. However, the analysis yields important information concerning general suitability of the policy as a means of protecting life and property from floods. Firstly, the analysis clearly demonstrates that areas outside floodplain exemption boundaries are subject to significant development pressure and that these development proposals are approved at rates similar to proposals within exempt areas. Secondly, the predominance of industrial and commercial development means potentially higher economic damages (compared to residential uses) if a major flood event occurs. As a preventative measure, Richmond flood policies are not a very effective tool, especially given the nature of development pressures already occurring in higher flood risk areas of Richmond.

6.6 Public Access & Aesthetics: Results

Provision of public access to the waterfront was observed to occur in development site plans at a rate of 38.46 percent (see Table 6.9). For completed Development Permit applications, only half contained public waterfront access. Industrial development proposals were noted for failing to include a public access path to the waterfront in any of the proposal plans.

TABLE 6.9
Public Waterfront Access and Development Types

DEVELOPMENT TYPE	ACCESS PROVIDED	ACCESS NOT PROVIDED	†NOT APPLICABLE
MULTIPLE RESIDENTIAL	1 (50.0%)	0 (0.0%)	1 (50.0%)
COMMERCIAL	3 (50.0%)	1 (16.67%)	2 (33.33%)
INDUSTRIAL	0 (0.0%)	3 (100.0%)	0 (0.0%)
OTHER	1 (50.0%)	1 (50.0%)	0 (0.0%)
TOTAL	5 (38.46%)	5 (38.46%)	3 (23.08%)

† Development Permits that were either Closed or still Pending Completion were classified as Not Applicable for the purpose of this analysis.

Table 6.10 displays the results of an analysis of the requirement for site landscaping. The overall number of developments not requiring site landscaping was observed to be quite low at 3.66 percent. The results also revealed a clear trend in less site landscaping for developments

located closer to the waterfront. The highest rate for no landscape requirement was observed for development proposals which were located adjacent to the M.H.W.M.

TABLE 6.10
Landscape Requirements for Development Permit Applications

† DEVELOPMENT LOCATION	LANDSCAPE REQUIREMENT %	NO LANDSCAPE REQUIREMENT %	NOT APPLICABLE %
ADJACENT	46.15	15.38	38.46
ADJACENT to 100 m	58.33	8.33	33.33
100 to 250 m	59.09	13.64	27.27
250 to 500 m	76.19	4.76	19.05
500 to 1000 m	59.38	0	40.63
more than 1000 m	75.34	1.37	23.29
AVERAGE	69.51 %	3.66 %	26.83 %

† Location information missing for three Development Permit Applications.

6.6.1 Public Access & Aesthetics: Discussion and Evaluation

The results reveal that industrial foreshore development was the main contributor to a lowered incidence of public waterfront access. One possible explanation for this finding involves the issue of public safety if a public access corridor were provided through a potentially dangerous industrial site. However, public safety should not be perceived as intrinsically incompatible with public access for such corridors may be designed with issues of safety in mind. In fact, waterfront industrial sites such as harbours often function as recreation magnets, drawing curious onlookers to the waterfront (F.R.E.M.P. 1990; Hotson 1988). Richmond

should endeavour to capitalize upon this phenomena by maximizing public access to its dynamic waterfront.

Public access to the waterfront was observed only half of the approved Development Permit applications. This amount of access seems far below what authors such as Hotson (1988) and Kerr *et al.* (1981) have implied as adequate for a community. Both sources concluded that maximization of water front access was a necessary step towards realising all waterfront opportunities. Since the range of passive recreation opportunities found along the waterfront is higher than those found elsewhere within a community (F.R.E.M.P. 1990), a continuation of waterfront development which fails to provide adequate public access may eliminate a number of recreation opportunities.

Evaluating Richmond's existing policies (refer to Section 5.3.1) revealed that only fifty percent of Development Permit proposals contained public waterfront access in site plans for . In spite of a small sample size, the findings suggest that these two policies have not been especially effective; particularly in the case of industrial proposals. Bylaw 5746 amended to Richmond's current O.C.P. (Bylaw 5400) attempts to add some 'regulatory teeth' to the policy of supporting the Richmond Trails Plan and promoting a safe pedestrian environment which have operated with little real success since 1986. The design guideline in Bylaw 5746 ensuring public access to the waterfront is perhaps the clear legislation needed to make the two O.C.P. policies function properly. The question of the performance of public access policies should also be

revisited in the future to determine if the regulations contained with Bylaw 5746 are effective from the perspective of this C.Z.M. issue.

Landscape requirements for development proposals revealed a clear association of fewer landscape requirements for development within 250 metres of M.H.W.M. Industrial proposals (analysis not included) constituted the majority of proposals not requiring the minimum level of aesthetic attention as provided by site landscaping. This pattern of landscaping requirement is perhaps a visual indication of the phenomenon of a community which has lost its intimacy with the waterfront (Hall 1988).

Richmond's policy of maintaining significant views is at a minimum, served by imposing minimum standards for site landscaping. Observing that less than one percent of development proposals located further than 500 metres from the M.H.W.M. contained no landscaping requirements, begs the question why over 15 percent of foreshore development within 500 metres of the M.H.W.M. had no landscaping requirements? The overall effectiveness of Richmond's view maintenance policy (in terms of landscaping only) is exemplary. However, the findings indicate a less favourable outcome for areas closer to the waterfront. A consistent application of site landscaping would render Richmond's overall view maintenance policy more effective and strengthen its role in coastal zone aesthetics.

6.7 Public Input: Results

Public involvement as indicated by the recorded occurrence of public hearings or Development Permit Panels (D.P.P.'s) within Development Permit application files was measured and the results presented in Table 6.11. All but two Development Permit applications (0.8 percent) were subject to some form of public review. A significant portion of Development Permit files (43 of 249) are recorded as missing observations due to a recording error. Observations appearing as not applicable (N/A) in Table 6.11 correspond to Development Permit applications that were closed before a public hearing or Development Permit Panel was arranged. Of the 134 completed, 15 closed and 24 pending Development Permit applications recorded, 98.9 percent were reviewed by the public through either public hearings or Development Permit Panels.

6.7.1 Public Input: Discussion and Evaluation

In the absence of a clear policy concerning the issue of public involvement in local land use regulation in the coastal zone, a policy evaluation is not possible. Instead a descriptive assessment of the current condition of public input into coastal land use decisions is presented with a view to identifying needs (if any) for a local policy response in Richmond.

TABLE 6.11
Public Involvement in Development Permit Applications.

PROPOSED DEVELOPMENT	†PUBLIC INPUT	NO PUBLIC INPUT	N/A	MISSING OBSERVATION(S)
Multiple Residential	89	0	11	24
Commercial	55	1	9	13
Industrial	11	0	4	2
Mixed- Comm./Res.	6	0	2	4
Mixed- Comm./Ind.	1	0	0	0
Mixed- Comm./Recr.	1	0	0	0
Mixed- Res./Recr.	1	0	0	0
Recreation	1	0	1	0
Public Utility	1	0	0	0
Other	7	1	4	0
TOTAL	173	2	31	43

†Public Input includes Public Hearings and/or Development Permit Panels (D.P.P.).

The foregoing analysis of public involvement in the Development Permit application review process indicated a very high rate of occurrence of public input. However, the high rate of public involvement says little of the meaningfulness of this involvement in land use decisions (represented by Development Permits). According to Arnstein (1969), public participation can have no effect on the decision if it serves only to inform or consult, for the public cannot monitor the effect of its advice on the decision. For Arnstein, participation must involve the sharing of power in the decision-making process. The current approach to public participation

through special committees (in Richmond, Development Permit Panels) or public hearings is representative of what Parenteau (1988) described as an administrative response to the public's expectations in participation. As such, Richmond's public involvement approach probably falls short of what Arnstein considers as indicative of citizen power in her 'ladder of citizen participation'.

Public participation is generally distinguished from the planning stage and oriented towards the decision-making stage (Parenteau 1988). Similarly in Richmond's approach to public involvement in decision concerning the coastal zone, all of the focus seems to favour the final decisions. If the point of public participation is simply to enlighten the final decision-maker then the public must place considerable faith in a select few (namely planners and municipal council) to competently address community interests in the planning stage. In a 1984 article, Reed commented that there is considerable mistrust and dissatisfaction with government's ability to respond to the public's needs. Many would argue that Canadian's mistrust of government has intensified since 1984.

The findings revealed a consistent level of public involvement for Development Permit files. This suggests, at least superficially, that an adequate method of including public values is built into the land use regulation process for Richmond. The methodology, however, is incapable of addressing the more important question of how meaningful the public input (facilitated by Development Permit Panels) is for each development proposal occurring throughout Richmond's coastal zone.

6.8 Water Dependency: Results

To facilitate a complete analysis of foreshore land use patterns and water dependent activities, development proposals were classified as one of either water dependent, water related or water independent categories. The classification of uses is based on the criteria and definitions contained within section 3.7 and Table 3.3. The necessary information was obtained from the Development Permit application files and business licences which provided a detailed description of the commercial nature of the development.

Table 6.12 displays the results of an analysis of water dependency for Development Permit applications processed by Richmond from 1988 to 1991. The results indicate that the vast majority (94.76 percent) of development proposals are represented by the water independent category. The remainder of development proposals were either considered water dependent (2.01 percent) or water related (3.23 percent). Water dependent Development Permit application accounted for 16.67 percent of all 'other' land use proposals. The majority (62.5 percent) of development proposals classified as water related were commercial uses.

A closer examination of water dependency and foreshore coastal showed that 62.86 percent of all development proposals located within 200 metres of the M.H.W.M. were classified as water independent (Figure 6.5). The results presented in Table 6.13 reveal that 30.77 percent of development proposals located adjacent to the M.H.W.M. were classified as water dependent. Water related uses also represented 30.77 percent of the development proposal located adjacent to the M.H.W.M.

TABLE 6.12
Water Dependency and Development Type

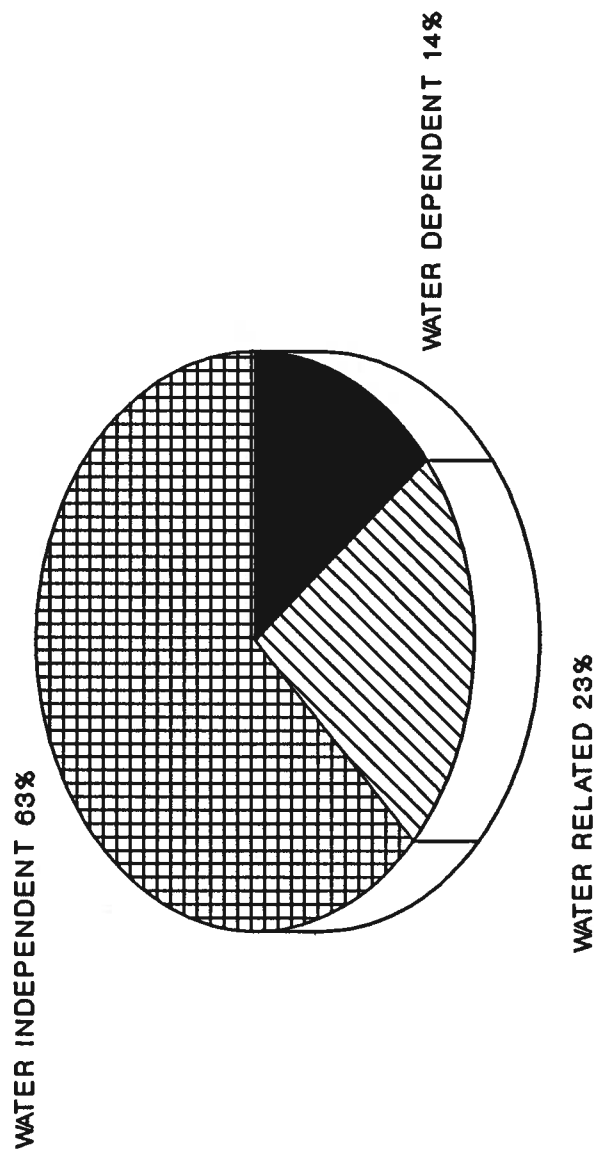
DEVELOPMENT TYPE	WATER DEPENDENT DEV. PERMITS		WATER RELATED DEV. PERMITS		WATER INDEPENDENT DEV. PERMITS	
MULTIPLE RESIDENTIAL	0	(0.0%)	2	(1.63%)	121	(98.37%)
COMMERCIAL	2	(2.56%)	5	(6.41%)	71	(91.03%)
INDUSTRIAL	1	(5.88%)	0	(0.0%)	16	(94.12%)
MIXED- COMM./RES.	0	(0.0%)	0	(0.0%)	12	(100.0%)
MIXED- COMM./IND.	0	(0.0%)	0	(0.0%)	1	(100.0%)
MIXED- COMM./REC.	0	(0.0%)	0	(0.0%)	1	(100.0%)
MIXED- RES./REC.	0	(0.0%)	0	(0.0%)	1	(100.0%)
RECREATION	0	(0.0%)	0	(0.0%)	2	(100.0%)
PUBLIC UTILITY	0	(0.0%)	0	(0.0%)	1	(100.0%)
OTHER	2	(16.67%)	1	(8.33%)	9	(75.0%)
† TOTAL	5	(2.01%)	8	(3.23%)	235	(94.76%)

† Missing one observation in the Multiple Residential category.

TABLE 6.13
Water Dependency and Coastal Zone Location

DISTANCE TO HIGH TIDE MARK	WATER DEPENDENT APPLICATIONS		WATER RELATED APPLICATIONS		WATER INDEPENDENT APPLICATIONS	
ADJACENT	4	(30.77%)	4	(30.77%)	5	(38.46%)
ADJACENT to 200 m	1	(4.55%)	4	(18.18%)	17	(77.27%)
TOTAL	5	(14.29%)	8	(22.86%)	22	(62.86%)

FIGURE 6.5
Water Dependency and Proposed Developments



PROPOSED DEVELOPMENTS

6.8.1 Water Dependency: Discussion and Evaluation

The results presented in Figure 6.5 revealed a fairly obvious pattern of non-dependent waterfront development proposals located within 200 metres of the M.H.W.M. Marinas, waterfront restaurants and marine related manufacturing and repair are some of the activities represented by the 14 percent of proposals classified as 'water dependent' (data not presented). Ketchum (1972) stated that an 'assigning of priority' should be granted to uses that depend on some biophysical, socio-cultural or economic attribute of the coastal zone. The observation that the largest proportion of proposals located adjacent to the M.H.W.M. are water independent uses raises the question about appropriateness of waterfront land allocation patterns within Richmond.

The total number of development proposals classified as water dependent and water related was lower than initially expected of a municipality totally surrounded by water. Only thirteen of two hundred and forty-nine (5.2 percent) development proposals were considered as either water related or water dependent. This may help explain why the issue of water dependency for foreshore uses has attracted little policy attention from Richmond. The opportunity for future water related and water dependent projects such as recreation or housing will be constrained by existing and proposed water independent industrial, agricultural and transportation uses (Richmond 1986). The potential for conflict between water dependant and water independent uses is no doubt certain if observed patterns in foreshore land use continue in Richmond.

In the absence of a clear policy recognizing the necessity of balancing water dependent/related foreshore land uses with other uses, the finding should be regarded as a description of foreshore land use demand and a prediction of possible conflict in the future. A continuation of observed foreshore land use patterns in Richmond suggests the need for proactive policies regarding water dependency.

The issue of water dependency has emerged as a double-edged sword in many coastal communities, particularly where aesthetics, public access and environmental quality is concerned (Whidden and Carr 1988). A mixed-use concept to waterfront development combined with a concomitant acknowledgement of the importance of the other six coastal issues should provide the basic formula for balancing coastal demands.

6.9 Interjurisdictional Coordination: Results

Interjurisdictional involvement was found to occur in 8.43 percent of Development Permit applications (see Table 6.14). The Inspector of Dykes and Water Management Branch, both agencies of the provincial Ministry of Environment, Lands and Parks (M.O.E.L.P.), were each involved in 1.606 percent of Development Permit applications. The M.O.E.L.P. was the most involved provincial ministry, involved in 11 (4.42 percent) of 249 Development Permit applications processed by Richmond between 1988 and 1991.

TABLE 6.14
Agencies Involved in Reviewing Development Permit Applications

AGENCY	NUMBER	PERCENT
Township of Richmond	249	100.0
Inspector of Dykes, M.O.E.L.P.	4	1.606
Water Management, M.O.E.L.P.	4	1.606
Ministry of Transportation and Highways	3	1.205
Water Management, M.O.E.L.P.	3	1.205
Liquor Control Board, M.O.L.C.S.	2	0.803
F.R.E.M.P.	2	0.803
B.C. Transit	2	0.803
Public Works Canada	2	0.803
Fisheries and Oceans, Canada	2	0.803
Fraser River Harbour Commission	2	0.803
North Fraser Harbour Commission	1	0.402
New Westminster	1	0.402
Vancouver International Airport	1	0.402
Agricultural Land Commission	1	0.402
Total	21	8.43

6.9.1 Interjurisdictional Coordination: Discussion and Evaluation

The measurement of the occurrence of direct involvement with other agencies during the processing of Development Permit applications revealed a surprisingly low involvement rate of 8.43 percent. The low rate of outside contact observed in this analysis is misleading as much

of the contact with the F.R.E.M.P. is not recorded in Development Permit application files (Jamieson 1994, Pers. Comm.). Contact with the F.R.E.M.P. is only in cases where development affects land seaward from the dyke crest. The results produced by this analysis reveal the incidence of outside agency contact for Development Permit application landward of the dyke crest.

Richmond policy of supporting F.R.E.M.P. constitutes a clear commitment to pursue an efficient and effective relationship (coordination) with other agencies since the purpose of the F.R.E.M.P. is to "work toward common goals and objectives" on an estuary wide basis (Kennett and McPhee 1988). The findings suggest that at the level of land use regulation through Development Permits, the magnitude of coordination with other agencies is very small. The results may be accepted as empirical proof of what Dorcey referred to as the 'myth of interagency cooperation' in resource management (Dorcey 1987). The low rate of contact with outside agencies, especially the F.R.E.M.P., for Development Permit proposals affecting E.S.A.'s landward from the dykes indicates that the interjurisdictional coordination ends at the dyke. Given the low rate of interagency cooperation for development landward from the dyke, Richmond's policy of supporting the F.R.E.M.P. does not appear to be implemented on an estuary wide basis.

A great deal of emphasis is placed on expanding the amount of agency coordination as a means to effectively implement policies in the coastal zone's complex jurisdictional environment (Jacobs and Williams, 1982). Although analysis revealed a low rate of inter-agency

contact in Richmond Development Permit application files, the methodology provides no insights into whether the observed levels of contact are actually adequate or why the levels of interagency contact are so low to begin with. Furthermore, one must accept certain limitations in equating the review of Development Permit Applications with *bona fide* interjurisdictional coordination. One possible explanation for the infrequency of interagency contact is that Richmond 'filters' the Development Permit applications, forwarding certain proposals warranting extra attention to the appropriate outside agencies. The main criticism with this approach is that the lead agency (in this particular case, the Richmond Planning Department) determines unilaterally who the stakeholders are. Perhaps a more desirable alternative for determining when Richmond solicits input from other government agencies, particularly through F.R.E.M.P., would involve the establishment of clear guidelines *a priori* in conjunction with key external agencies.

6.10 Comments on the Data Used

Every reasonable effort has been taken to ensure the accuracy of the analysis provided. However, it is possible that errors have been introduced into the data through incorrect data recording or entry on the part of the author. In addition, the nature of data was such that in certain instances, discussion of the results was not attempted due to the infrequency of observations (small sample size) where there were less than five observations per variable. Statistical analysis of variance as a test of significance for the results was not attempted due to the presence of small sample sizes.

6.11 Summary

The four year survey of Development Permit applications and rezoning produced some noteworthy findings concerning land use regulation and the evaluation of policy performance in Richmond's coastal zone. The highlights of the analysis are summarized in Table 6.15.

TABLE 6.15
Summary of Results

Issue	Key Findings
Habitat Conservation	Approximately one out of ten D.P.'s were located in an E.S.A. No difference in completion rates for D.P.'s located in an E.S.A. Industrial development most likely to locate in E.S.A.'s.
Water Quality	Relatively little development pressure close to waterfront but industrial uses more common on waterfront.
Natural Hazards	Approximately one out of seven D.P.'s was located outside floodplain exemption boundaries. No difference in rate of completion for D.P. proposals. Industrial and commercial uses most likely to locate outside floodplain exempt areas.
Public Access and Aesthetics	Clear public access observed for one third of D.P. proposals. Aesthetic requirements (landscaping) were high, but lower for D.P.'s closer to coast.
Public Input	Public input was very high.
Water Dependency	Greatest number of waterfront D.P. proposals were observed to be water independent.
Interjurisdictional Coordination	Coordination with other coastal zone regulatory agencies was infrequent.
General Evaluative Criteria	Residential and Commercial development were the predominant aspects of the development pressure. Application processing time found to be lengthy, averaging about fifty weeks.

The analysis of Development Permit application files permitted an evaluation of specific policies created by Richmond to address certain issues or problems present within the community. It was discovered that many of the issues represented by statements of objective or policy within Richmond's Official Community Plan corresponded directly to issues described in C.Z.M. literature, most notably C.C.R.E.M. (1978) and Gamble (1989). The summary of findings for the policy evaluations is presented in Table 6.16.

TABLE 6.16
Summary of Policy Evaluation Findings

C.Z.M. issue	Local Policy (Abridged)	Policy Evaluation
Habitat Conservation	Acquire threatened sensitive areas. Use D.P.'s to mitigate negative environmental impacts.	Acquisition policy effectiveness was limited by its abilities to offset high rate of development. Effectiveness of policy was limited by lack of specific development controls.
Water Quality	Discourage water polluting industry from locating along estuary.	Limited policy effectiveness due to continued industrial/commercial development along estuary.
Coastal Hazards	Encourage flood-proofing for development outside Floodplain Exempt areas.	Policy has low effectiveness as it is unable to address magnitude of floodplain development.
Public Access	Promote a pedestrian environment & support Richmond Trails Plan.	Moderate effectiveness as public access to waterfront observed for half the proposals.
Aesthetics	Maintain significant views form waterfront.	High effectiveness but landscape requirements less frequent for developments closer to M.H.W.M.
Public Input	N/A	High rate of public contribution. Policy response not recommended.
Water Dependency	N/A	Majority of foreshore development not water dependent. Policy response is recommended.
Interjurisdictional Coordination	Support the F.R.E.M.P.	Limited policy effectiveness landward of dyke.

Interjurisdictional Coordination, coastal hazards and habitat conservation are the three areas of C.Z.M. where Richmond's policies appear to be the least effective. In addition, analysis conducted on water dependency and foreshore development pressure suggest a possible future need for a specific policy to address the issue of water dependent foreshore land uses.

Richmond's policies concerning the coastal zone issues of public access and water quality, raised some questions given the moderate performance of these policies. The findings indicate that local policies addressing aesthetics and public input were highly effective. In the instance of aesthetics it was concluded that a stricter enforcement of landscape requirements was needed to make the overall performance of the policy more consistent throughout Richmond's coastal uplands.

Conclusions based on the analysis presented in this chapter, policy recommendations and opportunities for further research will be discussed in the following chapter.

CHAPTER 7

CONCLUSIONS

7.1 Summary of the Findings

A review of the British Columbia Municipal Act revealed that a considerable amount of regulatory authority relevant to C.Z.M. has been delegated to local governments. The British Columbia Municipal Act provides local governments with regulatory authority for all but one of the seven coastal zone management issues identified in the thesis. The B.C. Municipal Act is vague regarding when and where interjurisdictional involvement is required or recommended. Official Community Plan bylaws, Zoning bylaws and Development Permits were identified as some of the most useful regulatory devices available to local governments for the purposes of managing the shoreland and upland segments of the coastal zone.

The foregoing evaluation of Richmond's policy contribution to the management of the coastal zone was based on a land use survey methodology similar to that of Rosentraub (1975) and Jessen *et al.* (1983). The results observed in development patterns and land use decisions demonstrated that most of Richmond's policies which were intended to address certain coastal issues have had little measurable effect on the *status quo* of development. The relative performance of Richmond policies affecting C.Z.M. is important since it is assumed that these policies have guided development and have been essential components of two Official Community Plans (Bylaw 4700 and 5400). The findings also suggest that from the point of view

of C.Z.M. in Richmond, land use regulation has favoured development probably at the expense of environmentally sensitive habitat and water quality.

The results of this study also revealed some successful aspects of Richmond's efforts in C.Z.M. Richmond's coastal aesthetics policy appears to have operated effectively overall despite a noticeable drop in the occurrence of landscaping requirements for developments located closest to the foreshore. The analysis of public input for Development Permit proposals revealed a consistent level of public input through Development Permit Panels. For this C.Z.M. issue, it appears that local governments are far more likely to involve the community in day to day decision versus their provincial and federal counterparts.

Richmond's overall policy performance in addressing each of the seven coastal zone issues of this evaluation may be far from exemplary but this may be largely due to the overall unfamiliarity with C.Z.M. at the local level of government. If anything, this research has accomplished its primary objective by simply describing C.Z.M. in terms of a responsibility which faces many municipalities in British Columbia.

At the end of the time frame of this analysis, Richmond adopted a Bylaw (5746) amending its current Official Community Plan (Bylaw 5400). Within this bylaw are a number of specific regulatory guidelines and development requirements which have the potential of improving the performance of the policies evaluated in this thesis. As the findings suggest, prior

to the adoption of Bylaw 5746, Richmond policies appeared to have little effect on the overall management of the coastal zone.

7.2 Policy Recommendations

One of the strengths of the evaluative methodology employed in this study is that it is comprehensive and it subdivides its analysis on the basis of C.Z.M. issues. Thus, a number of recommendations may be suggested to improve the local management of coastal issues which have not been adequately addressed by existing policies in Richmond.

The evaluation of Richmond's C.Z.M. policies and the recommendations suggested to improve the management of the coastal zone may be of interest to other local governments sharing similar coastal zone concerns. The evaluation of an array of policies affecting the coastal zone may demonstrate the general effectiveness of such policies to other local governments. As the findings suggest, the overall effectiveness of policies contained within Richmond's Official Community Plan (Bylaw 4700) have serious limitations when there are no specific regulatory requirements to enforce the intentions of the policy.

First and foremost of the recommendations suggested to improve Richmond's role in C.Z.M. is a policy recognition of Richmond's role and responsibility in C.Z.M. The recently adopted Bylaw 5746 amendment to Richmond's Official Community Plan specifies design regulation for foreshore developments. As it stands, Bylaw 5746 comes close to recognising Richmond's role in C.Z.M. Bylaw 5746 should go one step further in recognizing that the

community is located within the coastal zone (as defined in this thesis) and that protection of Richmond's natural environment necessitates a positive local contribution to C.Z.M.

Steps to improve Richmond's policy performance in the field of habitat conservation have been taken with the adoption of Bylaw 5746 which includes guidelines regulating development in E.S.A.'s. This Bylaw certainly enhances the potential of the policy to mitigate the negative impacts of development on the environment. The findings of this study suggest that E.S.A.'s are experiencing a significant amount of development pressure from industrial proposals. A re-examination of current zoning in E.S.A.'s is recommended as another way of avoiding environmental damages and costly mitigative measures for incompatible uses.

In order to protect coastal water quality, Richmond must improve the performance of its policy of discouraging water polluting industrial uses from locating close to the waterfront. Mitigative measures such as those contained within Bylaw 5746 may indirectly function as a 'discouragement' to potential development, but as with the protection of E.S.A.'s, a revision of current zoning patterns to ensure that incompatible uses are avoided might be preferable to the expensive mitigative approach.

The results identified the need for expanding interjurisdictional contact, particularly for development proposals affecting E.S.A.'s and outside floodplain exemption boundaries. It is recommended that all Development Permit applications located within E.S.A.'s and outside floodplain exempt boundaries be circulated to F.R.E.M.P. or other agencies such as M.O.E.L.P.

The results revealed that the provision of public waterfront access in industrial Development Permits was non-existent, thus a stronger and more effective policy response is necessary. The measures taken by Bylaw 5746 requiring all foreshore development proposals to provide public waterfront access appear to be an adequate policy response.

The magnitude of floodplain development suggests that a highly effective policy ensuring that all development in floodplain exempt areas is built to floodproof standards. The requirements of floodproof construction standards imposed on all developments located inside the Floodplain Exemption Boundary should be extended to encompass all developments.

The analysis of water dependency and foreshore land use in Richmond pointed to the need for a clear policy recognizing the importance of allocating a sufficient supply of foreshore land for water dependent and water related uses. The effectiveness of such a policy might be enhanced through the creation of a foreshore zoning category that recognizes water dependency as a requisite attribute.

These policy recommendations, in conjunction with the newly adopted Bylaw 5746 could vastly improve Richmond's policies affecting the overall management of coastal zone. A critical step is the recognition that the local level of government is fully capable of assuming a proactive role in C.Z.M. through its authority in land use regulation.

7.3 Directions for Further Research

The case study of Richmond, British Columbia provided an empirically based evaluation of existing policies affecting the management of various issues within the coastal zone. In December of 1991, at the end of the review of data used in this study, the Township of Richmond amended its Official Community Plan with Bylaw 5746. It is anticipated that the development guidelines contained within this bylaw will have a positive impact on the performance of the policies evaluated in this thesis as well as on the overall management of the coastal zone. The logical next step would be to employ the methodology developed in this thesis to assess the effect of the new guidelines in Bylaw 5746 based on a four year survey of Development Permit Applications (from 1992 to 1996 for example). The result of the future analysis could be compared to the results produced in this study to yield an evaluation of policy performance in Richmond. It will be interesting to see if the Bylaw 5746 amendments are sufficient to uphold the intent of the O.C.P. policies, especially given the observed magnitude of development pressure.

As an evaluative instrument, the methodology appeared to be fairly blunt. Although it was able to address a wide breadth of C.Z.M. issues in sufficient detail, the methodology frequently failed to provide insight into the reasons why a given policy fell short of the desired regulatory effect. Factors such as a lack of specific regulatory requirements or an inconsistent enforcement of policy principles may also be affecting the results. The 'resolution' of this methodology could be further enhanced simply by increasing the number of criteria used in the analysis. Other options for further research include expanding the list of coastal management

issues to include such factors as land use economics or political influences. The seven coastal zone issues developed in this thesis could be also examined using a detailed analysis of a single coastal zone development as demonstrated by Brownlee's (1992) study of Bridgepoint Market in Richmond, B.C.

7.4 Final Comments

Throughout this study, the character of the coastal zone has been portrayed in the language of Rachel Carson as the *meeting place of the elements* and people. This thesis also considered the coastal zone as a diverse and bountiful living system characterized by *compromise, conflict and eternal change*. It is within this reality that people assume the responsibility of stewardship for the coast's resources. Perhaps at the forefront of the compromise, conflict and eternal change are local governments who must make decisions on a day-to-day basis concerning the use of a major segment of the coastal zone: land. The magnitude of local responsibility in the management of the coast is further underlined by the complexity and severity of land use impacts throughout a coastal zone unfettered by political boundaries.

The municipality of Richmond exemplifies many of the problems that exist in the coastal zone. The challenge facing Richmond is to seek ways to resolve conflicts arising from the urban use of the coastal zone. Mirroring the characteristics of the coastal zone, local management efforts are full of compromise, conflict and change. A sense of urgency is felt because

Richmond must resolve the conflicts that exist between biophysical, socio-political and economic concerns with a limited land area currently subject to intense development pressures.

Richmond's coat-of-arms is graced by the words **Child of the Fraser**. A recognition of responsibilities in its role as manager of the coastal zone and the adoption of appropriate C.Z.M. policies will insure that Richmond, as a **Child of the Fraser**, will mature properly.

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APPENDIX A
SELECTED FEDERAL DEPARTMENTS AND ENABLING C.Z.M. LEGISLATION
(Adapted from Gamble 1989).

Department	Federal Branch	Enabling Legislation
Fisheries and Oceans	● Habitat Management Branch	<u>Fisheries Act</u> ● Regulation of catch taken in commercial, sport and native fisheries.
	● Field Services Branch	● Protection of fish and fish habitat.
	● Fisheries and Oceans Research Council	<u>Fisheries and Oceans Advisory Council Research Act</u> ● Research and development programs.
	● Small Craft Harbours Branch	<u>Fishing and Recreational Harbours Act</u> ● Management and maintenance of harbour facilities.
Environment Canada	● Environmental Protection	<u>Fisheries Act</u> ● Regulation of activities which may result in the deposit of deleterious substances.
		<u>Ocean Dumping Control Act</u> ● Regulation of deliberate disposal of substances from ships, aircrafts, or platforms.
	● Inland Waters and Lands	<u>Canada Water Act</u> ● Regulation of effluent standards and joint federal-provincial projects.
	● Canadian Wildlife Service	<u>Canada Wildlife Act</u> ● Purchase, acquire, and lease lands for wildlife and migratory bird research and conservation.
		<u>Migratory Birds Convention Act</u> ● Protection of migratory game-, insectivorous-, and nongame birds.

**Energy, Mines,
and Resources**

- Canada Oil and Gas
Lands Administration

Canada Oil and Gas Act

- Management of federal interests in oil, gas, and mineral exploration, production and development.

Oil and Gas Production and Conservation Act

- Management of exploration and drilling for the production, conservation, processing, and transportation of oil and gas.

**Transport
Canada**

- Canadian Coast
Guard

Navigable Waters Protection Act

- Regulation of navigation interferences in, upon, over, under, through, or across any navigable water.

Canada Shipping Act

- Prohibits the pollution of all Canadian waters from ships except where discharge is due to damage or leakage from a ship as a result of stranding, collision, or foundering.

- Harbours and Ports

Public Harbours and Ports Facilities Act

- Management of designated public harbours and ports including Esquimalt, Victoria, Alberni, New Westminster, and Burrard Inlet.

- Prohibits anyone encumbering the water or shore, endangering or obstructing navigation, or depositing anything on the shore or in the water that might damage vessels or property.

- Canada Ports
Corporation

Canada Ports Corporation Act

- Management of nationally significant ports including Halifax, St. John, Chicoutimi, Quebec, Trois Rivières, Montreal, Prince Rupert, and Vancouver.

- Harbour
Commissions

Harbour Commissions Act

- Management of designated harbours, including Fraser, North Fraser, Nanaimo, Port Alberni.

- Canada Transport Commission

Railway Act

- Authorizes any railway company to take and appropriate unalienated crown lands as is necessary.

**Public Works
Canada**

Public Works Act

- Management and maintenance of all federal dams, hydraulic works, harbours, and piers.

APPENDIX B

SELECTED PROVINCIAL MINISTRIES AND ENABLING C.Z.M. LEGISLATION (Adapted from Gamble 1989).

Provincial Ministry	Branch	Enabling Legislation
Environment, Lands and Parks	• Lands Branch	<u>Land Act</u> • Powers to sell, lease, grant right-of-ways, or issue licenses-to-occupy crown land.
	• Planning and Assessment Branch	<u>Environment and Land Use Act</u> • Establishes Environment and Land Use Committee with broad authority for the preservation and maintenance of the natural environment.
	• Waste Management Branch	<u>Environment Management Act</u> • Requirement of an environmental impact assessment for any work which could substantially change the quality of air, land, or water. • Establishes the Environmental Appeal Board.
		<u>Waste Management Act</u> • Prohibits discharge or disposal of wastes without a permit, approval, or order of regulations.
	• Water Management Branch	<u>Water Act</u> • Issuance of licenses or approvals for the right to use or divert water vested in the crown.
	• Wildlife Branch	<u>Wildlife Act</u> • Regulation and management of freshwater fish culture.
	• Recreational Fisheries Branch	<u>Wildlife Act</u> • Regulation and management of freshwater fish culture

	<ul style="list-style-type: none"> ● Parks and Outdoor Recreation 	<u>Park Act</u> <ul style="list-style-type: none"> ● Management of all matters concerning parks and recreation areas.
	<ul style="list-style-type: none"> ● Parks Program Branch, Ecological Reserves Program 	<u>Ecological Reserves Act</u> <ul style="list-style-type: none"> ● Establishment of reserves for ecological significance and scientific and preservation purposes.
Agriculture, Fisheries and Food	<ul style="list-style-type: none"> ● Commercial Fisheries Branch 	<u>Fisheries Act</u> <ul style="list-style-type: none"> ● Regulation of safe and orderly growing, cultivation, and distribution of oysters, clams, and other shellfish.
Health	<ul style="list-style-type: none"> ● Community Health Services Branch 	<u>Health Act</u> <ul style="list-style-type: none"> ● Regulation of domestic water supplies and systems which are potential public health hazards.
Transportation and Highways	<ul style="list-style-type: none"> ● Geotechnical and Materials Branch 	<u>Highway Act</u> <ul style="list-style-type: none"> ● Establishes setbacks along public roads from which buildings and other structures may be placed.
		<u>Land Titles Act</u> <ul style="list-style-type: none"> ● Geological hazard investigations of proposed subdivisions in unincorporated areas.
Municipal Affairs, Recreation and Housing	<ul style="list-style-type: none"> ● Islands Trust 	<u>Islands Trust Act</u> <ul style="list-style-type: none"> ● Make recommendations for the acquisition, use and disposition of land situated within the trust area.

- Development Services Branch

Local Services Act

- Establishment of local community plans and rural land use bylaws in unincorporated areas.

Municipal Act

- Authorizes municipalities and regional districts to make bylaws regulating the operation of businesses within respective jurisdictions for protecting the public, or preventing or minimizing nuisances.

Land Titles Act

- Geological hazard investigation of proposed subdivisions in municipalities.
-

APPENDIX C

RICHMOND LAND USE ZONES SUMMARY

SPECIFIC ZONE	ABBREVIATION	*GENERAL LAND USE
Single-Family Housing District	R1	Residential
Townhouse District	R2	
Townhouse & Apartment District	R3	
High Density Residential District	R4	
Two-Family Housing District	R5	
Agricultural District	AG1	Agricultural
Golf Course District	AG2	
Roadside Stand (Class C) District	RSC	
Agripark District	AG3	
Local Commercial District	C1	Commercial and Multiple Use
Neighbourhood Commercial District	C2	
Community commercial District	C3	
Steveston Commercial (2-storey) District	C4	
Steveston Commercial (3-storey) District	C5	
Automobile-Oriented Commercial District	C6	
Downtown Commercial District	C7	
Gas Station District	G1	
Service Station District	G2	
Neighbourhood Pub District	NHP	
Automotive Park District	AUP	
Botanical Garden District 1	BG1	
Botanical Garden District 2	BG2	
Industrial District	I1	Industrial
Light Industrial District	I2	
Business Park Industrial District	I3	
Limited Industrial Retail District	I4	
Industrial Storage District	I5	
Airport District	AIR	

RICHMOND LAND USE ZONES SUMMARY CONTINUED

SPECIFIC ZONE	ABBREVIATION	*GENERAL LAND USE
School & Public Use District	SPU	'Other'
Assembly District	ASY	
Recreational Vehicle Park District	RVP	
Health Care Facilities District	HCF	
Marina District 1	MA1	
Marina District 2	MA2	

* General Land use categories correspond to those employed in C.Z.M. analysis.

APPENDIX D
CIRCULATION OF DEVELOPMENT APPLICATIONS

REZONING

COMMUNITY PLANNING

PERMITS

UTILITIES/TRANSPORTATION

FIRE

LEISURE

DEVELOPMENT PERMIT

AREA PLANNING

DESIGN

PERMITS

UTILITIES/TRANSPORTATION

FIRE

HEALTH (only if unsewered)

R.C.M.P.

C.M.H.C.