

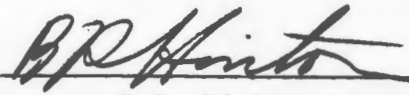
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Federal - Provincial Joint Committee
on Tsimpsean Peninsula Port Development
Prince Rupert Bulk Loading Facility
Phase 2
Environmental Assessment of Alternatives

VOLUME 1
MAIN REPORT

Approved by:


B.R. Hinton

File:741
Date: February 13, 1975

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PREFACE

This Report is a summary of the environmental implications of alternative bulk-loading sites on the Tsimpsean Peninsula. Although it is primarily concerned with the natural and cultural environment, the engineering factors developed during phase 1 are major considerations.

The Report is not a "statement" of environmental impact, but rather the result of an interdisciplinary fact-finding study hopefully leading to an optimal compromise in the design of a bulk-loading facility for the Prince Rupert area.

The environmental evaluation indicated that the sites listed were suitable for development on the Tsimpsean Peninsula. The study also indicated that a major impact on the environment would be the construction of the bulk-loading facility.

An assessment of the regional environment of the Tsimpsean Peninsula and the most valuable areas of the Tsimpsean Peninsula was conducted. It was found that the Tsimpsean Peninsula is a valuable area for development and that the Tsimpsean Peninsula is a valuable area for development.

The study also indicated that the Tsimpsean Peninsula is a valuable area for development and that the Tsimpsean Peninsula is a valuable area for development. The study also indicated that the Tsimpsean Peninsula is a valuable area for development and that the Tsimpsean Peninsula is a valuable area for development.

EXECUTIVE SUMMARY

1. This study was commissioned in August, 1974 by a joint federal/provincial committee and was preceded by a phase 1 engineering study of available sites.
2. The engineering assessment initially ruled out sites in Work Channel, the Skeena River, and along the outer coast of the Tsimpsean Peninsula. Further engineering evaluation narrowed the choice to three sites: Kitson Island, Ridley Island, and Port Simpson. Kitson and Ridley were estimated to be equal in cost, but the high cost of railway operation and access to the Port Simpson site resulted in a large cost disadvantage for that site. Considering land and ocean access as well as cost, the engineering consultant concluded that Ridley Island seemed to be the preferred site.
3. The environmental evaluation indicated that the Kitson Island site would result directly in a large impact on anadromous fish. Related industrial development on Flora Bank would intensify this impact, and would add a major waterfowl impact as well. Accordingly, this option was judged to be environmentally unacceptable.
4. An assessment of the regional environmental values indicated that the most valuable areas occur around Flora Bank (salmon and waterfowl), in the western end of Prince Rupert Harbour, and along the west coast of the Tsimpsean Peninsula (herring, waterfowl, and possibly salmon). An "environmental sensitivity" map is enclosed at the back of this volume of the report for reference.
5. While the local impacts of development at Ridley Island or Port Simpson on the natural environment are small and about equal, the probability of pollution related problems weighed strongly against the Ridley and Kitson sites. Large ships entering ports at either southern site would have to use Port Simpson as their anchorage. Accordingly, all impacts related to ships in Port Simpson harbour would be common to all three options. In addition, choice of Ridley or Kitson would mean large vessels would be plying Chatham Sound to and from the Port Simpson anchorage just off the most ecologically valuable part of the study area. Ships using a port at Port Simpson would probably approach via the north end of Chatham Sound, and would not come near the valuable Big Bay-Pearl Harbour area.

6. Any surface water pollution with its source at or near Ridley or Kitson would be carried by the wind and current northwards towards Venn Passage, Big Bay, and Pearl Harbour, with a resultant impact on waterfowl and on herring spawning. Surface pollution from a port in Port Simpson would be carried westward, out to sea. Control of oil spills in Port Simpson harbour should be easier than at either Ridley or Kitson.
7. Consideration of available land indicates that Port Simpson is the best site for a major industrial complex related to the bulk-loading facility. Although the social impacts of such major facilities were not studied, other environmental impacts (including air and water pollution) would be less if further industrial development occurred at Port Simpson than if it occurred at either Kitson or Ridley Island. Once again, Port Simpson suffers from a cost disadvantage related to its access requirements. However, with very large scale developments, the extra costs of land development at the southern sites renders all options about equal in industrial development cost.
8. Based solely on environmental grounds, it was concluded that Port Simpson would be the best site for development of the bulk-loading facility. However, considering all factors, Ridley and Port Simpson were felt to be about equal. It was recommended that a decision on the choice of site await the results of industrial development studies. For the Prince Rupert area, the probable site for a combined port and industrial complex should be considered to be Port Simpson. If no major heavy industry is envisioned for the study area, the choice of site should depend on local opinions expressed after the options have been presented. The working assumption should be that Ridley Island is the site of choice for a bulk-loading facility alone.

FOREWARD

As is explained below, an environmental assessment of all sites examined by the engineering consultant was carried out, whether the site was judged capable of meeting the terms of reference or not. This assessment is tab-indexed as Part 2. We would recommend that, for most readers, only Parts 1, 3 and 4 need be read to gain an appreciation of the study as originally designed.

Part 2 does, however, provide some information on the top-ranked sites not repeated later. Part 2 may also be useful if consideration is given to commodity throughputs less than noted in our terms of reference, which may be shipped from some of the rejected sites.

The conclusions and recommendations are tab-indexed as Part 4.

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- 1. Highlights of the Existing Environment
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 - 1.2 The Outer Marine Estuary
 - 1.3 The Middle Zone
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CHAPTER 1. INTRODUCTION AND TERMS OF REFERENCE

- 1.1 Introduction: On August 13, 1974 a joint federal/provincial committee examining bulk-loading facilities on the Yukon River Commission commissioned a six month program of engineering and environmental studies of alternative sites. Phase 1 (engineering assessment) was carried out by Swan Master Engineering Company Ltd. and was completed November 15, 1974. Phase 2 (environmental analysis) was carried out by the Northwest Environmental Analysis Team (NEAT), a group of strategic consulting firms headed by B.R. Hinton & Associates Ltd., and this report is the result of that phase 2 assessment.

It should be noted that phase 2 concentrated on breadth rather than depth of study. That is, NEAT attempted a comprehensive analysis to identify all significant environmental implications of each reasonable site. Specific problem areas were not studied in detail, but sufficient information was developed to permit an informed comparison of the major environmental impacts of particular problems to be listed in phase 2 "Development of Detailed Environmental Design Criteria".

INTRODUCTION AND TERMS OF REFERENCE

This phase 2 study was subject to only one important constraint, that of timing. Site-specific studies could be conducted only after the engineering recommendations were apparent in late October. In order to permit analysis of samples and data in time for completion of the NEAT report in mid-February, 1975, all field work had to be completed by the end of November. Thus, specific field work was concentrated into a five week time period at a time of year when many species of animals (including rearing juvenile salmon) were not in the study area.

Nevertheless, we are confident that sufficient information has been developed to permit a reasonably informed choice from among the available options.

- 1.2 Report Organization

A few comments about the organization of this report are in order. In general, the main report contains only a brief outline of the existing environment, together with the analysis of impacts on that environment. Appendices A, B and C provide the back-up details on the existing terrestrial, cultural, and aquatic environments respectively. Appendix D gives an assessment of the existing climate, and an overview of the impact of noise and chemical pollution. Appendix E contains the phase 1 engineering report along with details of the engineering input

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to phase 2. Each appendix is contained in a separate volume for the convenience of agencies or organizations with interests in specific areas.

A separate volume of maps related to the appendices was prepared so the reader may examine certain maps while simultaneously reading the text which refers to them. The use of a separate map volume eliminates the need to continually turn pages of the text to refer to the maps. Most of the maps are printed to a metric scale to allow them to be used for future reference after Canada has adopted the international system of measurement. However, the text is generally written in the measurement system familiar to most readers.

In spite of the fact that this report contains over 700 pages of text and some two dozen maps, there is a considerable amount of additional detailed information not included. As inclusion of this information would result in a report of unmanageable size, these data have been retained in the NEAT "archives" in the office of B.R. Hinton and Associates Ltd., and are available for viewing with the permission of the federal/provincial committee.

1.3 Terms of Reference for Phase 2

" General Objective

To identify alternative sites for bulk loading facilities in the Prince Rupert area (see map for area of reference) by assessing the suitability and feasibility of alternative locations in terms of the physical requirements of the proposed facility, and in terms of the potential environmental impacts of the facility on physical, biological, and social resources of the area.

The specific objectives of this project will be conducted as follows: ---

Phase 2 Environmental Suitability

- (1) *To collate environmental baseline information and to conduct programs (In accordance with data gaps identified) to assess the potential extensive environmental ramifications of each alternative location on the region including type, magnitude, and duration of both short and long term -*
 - (a) *Impact of location*
 - (b) *Impact of construction*
 - (c) *Impact of operation*

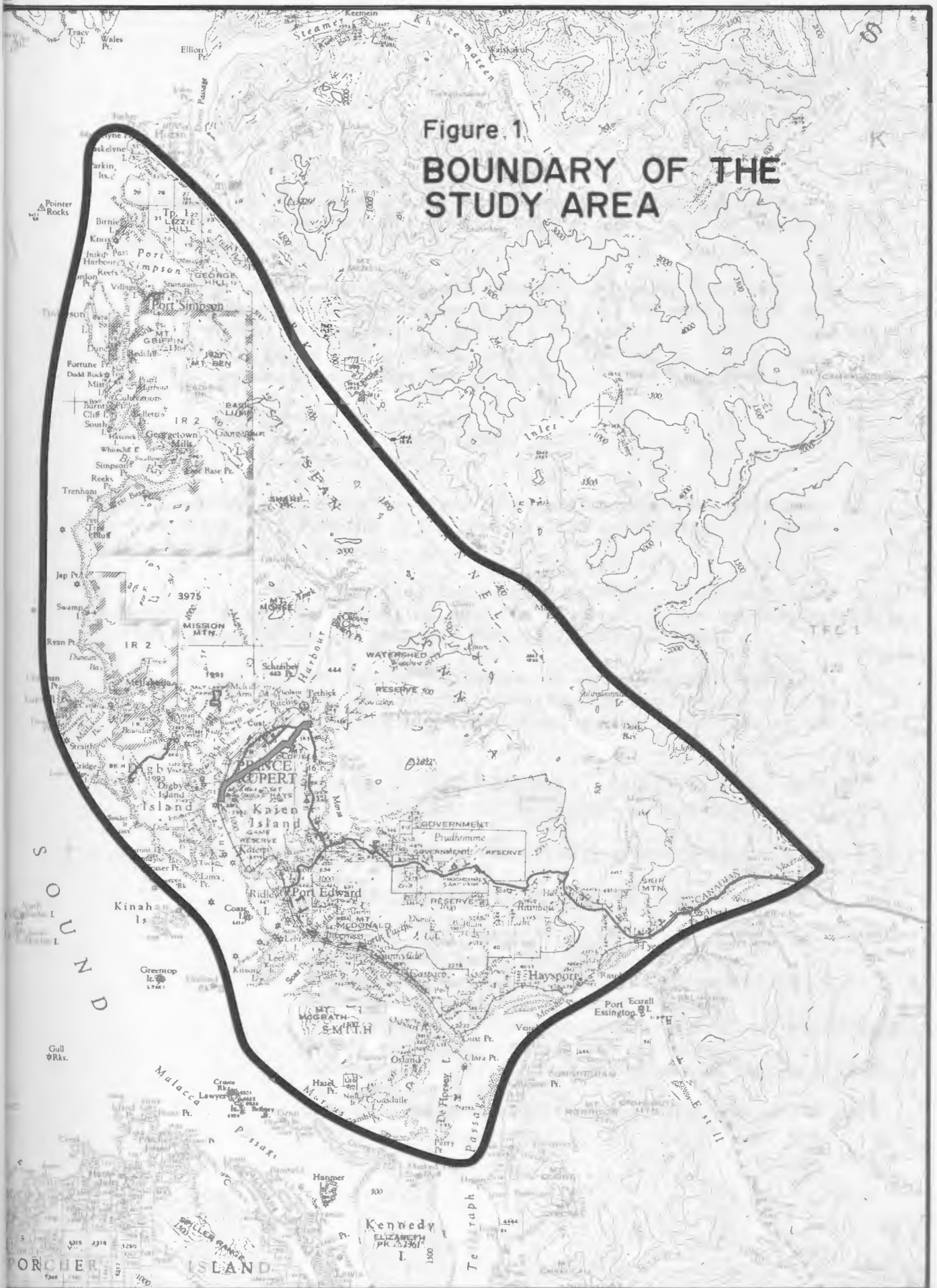


Figure 1
**BOUNDARY OF THE
STUDY AREA**

Map labels include: Keemim, Waikohu, Tract L, Wales Pt., Elliott Pt., Dava Passage, Skelvine, Parkin, Its., Birnie L., Knux Pt., Inskip Pass, Harbours, Port Simpson, GEORGE HILL, GRIFIN, MT. BEN, FORTUNE I., DODD ROCK, Mist I., Culcannon, HARRIS CLIFF, South, Havock, Georgetown, Whinche I., Simpson, Reeks, Trenham Pt., Jap Pt., Swamp I., Ryan Pt., IR 2, MISSION MTS., 3975, MT. MOORE, Schuber Harbour, 444, WATERSHED, RESERVE 300, GOVERNMENT, Pruhomme, RESERVE, RESERVE 1740, Rambou, Haysport, Port Essington, Ecrall, Mt. Magrath, Mt. Smith, Hazle Pt., Kennedy Elizabeth I., 4444, Te raph Pass, Malacca Pass, Kinah Is., Green Top, Gull Pt., PORCHER ISLAND, 1200, 1000, 800, 600, 400, 200, 100, 50, 0, 1000, 2000, 3000, 4000, 5000, 6000, 7000, 8000, 9000, 10000, 11000, 12000, 13000, 14000, 15000, 16000, 17000, 18000, 19000, 20000, 21000, 22000, 23000, 24000, 25000, 26000, 27000, 28000, 29000, 30000, 31000, 32000, 33000, 34000, 35000, 36000, 37000, 38000, 39000, 40000, 41000, 42000, 43000, 44000, 45000, 46000, 47000, 48000, 49000, 50000, 51000, 52000, 53000, 54000, 55000, 56000, 57000, 58000, 59000, 60000, 61000, 62000, 63000, 64000, 65000, 66000, 67000, 68000, 69000, 70000, 71000, 72000, 73000, 74000, 75000, 76000, 77000, 78000, 79000, 80000, 81000, 82000, 83000, 84000, 85000, 86000, 87000, 88000, 89000, 90000, 91000, 92000, 93000, 94000, 95000, 96000, 97000, 98000, 99000, 100000.

" (See Appendix C for terms of reference and types of issues to be considered and Appendix B for partial list of existing information that should be assessed).

(2) To collate environmental baseline information and to conduct programs (in accordance with data gaps as identified) to assess the potential intensive environmental ramifications as associated with each alternative location including type, magnitude, and duration of both short and long term -

- (a) Impacts of Location
- (b) Impacts of Construction
- (c) Impacts of Operation

(See Appendix C for specific terms of reference and types of issues to be considered and Appendix B for partial list of existing information that should be assessed).

This phase is oriented to selecting and rating those sites from among the identified capable sites which are environmentally suited to supporting the proposed facility. Included will be:

- (a) Examination of the potential extensive and intensive effects of location, construction and operation of the facility and ancillary works on the region and at the site.
- (b) Elimination of environmentally unsuitable sites on the basis of extensive and intensive environmental ramifications.
- (c) Rating of locations identified as environmentally suitable.
- (d) The final report should include the following:
 - 1. Rating of site suitability.
 - 2. Environmental basis for the above rating.
 - 3. Recommended mitigation measures and approximate costs on the most highly rated locations.
 - 4. Specification of investigations required to appropriately detail recommended mitigation measures.
 - 5. Recommendation of general environmental design criteria and operational criteria.
 - 6. General comparative capital cost estimate on the most highly rated locations.

APPENDIX "C"

SPECIFIC TERMS OF REFERENCE AND KINDS OF ISSUES TO BE
ADDRESSED IN THE ASSESSMENT OF BOTH EXTENSIVE AND
INTENSIVE ENVIRONMENTAL RAMIFICATIONS

Part 1

Example of the kinds of environmental baseline information that should be collated and analyzed as a base for assessing the potential impacts of the port development on the existing environmental conditions and values are as follows:

(A) Land Resources

- Surficial materials;
- Soils and soil depth to bedrock;
- Type of bedrock;
- Source for fill materials;
- Stability and suitability of the land for development and biological productivity values that could be affected.

(B) OCEANOGRAPHIC PARAMETERS

- Water temperature profile of estuarine waters;
- Salinity regimes of estuarine waters;
- Current patterns in estuary;
- Establishment of physical boundaries of the estuary;
- Description of wind and wave patterns relative to development site;
- Distribution and abundance of zooplankton and phytoplankton communities;
- Mapping and description of bottom composition in the estuary;

A matter of prime concern is that of water circulation, water movement, storm surges, etc., where at present there is insufficient data for daily predictions, or for calculating water exchange or rate of dilution and dispersion of pollutants. Any further information that could be obtained on water circulation would be most valuable.

Matters of water quality are of such magnitude as to be best left until one can be more site specific.

" (D) Water Resources

- *Water Supply and Demand:*

- (a) *Industrial*
- (b) *Domestic*
- (c) *Water Power*
- (d) *Use for liquid and solid wastes*

- *Flow characteristics of fresh water courses*
- *Navigable waters*
- *Sediment data, concentrations, load, river regimes and sediment feed to deltas*
- *Water quality data*
- *Tidal limits of rivers*

(E) Climate and Atmospheric Environment

A number of points should be investigated in some way or other, for example:

- (a) *What will be the effect of the strong northerly winter winds on the manoeuvring and docking of ships on lower portions of Portland Canal?*
- (b) *What is the extent of icing at heads of inlets and along semi-enclosed basins?*
- (c) *What are the problems associated with connecting rail routes from the point of view of avalanches, floods, wash-outs, snow clearing and general road maintenance?*
- (d) *What is the frequency of dense fog over the approaches?*
- (e) *What are the capabilities of the atmosphere to disperse pollutants from bulk loading and other industrial facilities at the site or en route to the site.*

Part II

The following is a partial list of issues and effects that must be accounted for in this environmental assessment.

The impact of the development construction and operation of the facility on:

- (a) *Atmospheric Environment*

- ability to disperse pollutants;
- direction and destination of atmospheric dispersal.

(b) *Physical and Biological Marine, Estuarine and Riverine Environments.*

- alternations in flow, circulation, temperature, quality of water, sedimentation;
- effects of benthic and littoral organisms including extent, timing and utilization of areas by represented fish species at various life stages.
- effects on wetland terrestrial wildlife habitat and species.

(c) *Physical and Biological Terrestrial Environments.*

- effects on vegetation communities vis-a-vis natural and commercial values.
- effects on upland wildlife habitats and species.

(d) *Human and Social Environment*

- effects on present land uses and projected future land uses; effects on traditional land uses, ownership patterns, etc.
- effects on historical and archaeological cultural features;
- effects on fishing, shipping, boating and harbour-fronting activities;
- effects on existing and potential outdoor recreational resources and recourse capability;
- implications of projected related urban and regional development;
- an assessment of the attitudes of the local and regional populace to the alternative sites will be conducted.

The above terms (where applicable) will also be considered in relation to new and upgraded transportation links that may be required for some of the alternative bulk loading locations."

During the course of the study, the committee requested that, in addition to selecting and rating the sites judged "capable" by the engineering consultant, NEAT examine all sites considered and rate the unacceptable sites along with the ones accepted as capable by the engineering consultant. Furthermore, NEAT was instructed to consider related developments induced by the port location, design or construction, and to treat such developments as important factors. While related developments were not involved in the engineering study. Swan Wooster provided NEAT with considerable assistance on this topic.

While the terms of reference are oriented towards choosing the best site rather than deciding whether a port is justified or not, it became apparent that all the sites examined had significant drawbacks. Accordingly, a new option (the "no port" option) was introduced into the ranking system by NEAT. The purpose of its inclusion was to demonstrate what socio-economic impacts would be experienced in the study area if no port was developed. This then provided a baseline against which the other options could be judged.

While the study area included only the intertidal and subtidal shelf of the Tsimpsean Peninsula, some results of our assessments obliged us to speculate on the ecological importance of the deeper parts of Chatham Sound based on past work in this and similar areas. Partly because of budgetary limitations, but mainly because the biological resources in question were not present at the time of year our field studies had to be conducted, no field work was carried out in this area.

CHAPTER I

HIGHLIGHTS OF THE EXISTING ENVIRONMENT

PHYSIOGRAPHIC AND BIOLOGICAL CHARACTERISTICS OF THE STUDY AREA

The 725 square mile study area centered on Prince Rupert is half land and half water. Its physiographic divisions, as shown in Figure 2, describe characteristically different environments, which can be considered separate (but linked) ecosystems.

The Skeena River division is entirely riverine and freshwater (partly tidal influenced), draining 20,000 square miles of mountainous terrain and part of the central interior plateau. The recorded flow has varied from 1,800 cfs to 330,000 cfs averaging 32,400 cfs with a major spring flood of 100,000 cfs. Considerable sediment is carried in flow. As the river flows to the north, the gravel bed gives way to sand and silt which shift with every freshet.

PART 1

THE REGIONAL ENVIRONMENT

Thirty-one species of fish are found in the Skeena system, including eulachon, steelhead, Golly Vardoe, cutthroat, rainbow and lake trout, trout, coho and chinook salmon, and major commercial exploited populations of sockeye and pink salmon. Salmon enhancement programs are now being undertaken by the Fisheries and Marine Service of Environment Canada, and are expected to approximately double the size of the commercial catch.

Several low salinity tidal marshes border the Skeena River in this portion of the study area. These marshes have great importance as feeding and resting areas for migrant waterfowl. The largest of these, at the confluence of the River and Skeena Rivers, is especially important in this respect, and offers a readily accessible opportunity for hunting. A number of bars distributed throughout this section of the Skeena River are used as "haul-out" areas by several hundred harbor seals during this hunt and salmon spawning. These are also believed to be extensively used as "pupping" areas. Several tree islands in the upper portion of the lower Skeena are used by nesting bald eagles, and some mouse perches locally winter on the dense winter growth of these islands.

The lower Skeena estuary includes the Skeena delta, covered by slightly saline water over a salt water wedge. This portion of the estuary is dominated by fresh water, mainly because of the large

CHAPTER 2

HIGHLIGHTS OF THE EXISTING ENVIRONMENT

2.0 PHYSIOGRAPHIC AND BIOLOGICAL CHARACTERISTICS OF THE STUDY AREA

The 735 square mile study area centered on Prince Rupert is half land and half water. Its physiographic divisions, as shown in figure 2, describe characteristically different environments, which can be considered separate (but linked) ecosystems.

- 2.1 *The Skeena River* division is entirely riverine and freshwater (partly tidal influenced), draining 20,000 square miles of mountainous terrain and part of the central interior plateau. The recorded flow has varied from 1,830 cfs to 330,000 cfs averaging 32,400 cfs with a median spring flood of 167,000 cfs. Considerable sediment is carried by this swift mountain stream, although the quantities vary with the changes in flow. As the river becomes less steep near its mouth, the gravel bed gives way to sand and mud, forming bars which shift with every freshet.

Thirty-one species of fish are found in the Skeena system, including eulachon, steehead, Dolly Varden, cutthroat, rainbow and lake trout, chum, coho and chinook salmon, and major commercially exploited populations of sockeye and pink salmon. Salmon enhancement programs are now being undertaken by the Fisheries and Marine Service of Environment Canada, and are expected to approximately double the size of the commercial catch.

Several low salinity tidal marshes border the Skeena River in this portion of the study area. These marshes have great importance as feeding and resting areas for migrant waterfowl. The largest of these, at the confluence of the Khyex and Skeena Rivers, is especially important in this respect, and offers a readily accessible opportunity for hunting. A number of bars distributed throughout this section of the Skeena River are used as "haul-out" areas by several hundred harbour seals during eulachon and salmon spawning. These are also believed to be extensively used as "pupping" areas. Several treed islands in the upper portion of the lower Skeena are used by nesting bald eagles, and some moose periodically winter on the dense winter growth of these islands.

- 2.2 *The Inner Skeena Estuary* includes the Skeena delta, covered by slightly saline water over a salt water wedge. This portion of the estuary is dominated by fresh water, mainly because of the large

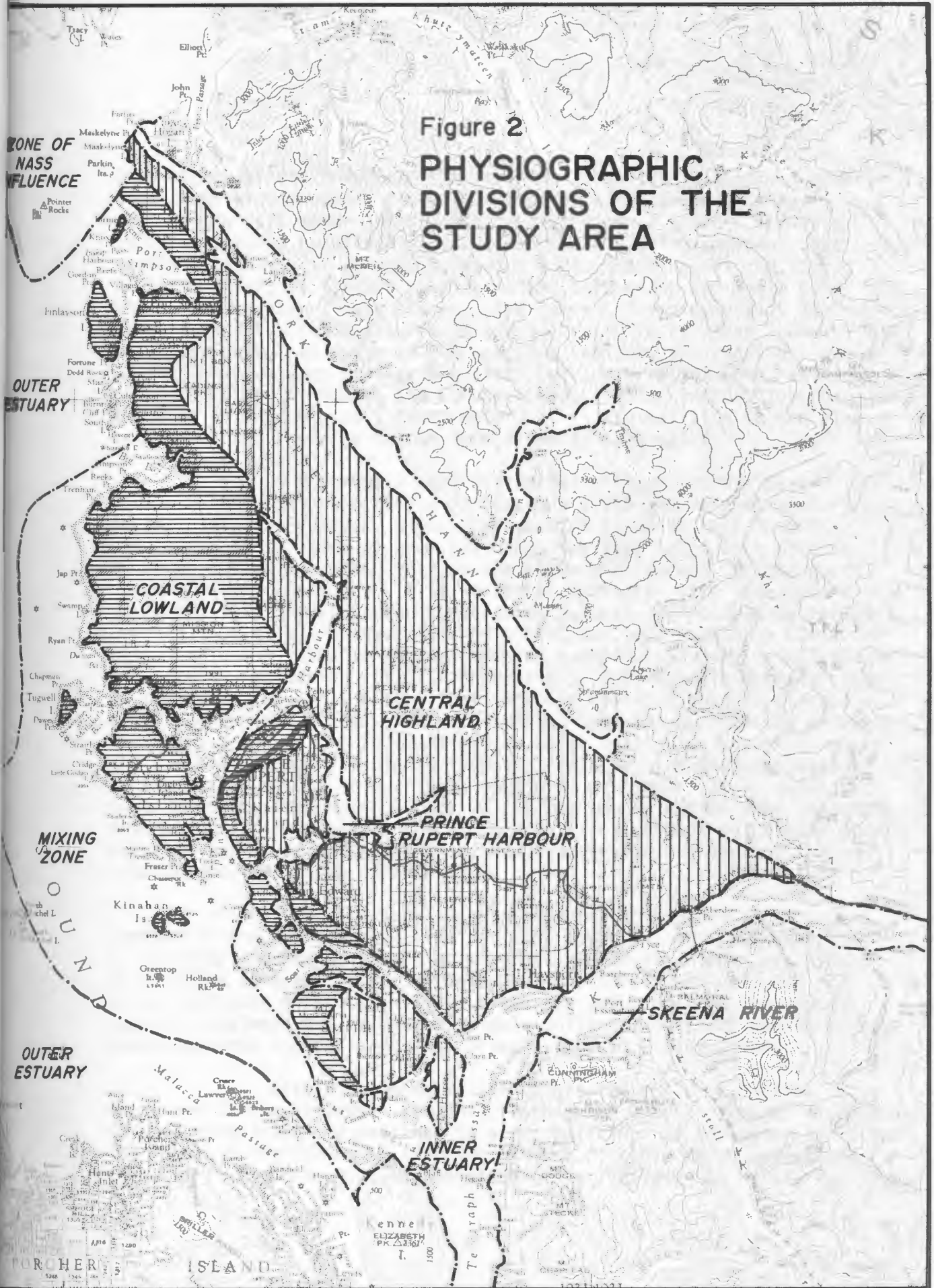


Figure 2
PHYSIOGRAPHIC
DIVISIONS OF THE
STUDY AREA

flow of the Skeena River and the very shallow bottom. As fresh water floats above salt water, the shallow bottom effectively eliminates most of the salt water intrusion except at highest tides. The area is characterized by extensive sub-tidal banks of fine sediment, but rooted vegetation is abraded by moving bottom material in the strong Skeena current, is flushed by alternating salt water and fresh water tides, and is accordingly sparse. The current moves generally northwest, with fresh water surface currents significantly faster than lower salt water currents. In spite of the mediocre habitat, the sub-tidal banks of the Inner Estuary provide important rearing area for chum, chinook, and coho salmon, (Higgins and Schouwenburg, 1973). In addition, because the area is predominantly fresh water, it is a vital link in the slow acclimation of juvenile salmon from fresh to salt water.

A major pulp mill discharges effluent on northern Ridley Island, and renders the surrounding areas unusable at higher trophic levels. However, biomass production is quite high in this area, and our sampling program has shown the area to be more diverse in species than any other site in the study area except for the north shore of Rupert Harbour. It is worthy of note that some researchers (Drinnan, 1974) have found the area to be quickly repopulated by feeding herring populations whenever the pulp mill has been shut down for a few days, indicating that improvement of the water quality may re-introduce this area as valuable habitat. According to our verbally modified terms of reference, we shall assume that the pulp mill effluent is cleaned up to an appropriate degree. We would assume that "an appropriate degree" indicates a careful improvement of the water quality to the point where the area can be used at higher trophic levels but the high production of biomass as result of nutrient input will continue. It is suspected that the area surrounding Ridley Island may be one of the most important potential feeding areas in the study area (an important point at a time when the Skeena salmon population, and hence estuarial feeding requirements, is being expanded).

The Flora Bank area is reported to support an important commercial and recreational clam and crab fishery. This was supported by our sampling program where an enormous number of animals was picked up on Flora Bank and De Horsey Bank, but the sample was composed almost entirely of crabs. If the crabs are deducted from the benthic samples obtained, the number of animals collected on Flora and De Horsey banks per grab is lower and less diverse than at Ridley Island.

Little delta formation exists above tide elevation in the Inner Skeena Estuary. For this reason, the extent of marsh development is much restricted and confined to a narrow fringe of the river banks and the edges of the islands. The significance of these marsh formations for waterfowl and hunting is therefore quite limited. De Horsey Passage,

Inverness Passage and the mainland provide some high salinity marsh habitat of significance to waterfowl, shore birds, and heron. These marshes and the adjacent timber cover on Lelu and Ridley Islands also offer winter range for deer. Flora Bank is important winter habitat for diving ducks, and during lower tides is used as a haul-out area for harbour seals.

2.3

The Mixing Zone as shown on figure 2 is an area whose outer border will change according to the time of year, the flow of the Skeena River, and other factors. It is considered to be an area with strong fresh water influence, but one in which the salt water-fresh water interface is beginning to break down. In this zone, both marine and estuarial species should be found, and, although production of any particular species would probably be limited by the fluctuating salinity, diversities would be expected to be quite high. In the absence of any other factors to define the limits of the Mixing Zone, we have chosen its inner boundary as the edge of the Skeena delta, and its outer boundary to be either (1) the line where Cameron (1948) and Trites (1956) found the top sixty feet to be fifteen percent fresh water during freshet or (2) where they found the top sixty feet to be both ten percent fresh water during freshet and at least six percent fresh water during the remainder of the year. The Skeena current moves strongly northward through Inverness Passage, over Flora Bank, and along the west coast of the Tsimpsean Peninsula, so this zone is generally a narrow band along the coast of the Peninsula. Its northernmost extension is approximately Big Bay.

Just as the Inner Skeena Estuary was valuable as a fresh water dominated environment for salmon becoming acclimated to salt water, so this Mixing Zone, which gradually becomes more saline, is expected to be equally valuable in the process. Because of the salt water preference exhibited by pink salmon, we would expect that juvenile pink would move quickly through the Inner Estuary and would use this Mixing Zone as their major rearing area. This is consistent with the data found by Higgins and Schouwenburg (1973), which indicated that coho, chinook, and chum used the Flora Bank and De Horsey Bank areas for a considerable time, but pink and sockeye moved through very quickly. Higgins and Schouwenburg did not investigate the Mixing Zone for utilization by these latter two species.

The passage of sockeye through the Inner Estuary can be rationalized by an examination of their food. While sockeye migrants have reared in a lake for one year and are therefore relatively large, they are plankton feeders, and used to the clear water in which plankton thrive. At the time of downstream migration, the Skeena is in flood, and sediment load should be quite high. Accordingly, the Inner Estuary should be turbid, and plankton should not be in great abundance. On the other hand,

with the lower current velocities in the Mixing Zone, and the greater salinity (which causes flocculation of the suspended sediment), one would expect greater light penetration and considerably increased plankton populations. As a result, one would expect to find sockeye moving quickly through the turbid Inner Estuary to their more productive feeding areas in the Chatham Sound Mixing Zone.

On the other hand, chum, and particularly coho and chinook, are stream rearing fish, used to feeding on benthic organisms in swift fresh water currents. Accordingly, the conditions in Inverness Passage and Flora Bank should be quite appealing to them.

As stated previously, we have no data on the utilization of Chatham Sound because no one else has studied the problem, and our study was carried out at the wrong time of year. Accordingly, the above speculation on the use of the Mixing Zone by the two most populous and most valuable species of salmon in the Skeena River is exactly that -- speculation.

Special attention in this area should be paid to the Prince Rupert Harbour portion. Here, the northbound surface currents reverse themselves at the entrance to the harbour during ebb tide. It is felt that any surface pollution entering this stream would go into Prince Rupert Harbour during the flood tide, and would return at ebb tide either out the entrance of the harbour or through Venn Passage. The actual route would, of course, depend greatly upon the wind situation at the time. There seems little likelihood of such surface pollution entering the main part of Prince Rupert Harbour (northeast of Bacon Cove).

The perimeters of Ridley and Digby Islands adjoining this unit of the study area, together with the north coast of Prince Rupert Harbour from Bacon Cove westward, comprise important deer winter range. The coast littoral habitat in the same locations provides winter habitat for diving ducks and marine birds, and the more sheltered shallow bays winter pond ducks and geese. Venn Passage is especially important to waterfowl. It is also felt to be apparently valuable habitat for herring spawning, and possibly salmon rearing. Rooted vegetation in the shallows, (mainly eelgrass) is significantly more dense than on the Inner Estuary shallows, and the area is heavily utilized by many species of waterfowl, deer, black bear, wolf, and mink. Venn Passage and the east coast of Digby Island is estimated to comprise the second most valuable waterfowl habitat in the study area.

2.4

The Outer Estuary begins at the outer edge of the Mixing Zone (where surface salinity has risen to about 94% of marine salinity throughout most of the year). The Outer Estuary contains typically clear saline water. It is speculated that this Outer Estuary may provide some

rearing habitat for sockeye and pink salmon during the later stages of their acclimation to the marine environment, but it is felt that this area should not be as important as the Mixing Zone.

The most important known aspect to this Outer Estuary is the coast littoral fringe from Big Bay to the northern tip of the Tsimpsean Peninsula. It is intriguing to note that the most productive herring spawning of the north coast of British Columbia (according to local Fishery Officers) occurs along this portion of the littoral fringe of the Tsimpsean Peninsula. South of Big Bay, herring spawning occurs, but it is quite intermittent. The only other significant herring spawning area occurs on the northern tip of Porcher Island, which is also in the Outer Estuary. Herring is a marine species.

The Big Bay to Port Simpson area is also rich in beds of eelgrass and related grasses. The growth is dense and lush, and is apparently heavily utilized by both spawning herring and waterfowl. Other researchers have found that such dense eelgrass beds provide the greatest survival rate among herring and also provide important feeding areas for rearing juvenile salmon (Outram, 1957; also see Appendix C).

In addition, the intertidal and subtidal reefs and flats surrounding Lucy and Rachael Islands and along the west coast of the Tsimpsean Peninsula provide most important wildlife habitat. The approximately nine square mile area of Big Bay and Pearl Harbour is especially significant in having extensive coast littoral habitat, large beds of rooted marine plants, and in containing several stream estuaries. The Big Bay - Pearl Harbour area provides the major unit of pond duck, goose, shore bird, and diving duck habitat in the study area. It is potentially the best location for hunting and other wildlife oriented recreation in the area. Large numbers of marine birds occur within the Outer Estuary, and adjacent upland habitat is better-than-average big game habitat, especially in the vicinity of Big Bay and Pearl Harbour.

Although outside the study area and the immediate proximity to port locations, Lucy and Rachael Islands are singularly important in that they support nesting of Peals's peregrine falcon and alcid birds. These birds are exceedingly sensitive to disturbance by human activity during the incubation and early brood rearing period, and the rare status of the falcons warrants effort to avoid them harm as a result of any installations for navigation or other port activity that may occur in the future.

Also of particular interest are Sandhill Cranes and Trumpeter Swans. Sandhill Cranes nest widely but sparingly on the coastal islands, while Trumpeter Swans winter mainly up the Skeena. The latter use the coast littoral zone when exceptionally cold winters force them down river. Both these species are rare.

One area of some value to wildlife, particularly waterfowl and marine birds, is the relatively small estuary of Stumaun Creek within Port Simpson Harbour. In the context of the other waterfowl areas of the Peninsula, it is marginal habitat and small, but it is locally important because of easy access by recreational users from Port Simpson.

2.5 The Outer Estuary gives way to the *Zone of Nass Influence* about the latitude of Port Simpson. At this point, the surface salinity begins to drop as the influence of the Nass river discharge is felt (about 70% of the Skeena fresh water flow has reached this point from the south). The combined Nass and Skeena currents then turn westward at about Port Simpson, and move out to sea. This is a most significant factor for two reasons. First, this westward movement maintains a zone of essentially saline water in the Port Simpson to Big Bay region, and secondly, any surface pollution generated in the Port Simpson area or in its ship approaches to the west would be carried directly westward. This westward movement would, of course, depend upon the wind at the time. The prevailing winds in this area are southeasterly, with some summer westerlies. The above comments about the value of the Skeena Mixing Zone to rearing salmon may also apply to this area for Nass River salmon, but we have no information to support this concept.

2.6 The upland area of the Tsimpsean Peninsula is broken into two main divisions. *The Coastal Lowland* borders the Outer Estuary and the Mixing Zone with minor lowland areas bordering the Inner Estuary. This area is characterized by low topography with greatly undulating micro-topography. The surface tends to be alternating bedrock and "coastalmuskeg" organic matter in pockets with a scrub forest surface cover. Major wildlife species associated with this habitat type are Sandhill Cranes, Canada Geese, Wilson Snipe, Sitka Deer, Wolf, and Black Bear. Sandhill Crane and Canada Geese use coastal muskeg as nesting and brood rearing habitat. As the Coastal Lowland is an emerging shoreline, beach gravel deposits may be expected at several locations throughout the area, but they are likely to be masked by the organic surface material. Biologically, the entire inland area is not felt to be particularly valuable as far as human oriented values are concerned. The only exploitable species in the area are deer, black bear, squirrel, and marten, all of which exist in low density. The deer population of some 300 animals is kept well in check on the mainland by populations of wolves.

However, it is worthy of note that the "coastal muskeg" areas of the Coastal Lowland are considered to contain sensitive vegetation. In addition, almost the entire Coastal Lowland is part of Indian Reserves. It is felt that these Reserves were established in this

location mainly to exploit the valuable wildlife populations of the coastal fringe rather than the inner Coastal Lowland.

- 2.7 The second land classification is the *Central Highland*. This area is comprised of rugged mountains covered by montane vegetation and coastal western hemlock forest. Deer, bald eagle, squirrel and marten are the important species associated with this forest type. Deer are occupants of the coastal forest fringe associated with intertidal flats during winter, and this coastal forest fringe provides a major nesting habitat of bald eagles. Montane vegetation at higher elevations in summer provide habitat for all big game species in the study area, and also is sparsely occupied by grouse, squirrel and marten. Heavy forest cover discourages hunting and other recreational pursuits associated with wildlife in the Central Highland area.

The Central Highland at the lower elevations tends to have dense forest cover but a relatively unstable soil base. Areas of the Central Highland lithic fibrisols occur on slopes greater than 30 degrees seem to be subject to randomly located slides when accompanied by heavy rain over two to three day periods.

- 2.8 The *Prince Rupert Harbour* area is a tidal-flushed coastal fiord with minor herring spawning, small salmon runs in Denise, Kloyia and Silver Creeks, crab fishing areas, and small pockets of deer winter range at the mouth of Silver Creek, Osborn Cove, the east side of Fern Passage and the southeast side of Kaien Island. Waterfowl habitat exists in small patches at the head of Tuck Inlet, the mouth of Silver Creek, Osborn Cove, and Fern Passage. None of these areas is high quality and heavy utilized, except Fern Passage.

Coastal cutthroat trout are apparently a locally valued sport fish; and may utilize numerous small estuaries throughout the study area, including Prince Rupert Harbour.

- 2.9 *Work Channel* is also a fiord with a few inter-tidal flats. Small salmon populations inhabit the Lachmach and Ensheshese Rivers. Wildlife resources in the area are sparse, and mainly centred on a number of small streamestuaries. The area is only accessible by boat and consequently is little used for wildlife exploitation purposes. Some goat and grizzly bear may be found along the eastern edge of Work Channel. The numerous small streams along the western side of Work Channel likely support very small populations of resident fish, and perhaps some anadromous fish.

CULTURAL CHARACTERISTICS OF THE STUDY AREA

2.10

Archaeological Sites are interesting first for their intrinsic heritage value, and second as indicators of biological activities of use to man. Historic and prehistoric man tended to occupy those areas where fish, shellfish, land animals, marine mammals, and waterfowl were plentiful and where the climate was not unreasonably harsh. Accordingly, a count of archaeological sites provides an indication of such productivity. Within the study area the following distribution of important shoreline sites was noted:

Skeena River	2 Sites
Inner Estuary	2 Sites
Mixing Zone	62 Sites (concentrated on Eastern Digby Island and in Venn Passage)
Prince Rupert Harbour	26 Sites (including 17 around Fern Passage)
Outer Estuary	44 Sites (along the coast littoral fringe)

The other areas have few or unimportant sites.

2.11

The present human population of the Tsimpsean Peninsula numbers about 21,600, - about half of whom are native Indians. The principal employers of this population are the Canadian Cellulose Company Pulp Mill at Port Edward, the fishing industry, and service industries. The unemployment rate is high and under-employment is widespread. A sizeable portion of the work force is engaged in part-time employment.

The NEAT community attitude study and socio-economic analysis indicated that people of the study area view development favorably in general, although there was concern for environmental protection and preservation of their current way of life. The people of Prince Rupert are generally development oriented, and are optimistic about the future growth and development of their community.

There are no existing attitudes as to where the port should be located. Anywhere in the vicinity of Prince Rupert would be acceptable. Location of the port facilities in Port Simpson however, may receive strong negative reaction because it would be viewed as a splitting of potential service resources. The Indian community in Port Simpson would likely view a development there as quite favorable unless it threatened the fishing industry or crossed their land. The

people of Port Simpson likely would look very favorably upon the idea of a possible road access to Prince Rupert.

There is considerable evidence to suggest that the people of Prince Rupert have developed a psychological orientation toward accepting port development. Cancellation of port construction plans might be viewed as a severe set-back to the development of social amenities in Prince Rupert. Indicative of this prior acceptance of port development is the current excess of commercial and industrial space. Approximately 70,000 square feet of commercial space has been added within the past eighteen months, causing current vacancy rates of approximately 30%.

In contrast to the commercial sector, the housing situation is quite critical at the moment. In 1967, housing demand and supply was roughly in balance. By 1970, the community was approximately 80 housing units short of demand (1.8% of demand), and by 1974, it was 425 units short of demand (8.5% of demand). The slack has been taken up by hotel and motel facilities, but these limited facilities are now almost fully occupied with people who wish to make Prince Rupert their home rather than a short term stop-over.

The population of Prince Rupert can be characterized as extremely stable for northern community, with 66% of the people over the age of 5 being native to the community. An additional 20% have moved to Prince Rupert from other places within British Columbia. Additional indications of the stability of the population are obtained from the sex ratio. In contrast to most northern communities, there are 115 men for every 100 women, which although higher than that which be found in metropolitan centres, is much more in balance than in most northern towns. One reason for the relatively even distribution between men and women in Prince Rupert can perhaps be the development of the service sector and the high proportion of women employed in service industries. This, combined with the development orientation of the population, and the fact that a suprisingly large portion of them are in the younger working ages (under 35 years of age) indicates that a strong and stable work force is available for continued development. The current unemployment rate (reaching over 12% in December of 1974) is an indication of a need for development of basic industry in the area.

At the same time that unemployment is noted as being rather high and workers complain of a lack of opportunity, certain employers such as Canadian Cellulose have a great deal of difficulty attracting workers. The paradox may be translated into a lack of choice of jobs at the same time that the housing shortage (among other things) causes potential employees to stay away from the community.

2.12

Two maps are enclosed at the back of this report volume which describe the "environmental sensitivity" of the study area and its "physical suitability" for development. Used in conjunction, we believe these maps can be a useful planning tool for the study area. For example, the Coastal Lowland area is shown to be reasonably suitable for development, but environmentally quite sensitive. On the other hand, Work Channel is not very sensitive to development, but its poor physical suitability means construction will be difficult and expensive.

CHAPTER 3SUMMARY OF THE PHASE 1 ENGINEERING REPORT

The engineering consultant recommended that the Steens River proper and the Work Channel area be considered not feasible for construction and operation of a bulk loading facility. The coast littoral area from Port Simpson to Digby Island also was not considered suitable for port development because of the dredging required and the exposure to wave action.

Within the remaining coastal area, ten sites were chosen for examination of their potential for bulk loading facilities, and one site (Fairview Point) was chosen for potential partial development. The ten sites chosen for examination are as follows:

Port Simpson
 Selkirk Island
 Kitson Island
 Ridley Island
 Digby Island

PART 2

ASSESSMENT OF ALL SITES

Hell
 Bacon Cove
 Schreiner Point
 Peathic Point
 Osborn Cove

Sean Hooper rated these sites in their report as shown below:

"The three major factors (land transportation, coam transportation and site development) --- were rated on the basis of good, poor or not acceptable in order to develop an approximate site comparison. This is shown in Potential Site Ratings.

CHAPTER 3SUMMARY OF THE PHASE 1 ENGINEERING REPORT

3.0

The engineering consultant recommended that the Skeena River proper and the Work Channel area be considered not feasible for construction and operation of a bulk loading facility. The coast littoral area from Port Simpson to Digby Island also was not considered suitable for port development because of the dredging required and the exposure to wave action.

Within the remaining coastal area, ten sites were chosen for examination of their potential for bulk loading facilities, and one site (Fairview Point) was chosen for potential partial development. The ten sites chosen for examination are as follows:

- Port Simpson
- Smith Island
- Kitson Island
- Ridley Island
- Digby Island
- Melville Arm
- Bacon Cove
- Schreiber Point
- Pethic Point
- Osborn Cove

Swan Wooster rated these sites in their report as shown below:

"The three major factors (land transportation, ocean transportation and site development) --- were rated on the basis of good, poor or not acceptable in order to develop an approximate site comparison. This is shown in Potential Site Ratings.

" Potential Site Ratings

Assessment Factors

<u>Potential Site</u>	<u>Land Transportation</u>	<u>Ocean Transportation</u>	<u>Site Development</u>
1. Port Simpson	Poor	Good	Good
2. Smith Island	poor	Poor	Poor
3. Kitson Island	Good	Good	Good
4. Ridley Island	Good	Good	Good
5. Digby Island	Poor	N/A	Good
6. Melville Arm	Poor	N/A	Good
7. Bacon Cove	Poor	N/A	Good
8. Schreiber Point	Poor	N/A	Good
9. Pethick Point	Poor	N/A	Poor
10. Osborn Cove	Poor	N/A	Poor

The not acceptable (N/A) rating, applicable only to the ocean transportation factor for sites 5 to 10 inclusive, eliminates these sites from further consideration."

" The time taken to berth large vessels at sites in Prince Rupert harbour would be prohibitive. The vessel time factor would be such that it would limit the terminal capacity, as only a few vessels of the specified size (150,000 DWT) could be berthed per year. (Berthing conditions would have to be ideal, ie: slack tide, no fog, light winds and daylight). This problem would not be alleviated by increasing the number of berths as the capacity limitation is in the approaches."

" Of the four remaining sites left for consideration Site 2, Smith Island, is also unacceptable. This rates poor in all three major assessment factors and therefore has no redeeming features.

The other three sites - Port Simpson, Ridley Island and Kitson Island - are capable of supporting a bulk terminal facility as specified in the Terms of Reference."

Full details of the engineering assessment are included in Volume 6.

CHAPTER 4

ENVIRONMENTAL EXAMINATION OF OPTIONS

PORT SIMPSON

4.1

Existing Local Environment: Port Simpson is located in the northermost portion of the study area. The site chosen by the engineering consultant for port development is on the north shore of the harbour across from the community of Port Simpson. Port Simpson Harbour is a sheltered area with reefs at the harbour entrance. These reefs support extensive kelp beds, while the south shore of the harbour exhibits intertidal and subtidal flats covered by lush eelgrass. The head of Port Simpson Harbour contains the small intertidal estuary of Stumaun Creek. Stumaun Creek has a small salmon population which likely uses this estuary for rearing. The northeast shore of Port Simpson Harbour is typically alternating rocky and gravel beaches, with very little intertidal flats. Herring spawn on the entire shoreline at Port Simpson Harbour, and this area is considered by the local Fishery Officer to be the most productive herring spawning area on the north coast in some years. The south shore flats and Stumaun estuary are locally significant as waterfowl habitat, and have the best capability in the port area to sustain hunting activity. The capability of Stumaun estuary for hunting may be considered important by the Indian community at Port Simpson. However, these south shore flats and the Stumaun estuary are really rather marginal waterfowl habitat, and not used apparently for overwintering purposes.

The topography of the proposed port site is gentle, with slopes less than 10%. The microtopography shows ridge and swale characteristics with undulations up to 50 feet in amplitude. Bedrock geology shows foliated micaceous gneiss topped by colluvium generally less than 5 feet thick. The occasional pocket of organic substrate, in excess of 5 feet thick, is found inland. Soils on the site consist predominantly of podzols with shallow organic soils (lithic-fibrisols) less than 5 feet thick inland.

Vegetation on the site consists of coastal forest which grades inland into "coastal muskeg". The timber types are predominantly non-merchantable with some small pockets of merchantable timber. Waterfowl habitat and deer wintering habitat is insignificant at this site. One archaeological site may have to be salvaged directly north of the proposed port site.

The community of Port Simpson consists of about 1,200 people, who, in 1970, depended entirely upon fishing for their base income.⁽¹⁾ Since that time, their timber rights have been sold to foreign interests, and a small additional source of income has therefore been slowly developing. In spite of this, we estimate the local unemployment rate to be of the order of 30%.

A new cannery is being built in the community at the present time and is expected to be in operation in early 1975. There is no road or rail connection to other parts of the Tsimpsean Peninsula.

Rail access to the Port Simpson site would consist of 35 miles of rail line with steep grades. The rail line will have to traverse the steep western shores of Work Channel in order to reach the latitude of Port Simpson. Here the railway will swing west, skirting Neaxtoalk Lake to reach the site. Special care has to be taken not to disturb a total of six archaeological sites along Work Channel, and a valuable waterfowl marsh habitat at the mouth of the Khyex River. About 3,000 acres of reasonably flat upland back-up land is available on the north-east shore of the harbour behind the proposed port site. This land would be available for related industrial development and is the largest area of developable land on the Tsimpsean Peninsula.

The highway access is shorter than the rail access, consisting of a ferry service between Prince Rupert and Schreiber Point and a road along Tuck Inlet to Port Simpson.

Impact of the Proposal; The development of the site itself in Port Simpson Harbour would not have a major environmental impact. There would be a minor loss of herring spawning area at the port site, and some threat to the remaining herring spawning area within Port Simpson Harbour from pollution aspects. Stumaun estuary would not be directly affected, but it would be threatened by pollution aspects of the port. The salmon population in Stumaun Creek is considered to be minor.

The only significant adverse environmental impacts anticipated arise from the railway and involve the numerous stream crossings (a problem which can be solved with proper design), the possible removal of gravel from streams for construction purposes, and the removal of streamside vegetation with resultant siltation and temperature increases in Lachmach Creek (which contains a small salmon population as well as resident trout). Some interference would be experienced with future logging of the west shore of Work Channel, but it is not known at the present time if such logging will ever be carried out.

⁽¹⁾ Sinclair, (1971) found that 100% of the basic employment was from fishing in Port Simpson, which accounted for 52% of the basic income. The remainder of the basic income was composed of government transfer payments (Unemployment Insurance, Welfare, Pensions, etc.).

The road connecting the port development in Port Simpson to Prince Rupert would be approximately nineteen miles long and would go up to the centre of the Tsimpsean Peninsula. There is some conflict with the Stumaun Creek salmon populations. However, this can be turned into a net benefit with the development of a tourist attraction for the people of Prince Rupert similar to the Goldstream Park area in greater Victoria. The introduction of a road from Port Simpson to Prince Rupert is one of the major impacts of the Port Simpson port development. The community of 1,200 previously isolated people in Port Simpson would now have ready access to the city of Prince Rupert, and it is felt that the introduction of the urban attractions of Prince Rupert may alter the socio-cultural characteristics of this community. Frequent interchange by car and the use of the road for recreational pursuits by people from Prince Rupert should move the cultural characteristics of the Port Simpson band away from their more traditional state.

A socio-economic impact of a different sort is likely in Prince Rupert. As noted above, the people of Prince Rupert have anticipated port development for quite some time. The community contains nearly 20,000 people, but is based on a rather narrow industrial base. Empirical evidence around the province (Prince George, Kamloops, Kelowna) suggests that communities are slow to develop until they reach a population of approximately 30,000 people. At this point, the community's service infrastructure seems to be properly developed to supply an internal growing force of its own, and the town seems to "take off". Prince Rupert has not, as yet, reached this state, in spite of half a century or more of planning for the "port of the north". If the proposed port development goes in at Port Simpson, it will establish a second nearby centre for industrial development. This will pull not only industry, but related human population and their social services away from Prince Rupert to the Port Simpson area, to the detriment of the total community growth. There is little doubt that the people of Prince Rupert would view this as a serious setback.

4.2

Smith Island

The Smith Island site is on the western-most tip of the island, and would require overland transportation routes from the main rail and road connections. The site is on the edge of the Inner Estuary but very little of the foreshore has intertidal flats. Smith Island supports an important population of deer, which flourishes in the absence of wolves on the island.

The site itself shows steep to moderate topography with a precipitous microtopography. The shorelines in particular are quite vertical. The geology shows gneiss and foliated quartz diorite. This is

topped by thin colluvium. The soils vary between podzols and shallow organic soils on some of the rocky ledges.

The vegetation consists entirely of coastal forest. Forests are non-merchantable timber with some merchantable pockets. Waterfowl habitat is insignificant, while the deer habitat is important.

Rail access to Smith Island would be relatively elaborate with two large bridges. No archaeological sites are present.

Some significant pollution problems may exist with respect to Flora Bank being nearby. The construction of bridges across Inverness Passage may introduce wolves to the island and cause a drop in the local deer population. Improvement of access to the island for humans may also increase the exploitation of deer. There will be a minor loss of some merchantable timber. In all, local environmental disruption will be most moderate.

4.3

Kitson Island

Existing Local Environment; The Kitson Island/Flora Bank area is probably the most valuable portion of the Inner Estuary for salmon rearing. It is of some minor use to waterfowl, and Kitson Island itself is used occasionally for picnics by local boaters. It has a sandy beach, with water that, although quite cold, is warmer than most other available beach areas in the Prince Rupert area.

The terrain of the Kitson Island site is flat. However, most of the site would need to be filled from the adjacent Skeena delta, partly using rock obtained by leveling and blasting the island itself. The microtopography traversed by the access corridor shows ridge and swale characteristics with amplitudes of 75 feet. The geology of Kitson Island, Lelu Island, and Kitson Islet consists of micaceous schist. This bedrock is overlain by colluvium, generally organic substrate in excess of 5 feet thick. The soils are all organic and range from dry, undecomposed organic soils (folisols) to the decomposed bog soils (mesic-fibrisols). The latter are in excess of 5 feet thick.

Vegetation consists primarily of coastal forest and "coastal muskeg" on Lelu Island. Some low salinity marshes border Inverness Passage. All of the forest of Kitson, Lelu and Kitson Islet are non-merchantable and non-productive. Most of the Kitson Island and Lelu Island port site and its access corridor is located on the intertidal and subtidal flats. This substrate can amplify earthquake transmission. There are no archaeological sites at Kitson/Lelu Island.

Impact of the Proposal; Site development at Kitson Island would remove a certain amount of Flora Bank from salmon rearing potential, and would level Kitson Island. The causeway carrying the road and rail facilities from the mainland would cause important changes in ocean circulation in the local vicinity. This is likely to cause increased water temperatures and salinity over Flora Bank. The effect on rearing salmon is not known, but this aspect is likely to be beneficial to waterfowl. Some pollution aspects of this site may be bothersome with respect to the Flora Bank area, as coal dust may settle on parts of the bank.

4.4

Ridley Island

Existing Local Environment; At the moment, the Cancel Pulp Mill in Port Edward discharges partly treated effluent into the sea almost directly at the proposed Ridley Island port site. Accordingly, this area is not highly utilized by valuable fish species. However, our study found a fairly high abundance of other animals at lower trophic levels, and a reasonably high diversity. Our Terms of Reference indicate that we are not to consider this area as unusable in future, but to assume that the effluent quality will be improved to the point where the area may be utilized by valuable fish species. There are indications (Drinnan, 1974) that the area would quickly rejuvenate in the absence of such effluent.

The land form parameters on Ridley Island show relatively flat lands. Slopes do not exceed 10% except for some small headlands facing Chatham Sound. The microtopography shows again the characteristic ridge and swale topography with amplitudes up to 50 feet. The geology consists of micaceous schists with some minor diorite intrusions. This geological complex is topped by colluvium generally less than 5 feet thick and pockets of organic substrate landward on the island in excess of 5 feet thick. The organic deposits may be underlain by thin glacial veneer. The soils on the Ridley Island site consist entirely of organics and are from 5 to 15 feet thick. The more decomposed thicker organics (mesic-fibrisols) occur inland.

Vegetation consists of coastal forest which inland grades into coastal muskeg. The forests on the Ridley Island site range from non-merchantable timber to non-productive timber. The Ridley Island site shows some wintering habitat for ungulates as well as some moderately valued area for diving ducks. The narrow inter-tidal marsh around the island is extensively utilized by waterfowl, but as this is quite narrow, the area utilized is rather small. Ridley Island has a significant deer population which flourishes in the absence of wolves.

Two archaeological sites would have to be salvaged before any construction could commence, as they are directly under the proposed development and its access. The access to Ridley Island is directly from the existing CN line on Kaien Island and is not expected to be extensive. However, it is worthy of note that the road access from Zanardi Rapids traverses half the available deer winter range on Kaien Island. Kaien Island is a wildlife reserve, and the other half of the available deer winter range on the island would be eliminated by the proposed Heilbroner Estates development for industrial purposes.

Impact of the Proposal; The direct impact of this site is relatively minor, except for the interruption of deer winter range on Kaien Island by the access road. Some loss of intertidal marsh would occur, and there would be a loss in potential salmon rearing and herring spawning area. This latter loss may become significant if salmon enhancement programs on the Skeena River proceed and all of the estuarial rearing area must be utilized by the increased populations of fish. The ungulate population on Ridley Island would probably be decimated by wolves and humans once access from the mainland is improved. In common with all of the southern port sites, access to the water for recreational boating would probably be improved by provision of boat launching ramps at or near the site.

4.5

Digby Island

Existing Local Environment; This site is located at the southeast corner of Digby Island, and exhibits slopes ranging between 0% and 30%. In particular, the shoreline relief reaches 30%. The microtopography shows ridge and swales which can reach amplitudes of more than 75 feet. Bedrock consists of micaceous schist which in turn is topped by colluvium not exceeding 5 feet in thickness. The soils of the Digby Island site are mainly undecomposed organics (lithic-fibrisols) less than 5 feet thick.

Vegetation consists entirely of coastal forest with one small pocket of coastal muskeg. The forest types encountered are non-merchantable timber. The site is adjacent to a log boom storage area, and there are numerous archaeological sites on or around the port facility. The port site itself is now occupied by an indian reserve and two archaeological sites.

In addition, there is a significant intertidal foreshore, which is utilized by waterfowl and spawning herring as well as shellfish. The upland area contains deer winter range.

Impact of the Proposal; If carefully designed, this site development need not cause disruption of the archaeological sites. However, encroachment on the Indian reserve is unavoidable. Furthermore, the adverse affects on the inter-tidal foreshore, although small, may be locally significant. The loss of a small percentage of the available deer winter range should not be important. The most significant disadvantage of this site from the environment point of view is a relatively high probability of collision or other congestion related problems in the main entrance to Prince Rupert Harbour. It should be noted that the high tide differential in the area causes rather fast currents in this harbour entrance.

4.6

Melville Arm And Bacon Cove

Existing Local Environment; The topography of all the north shore harbour sites is variable, ranging from moderate to flat. Again, the coastline shows steeper portions which rise to a flat upland. The microtopography is steep and does not show the characteristic ridge and swale, but rather is hummocky. The geology consists of foliated diorite and quartz diorite which is embedded in micaceous schist. The granodiorite is massive and jointed which explains the hummocky surface. The bedrock is topped by colluvium less than 5 feet thick which grades into stream deposits of McNichol Creek at Melville Arm. This unconsolidated material is topped in turn by podzols, thin undecomposed organic soils (lithic-firbrisols), and the regosols of the stream valley. The vegetation of the north shore site ranges from tidal marshes in Melville Arm to coastal forest along the rocky coastline, and "coastal muskeg" in the upper portions of the uplands. McNichol Creek is bordered by Sitka Spruce Forest and other riparian vegetation. The timber types range from non-merchantable to productive merchantable.

The Melville Arm and Bacon Cove sites contain at least three major archaeological sites, a Provincial Park, and existing log boom leases. The Melville Arm area is also a clam and crab fishery area and all of the shoreline is utilized by herring for spawning to some degree. McNichol Creek, which flows into Melville Arm, has a small but important salmon population.

The intertidal zone of the area is frequented by waterfowl, and the upland area constitutes deer winter range.

Impact of the Proposal; While some impact is expected with regard to archaeological sites and the salmon population, these can probably be avoided through careful design. Of significant consideration is the available backup land (about 1,500 acres) which would permit industrial expansion in the area at the expense of some deer winter range.

Locating related industrial facilities here would be better than many other areas from an environmental point of view as prevailing winds would blow air pollution away from the community of Prince Rupert. On the other hand, such industrial facilities would be highly visible from Prince Rupert, and noise transmission from the site itself and from rail access would be quite important.

Unfortunately, water pollution problems may be serious with respect to surface currents from Melville Arm and Bacon Cove toward the sensitive Venn Passage area. Furthermore, the navigational problems involved in bringing large vessels into this area cause concern with respect to oil spills and collisions.

4.7

Schreiber Point

While there are virtually no local environmental concerns at Schreiber Point, navigation to this point is more restricted than to Melville Arm and Bacon Cove. Accordingly, concern over navigation and collision aspects would be somewhat greater.

4.8

Pethick Point and Osborn Cove

Existing Local Environment; These sites are located at the northeast extension of Prince Rupert Harbour. Both sites have certain similarities which warrant collective discussion. The topography of both sites is variable, ranging from steep to moderate flat. The Shawatlan/Pethick Point area shows a relatively steep coastline, including a vertical bluff, and rises to a flat upland. In contrast the Osborn Cove area shows a flat bowl surrounded by relatively steep hills. The microtopography of Pethick Point is moderate with ridge and swale characteristics reaching amplitudes of up to 35 feet. In contrast, the Osborn Cove bowl has little micro relief. The bedrock at both sites is micaceous schist overlain by colluvium not exceeding 5 feet in thickness. This, in turn, is topped by podzols and undecomposed organic soils (lithic-fibrisols). The small tidal marsh area of Osborn Cove contains gleysols. Both sites grade inland into small pockets of decomposed organics (mesic-fibrisols).

Vegetation ranges from the traditional coastal forest to Sitka Spruce forest on the steeper shore lines, to coastal muskeg on the uplands. A special note should be made of the high salinity marshes in Osborn Cove. The timber varies from productive merchantable on the better drained sites along the coast to non-productive muskeg inland. The coast forest fringes along the tide water show relatively important winter range for ungulates. This is complemented by significant habitat for waterfowl at the Pethick Point and Osborn Cove areas. The Osborn Cove area has log boom storage. Archaeological sites are present both at

Pethick Point and Osborn Cove, with a large number in the Fern Passage area (which would be traversed by the rail and road connections to the port site).

Impact of the Proposal; A port development at either of these sites would involve transportation through and development of part of the Shawatlan watershed. In addition, some disruption of archaeological sites, waterfowl areas, and deer winter range in the Fern Passage area is unavoidable. Log boom leases along the shore of Prince Rupert Harbour would be disrupted. However, none of these aspects is particularly serious. The major adverse affect of these two sites is the severe restriction on navigation (probably limiting the maximum ship size to 50,000 DWT), which raises serious questions about pollution potential as well as economic viability of the project.

4.9

Rail Access to Sites in Prince Rupert Harbour

All the sites located around Prince Rupert Harbour require construction of rail access from Kaien Island, across Fern Passage, and around the perimeter of the harbour. Sites at the western end of the north shore and on Digby Island would involve a railway which incircles nearly the entire harbour while the Osborn Cove and Pethick Point Sites require less track. In all cases, some impact would be felt on waterfowl and deer winter range near Fern Passage, while the severe engineering restrictions on railway construction near Pethick Point would likely necessitate destruction or damage to some archaeological sites in the area.

CHAPTER 5
COMPARISON OF OPTIONS

The environment factors of fish impact, wildlife impact, pollution potential, and sociological disruption were compared to the engineering factors of land transportation, ocean transportation, and site development as developed by the engineering consultant. The resultant comparison is shown below, based on initial overview information only:

Comparison of Factors

Table 1

Site	Land Trans.	Ocean Trans.	Site Dev.	Wildlife Impact	Fish Impact	Pollution Potential	Sociological Disruption
Port Simpson	Poor	Good	Good	Low	Moderate	Moderate	High
Smith Island	Poor	Poor	Poor	Moderate	Low	Moderate	nil
Kitson Island	Good	Good	Good	Low	High	High	nil
Ridley Island	Good	Good	Good	Moderate	Low	Moderate	nil
Digby Island	Poor	N/A	Good	Moderate	Moderate	High	nil
Melville Arm	Poor	N/A	Good	Moderate	Moderate	High	nil
Bacon Cove	Poor	N/A	Good	Moderate	Moderate	High	nil
Schreiber Pt.	Poor	N/A	Good	Low	Low	High	nil
Pethick Pt.	Poor	N/A	Poor	Moderate	Moderate	High	nil
Osborn Cove	Poor	N/A	Poor	Moderate	Moderate	High	nil

In order to prepare a very simple ranking, the environmental factors were given the following scoring:

Nil Impact	= 0
Low Impact	= -1
Moderate Impact	= -2
High Impact	= -4

Considering this, the environmental ranking and engineering rating of the sites is as shown on Table 2. Sites which are likely to be environmentally unacceptable because of a "high" rating in one of the above categories are noted with an asterisk.

Ranking and Rating of SitesTable 2

Environmental Rank	Site	Environmental Score	Engineering Rating
1	Smith Island	-5	Not acceptable
2	Ridley Island	-6	Acceptable
3	*Schreiber Pt..	-6	Not Acceptable
	*Melville Arm	-8	Not Acceptable
	*Bacon Cove	-8	Not Acceptable
	*Pethick Point	-8	Not Acceptable
4	*Osborn Cove	-8	Not Acceptable
	*Digby Island	-8	Not Acceptable
	*Kitson Island	-9	Acceptable
	*Port Simpson	-9	Acceptable

* Probably not environmentally acceptable.

After rejecting those sites which are physically incapable of meeting the terms of reference, the engineering consultant recommended further study be directed towards Ridley Island, Kitson Island, and Port Simpson. On the basis of the NEAT overview work and the work of previous researchers, Kitson Island appeared certain to be environmentally unacceptable, while the Port Simpson alternative seemed to be unacceptable on community development and sociological grounds as well as on a development cost basis.

In short, at this point, the study seemed to conclude exactly what previous overview assessments had concluded, that the only site which was acceptable to all concerned was Ridley Island.

However, in order not to foreclose any possible options, the committee in late October, 1974 directed NEAT to carry out a more detailed environmental analysis of Port Simpson, Ridley and Kitson. This assessment and the subsequent removal of constraints is included in Part 3.

CHAPTER 6

SUMMARY OF THE PHASE 1 ENGINEERING REPORT

AND ADDENDA RELATED TO SITES STUDIED INTENSIVELY

Site Analysis

The preliminary engineering work established that three potential sites were capable of supporting a bulk terminal facility within the terms of reference. These three sites (Fort Simpson, Ridley Island, Kitson Island) were analyzed in more detail in order to better compare their characteristics. Each site was analyzed and compared on the basis of four major factors:

1. land transportation
2. ocean navigation
3. site development

PART 3

ASSESSMENT OF CAPABLE SITES

A further refinement was introduced in which the terminal is split so that coal is handled at one location and the non-coal products at another. This requires consideration of two additional alternatives. Both involve the handling of non-coal products through Service Point while the coal is handled at either Ridley Island or Kitson Island. Details of the comparison factors and the actual comparison are included in Volume 6 of this report.

Site Details

The capital costs for each site were estimated on an order of magnitude basis. In addition, in those areas where the annual operation and maintenance costs are expected to differ between sites, the differential annual costs were calculated. However, the full annual costs were not detailed.

Fort Simpson

Land Transportation: The land transportation problems at Fort Simpson are the most serious engineering drawback to this site. The best railway route is along the Lockwood River valley and the inland shore of Work Channel up to Fort Simpson. This involves 25 miles of railway construction along a difficult route, involving a 14% grade.

CHAPTER 6

SUMMARY OF THE PHASE 1 ENGINEERING REPORT

AND ADDENDA RELATED TO SITES STUDIED INTENSIVELY

6.0

Site Analysis

The preliminary engineering work established that three potential sites were capable of supporting a bulk terminal facility within the terms of reference. These three sites (Port Simpson, Ridley Island, Kitson Island) were analyzed in more detail in order to better compare their characteristics. Each site was analyzed and compared on the basis of four major factors:

1. land transportation
2. ocean transportation
3. site development
4. materials handling

A further refinement was introduced in which the terminal is split so that coal is handled at one location and the non-coal products at another. This requires consideration of two additional alternatives. Both involve the handling of non-coal products through Fairview Point while the coal is handled at either Ridley Island or Kitson Island. Details of the comparison factors and the actual comparison are included in Volume 6 of this report.

6.1

Site Details

The capital costs for each site were estimated on an order of magnitude basis. In addition, in those areas where the annual operation and maintenance costs are expected to differ between sites, the differential annual costs were calculated. However, the full annual costs were not detailed.

6.1.1

Port Simpson

Land Transportation: The land transportation problems of Port Simpson are the most serious engineering drawback to this site. The best railway route is along the Lachmach River valley and the west shore of Work Channel up to Port Simpson. This involves 35 miles of railway construction along a difficult route, involving a 1½% grade.

High operating costs would be incurred by the extra power required to move traffic over this grade, and by the need to transport crews to and from Prince Rupert for each run. However, later study has indicated a maximum grade of 0.8% may be possible at increased capital cost, and would result in decreased operating cost. These grades and costs must be considered as very approximate until detailed assessment is carried out on the ground.

Road access to the site would involve construction of 19 miles of road from the north shore of Prince Rupert Harbour along Tuck Inlet past Georgetown Lake and then the existing logging road overland to Port Simpson. This road connection would involve a ferry connection across Prince Rupert Harbour.

The railway is expected to cost \$30,000,000 initially and the road \$10,000,000. After completion of the phase 1 report, it was learned that the B.C. Department of Highways is currently engaged in final location surveys and design for construction of a road from Prince Rupert to Port Simpson. Accordingly, the cost of the road as detailed in the phase 1 report is not entirely applicable to the cost of port development. For comparison purposes, site access road costs for Ridley Island were used to replace the Port Simpson road costs in the cost data shown below.

Ocean Transportation: Port Simpson offers the best sheltered harbour among the five options considered. Although minor modifications of shoal areas would be required, no major maintenance or initial capital expenses are envisioned. A berth availability factor of 95% is expected. Problems may be anticipated with regard to tugs, as some of the tugs may have to be located in Prince Rupert. Wave activity is estimated to total 2700 hours per year, almost all less than two feet high.

Site Development: Development of the port site is expected to be roughly equal in cost to all the other sites. Available backup land totals about 3,000 acres and 6 additional berths could be made available for deep sea vessels. Both could be developed at moderate cost. The land is believed to be crown land.

Materials Handling: The only problem envisioned at Port Simpson with regard to materials handling and operation of the port would be related to the transportation of operating personnel to and from the site from Prince Rupert or, alternatively the construction of a town site adjacent to the site.

Costs: The differential cost items are summarized along with the capital costs in Table 3.

Table 3

Preliminary Cost Estimate of a Bulk Terminal Facility at Port SimpsonCapital Costs (in millions of 1974 dollars)

Railway Construction	30
Road Construction	2
Site Development	32
Materials Handling	<u>30</u>
Total Capital Cost	94

Operating Costs (in millions of 1974 dollars)(a) Capital Expenditures:

Locomotives	10.8	amortized @8% over 15 years = 1.2 per year
Tugs	<u>5.1</u>	amortized @10% over 15 years = <u>0.6</u>
Total Capital Expenditures	15.9	1.8 per year

(b) Operation and Maintenance

Railway	2.5 per year
Roads	0.1 per year
Tug Operations	2.0 per year
Demurrage	0.5 per year
Site Maintenance	0.3 per year
Materials Handling Labour	<u>*0.6 per year</u>
Total Operational and Maintenance	6.0 per year

Operation and Maintenance costs are estimated to increase at a rate of 2% per year in constant, non-inflationary dollars.

* Based on the existing Prince Rupert longshoreman's contract which requires payment for transportation time from Prince Rupert to the job location.

6.1.2

Ridley Island

Land Transportation: Land transportation access into a site at Ridley Island is quite straight forward. Only about 2 miles of track would be required from the existing CNR main line in the vicinity of Zanardi Rapids.

Ocean Transportation: The major problem in the ocean transportation sector for vessels berthing and unberthing is the close proximity of the shoreline, particularly in view of the 5,300 annual hours of wave activity and the 2 to 3 knot tidal currents in the area. This problem affects future operations in that the tug boats assisting in the berthing and turning operations will have to have more horsepower than would normally be required. Another but lesser factor is that the facilities are located in the entrance to Prince Rupert Harbour. While the volumes of traffic arriving and departing from this harbour are low, such a potential hindrance at the entrance could prove to be a modest shortcoming in future development. Berth availability is estimated to be about 95%.

Site Development: Site development at Ridley Island is expected to present few difficulties, although it involves drilling and blasting solid rock for site leveling and fill as well as removal and disposal of organic overburden. The Ridley Island site has fair expansion capabilities with room for two additional deep sea berths and some 800 acres of land at moderate cost. Two hundred acres more are available on Kaien Island to the north of Ridley Island at moderate cost, while a further 200 to 250 acres could be acquired by filling the bays and shallow waters surrounding Ridley Island at relatively high cost.

Materials Handling: The materials handling aspects of this site involve no major problems, except for a rather long conveyor system from the storage area to the berths.

Costs: The major cost comparison factors, both capital and differential operating costs, are summarized for the Ridley Island site in Table 4.

Table 4

Preliminary Cost Estimate of a Bulk Loading Terminal Facility
at Ridley Island

Capital Costs (in millions of 1974 dollars)

Railway	1
Road Construction	2
Site Development	28
Materials Handling	<u>30</u>

Total Capital Cost 61

Operating Costs (in millions of 1974 dollars)(a) Capital Expenditures

Tugs 3.8 amortized over 15 years @10% = 0.4 per year

(b) Operation and Maintenance

Railway	0.4 Per Year
Roads	0.1 Per Year
Tug Operations	1.5 Per Year
Demurrage	0.5 Per Year
Site Maintenance	0.3 Per Year
Materials Handling Labour	<u>*0.3 Per Year</u>

Total Operation and Maintenance 31 per year

Operation and Maintenance costs are estimated to increase at a rate of 2% per year in constant dollar terms.

* Based on the existing Prince Rupert Longshoreman's contract, which requires payment for transportation time from Prince Rupert to the job location.

6.1.3

Kitson Island

Land Transportation: Transportation access to the site is gained by constructing a causeway from the vicinity of the CNR mainline behind Lelu Island across tidal flats to Kitson Island. Some difficulties are expected with train operations, as the unit train would be terminating at a location remote from established train operations along the Prince Rupert waterfront.

Ocean Transportation: In general, the navigational aspects of this site are reasonably good. There are 5,300 annual hours of wave action, with a greater percentage of waves over 2 feet than at the other sites. It is expected however that the berth availability at this site would be similar to the others (about 95%).

Site Development: Site development at this location would involve a combination of cut and fill as well as dredging. It is proposed that Kitson Island itself be leveled by drilling and blasting solid rock to contribute a significant portion of the fill requirements. The solid rock obtained from this operation would be used to construct a dike around the perimeter of the site to contain the dredged material as well as to construct a portion of the transportation access causeway. The dredged fill material will come from Flora Bank. Construction of the main structures is expected to be easier here than at the other sites. However, the maintenance for this site is expected to be higher than at any other site because of increased wave action and site settlement problems as well as maintenance dredging requirements. The site may be expanded to 6 more deep sea berths and approximately 2,000 acres of land which can be developed at a high cost. However, the end use of the developed land may be restricted because of poor foundation conditions on the dredged fill.

Materials Handling: Construction of the materials handling facilities should present no problems at this site. However, greater operating costs are anticipated because of the need for crew transport from Prince Rupert and the need to move the products a greater distance from the warehouse to the wharf face than at any of the other sites.

Costs: The differential operating costs and the capital costs for this site are summarized in Table 5.

Table 5

Preliminary Cost Estimate of a Bulk Terminal Facility
at Kitson Island

Capital Costs (in millions of 1974 dollars)

Railway	3
Road Construction	3
Site Development	25
Materials Handling	<u>30</u>

Total Capital Cost 61

Operating Costs (in millions of 1974 dollars)

(a) Capital Expenditures

Tugs 3.8 amortized @10% over 15 years = 0.4 per year

(b) Operation and Maintenance

Railway and Road	0.4 per year
Tug Operations	1.5 per year
Demurrage	0.5 per year
Site Maintenance	0.4 per year
Materials Handling Labour	*0.5 per year
Total Operation and Maintenance	<u>3.3 per year</u>

Operation and Maintenance costs are estimated to increase at a rate of 2% per year in constant dollars.

* Based on the existing Prince Rupert longshoreman's contract, which requires payment for transportation time from Prince Rupert to the job location.

6.1.4

Fairyview Point

This section considers only the Fairyview Point development for copper concentrate, asbestos and unitized cargo. Coal would be handled at either Ridley Island or Kitson Island.

Land Transportation: Road and rail developments for the Fairyview Point section would be in conjunction with existing facilities and would not incur significant capital or operating differential costs.

Ocean Transportation: An advantage to the Fairyview scheme is the avoidance of moving ships to pick up loads at two points, as vessels handling partial loads of non-coal products would probably also call at Fairyview Point. This advantage would likely be offset by the increased congestion created at Fairyview Point, on the harbour entrance channel, by more vessel calls.

Site Development: 30 acres of development would be required at Fairyview Point, constructed adjacent to the National Harbours Board Development now being constructed at the site.

Materials Handling: The materials handling aspects of this alternative are improved in terms of operating costs when compared to the Ridley or Kitson options.

Summary: The summary of capital and differential operating costs for the split size alternatives are shown in Tables 6 and 7.

Table 6

Preliminary Cost Estimate of a Bulk Terminal Facility
at Fairview Point/Ridley Island

Capital Costs (in millions of 1974 dollars)

Railway	1
Road Construction	2
Site Development	19
Materials Handling	<u>30</u>

Total Capital Costs 52

Operating Costs (in millions of 1974 dollars)(a) Capital Expenditures:

Tugs 3.8 amortized @10% over 15 years = 0.4 per year

(b) Operation and Maintenance:

Railway	0.3 per year
Roads	0.1 per year
Tug Operations	1.4 per year
Demurrage	0.4 per year
Site Maintenance	0.2 per year
Materials Handling Labour	<u>*0.1 per year</u>

Total Operation and Maintenance 2.5

Operation and Maintenance costs are estimated to increase at a rate of 2% per year in constant dollars.

* Based on the existing Prince Rupert Longshormen's contract, which requires payment for transportation time from Prince Rupert to the job location.

Table 7

Preliminary Cost Estimate of a Bulk Terminal Facility
at Fairview Point/Kitson Island

Capital Costs (in millions of 1974 dollars)

Railway Construction	3
Road Construction	3
Site Development	18
Materials Handling	<u>30</u>
Total Capital Costs	54

Operating Costs (in millions of 1974 dollars)(a) Capital Expenditures:

Tugs 3.8 amortized @10% over 15 years = 0.4 per year

(b) Operation and Maintenance:

Railway and Roads	0.2
Tug Operation	1.4
Demurrage	0.4
Site Maintenance	0.2
Materials Handling Labour	<u>*0.1</u>
Total Operation and Maintenance	2.3

Operation and Maintenance costs are estimated to increase at a rate of 2% per year in constant dollars.

* Based on the existing Prince Rupert longshoremen's contract, which requires payment for transportation time from Prince Rupert to the job location.

6.2

Comparison of Sites

The engineering consultant concluded that, on the basis of the estimated costs, "the optimum sites should be the split site alternatives with non-coal products at Fairview Point (or a similar inner harbour site) and coal at either Ridley or Kitson Island. The next sites in the ranking are the combined terminals at either Ridley or Kitson Islands. The least attractive site is the Port Simpson site, mainly because of the large land transportation costs the site bears." (1)

As a part of the Phase 1 study, the Canadian National Railway was asked to comment on the possible sites listed in Part 2 and to rank the sites analyzed in this chapter. The Pacific Pilotage Authority was also contacted with regard to their preferences in sites. In addition, the engineering consultant considered expansion capabilities. These three "non-cost factors" were ranked by the engineering consultant as shown in Table 8.

Table 8 NON-COST RANKING FACTORS

	<u>CNR</u>	<u>Pilotage</u>	<u>Expansion</u>
Port Simpson	5	1	1
Ridley Island	3	2	2
Kitson Island	4	3	3
Fairview Point/ Ridley Island	1	4	3
Fairview Point/ Kitson Island	2	4	3

This matrix illustrates that Port Simpson or Ridley Island would be preferable. However the CNR indicated that a 1½% gradient on the rail approach to Port Simpson exceeds their standards for mainline railways. Accordingly, the engineering consultant assumed that Ridley Island ranked number one.

Combining these cost and non cost factors from an engineering point of view only, the following summary was prepared by the engineering consultant. (Table 9):

(1) See Volume 6 for Phase 1 report

Table 9

COMBINED FACTORS RANKING

	<u>Cost</u>	<u>Non-Cost</u>
Port Simpson	5	2
Ridley Island	3	1
Kitson Island	4	4
Fairview Point/ Ridley Island	1	3
Fairview Point/ Kitson Island	2	5

These tables were presented to illustrate some of the rationale behind the conclusion of the engineering consultant that the preferred sites from an engineering point of view are a combined site at Ridley Island or a split site with coal at Ridley Island and non-coal products at Fairview Point. It was pointed out that, "if further differentiation between these two possibilities is required, a more detailed analysis must be done." (1)

(1) See Volume 6 for the Phase 1 report

CHAPTER 7

Environmental Examination of Top-Ranked Options

7.0 This chapter examines the five options selected for further detailed study (Port Simpson, Ridley Island, Kitson Island, Ridley/Fairview, and Kitson/Fairview) from what is essentially an environmental point of view. Notice is taken, however, of engineering and cost factors, and all considerations taken into account the local community attitudes.

7.1 Further Environmental Considerations

7.1.1 Environmentally Sensitive Areas

For an appreciation of the environmental aspects of the major development areas, reference should be made to the environmental sensitivity map contained at the back of this volume. This map was developed as a composite of many natural and cultural characteristics which are sensitive to the types of development discussed in this report. Of the five shades of red used, only human communities, major industrial facilities, or archaeological sites rate the darkest shade (most sensitive) by themselves.

Areas known to be extremely valuable to major fish or wildlife species important to man were given the next darkest shade if the habitat involved was the controlling factor in their population size (for example, deer winter range on Kaien Island, where such range probably controls the population). Similar areas where other factors control the species in question were assigned one shade lighter (for example, deer winter range in the northern half of the Peninsula, where wolves probably control the population).

The two lightest shades were assigned to sensitive soils or vegetation, political divisions such as indian or recreational reserves, those areas which are only suspected as being ecologically valuable, and general recreational areas which exist as a result of other environmental factors (eg. hunting, fishing, boating).

Where valuable areas overlap the shading was darkened. An exception to this occurred in areas where, for example, sensitive soil supports sensitive vegetation which provides valuable waterfowl habitat, or where an indian reserve has been established because of the enclosed wildlife values. In cases such as these, the shading was left equal to the shading for the major factor involved in

order to avoid double counting. For detailed evaluation of the existing environment, reference should be made to the appendices (Volumes 2 to 5) or the NEAT archives.

As may be seen from the map, the most sensitive areas occur around the fringe of Kaien Island, on Flora Bank, the east shore of Digby Island, and the shore of the Tsimpsean Peninsula from Melville Arm through Venn Passage up to Port Simpson. It is also speculated that the Chatham Sound area constituting the Mixing Zone is valuable for fish rearing.

The three options which involve ships larger than 50,000 dwt (Port Simpson, Ridley, Kitson) are also plotted on the map with their land and sea access. Of significance is the fact that ships over 50,000 DWT must use Port Simpson for anchorage for any length of time. This means that, for port development at Ridley Island or Kitson Island, twenty to thirty large vessels will be plying along the west coast of the Tsimpsean Peninsula each year, and Port Simpson will have large ships anchored in it for from 60 to 120 vessel days per year no matter which option is taken. The entrance shoals and associated kelp beds in Port Simpson will not have to be blasted out in the anchorage is to be used only by ships in ballast.

However, as an "example of the possible variance in these figures is the extent of delay incurred at a terminal because of a strike in another country. It was found that 70% of the vessels using the facility were anchored an average of $7\frac{1}{2}$ days each. The remote strike created a temporary surplus of shipping in that particular industry which resulted in vessels using the terminal area for anchorage."¹

If such an event occurred for the Prince Rupert facility seventy large ships would be anchored in Port Simpson at various times in one year, totaling 525 vessel-days in anchorage.

Ships smaller than 50,000 DWT will be able to anchor in Prince Rupert Harbour.

7.1.2 Ship Discharges and Collision

The proposed ship traffic to the new port facilities will increase the traffic of deep sea vessels in the Prince Rupert area by about 50%. Relating this increased traffic to the characteristics of the Port of Vancouver area, it is estimated that an average of less than one additional spill of oil or other related wastes per year will occur of a size likely to cause some environmental damage (assumed to be about 20 barrels of oil).

¹ Addendum to the phase I report by Swan Wooster, Volume 6

Further projecting the Vancouver and Strait of Georgia data to the Chatham Sound - Prince Rupert area, and comparing them to the current record of the port of Prince Rupert, it is estimated that the new facilities will result in an additional collision or grounding about once in twenty-five to thirty-five years.

Both of these estimates are approximate and based on very limited data (the details of the assessment are included in Appendix D, Volume 5). They are presented simply to indicate the obvious: that there will be a few small discharges from ships and shore facilities as a result of the port activity and, given sufficient time, there will certainly be a large spill-related emergency. These risks are quite small, but in view of the possible impacts, they cannot be neglected.

7.1.3 Movement of Surface Pollutants and the Resultant Impact

In order to investigate the relative impact of such pollution, a simple vector analysis was carried out and is presented in Part 3 of Appendix D (Volume 5). This analysis considered wind, wave, tide, and current interactions at various times of the year and rated the potential of each major port location option for pollution impact on each of the following ecologically valuable areas:

- (1) The Inner Estuary
- (2) Digby Island and Venn Passage
- (3) Lucy and Rachael Islands
- (4) Big Bay - Pearl Harbour
- (5) Port Simpson

Each area was assigned a weight according to its ecological value during each season, and a slight adjustment was made to allow for the relative probabilities of spills or collisions at or near the sites. The following pollution impact scores resulted from the analysis (higher numbers mean greater impact):

Port Simpson	6
Ridley Island	34
Kitson Island	47

No great importance should be placed on the actual numerical values noted, but notice should be taken of the conclusion that Ridley Island poses a significantly greater overall environmental threat due to pollution than Port Simpson, and that Kitson Island is somewhat worse than Ridley. In none of these cases could this "threat" be considered an imminent danger, but simply a very small (but definite) annual environmental risk.

It should be pointed out that waterfowl experience by far the greatest impact from oil spills, while fish are affected very little. On the other hand, fish are the only animals which produce a commercial return in the study area, so even a major spill would not really show up in an important way in the local economic picture. While an economic assessment is presented below, these facts should be kept in mind.

Furthermore, while waterfowl do not appear as an economic factor, Canada has signed international agreements to preserve migratory birds and their habitat. These agreements are reflected in the Migratory Birds Convention Act, which in effect gives the Federal Minister of the Environment veto power over any development which could adversely affect migratory birds.

An interesting case study of the importance placed on waterfowl by people in other areas can be found in San Francisco. There, San Francisco Bay was steadily being filled for industrial development, but pressure from citizen's action groups forced the establishment of the Bay Conservation and Development Commission in 1969. The BCDC has regulatory authority over all filling and dredging, jurisdiction over a 100 foot wide shoreline strip around the Bay, and regulation authority on wetlands that are wildlife habitat. Several "cease-and-desist" orders have been issued by the BCDC in order to preserve the largest remaining marsh in the Bay area that is part of the Pacific Flyway (for migratory birds). All of this has occurred in a major urban and industrial area, where the value of developable land is very high, while the value of the waterfowl does not appear in the economic system.

7.1.4 Economic Value of the Fishing Industry

It is very difficult to project the future economic value of the natural resources of this area based on present economic worth. The value per pound of salmon catches in the last few years has risen extraordinarily quickly and a significant herring fishery has just begun. Furthermore, there are other values associated with these resources, related to their food value in a world which is now becoming short of food, or their intrinsic value for just knowing they are there. None of these factors is taken into account in our economic analysis, because they cannot as yet be expressed in "hard" dollars. In this study we will attempt to put dollar figures only on those values which represent a hard cash flow within the community. We recognize this as a conservative viewpoint in an environmental study.

The value of the commercial fishing industry to¹ the Prince Rupert area is felt to be represented by the direct income accruing to local residents from employment in fishing or fish processing activity plus the indirect income which results from the expenditure of fishing income associated with the fishing industry as follows:

direct income of fishermen and processing plant employees	\$19,465,000 ²
indirect income of residents employed in the service functions	<u>\$19,465,000²</u>
Total	\$38,938,000

The value of the sport fishing to the Skeena region was estimated at just under \$2,000,000 annually, but will not be utilized for economic calculations here. The economic value of the Indian food catch in the Skeena basin and adjacent tidal waters is estimated to be \$616,000, and may be considered in addition to commercial fishing.

Within the range of estimating accuracy, we may therefore assume that the hard cash flow within the communities of the study area as related to the fishing industry is approximately \$40,000,000 per year. While it is not normal practice to consider the gross value of this industry, this gross value is equivalent to the capital cost and differential operating costs of the various port facilities as calculated by the engineering consultant. (The net value of the fishery would be compared to the profitability of the port, which is not available). It is also a figure which can later be compared to the sales volume through the port or the incomes generated in the community by development.

There is further rationale for using the gross income as the actual value of the fishing industry. First, to use net value, one must assume those people who would lose their fishing income would be able to find alternative employment. The fact that the unemployment rate in the study area averaged about 9% in 1974 and rose to over 12% in Prince Rupert (30% in Port Simpson) at the close of the fishing season indicates this is not necessarily the case. When allowance is made for the number of students and housewives who seek employment only during the fishing and processing season and therefore do not show up on the subsequent employment roles, more emphasis is added.

¹The economic assessment of the fishing industry is included in Appendix B, Chapter 6, (Volume 3).

²Assuming one dollar of secondary income to produced by each dollar of basic income. Sinclair (1971) found that each dollar of basic income produces one dollar in secondary income in Prince Rupert.

We found that 45% of women and 32% of men in the local labour force were not permanent employees (ie: they were employed less than 40 weeks during 1970). In addition, 30% of the people not listed as being in the local labour force did work for some period during 1970. Thus, part-time or seasonal employment plays a major role in the Prince Rupert employment picture. It is further interesting to note that, while we estimate over 1,400 people in the study area are employed as fishermen, supplying about 600 man-years per year, only 285 people in the 1971 census reported earning their major income from fishing.¹ It would appear that the seasonal nature of fishing provides employment for either a number of people who wish to work only seasonally and/or people who can earn a separate wage for most of the year, but work as fishermen during the season (possibly for the high financial return produced during a short period, although the return as an annual salary is relatively low).

The value of the fishing industry to the study area at the moment cannot be overstated. Sinclair (1971) in a study of B.C. fishing communities found that, of the five "villages" studied, only Port Simpson derived 100% of its basic employment from fishing, and of the three "towns" studied, Prince Rupert was by far the most dependent on fishing for its basic employment (57% of all basic employment in the community, vs. 15% for Port Hardy and 2% for Port Alberni). When communities are this dependent upon one industry, alternative employment in case of a decline in that industry becomes questionable indeed.

The Skeena River contributes the bulk of the catch for the fishermen of the study area. However, it does not constitute the entire catch. On the other hand, fishermen in other parts of British Columbia and in other nations catch part of the Skeena River population. Within the limits of this study, it is impossible to sub-divide the Skeena population in order to estimate the Prince Rupert and Port Simpson portions. Accordingly, it will be assumed that the full impact of a drop in the Skeena River fish production will pass directly to the communities of the study area. This is incorrect, and overstates the local impact of the loss, but it does include, therefore, an estimation of the loss in fish revenue for residents in other parts of British Columbia.

7.1.5 Noise

An overview assessment of the relative noise impact of the various options and their access was carried out and is included in Part 2 of Appendix D (Volume 5). In brief, it was

¹See Appendix B, Chapter 1, (Volume 3)

We found that 45% of women and 32% of men in the local labour force were not permanent employees (ie: they were employed less than 40 weeks during 1970). In addition, 30% of the people not listed as being in the local labour force did work for some period during 1970. Thus, part-time or seasonal employment plays a major role in the Prince Rupert employment picture. It is further interesting to note that, while we estimate over 1,400 people in the study area are employed as fishermen, supplying about 600 man-years per year, only 285 people in the 1971 census reported earning their major income from fishing.¹ It would appear that the seasonal nature of fishing provides employment for either a number of people who wish to work only seasonally and/or people who can earn a separate wage for most of the year, but work as fishermen during the season (possibly for the high financial return produced during a short period, although the return as an annual salary is relatively low).

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¹See Appendix B, Chapter 1, (Volume 3)

found that those sites directly across open water from population centres would be the most bothersome. This would not be a significant problem except in areas where the distances are short or the current noise level is low. The ranking of all options for acoustical acceptability is as follows (the higher ranked options have lower impact):

1. Smith Island
2. Digby Island
3. Kitson Island
4. Ridley Island
5. Osborn Cove
6. Port Simpson
7. (equal) Melville Arm, Bacon Cove, Schrieber Point, Pethick Point.

For the top-ranked sites, the acoustical acceptability is as follows:

1. Kitson or Kitson/Fairview
2. Ridley or Ridley/Fairview
3. Port Simpson

7.1.6 Related Further Development

The construction of a general cargo dock facility can induce many types of secondary industries to locate nearby and take advantage of the improved transportation facilities. However, this is not the case with a high volume bulk-loading facility. The only industries which are likely to use bulk loading facilities and unit trains for the commodities under consideration in this report are a steel mill or a copper smelter.

Both these possibilities have been publicly proposed recently for the Prince Rupert area, and we have access to a preliminary engineering report on the feasibility of establishing such facilities at either Ridley Island or Port Simpson.¹ In addition, an overview report is available on the environmental impact of these facilities if located on Ridley Island.²

Combining this information with a few considerations of the environmental suitability of Port Simpson and Kitson Island for heavy industry, the following points are pertinent:

¹ CBA Engineering Ltd.; Report on the Comparison of Ridley Island and Port Simpson for Bulk-Loading and Industrial Uses, December 1974.

² B.R. Hinton & Associates Ltd.; An Environmental Overview of the Suitability of Ridley Island for Heavy Industry, February 1975.

- (i) For relatively small-scale developments (i.e. up to a small steel mill), Port Simpson suffers a major cost disadvantage as a result of rail access costs.
- (ii) For large scale development (a major heavy industrial complex), the higher costs of extra land development at Ridley Island renders the two areas approximately equal in development cost.
- (iii) The poor foundation conditions at Kitson Island (i.e. on Flora Bank) make site development difficult and expensive. Filling of Flora Bank for industrial development would result in a severe impact on fish and wildlife resources.
- (iv) Small-scale development at Port Simpson would establish a second local growth centre which would retard the desired development of Prince Rupert.
- (v) Major industrial development at Port Simpson may be sufficient to turn the entire Tsimpsean Peninsula into a large unified community, and thus not hamper the development of Prince Rupert. The resultant sociological effects and the community attitudes towards such major development are beyond the scope of our study data base.
- (vi) Local impacts on the natural environment would be approximately equal for further development at either Ridley Island or Port Simpson. Regional impacts related to water pollution would be of much greater concern at Ridley Island, resulting in stricter water pollution control standards than at Port Simpson.
- (vii) Prevailing winds would likely produce a serious air pollution problem in Prince Rupert if Ridley Island was to be developed, unless very strict air pollution controls were enforced. Air pollution is expected to be a much smaller problem at Port Simpson because of the prevailing winds and the location of the site relative to the community.
- (viii) Further development of Ridley Island by industries requiring ocean transportation would result in an increase in the number of ships travelling along

the west coast of the Tsimpsean Peninsula to and from the anchorage in Port Simpson. This would increase the environmental risk factor. (The CBA report indicates that development of heavy industry on Ridley Island will require double the number of ships required for the bulk loading facility alone.)

- (ix) Virtually all the reasonably level land available for development of a community between Port Simpson and Prince Rupert is on Indian reserves.

7.1.7 Physical Hazards

As detailed in Appendix B, rock and debris slides are common throughout the study area, and seem to be related to very heavy rainfall in the preceding 48 hours. In the last stages of writing this main report, a correlation was noticed for such slide areas.

Specifically, areas where lithic fibrisol soils (shallow, organic soil close to bedrock) exists on a slope of at least 30% seem to be the starting points for such slides. Figure 3 shows those parts of the study area which are below such areas of correlation, and has designated them possible danger areas. It is interesting to note that, while these danger areas cover just 20% of the map, eight of the ten rock and debris slides known to NEAT have occurred in such zones.

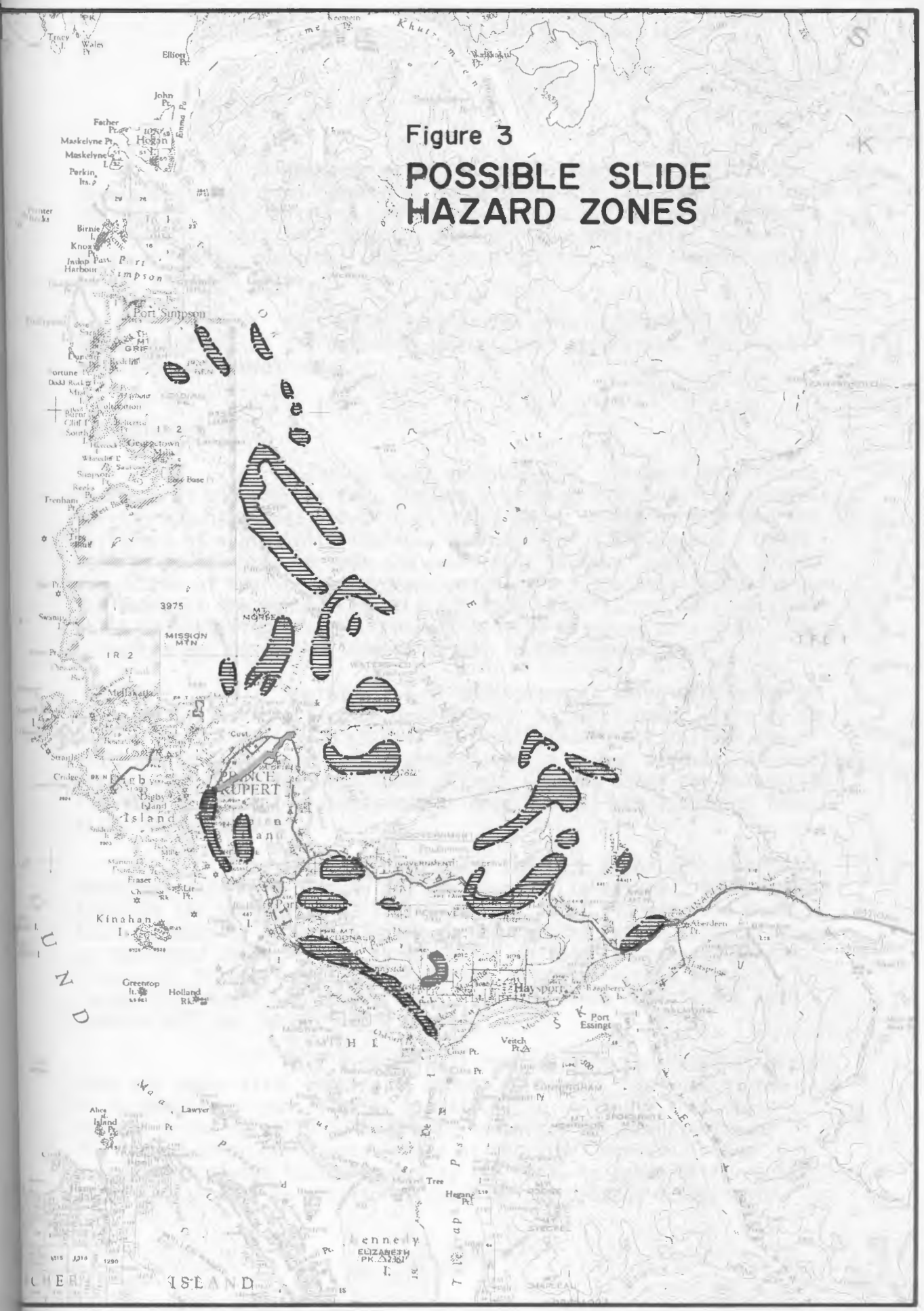
This must be considered just speculation at the moment but it should be noted that the proposed rail line to Port Simpson passes through very few of those danger areas, in spite of the steep side slope involved.

Accordingly, we would suggest the proposed rail line may not be subject to more slides than the existing line to Prince Rupert, as had been previously assumed.

7.2 Environmental Impacts of the Port Development Options

The environmental highlights of each major port development option are examined below. These descriptions are followed by a series of summary tables, detailing the direct effects of location, construction and operation, then the impact of those direct effects on specific important sectors of the environment.

Figure 3
**POSSIBLE SLIDE
HAZARD ZONES**



Wherever possible, environmental constraints to development have been removed by redesigning the facility to mitigate the impact. Such measures are outlined below and in the addendum to the Phase 1 report in Volume 6. None of these mitigation measures is expect to increase the cost of the project by a measurable amount except as noted below.

Further mitigation measures undoubtedly will become apparent as the detailed design phase progresses, and exact locations are developed.

1.2.1 Port Simpson

Existing Local Environment: The most significant features of the present Port Simpson environment include the valuable herring spawning area around the entire shore of the harbour and the existence of a presently isolated community of 1,200 people. Other aspects in the area include the estuary of Stumaun Creek, the salmon population of that creek, archaeological sites sparsely located around the shore of the harbour and the entrance islands, and Neaxtoalk Lake, which is presently used for recreation and has good potential. These resources are described in more detail in the appendices.

Another area of environmental value which will be affected by the Port Simpson development is the Lachmach River at the head of Work Channel, which will be paralleled by the railway and which contains a small salmon population. A number of small archaeological sites exist along the west shore of Work Channel where the railway is intended to go, but reassessment by Swan Wooster has indicated these sites can be avoided.

Community Impacts: The most important impacts of development in Port Simpson are sociological in nature. One of these involves the implications of a relatively short highway from the Indian community in Port Simpson to the City of Prince Rupert. However, as mentioned above, a road is now being designed to connect Port Simpson to Prince Rupert. Accordingly, impacts related to this connection should not be applied to the port development, and such impacts will not be presented here.

Port Simpson will require more construction workers than any other site, peaking at about 300 people. Because of the lack of accommodation and relative isolation, it is likely that these workers would normally be housed in temporary construction camps. The introduction of a large number of "outside" workers into a presently isolated Indian community is likely to cause inter-racial friction, as well as a cultural shock to the present inhabitants.

There are now no urban-oriented recreational pursuits within the community of Port Simpson, but it is anticipated that a significant amount of money will be spent in the community for company and personal supplies. In addition, over the four year construction period, local service establishments will likely spring up. When construction ceases, the community is likely to experience an economic slump which will be deepened by comparison to the economic buoyancy experienced during construction (the "boom and bust" problem).

Several methods can be used to mitigate these impacts, most of which are oriented towards keeping the flow of "outside" people and money to a manageable minimum.

First, every effort should be made to hire local Port Simpson workers, even if they must first receive training in the specialized trades required. Such training should be conducted in trades which can be used in maintaining the port after construction as well as during construction.

Second, construction of the port should be phased with the highway construction so that ready access to Prince Rupert is provided for construction workers. No large camp will be built, and, except for security and maintenance personnel, no one should be housed at the site except for short periods.

Third, the village of Port Simpson should be considered "off limits" to all non-resident workers. Port Simpson residents working at the site should add sufficient income to the community (probably about \$500,000 per year) to provide strong local economic growth without a boom and bust situation.

Fourth, all workers not resident in Port Simpson should receive their pay in Prince Rupert, and be encouraged to save or spend it there (perhaps through subsidized interest accounts at a Prince Rupert financial institution).

It should be noted that these recommendations serve a dual purpose. While the employment and income of Port Simpson would rise about 20%, a rise in the Prince Rupert employment and income equal to that experienced with construction at Ridley or Kitson would also be felt, so Prince Rupert would not suffer from an economic slowdown.

More lasting impacts on the cultural fabric of Port Simpson would occur during operation of the port facility. While employment of the present residents of Port Simpson would be encouraged

at the port, most of the 200 jobs would be filled by outside people. If these workers and their families are permitted to live close to their job, up to 1,000 new residents could be added to the Port Simpson area, completely altering the social and cultural structure of the community. It is likely that a new town site and extended community services would be necessary, and a "new and old" division of the town would probably be set up, heightening the inter-racial tension which would be certain to develop.

These problems can be solved initially by prohibiting development in the area by any outsider (including residential development), either native or white. Over the longer term, as the residents of the village become acclimatized to their new environment, residential development could proceed at a controlled rate. Control of the development should be vested in the people of Port Simpson, as they are best qualified to gauge the desired rate of growth.

There is another distinct advantage to initially prohibiting growth. Communities in B.C. tend to be slow developing and to have a narrow (and fragile) income base until they reach a population of about 30,000 people. Until Prince Rupert reaches this dynamic growth stage (which is apparently desired by a large majority of its citizens), the community should be "force-fed" by restraining development in neighbouring communities, such as Port Simpson.

We expect that Prince Rupert should reach its growth stage at about the same time that the people of Port Simpson are ready to become a distant suburb of such a centre.

Because of the nature of a bulk-loading facility, no light industry is likely to be induced to locate nearby. Accordingly, neither the Port Simpson environment nor Prince Rupert's economic development is likely to suffer from related developments near the port at the northern site.

However, the introduction of a railway is a different situation. If the CNR is forced to build and operate the rail line to Port Simpson (no railway would build such a line voluntarily), it would then be required by law to carry all goods destined to or from the area (as a "common carrier").

Furthermore, as the cost of the line is largely a fixed cost, the railway is likely to attempt to recover its investment by encouraging traffic on the line and related development in the Port Simpson area.

As we contend that development of Port Simpson should be tightly controlled to avoid socio-economic disruption in both Port Simpson and Prince Rupert, no such expansion of the railway's business could be permitted for several years. It seems, therefore, that an operating subsidy may be considered for the CNR if Port Simpson is chosen as the port site, in exchange for an agreement from the CNR not to solicit business for that line.

Although light industry will not be influenced by a bulk-loading facility, certain types of heavy industry, such as a copper smelter or steel mill as noted above, could be interested in co-locating with the port. It is interesting to note that any such facility requiring more than 1,200 acres of reasonably flat land can locate nowhere in the study area except Port Simpson. As the cost of railway construction would probably rule out Port Simpson for any private developer, it must be assumed that the Tsimpsean Peninsula will be unacceptable for large scale industrial development unless the railway is constructed to Port Simpson as a public investment "loss leader".

We have no data to judge whether such large-scale development would be good for the area or whether the communities would favour it. However, acknowledging the pro-development outlook of the people of Prince Rupert, it does appear that there is considerable value in preserving at least the option of major industrial development in the region. This option can be preserved only by designating Port Simpson as the regional industrial centre. It should also be re-stated here that general environmental disruption, as well as air and water pollution, will be much less of a problem in Port Simpson than in the Prince Rupert area.

Impacts on the Natural Environment: The major impacts of development at this site include the probable loss of the Lachmach River fish population, some small loss of herring spawning area at the site, and a pollution threat to the remaining herring spawning area in the harbour as well as the waterfowl and salmon populations using the Stumaun estuary.

As with all the sites, the probability of pollution problems is indeed small. However, as all options require large vessels to anchor in Port Simpson harbour, a part of this pollution danger in Port Simpson is common to each option. The differential threat to the small waterfowl population from development of the port at this site, while important locally, is by no means critical.

Assuming a major oil spill did occur, the possible resultant loss of the most productive herring spawning area on the Tsimpsean Peninsula could be quite serious. However, herring seem to spawn in schools in a rather random fashion all up and down the coastline. It is possible that the temporary loss of this habitat will simply force the herring population into a slightly less desirable habitat just to the south. In this case, the losses would be quite minor. However, this facet is uncertain without further detailed investigation at other times of the year.

The impact of the access road construction on the Stumaun Creek salmon population could be minimized by careful design. Furthermore, as the people of Prince Rupert have identified a lack of a pleasant driving area as one of the major recreational drawbacks, the development of Stumaun Creek into a nature observation area similar to the Goldstream Park area in Victoria could turn a small environmental disruption into a major recreational plus for the community, provided the people on the reserve agree to such a development.

A railway is normally very restricted in locational design because of its critical grade requirements and curvatures. As a result, it is unlikely that even the most careful design will minimize to a great extent the adverse impacts on the Lachmach River salmon population. In fact, reduction of the grades in order to reduce the economic disadvantage of the Port Simpson site is likely to restrict the design still further, and make it even more difficult to modify the design for environmental reasons.

It is worth noting that incoming ships to a port in Port Simpson harbour would normally use the north entrance to Chatham Sound, and would not enter the mixing zone of Chatham Sound. Any pollution problems from operational discharges, oil spills, or ship collisions would be localized in Port Simpson, and the normal current would carry surface pollution directly westward (out to sea). Accordingly, the valuable coast littoral zone on the west coast of the Tsimpsean Peninsula would not be affected by the pollution aspects of port development in Port Simpson. Any spills in the harbour itself would be easily contained.

1.2.2 Kitson Island

Existing Local Environment: The Kitson Island site is immediately adjacent to Flora Bank, which has been demonstrated to be one of the most valuable salmon rearing areas in the Inner Estuary, (Higgins and Schouwenberg 1973). In addition, the outer edges of Flora Bank provide a clam and crab fishery, while the entire

area supports a shrimp fishery. Some populations of diving ducks along with large numbers of seals and marine birds also use the Bank.

Although the value of the Bank for salmon rearing should not be under-rated, one of the most significant aspects of the existing environment of the area is the location of Kitson Island, its approaches, and its short term anchorage off the Kinahan Islands in relation to the main current of the Skeena River. Nearly all the water from the Skeena flows along the surface of Chatham Sound past the Kitson and Kinahan Islands area north-westward to the west coast of the Tsimpsean Peninsula. The prevailing winds reinforce this movement, while tides, waves, and the common westerly winds in the middle of Chatham Sound push surface water eastward towards the Big Bay-Pearl Harbour shoreline.

Projected Impacts: Development of the Kitson Island site will remove Kitson Island entirely (with some adverse recreational impact) and will also remove part of Flora Bank from production. In addition, coal dust blowing from the Kitson Island site will probably cover some part of Flora Bank, reducing its biological productivity. The railway and road causeway from the mainland to Kitson Island will cut off 80% of Flora Bank from the direct flow of the Skeena River. This should cause a rise in salinity and in water temperature over much of the bank. While the effect of this change on fish is not clear, it is likely to be adverse and may severely limit the area of fresh water domination available for salmon acclimation. However, it is possible that there will be some beneficial effect on the local waterfowl population as a result of improved habitat. (The lack of abrasion and fluctuating salinity may permit increased growth of rooted vegetation.) Diving ducks may be affected by changes in clam populations.

Containment of oil spills or operational discharges at this location would be extremely difficult. The location is quite exposed with significant wave activity. In addition, the main current of the Skeena passes directly past the site, and the downstream area is essentially open water. Directly in line downstream of Kitson Island are the Kinahan Islands (which have valuable waterfowl habitat), the Rachael Islands, the Lucy Islands, Digby Island, and the entire west coast of the Tsimpsean Peninsula. Any collision or oil spill in the Kitson Island area or its anchorage off the Kinahan Islands would threaten the area which is possibly the most ecologically valuable area on the north coast of B.C.

Mitigation of spill related impacts would involve a reduction in the probability of spills. Two methods of achieving this end are apparent. First, all bunkering at the port site should be

prohibited. Second, navigational aids should be installed along Chatham Sound to minimize collisions and groundings during winter storms or summer fogs.

A simple triangulation system could be installed for two to three million dollars. A more sophisticated sea traffic control system would cost \$40 to \$50 million, but does not seem to be justified by the traffic volume and risk involved.

Acknowledging the wave and current action at the site, permanent oil spill booms would probably be of limited effectiveness. The risk of spills at the wharf itself is quite low in any case.

Related Development: About 2,000 acres of mediocre back-up land exists on Flora Bank. Foundation conditions are poor, and development costs would be high. For these reasons, it is unlikely that any industrial development would occur there, and industrial areas on Kaien Island would be more likely locations.

If Flora Bank was to be filled for back-up industrial land or port expansion, the impact on rearing fish and feeding waterfowl would be very high. In fact, this aspect of the Kitson Island development is likely to be more serious locally than the direct impact of the port itself.

Site Rating: Higgins and Schouwenberg (1973) concluded quite simply that Flora Bank is much more valuable than the Ridley Island area for salmon rearing and, all other things being equal, there would seem to be no reason to choose the Kitson site over Ridley Island. Our study found nothing to dispute this opinion, and, considering the engineering opinion that Ridley is a better site than Kitson, we see no reason to continue the evaluation of a port site at Kitson Island.

By comparison with the other major option available, we conclude, therefore, that Kitson Island (and Kitson/Fairview) is an environmentally unacceptable option because of the impact on fish.

7.2.3 Ridley Island

The Ridley Island port site is located on the northwest corner of the island, just about where the present Cancel Pulp Mill effluent is now discharged. This site contains two small archaeological sites which may be salvaged prior to construction. The area is not heavily utilized by fish at the moment. However, as stated above, there are indications that improvement of the effluent quality from the Port Edward pulp mill may encourage the utilization of this area by rearing fish.

Ridley Island is populated by a significant deer population, and the coastal fringe of the island is winter range for this population. In addition, the shallows all around the island are intensively-used waterfowl areas. Other, more important deer winter range occurs on Kaien Island from the southern tip next to Ridley Island eastward to Fern Passage. About half this winter range would be traversed by the new access road.

The Cancel pulp mill booms logs throughout the Porpoise Harbour area and into Wainwright Basin. Port Edward is expected to provide most of the new residential housing for the greater Prince Rupert area in the near future.

Projected Impacts: Development of the Ridley Island site will infringe on some deer winter range and intertidal waterfowl habitat on the island itself. This is not felt to be particularly serious. However, the introduction of a road through half the deer winter range on Kaien Island (a wildlife reserve) is somewhat more serious, resulting in automobile kills of deer as well as removal of habitat and some increased exploitation.

The value of the Ridley Island area for fish rearing is negligible at the moment because of the effects of the pulp mill effluent. If the effluent quality is improved, the area appears likely to be utilized by rearing fish. If, as is projected, extensive fish enhancement facilities are constructed on the Skeena River, the Inner Estuary would probably be heavily utilized by rearing coho, chum and chinook salmon among other species. In this situation, fringe areas such as Ridley Island would probably become more valuable than they are at present. Introduction of a port site, with its resultant coal dust and operational spills, as well as the removal of intertidal habitat, would adversely affect this potential.

The short term anchorage for ships docking at Ridley Island would be just southeast of the Kinahan Islands. Most of the ship movement for Ridley Island would occur at the entrance to Prince Rupert harbour. The movement of large ships in this constricted and heavily travelled area in the middle of a two to three knot tidal current is not a desirable situation, and the pilotage indicated some misgivings about this site accordingly.

Oil spills from collision or other causes at or near the Ridley Island site would head in different directions according to the tide. On an ebb tide, the surface currents move southward out of Prince Rupert harbour, and would carry the oil southwards into the main Skeena current. It is possible that Flora Bank and the Kinahan Islands

would be threatened by such an oil spill. Certainly the west coast of the Tsimpsean Peninsula would be downstream from such a spill. On a flood tide, oil on the surface would move with the current and the prevailing winds into the valuable waterfowl areas of Digby Island and into the western end of Prince Rupert harbour. The successive ebb tide should carry much of the surface oil into the Venn Passage area (noted as the second most valuable waterfowl habitat on the Tsimpsean Peninsula) and would cover most of the shore of Digby Island. After passing through Venn Passage, any surface oil would probably go past Tugwell Island and again along the west coast of the Tsimpsean Peninsula.

Containment of a spill near Ridley would be difficult because of the wave action, the tidal current, and the relatively exposed location. In addition, emergency activities at the mouth of Prince Rupert Harbour would likely shut the Port of Prince Rupert during spills. As noted above, this is expected to be a very infrequent occurrence.

As with Kitson Island, the long term anchorage for ships using a port at Ridley Island would be in Port Simpson harbour. Accordingly, all the impacts for ocean transport and pollution noted for Port Simpson harbour would also apply to this option, with the added danger of large vessels plying Chatham Sound just off the extremely valuable coast littoral zone of the Tsimpsean Peninsula.

Concern has been expressed by Cancel that coal dust blowing from the Ridley Island site would blow onto pulp log booms in Porpoise Harbour and perhaps Wainwright Basin. This may also occur with the passage of unit coal trains past the Port Edward pulp mill. Coal dust on pulp logs is a very serious industrial occurrence, as coal will not wash out entirely, and cannot be bleached. Accordingly, the resultant pulp mill will be flecked with black and will be of a non-commercial grade. This would render the Port Edward pulp mill uneconomic. Technical measures can be taken to prevent this problem, however, as detailed in Appendix D, (Volume 5).

Any residential community in Port Edward may possibly be adversely affected by some blowing coal dust from the Ridley Island port facility and from trains passing the community. In addition, noise from trains would likely be quite noticeable, although acclimatization through exposure to the pulp mill noise has likely occurred in the community.

Related Developments: About 800 acres of land on Ridley Island and 200 acres on southern Kaien Island could be developed at moderate costs. A further 200 to 250 acres could be developed by filling the bays and shallow waters surrounding Ridley Island at high cost.

This limited amount of back-up land may preclude development of major industrial facilities, particularly considering the encroachment on Porpoise Harbour log boom leases and interference with the existing Cancel pulp mill which would occur.

The prevailing wind from Ridley Island blows generally from the southeast, indicating that any air pollutants emitted from facilities on the island would blow up the entrance to Prince Rupert Harbour and generally in the direction of downtown Prince Rupert and its western-most residential areas (especially the likely future residential area on Digby Island). The plume from such facilities would combine with the currently undesirable air pollution from the Cancel pulp mill in Port Edward.

The climate of the area produces almost continual inversion conditions, which will trap pollutants over Prince Rupert Harbour. During most of the year, steady rain will "wash" the air clean, but frequent fogs during the summer dry season will intensify the problem.

Industrial water pollution will also be a major concern as the ecologically sensitive areas of Digby Island and Flora Bank are nearby. Accordingly, any industry locating on Ridley Island would be expected to have excellent air and water pollution control facilities.

Mitigation facilities as noted above for Kitson Island would also apply to Ridley Island.

7.2.4 Fairview Point

The small Fairview Point site proposed for non-coal products contains two small archaeological sites which may be salvaged before construction. There is no apparent fish or wildlife habitat at the site, although the site is directly across from the valuable waterfowl areas of eastern Digby Island.

However, the site is in the entrance channel to Prince Rupert harbour, and the introduction of several smaller ships to the traffic in this congested area would increase the possibility of navigational accidents.

Any spills of toxic or other material at this site could endanger the east coast of Digby Island and Venn Passage. However, because of the small size of the vessels that would be using this port, this effect is not felt to be as serious as it would be at Kitson or Ridley. Use of Fairview for non-coal products will, however, remove Fairview from consideration for grain handling facilities in the future.

One advantage for using Fairview, on the other hand, is the fact that it maintains a unified port structure within the community of Prince Rupert, giving the community the advantage of agglomeration in its growth process.

Overall, there seems to be no environmental advantage or disadvantage to the Fairview site combined with Ridley or Kitson when compared to a complete facility at either of the latter two sites. As there is also apparently no net engineering advantage or disadvantage, a decision on whether to use the unified or corresponding split site alternative should be considered a detailed design matter for resolution during phase 3. Accordingly, the split site alternatives will not be considered further in this report, but "Kitson Island" should be considered as also meaning Kitson/Fairview and "Ridley Island" as also meaning Ridley/Fairview below.

7.2.5 No Port

We feel that an opinion on whether a port should be constructed at all or on the choice of a general location (Prince Rupert, Kitimat, Squamish etc.) is well beyond our terms of reference. NEAT examined only the Prince Rupert area, and so has no comparative data on alternative locations. In addition, as we also have no data on the benefits of the development as a whole, we can make no judgments about the desirability of the development in general.

However, we do feel that we can logically offer some opinions on the impact on this study area of not developing a port near Prince Rupert. Presumably, this information may be useful to others who are charged with the responsibility of these larger decisions.

The option of not putting a port at all into the Tsimpsean Peninsula area must be considered as a baseline for comparison to the other options. For this option, of course, there would be no adverse biological impact. However, there would be significant cultural and sociological impacts.

As has been noted previously, the City of Prince Rupert is seriously overbuilt in its commercial and industrial facilities. While the community is suffering from a housing shortage there is a marked overabundance of commercial facilities.

This may be considered characteristic of a community which is expecting rapid growth and is preparing for it, and yet is concerned that a boom and bust situation may develop which does not warrant a heavy investment in housing.

While the people of Prince Rupert seem to be basically happy with the way their community is now, there is a distinct groundswell of opinion in favour of increased economic expansion and community growth (provided environmental quality can be maintained at approximately the present level).

Failure to construct a port in the general Prince Rupert area would have a serious adverse impact on the local economy and lifestyle. The over construction of commercial and industrial facilities indicates that without further expansion, these investments would be unwarranted, and very costly. Given this overabundance of existing commercial facilities, it would be extremely unlikely that

further facilities such as major shopping centres (which are greatly desired by the community) would be constructed for several years unless a further infusion of disposable income occurred.

The people of Prince Rupert complain almost universally about the lack of choice in jobs. Among major employers, one must choose between the fishing industry, the Cancell pulp mill, or their related service industries. The pulp mill employment fluctuates according to the world pulp market, and the fishing industry is seasonal in nature. A port in the area may provide better long term, high income employment than is currently available in Prince Rupert.

One opinion frequently expressed by Prince Rupert residents is that the community is growing quickly in spite of a lack of impetus from senior governments. However, designation of some site other than Prince Rupert as the west coast port alternative to Vancouver would be a severe blow to growth expectations. The people in the community seem to feel their's is the natural port outlet, and the choice of another location would amount almost to active discrimination against Prince Rupert.

Accordingly, a decision not to build in the Prince Rupert area would produce a psychological blow to the community which may significantly lower the rate of expansion now being experienced.

One important item should not be overlooked in regard to Prince Rupert. Its population is remarkably stable for a northern community, so any development which adversely affects the community will create a disgruntled population for a long time. In other northern communities, the transient ratio is so high that adverse impacts do not affect most people very long (those who are unhappy will move away, and those who arrive know the situation before they come). Accordingly, we would suggest that failure to build a port in the study area may have more long term psychological effects in Prince Rupert than a similar lack of development would elsewhere.

Once again, we would like to emphasize that the above is our interpretation of opinions expressed by the people of the study area. They should not be construed necessarily as endorsement by NEAT of the expansionist outlook of this community.

7.2.6 Impact Tables and Environmental Ranking

The details of impact projections from the three major port development options are shown on the following tables (Table 11 to Table 20 inclusive), which are preceded by a summary comparison table (Table 10). Table 10 shows the environmental scoring and thus illustrates the rationale behind the following environmental ranking of options:

- Acceptable: (1) Port Simpson
(2) Ridley Island or Ridley/Fairview

- Not Acceptable: (3) Kitson Island or Kitson/Fairview

It is assumed that mitigation measures as mentioned above will be included for each option.

Freshwater Fish	2	-4	-8	-2	-4	-2	-4
Anadromous Fish	10	0	0	-4	-40	-8	-80
Marine Fish and Invertebrates	4	-3	-12	-3	-12	-3	-12
Soils and Vegetation	2	-4	-8	-3	-6	-2	-4
Forestry	1	-3	-3	0	0	0	0
Upland Wildlife	3	-1	-3	-5	-15	0	0
Waterfowl	6	-1	-6	-4	-24	-6	-36
Marine Mammals	2	0	0	-1	-2	-4	-8
Archaeology	5	-2	-10	-2	-10	0	0
Unique or endangered Species	5	-1	-5	-3	-15	-3	-15
Total "natural" environment	40		-55		-128		-159
Study Area Population	2	+2	+4	+2	+4	+2	+4
Prince Rupert Income And Employment	8	+6	+48	+5	+40	+4	+32
Port Simpson Income And Employment	2	+8	+16	0	0	0	0
Study Area Economic Development	7	+6	+42	+5	+35	+2	+14
Prince Rupert Community Psychology	5	+4	+20	+6	+30	+5	+25
Port Simpson Community Psychology	5	-2	-10	0	0	0	0
Prince Rupert Aesthetics And Recreation	6	0	0	-4	-24	-4	-24
Port Simpson Aesthetics And Recreation	5	-8	-40	0	0	0	0
Total "cultural" environment	40		+80		+85		+51
Total Impact	80		+25		-43		-108
Comments							Impact on anadromous fish is unacceptable
Score range = +10 (beneficial) to -10 (detrimental)							

PORT SUBJECT	LOCATION, DESIGN AND CONSTRUCTION						OPERATION AND MAINTENANCE				OPTIONAL USES							
	SITE LOCATION		RAILWAY		SHIP ACCESS, UNLOADING, ANCHORAGE		CONSTRUCTION FACILITIES	POST-CONSTRUCTION DISPOSITION OF FACILITIES	SITE SERVICES	RIGHT OF WAY MAINTENANCE AND BRUSH CONTROL	MAINTENANCE OF PORT SITE AND NAVIGATION CHANNEL	LEACHATES, FUEL AND CHEMICAL STORAGE	MATERIALS HANDLING	COLLISION AND ACCIDENTAL DISCHARGES	ACCESS TO NEW LAND AREAS	FURTHER DEVELOPMENT		SUMPTION OF MAJOR EFFECTS
	Permanent Effects	Temporary Effects	Permanent Effects	Temporary Effects	Permanent Effects	Temporary Effects									Small Scale	Large Scale		
LAND FORMS	4,000,000 Cu. Yd. Rock cut and filled out from shore. Resultant rock face about 40 feet high.		Extensive cut and fill probable along Work Channel.		Shoal areas in Harbour and Inskip Passage to be blasted out.	Under water blasting.	Work camp at Port Simpson for 4 years for site, road and railway. Another work camp at Khyex River for 2 years. Other construction facilities would be on the final port site.	Work camps to be removed. Khyex River camp may become maintenance depot. Construction equipment and material to be removed. Re-vegetation to be permitted.							Terraced level areas north of port site could be used for industry.	More drastic cut and fill likely required for heavy industry.	Extensive cut and fill in solid rock at port site and along Work Channel. Shoals in Harbour to be blasted out.	
SURFACE MATERIAL	All inorganic material will be incorporated in the fill. Surface gravel from existing commercial pits. Little or no dredging.		Intertidal shelf along west side of Work Channel to be covered and steepened.						Road & Railway bed maintenance should require 5,000 cu. yd. gravel annually.	No dredging.				Construction siltar to port development.		Large amounts of surface gravel required. Little or no dredging. Some loss of rocky intertidal areas in Port Simpson Harbour and Work Channel.		
VEGETATION	100,000 cu. yd. of organic material to be grubbed and burned or disposed of in near-by Land Fill.	100,000 cu. yd. of material dumped on existing vegetation off site.	Right of Way occupies about 650 acres. Stream Side vegetation on Leachach River probably removed.					Power transmission line from Prince Rupert.									Removal and disposal of organic overburden. Loss of some productive timber areas. Removal of stream-side vegetation. Pollution danger on eelgrass beds.	
SURFACE & SUBSURFACE HYDROLOGY	Possibility of using ground water.	29 Streams crossed and Leachach River followed for its whole length.					25,000 gal./day fresh water needed at Port Simpson Camp + 12,000 gal./day at Khyex River Camp.	Salt water to be used for fire protection. Dust suppression and wash water to be recycled. Coal storage, sprinkling and drinking water needed 100,000 GPD fresh water (500,000 GPD peak).									29 Streams crossed or paralleled. 100,000 gal./day taken from Stumson Creek. Changes in Runoff drainage possible.	
PHYSICAL OCEANOGRAPHY																	No major effects.	
PHYSICAL WATER QUALITY	Some coal dust expected over neighbouring intertidal areas.	Some turbidity expected in salt water near site. Organic & inorganic material likely to run-off.	Leachach River may experience temperature rise.				Turbidity & siltation from construction along Work Channel.	Sedimentation basins for wash water and storm drain age overflow to the sea.									Higher temperatures and turbidity in Leachach Creek. Minor siltation on other streams may be important during construction.	
CHEMICAL WATER QUALITY	Minor discharges from ships in relatively pristine harbour.								Brush control with herbicides only if allowed.		Fuel & chemicals to be stored within circle of railway. Leachach material to be stored under cover.		Discharge in harbour would foul harbour. containment possibilities are good.				Oil or other discharges would foul Port Simpson Harbour.	
METEOROLOGY & AIR QUALITY												Prevailing wind should blow coal dust away from Community and onto land.		Prevailing winds blow away from populated areas.			No major effects.	
RESOURCE EXPLOITATION			Economics of transportation improved for related development.														Possible improved economics for logging operations.	
UNIQUE ASPECTS OF THE EXISTING ENVIRONMENT	Site is very visible from overcast community along the natural view would be lost.		Disrupted Work Channel will lose its wilderness character.		Anchored and berthed large ships would have interest value.												Loss of Wilderness areas. Threat to west coast of Tsipsoan Peninsula not likely a major concern as surface water generally flows west and northward.	
NOISE	Site is directly across the harbour from community. no noise buffer.	No buffer for construction noise.	No effect on humans.		Railway construction noise in a wilderness area.							No noise buffer between community and equipment noise.					No noise buffer between port site and Port Simpson Community.	
HUMAN POPULATION						Ships crew in Port Simpson.		Fluctuating work force up to 300 at Port Simpson & 150 at Khyex River.					Employment for 150-200 generated. Employees to live in Prince Rupert.	Port and industrial facilities at Port Simpson may encourage residential and other development northward.	Prince Rupert would likely remain the residential centre of the Tsipsoan Peninsula, but development would spread northward. A town site in Port Simpson is only likely with major industrial development.	25% temporary increase in Port Simpson population during construction. Northern Tsipsoan Peninsula may be developed.	25% to 50% increase in Port Simpson income during construction, dropping to near original level later. Some new permanent employment for local residents.	
DISPOSABLE INCOME	Some Port Simpson residents would be employed at the port during operations.							25% to 80% increase in local income during construction.										
OTHER INDUSTRIES			Interference with future logging of Work Channel.											Growth of Prince Rupert as commercial and industrial centre may be impeded.			Growth of Prince Rupert may be impeded with development of second growth centre.	
GENERAL COMMENTS													Probability of collision is lower at this site than any other. Pollution of discharges should be easier here than at other sites.			Light industry is unlikely to locate in Port Simpson unless a broader-based industrial complex is introduced. Port Expansion to 5 Berths possible.	3,000 acres of "cow-carryer" could be used to carry a "goods" they are not used at other sites. Also economics will encourage Port Simpson business.	Once a railway is built, CNR, as a "cow-carryer" is required by law to carry a "goods" they are not used at other sites. Also economics will encourage Port Simpson business.

Table 12

KITSON ISLAND	LOCATION, DESIGN AND CONSTRUCTION						OPERATION AND MAINTENANCE						OPTIONAL USES		SUMMATION OF MAJOR EFFECTS				
	SITE LOCATION		ROAD AND RAILWAY		SHIP ACCESS, UNLOADING, ANCHORAGE		CONSTRUCTION FACILITIES	POST-CONSTRUCTION DISPOSITION OF FACILITIES	SITE SERVICES	RIGHT-OF-WAY MAINTENANCE & BRUSH CONTROL	MAINTENANCE OF PORT SITE AND NAVIGATION CHANNEL	LEACHATES: FUEL AND CHEMICAL STORAGE	MATERIALS HANDLING	COLLISION AND ACCIDENTAL DISCHARGES		ACCESS TO NEW LAND AREAS	ACCESS TO WATER AREAS	FURTHER DEVELOPMENT	
	Permanent Effects	Temporary Effects	Permanent Effects	Temporary Effects	Permanent Effects	Temporary Effects													
LAND FORMS	Kitson Island to be leveled 1,000,000 Cu. yd. of rock used as fill around island.		New Causeway 1/2 mile of Lala Island used as Right-of-Way.				Work camp at Port Edwards for 18 months. Other construction facilities to be located on 100 acre port site.	Work camps to be removed.									Flora Bank could be filled for use by some light industry. Foundation conditions generally limit the industrial potential.	Kitson Island to be leveled and surrounding area filled.	
SURFACE MATERIAL	Approx. 100 acres of Flora Bank to be filled. 7-8,000,000 cu. yd. dredged, filled from surrounding area.	Current changes during dredging. Likely to affect half of Flora Bank until a new equilibrium is established. Hydraulic section dredges to be used.	20 acres of Flora Bank raised above water line.	Rock fill and dredging likely to cause temporary surface instability on east of Flora Bank.			Minor dredging on the edge of Flora Bank.			Gravel supplied from commercial pits.	Annual Maintenance Dredging likely.						120 acres of Flora Bank raised above waterline. Dredging may cause surface movements over half of Flora Bank during construction. Annual maintenance with hydraulic section dredge.		
VEGETATION	Approx. 100 acres saltgrass permanently removed from production. 25,000 cu. yd. organic material to be burned.								Very minor brush control.				Ecgrass beds of Inner Estuary quite vulnerable.				100 acres saltgrass removed from production. 3-4,000 acres saltgrass vulnerable to local pollution.		
SURFACE & SUBSURFACE HYDROLOGY							Estimated 18,000 gal/day fresh water required for work camp.		Salt water to be used for fire protection. Dust suppression & wash water to be recycled. Coal storage aprinkling & drinking water need 100,000 gal/day from Alwyn Lake or Wolf Creek.								Average of 100,000 gal/day taken from Alwyn Lake or Wolf Creek.		
PHYSICAL OCEANOGRAPHY	Some alterations to local current patterns likely.		80% of Flora Bank cut off from the Skeena River. Significant current shifts likely.															In-shore current pattern altered and 80% of Flora Bank cut off from Skeena River fresh water and sediment supply. Change in shape likely.	
PHYSICAL WATER QUALITY	Some coal dust expected over neighboring intertidal areas.	Large amounts of silt likely to be stirred up during dredging.	Increased salinity & temperature over Flora Bank.	Extensive siltation and high turbidity likely during construction.			Some siltation & high turbidity during construction.		Sedimentation basins for wash water and storm drainage overflow to the sea.		Continual moderate turbidity likely from dredging & resultant silt movement in altered currents.							High turbidity likely over Flora Bank during construction and maintenance dredging. Increased salinity and temperature over Flora Bank. Some coal dust on inter-tidal areas.	
CHEMICAL WATER QUALITY	Rain currents influenced by Skeena River will carry any pollutants along west coast of Tsipsoan Peninsula.			Berths and short-term anchorage in main current northwards.			Waste disposal for up to 200 workers at Port Edwards.		Sewage disposal by septic tank and tile field.			Fuel and chemicals to be contained within railway circle. Leachable material under cover.	Both temporary anchorage and berths are in main current northwards. Containment extremely difficult.					Any oil spills or operational discharges from ships at anchor or at berths would spread quickly in strong Skeena River current. Containment extremely difficult at this site.	
METEOROLOGY & AIR QUALITY	Prevailing winds could carry coal dust onto the edge of Flora Bank. Coal piles not silted with wind.											Prevailing winds tend to blow coal dust to sea. Some dust expected to fall in Port Edwards and fishing towns along Inverness Passage.						Prevailing winds blow generally towards Prince Rupert, although at some distance. Some coal dust would settle on Flora Bank. Industries located on back-up land may contribute to air pollution in Prince Rupert.	
RESOURCE EXPLOITATION			Boat launching facilities likely on the causeway.											A land route would be opened up to Flora Bank for nature walks.	New Boat launching facilities likely on causeway.			A new opening to intertidal flats and recreational boating would be created.	
UNIQUE ASPECTS OF THE EXISTING ENVIRONMENT			The exact current changes which would occur in the Inner Estuary are unknown, but Inverness Passage, De Hoop Passage, and Flora Bank should be affected.				20 to 30 large ships per year travelling from Port Simpson to Kitson Island a potential pollution threat to west coast of the Peninsula.						West coast of Tsipsoan Peninsula threatened by both major spills and smaller operational discharges.					West coast of Tsipsoan Peninsula threatened by oil spills or operational discharges at Kitson, as well as by 20 to 30 large ships per year travelling from Port Simpson to Kitson. Inner Estuary would be altered by current change.	
NOISE	No nearby population centres to be affected.																	No major effect.	
HUMAN POPULATION							Ships crews in Port Simpson.		Fluctuating work force up to 200 at Port Edwards.			Employment for 150 - 200 general employees would likely live in Prince Rupert.						Up to 200 employees, indicating 300 - 600 new residents in Prince Rupert.	
DISPOSABLE INCOME									25 increase in local income during construction.			About 1% change in Prince Rupert income base.						Minor community income increase.	
OTHER INDUSTRIES												Slight change of coal dust from open trains & Site blowing onto pulp log boom.						No major effect.	
EXTERNAL COMMENTS							Anchorage for ship under 50,000 DWT in Prince Rupert Harbor. Larger ships must use area S.E. of Kitson Island (short term) or Port Simpson where anchorage must be shared.												2,000 acres of poor back up land available at high cost.

RIDLEY ISLAND	LOCATION, DESIGN, AND CONSTRUCTION						OPERATION AND MAINTENANCE						OPTIONAL USES			
	SITE LOCATION		ACCESS ROAD AND RAILWAY		SHIP ACCESS, MANEUVERING, ANCHORAGE		CONSTRUCTION FACILITIES	POST-CONSTRUCTION DISPOSITION OF FACILITIES	SITE SERVICES	MAINTENANCE OF FACILITIES	LEACHATES, FUEL AND CHEMICAL STORAGE	MATERIALS HANDLING	COLLISION AND OPERATIONAL DISCHARGES	ACCESS TO LAND AND WATER	FURTHER DEVELOPMENT	SUPPRESSION OF MAJOR EFFECTS
	Permanent Effects	Temporary Effects	Permanent Effects	Temporary Effects	Permanent Effects	Temporary Effects										
LAND FORMS	2,000,000 cu. yd. bedrock blasted out and used as fill. Resultant rock face about 40' high.		All effects minor except the filling of the passage to Porpoise Harbour				Work camp at Port Edwards for 18 months. Other construction facilities to be located on the 100 acre site.	Work camp to be removed.							More drastic rock blasting and filling required.	Extensive cut and fill in solid rock at port site. Shoals in Port Simpson Harbour to be blasted out.
SURFACE MATERIAL	Surface gravel to be obtained from commercial pits. Minor development may be necessary. Clean shell after underwater blasting.		Cut and fill along beach, tidal flats, and deer winter range, road access through 100 acres of Porpoise.													Railway and road construction would cause filling of foreshore fronting half the deer winter range on Kaim Island.
VEGETATION	200,000 cu. yd. organic material produced and burned or buried.	200,000 cu. yd. of material to be dumped on existing vegetation.														Removal and disposal of organic material.
SURFACE & SUBSURFACE HYDROLOGY							Estimated 10,000 gal/day fresh water required for work camp.			Salt water to be used for fire protection. Dust suppression and wash water to be recycled. Coal storage sprinkling & drinking water need 100,000 gal/day fresh water.						Average of 100,000 gal/day to be taken from Algon Lake or Wolf Creek.
PHYSICAL OCEANOGRAPHY	Some alteration to local currents likely, tidal current at harbour entrance may be affected.		Obstructing tidal flow.													Some alteration in current patterns at entrance to Prince Rupert Harbour.
PHYSICAL WATER QUALITY	Some coal dust expected over neighbouring intertidal areas.	Some minor turbidity expected in salt water.								Sedimentation basins for wash water and storm drainage overflow to the sea. Wolf creek temperature should rise as flow drops. Sewage disposal by septic tank and tile field, subject to PCB regulation.						Higher water temperature in Wolf Creek.
CHEMICAL WATER QUALITY	Shoals-influenced northbound currents would carry any pollutants along the west coast of the Tsipisean Peninsula.		Berths and short-term anchorage in or near main northbound current.			Waste disposal for up to 200 workers at Port Edwards.				Fuels and chemicals to be contained within railway circle. Leachable material under cover.		Temporary anchorage in main northbound current. Flow from berths would go south on ebb tide and into harbour on flood.				Any oil spills or operational discharges from ships at temporary anchorages or berths would spread quickly into strong Seena current and tidal rip. Containment difficult at this site.
METEOROLOGY & AIR QUALITY	Prevailing winds would tend to blow coal dust onto Southern Kaim Island.															Prevailing winds blow directly into Prince Rupert Harbour. Industry on Ridley would compound air pollution problem from pulp mill.
RESOURCE EXPLOITATION													Ridley Island partly opened, Boat launching facilities likely on the causeway.			A new opening for recreational boaters would be created.
UNIQUE ASPECTS OF THE EXISTING ENVIRONMENT				20 to 30 large ships per year travelling between Port Simpson and Ridley pose a potential pollution threat to the west coast of the Peninsula.								West coast of Tsipisean Peninsula and part of Rupert Harbour both threatened by spills and leaks.				West coast of Tsipisean Peninsula is threatened by oil spills or operational discharges at Ridley as well as by 5 to 55 large ships per year travelling from Port Simpson to Ridley.
NOISE	Site is separated from Port Edwards by 1 ridge of hills on Ridley Island.															No major effect.
HUMAN POPULATION						Ships crews in Port Simpson for short periods.	Fluctuating work force for up to 200 at Port Edwards.			Should help continue Prince Rupert's development and thus provide a greater range of social and related services.			Employment for 150-200 generated. Employees would likely live in Prince Rupert.			Employment for up to 200 people.
DISPOSABLE INCOME		Increase in Prince Rupert														Increase disposable income by 15.
OTHER INDUSTRIES																No real effects.
GENERAL COMMENTS				Anchorage for ships under 50,000 DWT in Prince Rupert Harbour. Larger ships must use area S.E. of East Kaiman Island (short term) or Port Simpson (long term) where anchorage must be shored.						All effects should be minor.						800 acres on Ridley and 250 acres on Kaim Island available at moderate cost. 250 acres could be developed from shallows at high cost.

IMPACT OF DEVELOPMENT AT PORT SIMPSON ON AQUATIC RESOURCES

TABLE 14

DIRECT EFFECTS	AQUATIC ENVIRONMENT					
	1.	2.	3.	1.	2.	3.
FRESHWATER PLANTS: ALGAE ROOTED FRESHWATER INVERTEBRATES	U/V Blasting loss of rocky intertidal gravel removed from stream beds	Removal of stream-side vegetation	Loss of embriass beds	47 streams crossed or paralleled 100,000 gal./day removed from Stu. Cr. drainage	Higher temp. in Letchum River	Construction during Letchum River channelization increased velocity
FRESHWATER FISHES WHITEFISH, DOLLY VARDEN, RAINBOW, CUTTHROAT	U/V Blasting loss of rocky intertidal gravel removed from stream beds	Loss of spawning habitat; siltation	Loss of cover; terrestrial insects	1. loss of spawning habitat by channelization, 2. by withdrawal	1. increased plant growth; 1,2. decrease in production from temp. & siltation in invertebrates; 3. increase in invertebrate populations	1.3. loss of production in Letchum and Mintoalk systems, change in rel. abundance in invertebrate populations
ANADROMOUS FISHES STEELHEAD CHUM & PINK SALMON, COHO, CHINOOK & COW, SOCKEYE EULACHON	Loss of spawning habitat; mortality by blasting	Loss of cover; increased vulnerability; loss of juvenile habitat and food protection	1. loss of spawning habitat by channelization, 2. by withdrawal	1.2. increased mortality in eggs & fry; 2. decreased production; 3. loss of gravel, pool habitats; drop in capacity for fish production	1.3. loss of spawning habitat by channelization, 2. by withdrawal	1.3. local extinction of stocks; 3. loss of year-class by siltation
MARINE FISHES HERRING COD HALIBUT ROCKFISH	Loss of spawning habitat; mortality by blasting	Loss of cover; increased vulnerability; loss of juvenile habitat and food protection	1. loss of spawning habitat by channelization, 2. by withdrawal	1.2. increased mortality in eggs & fry; 2. decreased production; 3. loss of gravel, pool habitats; drop in capacity for fish production	1.3. loss of spawning habitat by channelization, 2. by withdrawal	1. loss of spawning, nursery habitat accessible to runs, 3. destabilization in stock size (poss. loss of year) 1.2. increased vulnerability to over-fishing and bad weather
MARINE INVERTEBRATES CLAMS CRAB AMPHIPPUS ANELES COPEPODS OTHER FAUNA	Loss of spawning habitat; mortality by blasting	Loss of cover; increased vulnerability; loss of juvenile habitat and food protection	1. loss of spawning habitat by channelization, 2. by withdrawal	1.2. increased mortality in eggs & fry; 2. decreased production; 3. loss of gravel, pool habitats; drop in capacity for fish production	1.3. loss of spawning habitat by channelization, 2. by withdrawal	1.2.3. increased her- ring if salmon stocks decline
MARINE PLANTS HYDROPLANTON INTERTIDAL ALGAE KELPS EELGRASS	Loss of spawning habitat; mortality by blasting	Loss of cover; increased vulnerability; loss of juvenile habitat and food protection	1. loss of spawning habitat by channelization, 2. by withdrawal	1.2. increased mortality in eggs & fry; 2. decreased production; 3. loss of gravel, pool habitats; drop in capacity for fish production	1.3. loss of spawning habitat by channelization, 2. by withdrawal	1.2.3. increased invertebrate population if predation declines

3. Change in Mesteg drainage = effects unknown.

<p>FRESHWATER PLANTS : ALGAE : ROOTED INVERTEBRATES</p>	<p>100 acres fill pld caseway</p> <p>2. possible landfill of total Flora Bank</p>	<p>Dredging _____ acre Surface instability during construction</p> <p>100 acres eelgrass lost under fill</p>	<p>Increase algae production & grazing invertebrates increased.</p>	<p>1. Alteration of current along const., insubri- dation of Flora Bank and sedimentation from fresh water and BOB of Flora Bank</p>	<p>2. temporary mortality and displacement of Wolf Creek invertebrates.</p>	<p>new access to Flora Bank</p> <p>large ships along coast - accident threat</p> <p>loss of 420 acres of invertebrate populations loss of major por- tion of local herring (spill) continuing removal of fauna in dredg- ing</p>
<p>FRESHWATER FISHES: WHITEFISH, DOLLY VARDEN RAINBOW, CUTTHROAT</p>	<p>1. loss of 100 acres of juvenile feeding & acclima- tion areas; 2. loss of estuary; serious reduction in stock sizes.</p>	<p>1. loss of 3007 acres of nursery areas, likely permanent reduc- tion in capacity of Skeena for fish; 2. distur- bance to inverte- prod. food supply.</p>	<p>loss of stream habitat; rise in downstream temperature.</p>	<p>2. increased pops. of resident sal- monids if Skeena salmon, steelhead decline.</p>	<p>2. displacement of small resident trout popula- tion; Creek increased resident species in Skeena if production of anadromous species drops, especially if angler use drops.</p>	<p>possible loss of large por- tion of salmonid year-class by mortality in juveniles.</p> <p>increased angler catch of incoming salmon & steel- heads; possible interference with commercial fishing.</p>
<p>ANADROMOUS FISHES STEELHEAD CHUM & PINK CHINOOK & COHO SALMON SOCIETEY EULACHON</p>	<p>1. some disorienta- tion of spawners; possible delay in migration; 2. de- cline of product- ivity in flora bank; loss of salmonid produc- tion; possible loss of Skeena anadromous popu- lation; 3. extreme impact on fish; P. Rupert fishery; loss of enhancement potential in Skeena</p>	<p>loss of poten- tial for future reestablishment of anadromous runs.</p>	<p>1. possible loss of large portion of salmon year- class, long-term imbalance in age structure and in commercial fishery. 1.5-1.7 loss of food species and concentration of toxic materials, possible degradation of quality and losses to fishery, public health hazards. 2. displacement of juveniles to less desirable areas, drop in production. 3. loss of large part of estuary to cold water fish, drop in production of pink salmon, particular. 4. drop in production of pink salmon, particular. 5. loss of potential capacity, drop in salmon production, serious limitation to capacity of Skeena for salmon due to loss of acclimation zone.</p>	<p>1. increased angler catch of incoming salmon & steel- heads; possible interference with commercial fishing.</p>	<p>1. incremental loss of food supply for seaward migrants. 2. serious loss of food supply for chinook salmon, drop in salmon production. 3. loss of food supply for salmon and salmon prey species especially herring and eulachon.</p>	<p>possible loss of large por- tion of herring spawners, mortality to juvenile hal- but, cod; loss of intertidals along coast.</p> <p>increased angler catch of cod rockfish, slight decline in popula- tion size.</p>
<p>MARINE FISHES: HERRING COD HALIBUT ROCKFISH INTERTIDALS</p>	<p>1. loss of 100 acres of feeding areas esp. for juveniles; 2. loss of 2000 acres of feeding & nursery areas possible reduc- tion in stock sizes.</p>	<p>1. loss of 3007 acres of feeding areas esp. for juveniles; 2. widespread disturbance to prey organisms, Juv. halbut possible drop in numbers.</p>	<p>loss of cover, juvenile nursery area; 2. drop in carrying capac- ity of estuary.</p>	<p>1. possible in- creased herring spawning potential, 2. drop in productivity of flora bank; drop in production of halbut juveniles, cod, rockfish, possible effects on P. Rupert fishery.</p>	<p>possible loss of large por- tion of herring spawners, mortality to juvenile hal- but, cod; loss of intertidals along coast.</p> <p>increased angler catch of cod rockfish, slight decline in popula- tion size.</p>	<p>1. some loss of diversity, res- ilience of flora bank fauna to bad weather, etc. 2. removal of herring predation would result in increased survival of larval stages, changes in relative abundance through increased competition; 3. drain on local populations, shift in abundance of herring or colonizing species.</p>
<p>MARINE INVERTEBRATES: CLAMS CRAB SHRIMP AMPHIPODS COPEPODS OTHER FAUNA</p>	<p>1. loss of 3007 acres of feeding areas esp. for juveniles; 2. widespread disturbance to prey organisms, Juv. halbut possible drop in numbers.</p>	<p>1. loss of 100 acres of imort- ant crab fishery. 2. loss of 2000 acres (entire) crab fishery. 3. loss of most of estuarine pro- ducts.</p>	<p>1. loss of 10 source of organic mater- ial; drop in pro- duction of decav, filter-feeding inverts.</p>	<p>1. possible distur- bance to shrimp & plankton produc- tion. 2. decline in clam and crab production of flora bank; pos- sible loss of P. Rupert crab fishery or reloca- tion with higher costs</p>	<p>increased rec- restional harvest of clams and crabs; decline in more sensitive species from traf- fic, outboard motor pollution.</p> <p>possible loss of productive coastal areas for clam, crabs fisheries; loss of unique asso- ciations and sensitive species along coast.</p>	<p>1. possible decrease in herbi- vores greater than decrease in production, hence increased plant growth.</p>
<p>MARINE PLANTS PHYTO PLANKTON INTERTIDAL ALGAE HELPS EELGRASS</p>	<p>1. loss of 3007 acres of feeding areas esp. for juveniles; 2. widespread disturbance to prey organisms, Juv. halbut possible drop in numbers.</p>	<p>1. loss of 3007 acres of vegetation including eel- grass. 2. wide- spread distur- bance to rooted plants.</p>	<p>release of nutrients to other types of vegetation.</p>	<p>3. 1.6.5 drop in production by shading; 3. increase algal production; 4. shift in species from estuarine to inner coastal; 7. loss of eelgrass and macro algae over large areas down current from spill site; un- known effects of cleanup operations; 1.5.1. loss of sensitive species, shift to pollution tolerant types.</p>	<p>3. 1.6.5 drop in production by shading; 3. increase algal production; 4. shift in species from estuarine to inner coastal; 7. loss of eelgrass and macro algae over large areas down current from spill site; un- known effects of cleanup operations; 1.5.1. loss of sensitive species, shift to pollution tolerant types.</p>	<p>decrease in pro- duction by physical disturbance, out- board motor pollu- tion.</p>

	LANDFORMS	VEGETATION	HYDROLOGY	PHYSICAL OCEANOGRAPHY	PHYSICAL WATER QUALITY	CHEMICAL WATER QUALITY	AIR QUALITY	RESOURCE EXPLOITATION	UNIQUE ASPECTS	GENERAL COMMENTS	AQUATIC FAUNA
RIDLIDY ISLAND	1. underwater blasting of rock fill 2. 2,000,000 cu. yds. of fill dumped on intertidal and sub-tidal plant communities	Fill dumped on intertidal and sub-tidal plant communities	100,000 gal. per day out of Wolf Creek	Some increase in current in P.R. Harbour entrance	Higher temp. in Wolf Creek	Spills into P.R. Harbour and up west coast of pen insula	Industrial pollution to surrounding watersheds	Increased access to angling, etc.	Risk of massive pollution to coast and P.R. Harbour	further 250 acres of shoals filled - optional	removal of 30 acres of invertebrate continuing minor destruction of invertebrates
DIRECT EFFECTS											
AQUATIC ENVIRONMENT											
FRESHWATER PLANTS: ALGAE											
CHUM & PINK YARDEN											
INVERTEBRATES:											
FRESHWATER FISHES:											
WHITEFISH, DOLLY BAITER, CUTTHROAT											
ANADROMOUS FISHES											
STEELHEAD, CHUM & PINK, JUVENILE COHO, SOCKEYE, EULACHON	1. local mortality of adults between July-November; 2. loss of access to upstream habitat; 3. increased mortality in estuarine habitat; 4. constraint on capacity of Skeena.	loss of cover for juveniles, feeding habitat.	increased mortality from drought, loss of access to upstream habitat; increased mortality in future re-established (none present now).	some changes in relative abundance of species toward current-dwelling communities.	degradation of habitat for spawners; increased mortality; potential for re-establishment.	possibly disastrous to salmon stocks by loss of spawning and nursery habitat; constraint on Skeena capacity.	possible severe degradation of habitat	increased catch on fjord bank and in harbour much by reaction	disastrous to salmon stocks by loss of spawning and nursery habitat; constraint on Skeena capacity.	small loss in feeding habitat; decrease in area's capacity of Skeena	small loss in available food constraint on Skeena capacity.
MARINE FISHES											
HERRING, HADDOCK, HALIBUT, ROCKFISH, INTERTIDAL FISHES	1. local mortality from blasting; 2. loss of shallow feeding habitat; 3. loss of habitat.	loss of feeding areas and cover.									
MARINE INVERTEBRATES											
CLAMS, CRAB, SHRIMP, POLYPODS, COPEPOD, OTHER FAUNA	1. loss of habitat; 2. reduction in numbers; 3. increase octopus habitat.	loss of major source of organic material.									
MARINE PLANTS: PHYTOPLANKTON, INTERTIDAL ALGAE, KELPS, EELGRASS	1. loss of 30 acres of habitat (loss for kelp)										

(Blasting shoals in Port Simpson Harbour treated in Port Simpson matrix)

	<u>Soils and Vegetation</u>	<u>Forestry</u>	<u>Archaeology</u>	<u>Upland Wildlife</u>	<u>Waterfowl</u>	<u>Indirect Effects</u>
Port Simpson (Site Only)	Loss of 145 acres of fibrisols (mainly lithic), including 42 acres of coastal muskeg and 16 acres of riparian forest. Possible effects on tidal marsh and shingle beach in Stumaun estuary as well as freshwater marsh in Neaxtoak Lake.	One booming area in Stumaun Bay.	Two salvagable sites may be affected, although avoidance is possible.	Loss of 179 acres of limited to high capability deer winter range of seal haul-out area on harbour reefs. High capability deer winter range in lower reaches of Stumaun Creek would be interrupted.	Loss of 156 acres of limited capability waterfowl habitat and harbour reefs. Moderate valuable areas of Neaxtoak Lake, Stumaun Bay, and Rushbrook Passage may be indirectly affected.	Conflict with local recreationists who value Stumaun Bay waterfowl. Impacts on herring and invertebrates would affect waterfowl, harbour seals, and porpoise.
Port Simpson (rail access)	Some possibility of debris slides. Loss of substantial acreage of riparian forest, some coastal muskeg, small tidal marsh areas, and some shingle beach vegetation. Several rare species of vegetation in Khyex marsh.	Interference with future logging along Work Channel. Loss of \$1,024 per year in mean annual increment. Salvage value during construction appraised at \$110,000.	Seven "preservation" sites and five salvagable sites nearby. Not likely to be affected if railway carefully constructed.	Possible interference with deer winter range around lower reaches of Lachmach and Khyex Rivers as well as small tidal marsh areas along Work Channel. Low acreages of good deer winter range may be affected.	Loss of marsh at the head of Work Channel likely, as is some interference with Khyex marsh.	Severing of numerous aquatic/littoral/terrestrial links in energy and food webs along the whole west side of Work Channel. Effects are difficult to evaluate but amount to a large local impact (not really important in regional human-oriented values, however).
Kitson Island	Loss of 40 acres of fibrisols, seven acres of gleysols. Affects seven acres of tidal marsh directly and five acres of coastal muskeg.	No effect.	No effect	Loss of 78 acres of moderate deer winter range. Introduction of stable vegetation and a new shoreline may aid ducks. Little or no effect on seal haul-out area.	Loss of 199 acres of highly valuable waterfowl habitat. Remaining habitat may be slightly improved for some species because of new shoreline and stable vegetation. Possible pollution danger to Venn Passage, Big Bay, and Pearl Harbour. (This would be a major impact).	Consequences of cause-way interrupting food chains, etc. cannot be evaluated. Local marine pollution would have serious consequences for waterfowl, harbour seals, and porpoises.
Ridley Island	Loss of 101 acres of fibrisols and 25 acres of gleysols. Affects 37 acres of coastal muskeg and two acres of tidal marsh.	Some problem possible from coal dust blowing onto pulp logs.	Two salvagable sites directly under development.	Loss of 72 acres of deer winter range and interruption of about 150 acres of good to excellent winter range in wildlife reserve. Deer access from Kaien to Ridley Islands must be maintained.	Loss of 142 acres of moderately valuable waterfowl habitat. Possible pollution danger to Digby Island, Venn Passage, Big Bay, and Pearl Harbour. (This would be a major impact).	Very close to Digby Island and Venn Passage.

Port SimpsonSocio-Economic Impact

Table 18

	<u>Construction</u>	<u>Permanent</u>
Population	<ul style="list-style-type: none"> - peak 300 jobs - favorable economic impact on Prince Rupert - adverse impact on Port Simpson can be avoided 	<ul style="list-style-type: none"> - 200 jobs - creation of town-site on subsequent development problems - change entire social and economic structure of Port Simpson
Income	<ul style="list-style-type: none"> - increase total yearly income of area - money spent in Prince Rupert will produce favorable impact - boom and bust in Port Simpson unless controlled 	<ul style="list-style-type: none"> - up to 6.8% increase in total area income - with controls, most of the money should go to Prince Rupert - change physical and cultural structure of Port Simpson
Economic Development	<ul style="list-style-type: none"> - reduce unemployment in Port Simpson 	<ul style="list-style-type: none"> - diversifying income base - stabilize employment - create demand for goods and services in Port Simpson - adverse impact on Prince Rupert may be avoided with controls - major industrial complex possible
Community Psychology	<ul style="list-style-type: none"> - raise Port Simpson morale 	<ul style="list-style-type: none"> - acceptable development in Prince Rupert - lower morale in Prince Rupert possible

Ridley/KitsonSocio-Economic Impact

Table 19

	<u>Construction</u>	<u>Permanent</u>
Population	<ul style="list-style-type: none"> - peak 140 to 280 jobs - favorable impact on Prince Rupert - no effect on Port Simpson 	<ul style="list-style-type: none"> - 200 jobs created - no impact of social or economic structure - more pressure on housing
Income	<ul style="list-style-type: none"> - increase total yearly income of area - no "boom and Bust" syndrome expected in Prince Rupert 	<ul style="list-style-type: none"> - up to 6.2% increase in total area income - less losses in fishing income - help justify present over-supply of retail and commercial infrastructure
Economic Development	<ul style="list-style-type: none"> - reduce unemployment in Prince Rupert - 	<ul style="list-style-type: none"> - diversify and stabilize economic base - may stimulate other industrial development
Community Psychology	<ul style="list-style-type: none"> - raise Prince Rupert morale 	<ul style="list-style-type: none"> - acceptable development in Prince Rupert - increase community spirit

No Port

Socio-Economic Impact

Table 20

	<u>Construction</u>	<u>Permanent</u>
Population	- relatively high unemployment continued	- reduce projected population by 450 persons - young people will continue to leave area
Income	- no construction wages	- reduce total area income
Economic Development		- reduce job opportunities - high vacancy in retail and commercial space - economic recession in service industries - slow down in construction industry possible - some industries or businesses will move out
Community Psychology		- reduction of community morale and drive - feeling of being sold out - fostering of recession psychology

CHAPTER 8

Consideration of Economic Factors

8.1 Development of a Discount Rate

All investment projects, public and private, involve the measurement of costs and benefits over a specified time period. The function of the discount rate is to bring these benefits and costs, which occur at varying times, to present value equivalents, and thus compare these costs and benefits in terms of current dollars.

There are two basic approaches to this problem. One is the "social time preference doctrine", which contends that public investment should be made in accordance with an estimate of society's general preference for current versus future consumption (a dollar today is worth more than a dollar tomorrow even in a non-inflationary world). The second approach is the opportunity cost of capital (if the return is not sufficiently high in this project, the capital will go elsewhere). For the type of project being examined here, several alternatives exist for capital investment, and the option of no port at all is a real possibility. For these and other technical reasons, we intend to use the opportunity cost approach.

In principle, the choice of this rate will guide public investments into areas of high return on capital investments. Furthermore, it is felt that public projects, which remove funds which would be invested in the private sector, should not be undertaken unless they generate a rate of return higher than or equal to the net rate which could be earned in the private sector. This rate of return should include social and environmental costs as well as direct financial return to the investor.

In order to establish an estimate of an appropriate discount rate, we examined empirical evidence relating to rates returned in the private sector. We feel the appropriate rate should be the weighted average of all private sectors. In developing this average, the effects of tax rates and inflation should be removed, and an adjustment for external costs has to be made. Research pertaining to both Canadian and American investments was examined, with specific attention being given to Canadian data. We believe the research most applicable to discount rates for Canadian public investments is summarized in an article by Jenkins (1972). The research by Jenkins dealt entirely with the Canadian private sector, but results were closely correlated with recent similar studies which examine American data. This particular research examined both the rates of return received by the owners of capital assets

and the income generated by this capital which was collected by governments through taxation. The investment considered was the total of fixed assets plus working capital of the ventures examined.

Jenkins found the financial rate of return to the investor averaged 5.82% during 1965 to 1969. To arrive at this figure, industries were examined by standard industrial classifications, and data sets disaggregated at the two and three digit levels. Effects of inflation were removed by using a perpetual inventory process which recorded values for the assets by original costs, current replacement costs, and constant dollar prices. A further adjustment was made to change the tax depreciated values to real depreciated values.

In addition to this return, society as a whole receives other benefits from industrial development and incurs other costs (known as "external" benefits and costs as they are external to the industry itself). By and large, the external benefits are generally reflected in financial returns to society in the form of taxes paid by the industry. Jenkins found the average social financial return in taxes from the assets of industry was as follows:

Property Taxes	1.49%
Income Tax	1.13%
Sales Taxes	1.11%
	<u>3.73%</u> of total industrial assets

Some of the external costs are also financial in nature. Typical of these are water, sewer, and electrical services supplied by the municipality, community recreational services provided for the industry's employees. Without a detailed analysis, it would seem reasonable that the municipal property taxes paid by the industry should approximate these external costs borne by the community. Thus, only income tax and sales taxes represent a net financial return to society, indicating society receives a total financial return (including the investors return) of 8.06%.

However, some of the external costs are not financial in nature. An excellent example of this type of cost is pollution. Until recently, society has had to put up with pollution as a hidden cost of industrial development. In the last few years in particular, society has attempted to internalize this cost by forcing industry to spend part of its profits on pollution control equipment. Some tax revenue has also been spent in subsidization of such measures (usually in the form of tax rebates or fast depreciation allowances), and more tax revenue has been spent on government regulatory agencies.

Similar external costs, particularly as related to Prince Rupert, were rather well put in a recent editorial from the Prince Rupert Daily News (January 31, 1975). This article is quoted in part below:

" Would it be conceivable, that instead of waiting until an injustice is done -- then reacting to stop it, the public could develop a pattern of looking ahead and thinking ahead to prevent the injustice from taking shape, in the first place?

There are, already, good indications that such a change is actually underway.

Rather than wait until harmful effects of pollution, ecological damage to the land, sea and air of the Northwest results from the multi-billion dollar Northwest Development plan, some citizens in the northwestern B.C. area have already banded together and are insisting that a thorough, full length, study be made on all the possible harmful effects by such a development plan; that full thought be given to the whole idea and a re-thinking as to whether or not the damages it would wreak on our land would possibly more than outweigh the advertised advantages.

If the public were to constantly question every major move made by civic, provincial and federal authorities, as well as by every major project undertaken by private capital, then we should be making true 'progress' indeed.

When a well-known lead battery industry started up in an eastern province several decades ago, the company officials stressed the favorable impact the plant would have on the local economy. They mentioned the huge payrolls, the amount of taxes, the number of families the plant would bring to the community. Nowhere was any mention made of the housing shortage, the school shortage, the water shortage, the parking space shortage, the hospital bed shortage, etc., that would result from the industry's locating within the city limits. This was something that far-sighted forward thinking community members should have thought about. Nor was any mention or study made on the awful health hazard that would occur once the industry began its lead battery manufacture, that eventually is being held responsible for scores of deaths it caused by lead poisoning.

"Alert, forward thinking and looking citizens could have prevented the tragedy that occurred whereby many persons are now believed to have died from lead poisoning produced by that one factory.

Had our local citizens been on their toes years ago, the ugly landscape brought about by what is now called CanCel, and the poisoning of the waters, polluting the beaches, and putrefying the breezes for miles around would not have happened. ---

The public is awake- at last. Only a short time ago, on these very pages, previous editors and writers and critics were lambasting the people of Rupert for being "apathetic". Well, apathetic they may have once been. Not anymore!"

To allow for this sort of non-financial external cost, we suggest the social financial rate of return of 8.06% should be reduced. On the other hand, if we acknowledge that society perceives some net benefit from industrial expansion, the net society rate of return should be somewhat above the investor's return of 5.82%. It would seem reasonable, therefore, to adopt a median rate of 7% as the net social rate of return of all industrial projects in Canada, and to use this as the discount rate for projects in the public sector.¹

8.2 Environmental Costs of Top Ranked Sites

As it is very difficult to accurately project the environmental risk that might be involved in particular projects, these environmental costs will not be added to the cost of the project itself. Instead, the alternative projects and their differential costs will be examined and compared to the environmental risks to decide whether, intuitively, the costs are comparable to the risk. Using a 7% discount rate, the costs of the three top ranked options as estimated by the engineering consultant are shown in Table 21. As Kitson Island is environmentally unacceptable and has no cost advantage over Ridley Island, there would seem to be no reason to continue an assessment of that site. Accordingly, we shall compare just Port Simpson and Ridley Island. As shown in Table 21, Port Simpson has a large cost disadvantage when compared to Ridley Island. However, virtually all that cost disadvantage is connected with the rail access to the site. Other differential costs involved with Port Simpson include mainly the tug and employee transportation from Prince Rupert, and would therefore not be applicable if Port Simpson was developed as a community in itself. Nevertheless, these costs are included in our analysis, assuming such community development would be discouraged in favour of developing Prince Rupert.

¹ A 7% discount rate has also been used on three major public studies recently conducted in British Columbia, including the B.C. Energy Board Study of power resources and the federal/provincial Okanagan Basin Study.

Table 21

DEVELOPMENT COST OF ALTERNATIVE SITES *

	<u>CAPITAL COST</u>	<u>PRESENT VALUE OF OPERATING DIFFERENTIAL</u>	<u>TOTAL</u>
Port Simpson			
Railway	30	68.1	98.1
Others	64	81.6	145.6
Total	94	149.7	243.7
Ridley Island	61	71.4	132.4
Kitson Island	61	75.5	136.5

Differential cost (capital plus present value of annual) between Ridley and Port Simpson = \$111.3 million.

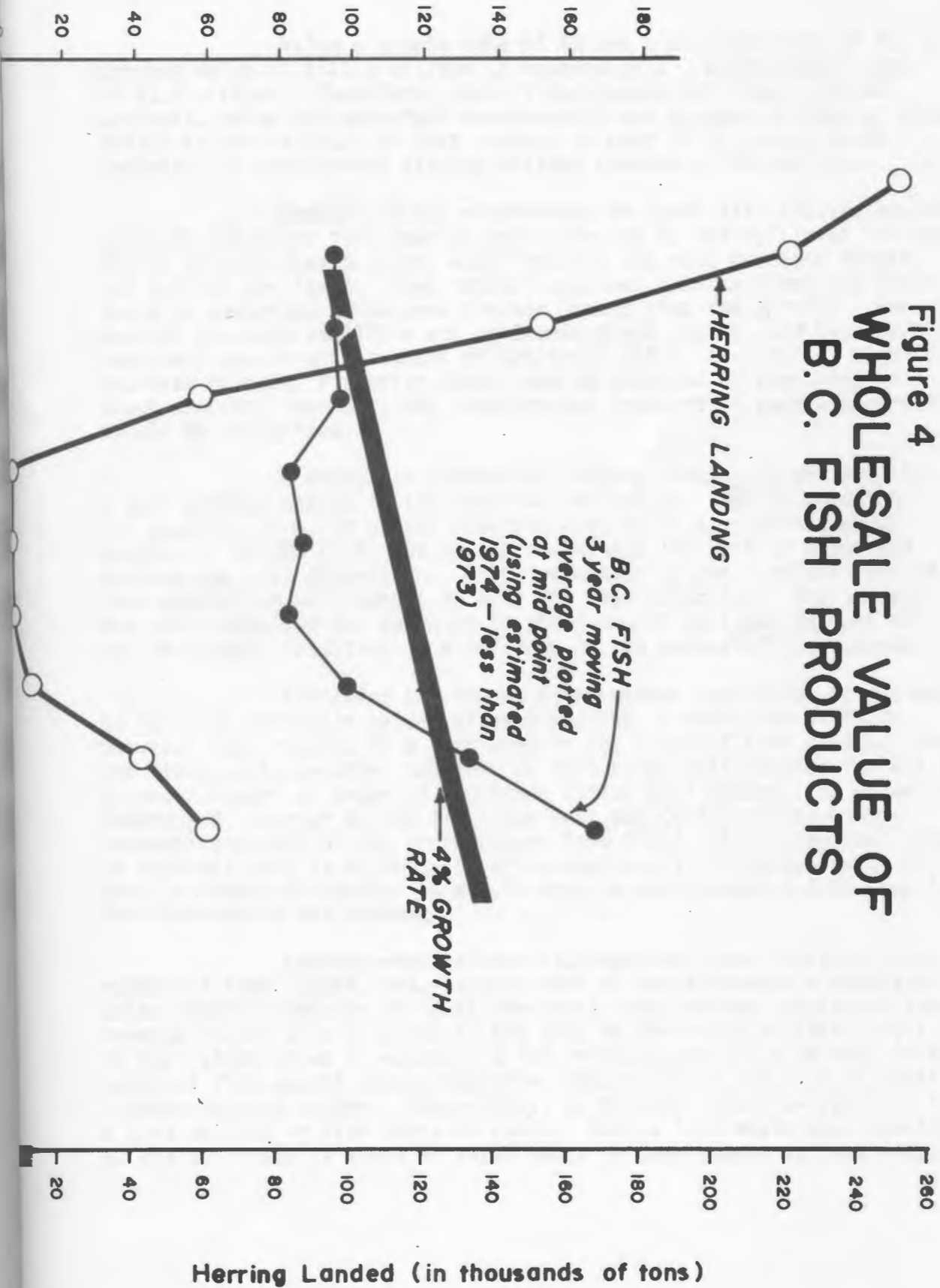
* All figures in millions of 1974 dollars

Some environmental costs show up in hard dollar terms. Specifically, the impact on the \$40 million per year fishery can be counted in dollars. Figure 4 shows the changes in the wholesale value of all fish and fish products produced in British Columbia in constant 1961 dollars (deflater indices from Statistics Canada) for the last ten years.

Salmon landing have accounted for up to 90% of this value in some of the last ten years as a result of the collapse of the herring population from 1967 to 1971. Careful management has built herring back up to the point where, in 1973, it accounted for 12.2% of the wholesale catch value (halibut amounted to 4.5%, salmon 77.8%, and "others" 5.5%).

As can be seen from Figure 4, the value of B.C. fish and fish products has been rising at an average rate of well over 4% annually in real dollar terms, assuming the herring fishery can be managed. The degree to which the value of B.C. fish products can continue this growth is uncertain, so we propose to use a growth figure of just 4% in real dollar terms for the following calculations.

Wholesale Value of Fish and Fish Products
from B.C. in Constant 1961 Dollars



Using a growth rate of 4% and a discount rate of 7%, a present value of \$111.3 million is equaled by a present annual cost of \$3.2 million. Therefore, even if non-commercial items such as aesthetic value and waterfowl preservation are assumed to have no value, Ridley Island is equal to Port Simpson in cost if it causes an 8% reduction in the current fishing related revenue of \$40 million.

Because of the differences in their life cycles, herring would be the major fish species most affected by oil spills at or near Ridley Island, Skeena salmon would receive the next greatest impact, and halibut the least. Some "other" species, such as clams and crabs, would be subjected to an even greater impact than the herring. Because most of the data available are on Skeena River salmon, and because they represent the largest segment of the total catch, an order of magnitude estimate of total fisheries impact can be obtained by examining only those species. However, the inaccuracies inherent in such a generalization should be recognized.

A change in commercial fishing revenue is achieved by a much smaller change in the survival rate of the fish in question. For example, if a run of 100 spawners results in a returning adult population of 200 fish, 100 may be caught and 100 left to spawn and produce the next generation. A 10% reduction in the survival rate of this population will result in only 180 fish returning. One hundred are still required for spawning or the run will decline, so just 80 can be caught, resulting in a 20% drop in the number of fish caught.

Examining the Skeena River salmon population on the basis of relative wholesale values of each species, a reduction of 1% in survival rate results in a 1.9% drop in the value of fish caught. There are little data on other species, so this ratio will be used for all fish in order to get an order of magnitude estimate of impact. As shown in Appendix B, Chapter 6, the fishermen must pay certain fixed costs (amounting to 47% of the gross return from fish). As a very small drop in survival rate is unlikely to drive anyone out of the business, this cost is likely to remain, so a 1.9% drop in catch means a 3.6% drop in the fishermen's net revenue.

Cannery wages should fluctuate in direct ratio to the number of fish caught, and, because much of the fishermen's operating costs involve payments to local merchants, the service industry's lost revenue should also be close to the drop in the value of fish caught. In the ratios shown in Appendix B for Prince Rupert, a 1.9% drop in the value of fish caught should therefore result in a 2.35% loss in total fishing related income. Accordingly, an 8% loss should be realized from a 3.4% decline in fish survival rates. Such a loss would mean development at Ridley Island is equal in total costs to development at Port Simpson.

Considering the potential value of the Ridley Island area for rearing fish, is an average of less than one spill per year at Ridley Island combined with a very infrequent large spill sufficient to cause such a decline? Probably not, but it is impossible to make such an estimate with the available data. Even with far more refined environmental information, the best guess which could be hazarded may be that the impact will amount to from 0.1% to 5% decline in average survival rate.

As a result, a cost comparison of the two sites cannot be made in the traditional fashion. Instead, we intend to examine the implications for certain specific interest groups.

8.3 The Sectors of Society Which Have an Interest in Costs

There are four main segments of society which should be examined separately to get an appreciation of what the total costs imply. These segments are the Canadian National Railway, the port developer, (assumed to be the same party as that selling coal), and the communities of Prince Rupert and Port Simpson.

8.3.1 The Canadian National Railway

As noted above, the major difference between port developments at Port Simpson and Ridley Island in direct costs is absorbed by the railway. This amounts to a capital cost for road construction of \$30 million (less the \$1 million that it would cost at Ridley), an expenditure of \$10.8 million for locomotives, and an operating and maintenance expenditure of \$2.5 million (less the \$0.4 million per year experienced at Ridley). Amortizing the railway construction costs and the cost of extra locomotives, this works out to a cost of \$2.9 million per year plus 31 cents per ton of material moved. Assuming the port is operating at full capacity, this means a full extra cost of 55 cents per ton moved.

Acknowledging the extra operational and administrative problems inherent in operating a rail system with two ends (at Port Simpson and Prince Rupert) and a governing grade twice the maximum grade on the rest of the line, we would assume for the sake of discussion that the CNR would charge a differential cost of about one dollar per ton for shipping to Port Simpson as opposed to shipping to Ridley Island.

8.3.2 The Port Owner and User

The non-coal products which are noted for this project are typically high value/low volume products. Accordingly, slight differences in transportation rates make very little difference to the

profitability of the companies mining and selling the product. On the other hand, coal is typically a very high volume and low profit commodity. Accordingly, transportation costs become an important item when examining coal shipment. The going world price for free market coal at the moment is about \$30 per ton, but for longer term contracts the price is normally based on the costs of the producer more than the alternative price for the purchaser. An excellent example of such a contract is the Kaiser Resources contract with its Japanese customers, which contains escalator clauses for increased costs and also involves debt and equity financing by the purchasers of the coal.

The addition of a transportation cost amounting to \$1 per ton is not a large item in coal selling for \$30 per ton. However, this difference of 3% of the selling price may have a major impact on the profitability of the operation. Once again turning to Kaiser Resources as an example, it is noteworthy that their latest financial report details the 1973 net earnings before extraordinary items to be 2.9% of sales. Therefore, a transportation surcharge of 3% of sales eliminates all profit in the operation. However, as stated above, this profit is based on a long term fixed price contract with built in escalator clauses. Rather than being at the mercy of the current fluctuations in energy prices, it is quite possible the purchaser may be willing to arrange such a long term contract with a shipper from the Prince Rupert area which will involve a selling price to yield a similar profit in spite of transportation costs.

One must acknowledge, however, that world coal prices are quite competitive, and this 3% differential at the purchaser level may be sufficient to send the purchasers to other countries, or to convince the developer not to build a coal port in Canada. A decision not to construct a port in the study area would cause important socio-economic effects in Prince Rupert.

8.3.3 The Community of Port Simpson

As stated above, a road is about to be built from Prince Rupert to Port Simpson. Accordingly, the local cultural implications of a road connection cannot be charged against the port development itself.

However, the introduction of a major port development in the beautiful natural harbour of Port Simpson directly across from the community, and the resultant automobile, train and ship movement is still a very large change in the local situation. Some local employment would be generated, including service facilities, but it is difficult to foresee

whether this would offset the loss of their existing life style for the local inhabitants.

We would suggest this is a question which can be answered only by the people of Port Simpson after they have been presented with the options and the information contained in this report.

Furthermore, it should be recognized that, if Ridley Island was chosen as the port site, there would be some small adverse effect on the fish and wildlife used by the people of Port Simpson. Accordingly, the people of the community must chose between a small loss for no gain (Ridley Island), or an important change in their current life style for a significant economic gain (Port Simpson). The fact that a rail line to Port Simpson removes any economic disadvantage from future development of heavy industry in Port Simpson should also be recognized, as should the fact that related community development would, of necessity, take place on the present Indian reserves of the Coastal Lowland.

8.3.4 The Community of Prince Rupert/Port Edward

The people of Prince Rupert have been promised port development for decades and the failure of these promises to materialize is one of the major items of dissatisfaction in the community. The details of the effects of such development are not apparent to most people, and we would hope this report will provide some information to permit the community to decide its priorities.

It appears to us that the choice of Ridley Island may result in no real gain to Prince Rupert unless it further stimulates local growth. The choice of Port Simpson provides more net income directly, and retains the option of major industrial expansion at a nearby location which will not really affect the natural environment of Prince Rupert, but will greatly enhance the community's economic health. However, the choice of Port Simpson carries with it the risk that the high cost of development (related to rail access) may be prohibitive to any private developer, and therefore no port at all may be built in the study area.

It is estimated that in 1974 the total gross income in the study area was about \$87,500,000. The gross income during construction is estimated to be about 1.6% of that (peaking at 2.5%) for the Ridley Island site and 2.5% (peaking at 4.5%) for the Port

CHAPTER 9Conclusions

1 Because port development at Kitson Island involves a large impact on anadromous fish and a major potential impact on both fish and wildlife, it is considered environmentally unacceptable.

2 On a strictly environmental basis, Port Simpson is quite clearly the best site in the study area for port development alone or with related industrial development.

3 Including the difficulties and costs of railway access to Port Simpson, port developments at Port Simpson, Ridley Island, or Ridley/Fairview (PART 4 be equal overall), although their characteristics are quite different.

CONCLUSIONS AND RECOMMENDATIONS

4 Considerations of further related industrial developments overshadow the direct effects of the port development itself. This study was not aimed to examine such related developments in detail.

CHAPTER 9Conclusions

- 9.1 Because port development at Kitson Island involves a large impact on anadromous fish and a major potential impact on both fish and wildlife, it is considered environmentally unacceptable.
- 9.2 On a strictly environmental basis, Port Simpson is quite clearly the best site in the study area for port development alone or with related industrial development.
- 9.3 Including the difficulties and costs of railway access to Port Simpson, port developments at Port Simpson, Ridley Island, or Ridley/Fairview seem to be equal overall, although their characteristics are quite different.
- 9.4 Considerations of further related industrial developments overshadow the direct effects of the port development itself. This study was not aligned to examine such related developments in detail.

CHAPTER 10Recommendations

- 10.1 The choice of a port site in the Prince Rupert area should await the outcome of current province-wide studies of the best locations for heavy industry in the province. For the Prince Rupert area, the working assumption should be that an integrated port and industrial complex will be centred on Port Simpson, with the access railway and road constructed as a public undertaking.
- 10.2 If no major heavy industrial complex is envisioned for Prince Rupert, the choice of the bulk-loading site within the study area should depend upon the opinions of the people of the study area (particularly those in Port Simpson) after they have been presented with the available options and impact projections. The working assumption should be that a bulk-loading facility will be constructed at Ridley Island, and that further industrial development in the area will not include major heavy industry.

CHAPTER 11

Recommended Terms of Reference for Phase 3

In accordance with our terms of reference, which include the "Specification of investigations required to appropriately detail recommended mitigating measures", we recommend the following terms of reference for Phase 3 - "Development of Detailed Environmental Design Criteria".

Two sets of recommended Terms of Reference are included, as the problems to be studied vary depending upon whether Ridley Island or Port Simpson is the site selected for a bulk-loading facility. The recommended terms of reference do not address the question of further related industrial development.

In addition, an assessment of the movement and extent of such pollutants is required. This aspect will involve the collection of current data as well as wind, wave, and tide information, and a statistical correlation of these factors with the wind directions as developed above. This correlation will also be used to establish the scope of the study area including all of Port Simpson, which are not restricted to those sites, as well as the movement of the pollutants.

Biological studies will be carried out near at least one of the bulk storage areas to define ecologically valuable areas. Particular attention should be paid to areas used by waterfowl, including nesting, and roosting colonies.

Based on all the above, the environmental plan will be developed and various forms of monitoring will be recommended as well as collection control systems and facilities will be assessed for their cost effectiveness in reducing the environmental risk. Necessary high level action will also be identified, as well as "contingency" in the cost effectiveness terms.

Statement of Work for Phase 3

This part of the study involves environmental issues in the detailed engineering design. There is little flexibility in the actual location of the facility and its works, but the specific location should recognize the need to minimize disturbance of some areas (including the areas from which Ridley Island and its

TERMS OF REFERENCE

PHASE 3 - DEVELOPMENT OF DETAILED ENVIRONMENTAL DESIGN CRITERIA

RIDLEY ISLAND BULK LOADING FACILITY

A. Assessment of Regional Impacts

The most important question in regard to port development at Ridley Island involves the probability of oil spills and operational discharges. Part A of this study involves a statistical analysis of the frequency, location and size of such incidents based on experience at similar facilities elsewhere in the world and on the local navigational characteristics of Ridley Island and its approaches.

In addition, an assessment of the movement and extent of such discharges is required. This aspect will involve the gathering of current data as well as wind, wave, and tide information, and a statistical correlation of these factors with the spill probabilities as developed above. This correlation will then be used to establish the parts of the study area including all of Chatham Sound, which are most threatened by these risks, as well as the magnitude of the risk.

Biological studies will be carried out over at least a twelve month field season to define ecologically valuable areas. Particular attention should be paid to areas used by waterfowl, spawning herring, and rearing salmon.

Based on all the above, the environmental risk will be evaluated, and various types of navigational aids and restrictions as well as pollution control measures and facilities will be assessed for their cost effectiveness in reducing the environmental risk. Unacceptably high risks which may exist will be identified, as well as any "break-points" in the cost effectiveness curve.

B. Assessment of Site-Specific Impacts

This part of the study involves environmental input to the detailed engineering design. There is little flexibility in the actual location of the facility and its access, but the specific location should recognize the need to minimize disruption of deer winter range (including the access from Kaien Island to Ridley Island) and of

waterfowl habitat between the islands. In addition, every effort should be made to preserve the area just off Ridley Island for future fish rearing. The latter aspect will involve inshore water quality and fish utilization studies, with a view to establishing overall water quality objectives to be met jointly by the bulk loading terminal and the pulp mill.

All locational design work by the engineering designers must be carried out jointly with the environmental study team to produce an optional design which minimizes both cost and impact. Close cooperation on all phases is essential.

In addition, navigational and operating experts will work jointly with the environmental team to produce an operating manual for port uses with detailed guidelines for sound operating practice. Responsible agencies for normal operation and emergency operations (for example, during spills) will be detailed, as will emergency stand-by equipment. In particular, responsibility for control and clean up of oil spills and coal dust will be given to specific bodies so that both authority and responsibility will be quite clear.

C. Assessment and Monitoring of Construction Impacts

In conjunction with the engineering team, the environmental study group will also develop a manual of construction techniques and procedures to be used, including restrictions on types of equipment, timing, and location of temporary access and facilities.

In close cooperation with government regulatory agencies, the construction will be monitored by the same environmental personnel who set up the construction manual, to ensure the "spirit" of the manual is followed, rather than the "letter".

D. Post-Construction Surveillance of Operations

During normal and emergency operations, surveillance of the effectiveness of the environmental control measures will be carried out, and any modifications deemed necessary will be made if the original measures do not have the desired effectiveness.

TERMS OF REFERENCE

PHASE 3 - DEVELOPMENT OF DETAILED ENVIRONMENTAL DESIGN CRITERIA

PORT SIMPSON BULK LOADING FACILITY

Parts B, C, and D of the terms of reference for the Ridley Island facility also apply to Port Simpson. However, special attention must also be given to minimizing the impacts of location, construction, and operation on fish-bearing streams, including establishment of artificial enhancement facilities as compensation for losses incurred.

In addition, expansion of the details of socio-economic mitigation measures as contained in the phase 2 report will also be carried out.

Library
Marine Sciences Branch
Pacific Region

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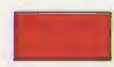


PRINCE RUPERT BULK LOADING FACILITY
ENVIRONMENTAL ASSESSMENT OF ALTERNATIVES

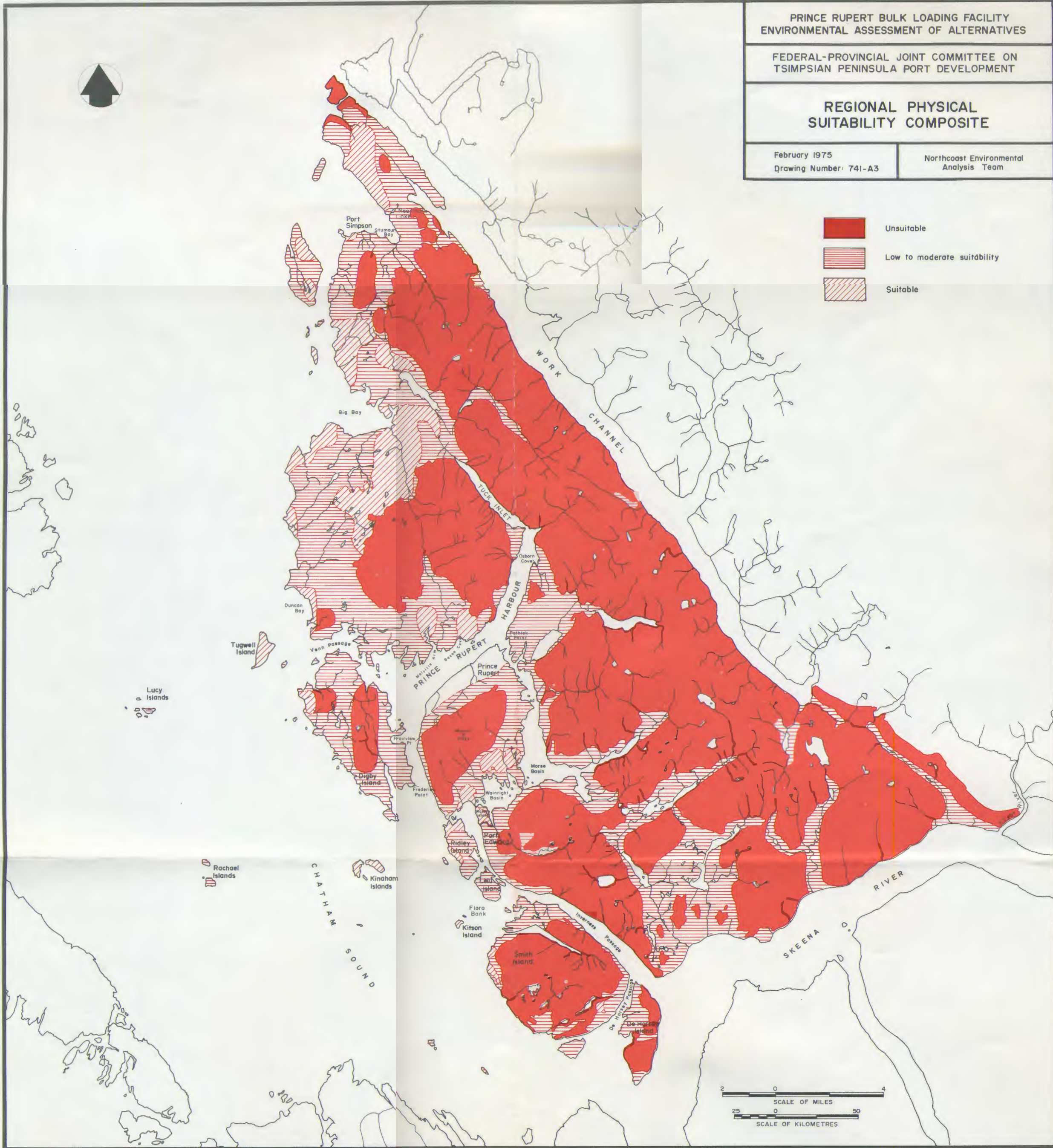
FEDERAL-PROVINCIAL JOINT COMMITTEE ON
TSIMPSIAN PENINSULA PORT DEVELOPMENT

REGIONAL PHYSICAL
SUITABILITY COMPOSITE

February 1975
Drawing Number: 741-A3

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Analysis Team

-  Unsuitable
-  Low to moderate suitability
-  Suitable



PRINCE RUPERT BULK LOADING FACILITY
ENVIRONMENTAL ASSESSMENT OF ALTERNATIVES

FEDERAL-PROVINCIAL JOINT COMMITTEE ON
TSIMPSIAN PENINSULA PORT DEVELOPMENT

ENVIRONMENTAL SENSITIVITY
TO DEVELOPMENT

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