Industrial Development Subsidiary Agreement

SKEENA - QUEEN CHARLOTTE REGIONAL DISTRICT FEASIBILITY STUDY FOR A KELP MEAL PROCESSING PLANT

AUGUST 1980

Research Report

Province of British Columbia

Ministry of Industry and Small Business Development

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SKEENA - QUEEN CHARLOTTE REGIONAL DISTRICT FEASIBILITY STUDY FOR A KELP MEAL PROCESSING PLANT

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SKEENA-QUEEN CHARLOTTE REGIONAL DISTRICT

FEASIBILITY STUDY

FOR A

KELP MEAL PROCESSING PLANT

August 1980

A REPORT FROM

Woods Gordon

MANAGEMENT CONSULTANTS

PREFACE

This study was funded by a grant from the Research Program of the Canada - British Columbia Industrial Development Subsidiary Agreement. The Agreement, which provides a variety of programs for industrial development, is cost shared equally by the Governments of Canada and British Columbia through the Department of Regional Economic Expansion and Ministry of Industry and Small Business Development respectively. Programs under the Agreement are administered by the Ministry of Industry and Small Business Development and managed by a joint Federal/Provincial Committee.

The responsibility for the contents of this report is the Consultant's alone, and the conclusions reached herein do not necessarily reflect the opinions of those who assisted in the course of this investigation or the Federal/Provincial Governments which funded the study.

SKEENA-QUEEN CHARLOTTE REGIONAL DISTRICT

FEASIBILITY STUDY

FOR A

KELP MEAL PROCESSING PLANT

August 1980

A REPORT FROM

Woods Gordon

MANAGEMENT CONSULTANTS

Woods Gordon

Management Consultants

P.O. Box 10101, Pacific Centre
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August 25, 1980

Mr. R. Clarke
Co-Ordinator
Skeena-Queen Charlotte
Regional District
#4 - 214 West 3rd Avenue
Prince Rupert, B.C.
V8J 1L1

Dear Mr. Clarke:

We have completed our study of the feasibility of establishing a kelp meal processing plant in the Prince Rupert - Queen Charlotte Islands area. We are pleased to present this executive summary letter followed by our detailed report of the study.

The feasibility study has been undertaken by our firm utilizing the expertise and experience of Agro-Mar Inc. of Los Angeles, Phillips Barratt and Peter S. Hatfield Ltd., both of Vancouver. We have carried out the study under the terms of reference of our proposal, dated December 29, 1978, modified as regards the plant site location by your letter of December 14, 1979 (Appendix A of the report).

ASSUMPTIONS

Our study has been based on the following key assumptions:

1. The kelp harvester and processing plant would be new and built to full design specifications.

2. The entire operation would be the responsibility of an employed Manager and not be Owner operated.

3. The entire capital cost of $2.3 million would be financed by a 10 year loan at 13% average annual interest over the 10 year period. We have assumed

that, irrespective of the initial debt/equity ratio, an imputed return to shareholders should be calculated equal to the current cost of capital. This would be equivalent to debt financing of the total capital cost.

4. All revenue and cost estimates in our report reflect 1980 constant dollars so as to provide a standard base which a potential investor may modify according to his own price and cost inflation assumptions.

SUMMARY OF FINDINGS

We have summarized below our findings from the various phases of the study.

Kelp Resource Survey

1. A sufficient volume of harvestable Macrocystis and Nereocystis kelp exists within an economic radius (65 km) of either the Masset or Prince Rupert area to support a plant producing the forecasted sales volume of kelp meal in years 1 - 10. The volume of harvestable kelp has been estimated as follows:

Type of Craft	Estimated Biomass Permitted To Be Harvested (Tonnes)		
	Masset Area	Prince Rupert Area	Total
Conventional - similar to that used by Kelco and Stauffer in California	5,800	10,100	15,900
Modified - perhaps harvestable under favourable conditions by specially developed craft	2,400	6,500	8,900
Total	8,200t	16,000t	24,800t

2. The likely length of the harvesting season would be 100 days between April and October, of which 75 - 85 days would be between June and September. Macrocystis harvesting may start in April (or as early as weather conditions permit) but Nereocystis harvesting may be prohibited before July 1st.

3. 100% of Macrocystis may be harvested. However, the Marine Resources Branch has indicated that only 15% - 20% of Nereocystis may be harvested annually, subject to the harvesting season.

4. Kelp harvesting and processing in B.C. are regulated by the Fisheries Act (Chapter 150, Section 30) and the Fisheries Act Regulations (Part II, Sections 5 and 6). The only significant regulation refers to the Minister's determination of the volume of kelp permitted to be harvested. Present regulations do not specify such volume but we have assumed this to be as in paragraph 3 above.

Market Review

1. At present, Stauffer Chemical Co. of Oxnard, California is the only North American source of Pacific Kelp Meal for human consumption. Stauffer currently deals through approximately 3 major distributors, selling mainly in 40,000 lbs. loads at a price of US$0.84/lb. FOB Oxnard (CN$0.97/lb.).

2. Approximately 320 tonnes of Pacific kelp are currently sold by Stauffer in North America. Ten years ago, the market volume was 1,100 - 1,400 tonnes per year and has steadily declined. Our interviews with distributors have

indicated that as the kelp selling price has increased, demand has decreased; however, several distributors have claimed that the market volume would expand if more kelp was available for sale. We have estimated that if B.C. kelp became available, the market would grow 3% - 5% per year.

3. The North American market for Pacific kelp is not significantly affected by either Atlantic or imported kelp. The three types of kelp are not interchangeable due to their different tastes and composition; moreover, the volume of imported kelp is insignificant.

4. We have estimated the selling price for B.C. kelp meal at CN$0.85/lb. FOB Masset for a 40,000 lbs. load ($1,870/tonne for a 18.2 tonne load). This price is competitive with Stauffer's present price of CN$0.97/lb. FOB Oxnard which we have estimated to be equivalent to CN$0.89/lb. on an FOB Masset basis.

5. At the above price of $1,870/tonne, we have estimated the market for B.C. kelp meal as follows:

Estimated Market For B.C. Kelp Meal

	Total Market (Tonnes)	B.C. Share (Tonnes)	% Approx.
Year 1	320	85 - 95	(30%)
Year 2	340	180 - 200	(55%)
Year 3	355	240 - 260	(70%)
Year 4	370	310 - 330	(85%)
Year 5	390	350 - 370	(90%)
Year 10	500	480 - 520	(100%)

On-Land Site Selection for Kelp Meal Plant

1. We inspected the seven on-land sites identified in our proposal to review their suitability for a kelp meal processing plant. The key aspects we examined included adequacy of site area, condition and suitability of existing buildings and dock, utility services available, access to transportation, estimated development costs and site availability.

2. We concluded from our site surveys that only North Pacific Cannery, Sunnyside Cannery and the Old Alginate plant were feasible sites. Of these, the Old Alginate plant was selected as the preferred site based on a comparison of preliminary capital and operating cost estimates.

3. Following the completion of this phase, however, it became apparent that difficulties regarding highway right-of-way and the availability of land would not be easily resolved. Therefore, the Old Alginate plant site could not be considered for the proposed kelp plant for purposes of this study. In light of this, we were directed by your letter dated December 14, 1979 to assume a theoretical site with the conditions prevailing at the Old Alginate plant as the basis for our costing.

Estimates of Capital Costs

1. Based on separate capital cost estimates for an on-land kelp plant and a floating kelp processing barge, we have selected the substantially cheaper on-land plant as the basis for our pro forma operating results.

Woods Gordon

Proposed Kelp Meal Plant

Pro Forma Profit/Loss Statements

(Thousands of 1980 Constant Dollars)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 10
% of total market (approximate)	30%	55%	70%	85%	90%	100%
Tonnes sold	90t	190t	250t	320t	360t	500t
	$	$	$	$	$	$
Revenue	168	355	468	598	673	935
Less:						
Operating expenses	156	197	233	269	287	340
Depreciation	143	143	143	143	143	143
Interest expense	314	344	367	385	392	303
	613	684	743	797	822	786
Net Profit (Loss) Before Taxes	$(445)	$(329)	$ (275)	$ (199)	$ (149)	$ 149

Estimated Cash Flow Analysis

(Thousands of 1980 Constant Dollars)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 10
Net Profit (Loss) Before Taxes	(445)	(329)	(275)	(199)	(149)	149
Add:						
Depreciation	143	143	143	143	143	143
Less:						
Cash deficit b/f	-	(532)	(948)	(1,310)	(1,596)	(2,763)
Loan repayment	(230)	(230)	(230)	(230)	(230)	(230)
Cash Surplus (Deficit) Before Taxes c/f	$(532)	$(948)	$(1,310)	$(1,596)	$(1,832)	$(2,701)

2. Following are the capital cost estimates of the on-land plant and the 25 metre harvester to be used with it:

On-Land Processing Plant	$	$
Land (0.6 acres)	14,000	
Building (1,206 m^2)	600,000	
Dock	290,000	
Fixed and mobile equipment	550,000	
Office furniture	6,000	1,460,000
25 m Harvester		800,000
		$2,260,000
TOTAL COST	Say	$2,300,000

Pro Forma Operating Results and Cash Flow Analysis

1. We have prepared, in the opposite page, our pro forma operating results and cash flow analysis of the proposed kelp plant based on our estimated market for B.C. kelp meal, our capital cost estimates and our operating cost assumptions.

2. It is clear that the main factors causing the operating losses in years 1 - 5 have been low revenue, high depreciation and high interest expense. In addition, the cash flow analysis has indicated that, under our assumptions, the proposed operation would generate insufficient cash to cover operating expenses, interest expense and loan repayments.

Proposed Kelp Meal Plant
Net Profit (Loss) Before Taxes
Under Various Assumptions

(Thousands of 1980 Constant Dollars)

		Year 1 $	Year 2 $	Year 3 $	Year 4 $	Year 5 $	Year 10 $
A. 50% of market in year 1							
% of market		50%	75%	100%	100%	100%	100%
Tonnes sold		150t	250t	350t	400t	450t	500t
with price	85¢/lb.	(362)	(238)	(105)	(32)	62	155
	89¢/lb.	(349)	(216)	(75)	3	101	199
	95¢/lb.	(329)	(183)	(28)	56	161	265
B. 100% of market from year 1 onwards							
% of market		100%	100%	100%	100%	100%	100%
Tonnes sold		320t	400t	450t	500t	550t	600t
with price	85¢/lb.	(120)	(15)	88	163	221	309
	89¢/lb.	(91)	44	127	207	269	362
	95¢/lb.	(49)	97	187	273	342	442
C. Capital cost reduction							
% of market		30%	55%	70%	85%	90%	100%
Tonnes sold		90t	190t	250t	320t	360t	500t
10% reduction		(400)	(280)	(221)	(139)	(83)	193
20% reduction		(355)	(231)	(168)	(80)	(19)	238
30% reduction		(310)	(182)	(114)	(22)	46	283
D. Interest rate							
% of market		30%	55%	70%	85%	90%	100%
Tonnes sold		90t	190t	250t	320t	360t	500t
10%		(372)	(242)	(175)	(83)	(20)	219
15%		(493)	(389)	(347)	(284)	(248)	(62)
E. ARDSA/RDIA plus LILA financial assistance							
% of market		30%	55%	70%	85%	90%	100%
Tonnes sold		90t	190t	250t	320t	360t	500t
Capital cost ($2.3 million) and working capital ($100,000) as follows:							
ARDSA or RDIA	$ 270,000						
LILA	$ 250,000						
Equity	$ 480,000						
Loan	$1,400,000						
Capital Cost	$2,400,000	(306)	(191)	(122)	(27)	60	269

Sensitivity Analysis

1. As indicated in page vi, the main factors causing the significant losses in years 1 - 5 have been low revenue, high depreciation and high interest expense. For comparative purposes, we have modified our assumptions regarding B.C. kelp's market share, kelp meal selling price, capital costs, interest rate, and financing arrangements. We have presented, on the opposite page, the adjusted operating results for years 1 - 5 and year 10 under such modifications. It is clear when considering these modified assumptions separately that the project could be viable only if 100% of the market was obtained in year 1.

2. In light of the above, we have also developed a pro forma cash flow analysis based on the assumption of 100% of the market in year 1 at a price of 85¢/lb.

Proposed Kelp Meal Plant
Pro Forma Cash Flow Analysis
Assuming Entire Market from Year 1 Onwards
(Thousands of 1980 Constant Dollars)

	Year 1 $	Year 2 $	Year 3 $	Year 4 $	Year 5 $	Year 10 $
Net profit (loss) before taxes	(120)	(9)	88	163	221	309
Add:						
Depreciation	143	143	143	143	143	143
Less:						
Cash surplus (deficit) b/f	-	(207)	(285)	(284)	(208)	638
Loan repayment	(230)	(230)	(230)	(230)	(230)	(230)
Cash Surplus (Deficit) Before Taxes c/f	(207)	(285)	(284)	(208)	(74)	860

A cash surplus before taxes would be generated from year 6 onwards rising to $860,000 by the end of year 10 and, under this assumption, a potential investor may well consider the project to be economically viable.

CONCLUSION

It is our opinion that the proposed kelp meal processing plant in Masset would not be economically viable under the market, operating cost and financing assumptions we have made. Further, based on our sensitivity analysis, the viability of the operation would not be significantly improved by any one of the following assumptions:

(i) A capital cost reduction of up to 30%, or

(ii) A selling price of 95¢/lb. FOB Masset compared with 89¢/lb. which is Stauffer Chemical's present price on a comparable basis, or

(iii) A lower average interest rate of 10%, or

(iv) Possible financial assistance through the ARDSA/RDIA and LILA programs.

We have not considered the cumulative effect of combining the above assumptions as we believe this to be an unrealistic possibility. A potential investor might think otherwise.

Under our pricing, cost and financing assumptions, a potential investor could consider the operation viable only if (a) 100% of the present North American market was obtained in year 1 and (b) the accumulated amounts of interest and loan repayments unable to be paid could be deferred. We do not believe the foregoing is likely to occur. However, under different design and cost assumptions,

the project's viability could improve significantly through substantial capital cost reductions and favourable financing arrangements. This would be possible if, say, an existing building, vessel and dock could be acquired at a sufficiently low price and modified as necessary.

Finally, the viability of the project would also be affected by future price and cost increases which we have not forecasted. It should be remembered that, under the terms of our proposal, all revenue and cost estimates in this report reflect 1980 constant dollars so as to provide a standard base which a potential investor may modify according to his own price and cost assumptions.

We have very much appreciated the opportunity to carry out this feasibility study on your behalf.

Yours very truly,

Woods Gordon

WOODS GORDON

N. S. MacKenzie
J. G. Scott

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TABLE OF CONTENTS

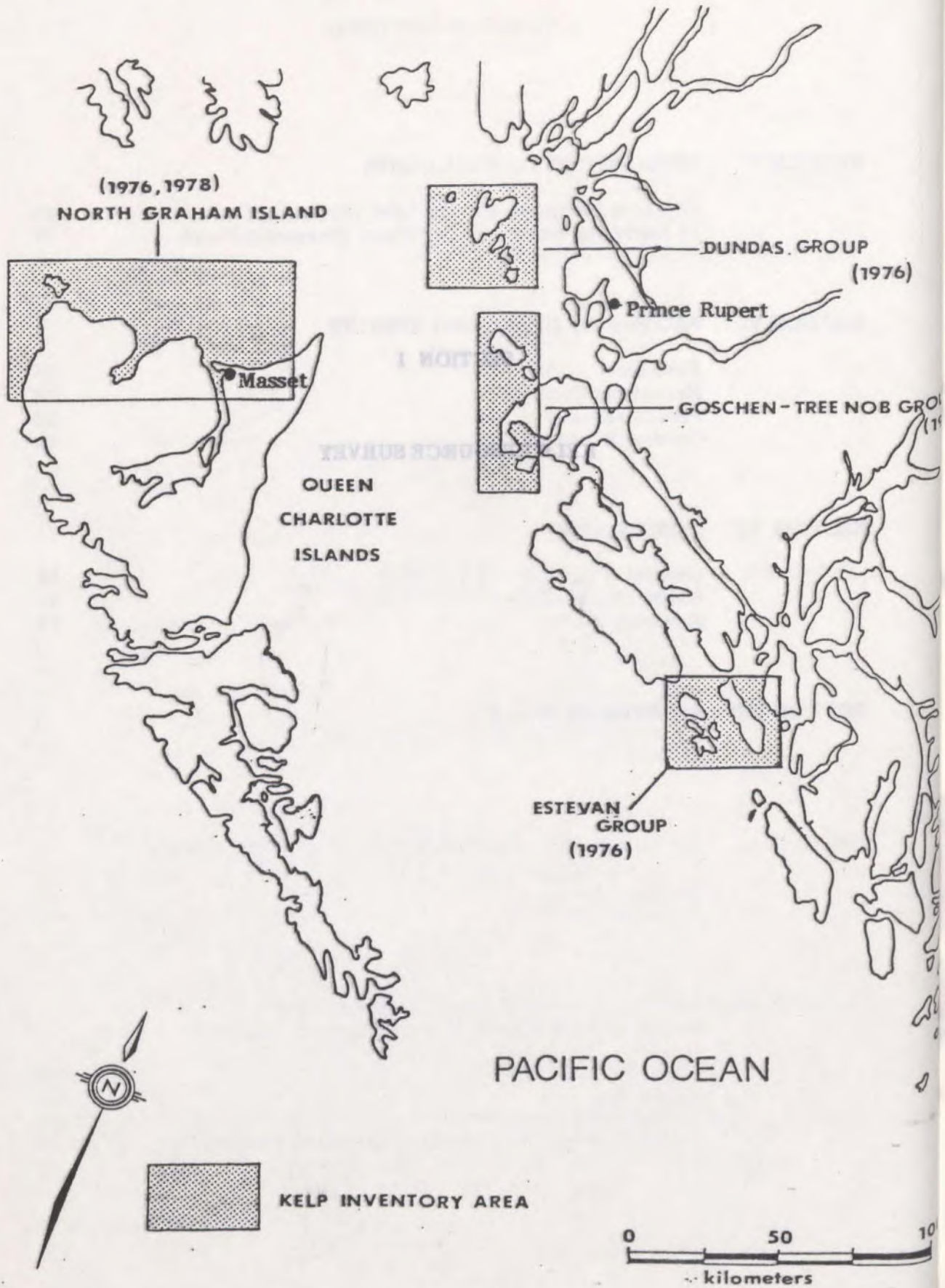
Continued...

TABLE OF CONTENTS

SECTION I

KELP RESOURCE SURVEY

THE SKEENA - QUEEN CHARLOTTE REGION



KELP RESOURCE SURVEY

METHODOLOGY

In this first phase of our study, we carried out a physical on-site survey of the following four island groups comprising the Prince Rupert - Queen Charlotte Islands area (PR/QC area) -- see map opposite:

Graham Island - North and Northwestern Coasts

The Dundas Island Group

The Goschen Island Group

The Estevan Island Group

The purpose of our survey was to determine, firstly, what proportion of the kelp growing in the PR/QC area could be commercially harvested and, secondly, whether the harvestable amount would be sufficient to support the proposed kelp meal processing plant.

Prior to our physical survey, we carried out the following steps to provide us with relevant background information:

1. We reviewed available information on kelp inventory and environmental and climatic conditions. Of particular importance were the results of four inventory surveys of the PR/QC area undertaken by the Marine Resources Branch of the Ministry of the Environment; we reviewed these results in detail together with relevant nautical charts, tide tables and weather station reports.

2. We interviewed Mr. Coon of the Marine Resources Branch and Dr. Foreman, a UBC Research Scientist, under contract to the Marine Resources Branch,

who was studying the effects of harvesting Nereocystis. These interviews were carried out to obtain a fuller understanding of the life cycle and growth patterns of Macrocystis integrifolia and Nereocystis luetkeana, the main kelp species growing in the QC/PR area. No other kelp species were considered in this study.

3. We discussed, with the Marine Resources Branch, any regulations that might impose constraints on harvesting and processing kelp.

4. We observed the experimental harvester of the Marine Resources Branch in operation in a dense bed of Nereocystis near Port McNeill.

PREVIOUS SURVEYS

The four surveys undertaken by the Marine Resources Branch were critically reviewed with our primary focus on the methodology used to determine the biomass of the kelp beds. However, we also made some preliminary classifications of the kelp beds and assessed the manner in which they might be harvested.

Findings of Previous Surveys

The Kelp Inventory Method of determining kelp biomass used in the studies that we reviewed appears to be reasonably conventional and similar to methods generally followed by major commercial firms and scientific organizations. We concluded that the survey estimates were reasonably accurate regarding the location of the kelp beds, the types and densities of kelp, and their biomass at the time of survey. However, the surveys did not attempt to estimate harvestability. These surveys were conducted in August and early-September, which is the

approximate time of maximum density in the season. Densities would be less in early spring and late fall.

The surveys classified the beds according to high or low density and showed that, within the Dundas Group, Goschen Group and Graham Island, the average low and high densities of Nereocystis at mean water level were significantly higher than those of Macrocystis.

Average Densities as of September 1976

(Tonnes per Hectare)

	Low	High
Nereocystis	31.97	69.02
Macrocystis	6.35	17.00

The cutting speed of a harvester is inversely proportional to the density of a kelp bed. Therefore, in order to operate in beds of both high and low densities, a harvester would need to have variable cutting speeds. Such a feature has been designed in the harvester proposed in this study.

Classification of Kelp Beds

Using the findings of the previous surveys outlined above, we have classified the kelp beds in the following manner:

1. Harvestable/Conventional - Harvestable by "conventional" craft similar to those already used by Kelco and Stauffer in southern California.

2. Harvestable/Modified - Perhaps harvestable under favourable conditions by specially developed craft.

3. Not Harvestable - because of natural hazards such as rock ledges, shallow water and uneven kelp beds.

The survey results showed that a significant amount of kelp might be suitable for harvesting by a conventional harvester. An example of this type of harvester is a 300 tonne (metric tonne), 55 metre barge with a stern-mounted cutting rig (rather like a mower) approximately 8 metres wide. The barge reverses into the kelp bed and rotates the cutting blades approximately 1 metre below the water surface. The cut kelp falls on to a spiked conveyor belt which transports it into the barge. The kelp is picked up by a dragline which distributes the load around the barge. This operation continues until the barge is fully loaded.

In addition to the kelp harvestable by conventional means, there appeared to be a considerable amount of kelp which could not be harvested on a commercial scale using conventional harvesters. However, it appears possible that some of this weed could be harvested under favourable conditions using specially developed equipment. The smaller (about 10-12 metres long) and more manoeuverable experimental harvester with a shallow draft used by the Marine Resources Branch is a suitable prototype for such a commerical harvester.

HARVESTING CONSIDERATIONS

Hazards

The marine terrain of the PR/QC area creates harvesting hazards that are not typical of other commercial harvesting areas, such as California, Mexico and Chile. In the PR/QC area, substantial portions of the kelp biomass occur adjacent to concentrations of small islands, submerged reefs and rocks, or close to rocky shores. We have allowed for such factors in our estimates of harvestable

inventory. High winds, large waves, changing tides, rapid tidal currents and fogs aggravate the hazards of harvesting in the PR/QC area. Climatic conditions are severe in winter months and would appear to preclude any harvesting except during the period of mid-May through mid-October.

Kelp Fish Interactions

We have been told by Mr. Coon of the Marine Resources Branch that newly announced B.C. Government policies guiding the development of the kelp industry will ensure that kelp harvesting does not become so intensive that significant damage is caused to the fish and invertebrate species found in kelp beds. Mr. Coon said that the Marine Resources Branch is carrying out an extensive study of the interactions between kelp and fish and the Branch will restrict growth of the kelp industry until the results of the study are evaluated.

LENGTH OF HARVESTING SEASON

Our review of weather information and our conversations with local residents and fishermen indicate that only a few days in April might be suitable for kelp harvesting. By early June most days are suitable. This condition continues until mid-September, when harvesting days progressively and rapidly decline. Only a few days are likely to be suitable in October. We estimate the maximum days available as follows:

Estimated Maximum Days Suitable for Harvesting

April	May	June	July	August	September	October	Total
5	10	20	25	25	20	10	115

EXAMPLE OF A MACROCYSTIS BED

EXAMPLE OF A NEREOCYSTIS BED

In estimating the maximum suitable days for harvesting, we have assumed 115 days of reasonably calm weather, a suitable harvesting craft, good harvesting judgement and the fact that the four surveys were reasonably accurate. In light of the foregoing variable factors, we have concluded that for planning purposes 100 days should be considered as the likely average length of a harvesting season.

TYPES OF KELP

The principal kelps growing in the PR/QC area are Macrocystis integrifolia and Nereocystis luetkeana (see photographs opposite). Depending on tide level, these plants occur at depths ranging between 1 and 20 meters and are usually attached to rocky substrata.

Macrocystis

Macrocystis intergrifolia is a perennial having a growth pattern similar to that of the Macrocystis pyrifera of California. In both species, the biomass is distributed more or less evenly along the length of the plant. Published information pertaining to the integrifolia growth in the PR/QC area was not available; however, it is currently under study and we were supplied with information based on data gathered in Barkley Sound by the Marine Resources Branch which we understand approximates the PR/QC area.

The Marine Resources Branch estimates of the relative monthly biomass are as follows:

April	May	June	July	August	September	October
90%	95%	100%	100%	95%	90%	80%

Nereocystis

Nereocystis luetkeana is an annual. We understand that spores start growing in late March to early April. By early to mid-May, the tops of the plants have reached the surface. The Marine Resources Branch estimates of the relative monthly biomass are as follows:

April	May	June	July	August	September	October
-	-	25%	50%	75%	100%	75%

Spore release begins as early as June and continues until mature plants are removed from the bed. The Nereocystis spore is extremely sensitive to shading by other plants and if cut too early, competitive seaweeds could establish growth that would prevent the Nereocystis spore from developing the following year. Because of this sensitivity to shading, the Marine Resources Branch believe that the harvesting of Nereocystis should not occur before early July, should not be concentrated in compact areas, and should be limited to 15% - 20% of the standing crop. We estimate, therefore, that the number of days available for harvesting Nereocystis is in the range of 65 to 75.

It is possible that the top portion of the fastest growing Nereocystis plants could be harvested by mid-June, thus allowing younger and smaller plants to reach maturity. These could then sporolate and be harvested between July and September.

The Marine Resources Branch believe that large beds would be adequately protected using a strip harvesting method and a 3-metre cutting blade. This technique, together with a 20% limit on harvesting should not endanger the reproduction of the kelp. In addition, it may be possible to remove larger percentages from early September onward, but this must first be determined to be safe in tests performed by the Marine Resources Branch.

GOVERNMENT REGULATIONS

At present, kelp harvesting and processing in British Columbia are regulated by the Fisheries Act (Chapter 150, Section 30) and the Fisheries Act Regulations (Part II, Sections 5 and 6).

The relevant sections of these two regulations have been summarized as follows:

1. Each person harvesting kelp shall hold a licence to do so and have paid the required fee (presently $50 per licence/year).

2. A royalty shall be paid on all kelp harvested by the licence holder (presently $1.00 per wet tonne).

3. The appropriate B.C. Government Minister may regulate the production, harvesting and processing of kelp. Specifically, he may:

   (a) Define an area and determine the quantity of kelp that may be harvested. While present regulations do not specify such quantity, Marine Resources Branch personnel have indicated that the harvesting of Nereocystis is likely to be limited to 15% - 20% of the total estimated biomass. It appears that 100% of Macrocystis may be harvested in two cuttings per season though, initially, only one cutting may be permitted.

   (b) Prescribe the manner in which harvesting is to be carried out, e.g. a cutting plan, similar to that used by forest companies, must be agreed to by the Marine Resources Branch. Additionally, kelp

harvesting equipment must be constructed so that, firstly, kelp stalks are severed cleanly and, secondly, it is not possible to cut Macrocystis deeper than 5 feet (1.5 m) below the water surface at any time during the harvest operation.

(c) Order the suspension of kelp harvesting in an area for any period of time as dictated by proper kelp resource management. The earliest harvesting date each season has not been prescribed in the regulations; however, the Marine Resources Branch has indicated that Macrocystis harvesting may start as early as weather permits but Nereocystis harvesting may be prohibited prior to July 1st. In certain areas, Macrocystis harvesting may have to be curtailed due to herring spawning and may not be allowed to resume until the herring spawn has hatched.

4. Written monthly records shall be kept of both kelp harvested and processed. A report shall also be submitted to the Minister in such form as he may require.

5. Written records shall be kept at the processing plant of kelp delivered for processing indicating the source, species and quantity of kelp received.

6. The licence fee for a kelp processing plant shall be $200 per licence/year.

TABLE A

ESTIMATED TOTAL KELP BIOMASS AT MEAN WATER LEVEL

(Metric Tonnes)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Harvestable/Conventional			Harvestable/Modified			Total Harvestable			Not Harvestable			Total Kelp Weed		
	Nereocystis	Macrocystis	Total	Nereocystis	Macrocystis	Total	Nereocystis (1 + 4)	Macrocystis (2 + 5)	Total (3 + 6)	Nereocystis	Macrocystis	Total	Nereocystis (7 + 10)	Macrocystis (8 + 11)	Total (9 + 12)
Graham Island															
- Northwestern shore	-	-	-	6,155	465	6,620	6,155	465	6,620	12,485	1,339	13,824	18,640	1,804	20,444
- Northern shore	10,050	3,800	13,850	11,475	150	11,625	21,525	3,950	25,475	11,783	4,102	15,885	33,308	8,052	41,360
Total	10,050	3,800	13,850	17,630	615	18,245	27,680	4,415	32,095	24,268	5,441	29,709	51,948	9,856	61,804
Dundas Island Group															
- Zayas Island	6,700	-	6,700	6,100	-	6,100	12,800	-	12,800	7,828	-	7,828	20,628	-	20,628
- Other Islands	-	-	-	9,800	-	9,800	9,800	-	9,800	26,472	-	26,472	36,272	-	36,272
Total	6,700	-	6,700	15,900	-	15,900	22,600	-	22,600	34,300	-	34,300	56,900	-	56,900
Goschen Island Group															
- Porcher Peninsula	32,450	2,250	34,700	9,050	475	9,525	41,500	2,725	44,225	5,747	340	6,087	47,247	3,065	50,312
- Treen Knob Group	-	-	-	2,900	-	2,900	2,900	-	2,900	10,487	-	10,487	13,387	-	13,387
- Other Islands	-	-	-	2,150	30	2,180	2,150	30	2,180	12,848	304	13,152	14,998	334	15,332
Total	32,450	2,250	34,700	14,100	505	14,605	46,550	2,755	49,305	29,082	644	29,726	75,632	3,399	79,031
Estevan Island Group															
- All Islands	-	-	-	14,250	-	14,250	14,250	-	14,250	33,599	-	33,599	47,849	-	47,849
Grand Total	49,200	6,050	55,250	61,880	1,120	63,000	111,080	7,170	118,250	121,249	6,085	127,334	232,329	13,255	245,584

ESTIMATES OF AVAILABLE KELP

Using the surveys as basic data for amount of biomass and location of kelp beds, we have inspected the beds in the following four areas and developed our estimates of available kelp:

Graham Island

Dundas Island Group

Goschen Island Group

Estevan Island Group

We have classified the kelp as "Harvestable/Conventional", "Harvestable/Modified" and "Not Harvestable" as defined in page 3 of this report. Our estimates of the available kelp at mean water level are shown in Table A opposite.

Graham Island

Northwestern Shore

These beds extend for approximately 30 km down the northwestern shore of Graham Island. This area faces the western ocean, is very exposed and is approximately 80-100 km from Masset Harbour.

We estimate that some 6,600 tonnes (column 9) of kelp weed is available assuming the development of a suitable "modified" harvester. However, beds in this area have two drawbacks compared with the other surveyed areas. First, the beds are a considerable distance from any proposed plant site. Second, the beds are exposed to severe weather and subject to the navigational hazards that have been outlined earlier.

For the present, we do not recommend this area as a source of kelp.

Northern Shore

These beds extend along the northern shore of Graham Island and compared with those on the northwestern shore are less exposed, are substantially larger and present fewer navigational hazards. Some 13,850 tonnes of the kelp from these beds could be harvested with a conventional harvester (column 3) and a further 11,600 tonnes using a modified craft (column 6).

Dundas Island Group

This survey area includes the area surrounding the Dundas Island group including Zayas, Dunira, Melville and Prince Leboo Islands.

These beds contain some 57,000 tonnes of kelp (column 15) and probably offer a greater potential for harvesting than other island areas - for example, the Tree Knob Group. At the northern end of Zayas Island, we confirmed the presence of a major Nereocystis bed. This bed appears to have more than doubled in size since it was surveyed in 1976. We estimate this bed is currently 3 km long, 1,000 metres wide, and contains in excess of 20,000 tonnes of harvestable kelp. As reported earlier, we have found the previous surveys to be accurate, and we therefore conclude that the bed has expanded in size. We understand from the Marine Resources Branch that Nereocystis beds can vary in size from year to year by 10% to 20%.

Because of these variations, we have conservatively estimated the volume of kelp in the Zayas bed as 6,700 tonnes (column 3) harvestable by a conventional harvester and another 6,100 tonnes (column 6) by a "modified" harvester. However, if this Zayas bed were to remain at its current size we estimate that a further 7-10,000 tonnes could be harvested with a conventional harvester. We have not included this additional amount in our estimates.

This large bed can be harvested in even moderately rough weather. The many smaller beds in the area can be harvested as conditions permit. For example, if the wind is from the west, it might be possible to harvest to the east of the small islands. If conditions are such that none of the small islands are approachable, the harvesting craft can proceed to the large bed where physical hazards are few. This would make it possible for the harvester to return fully loaded from the Dundas Island beds even under adverse conditions.

An additional 9,800 tonnes (column 6) is harvestable from other areas using a modified craft.

Goschen Island Group

This survey area includes the area surrounding Goschen Island comprised of the Porcher Peninsula, and Dolphin, Stephen, and Prescott Islands.

A major kelp bed exists along the Porcher Peninsula. The bed is several kilometres long and contains very few hazards to navigation. We estimate that approximately 34,700 tonnes (column 3) could be harvested by conventional equipment given suitably calm weather and 9,525 tonnes (column 6) by a modified craft.

As in the case of Zayas Island, this bed appears to have grown in size approximately 25% since the original surveys. There also appears to have been a change in the ratio of Macrocystis to Nereocystis with a significant increase in the density of the Macrocystis. Dense beds of Macrocystis have less biomass per given area than Nereocystis; however, we were unable to determine if there had been a reduction of Nereocystis density in those areas where Macrocystis densities had increased. Because of the possibility that the overall biomass may have decreased

per unit of area, our estimate of available kelp does not differ substantially from the previous survey estimate.

The only other significant amount of kelp found in the survey of this area was in the waters around the Tree Knob Group (some 2,900 tonnes of Nereocystis (column 6). There are some large beds of kelp in this area; however, the beds are generally intermingled with rock, small islands, and other hazards. The accessibility of this type of kelp would depend on the capabilities of the harvester to manoeuver around the small islands and rocks. The large amounts of kelp available around the Porcher Peninsula would appear to make harvesting around the Tree Knob Group unnecessary.

The other islands in this group are capable of yielding only a further 2,180 tonnes (column 6) using a modified harvester.

Estevan Island Group

Although a survey of this area was not in our terms of reference, we did survey it though not as extensively as the three areas described above. We noted several large kelp beds that could be harvested with a modified harvester. However, it appeared that many of the beds were growing on a "wash board" type of bottom. Some of the ridges of the wash board were near the surface and, in some instances, even broke the surface. We believe that the only way to safely survey this area would be in a boat, which would permit careful bottom examination. This area is over 150 km from any port which, we believe, eliminates it from current consideration as a source of kelp weed for a small kelp meal plant.

TABLE B

ESTIMATED KELP BIOMASS AT MEAN WATER LEVEL WITHIN 65 km OF THE MASSET/PRINCE RUPERT AREAS

(Metric Tonnes)

	1	2	3	4	5	6	7	8	9	10	11
	Harvestable Conventional (Table A - Columns 1-3)					Harvestable Modified (Table A - Columns 4-6)					
	Total	Nereocystis Not Permitted to be Harvested (80%)	Permitted to be Harvested (20%)	Macrocystis Permitted to be Harvested (100%)	Total Permitted to be Harvested (Col. 3+4)	Total	Nereocystis Not Permitted to be Harvested (80%)	Permitted to be Harvested (20%)	Macrocystis Permitted to be Harvested (100%)	Total Permitted to be Harvested (Col. 8+9)	Total Permitted to be Harvested by Conventional and Modified Craft (Col. 5+10)
Masset Area											
- Graham Island Northern Shore)	10,050	8,040	2,010	3,800	5,810	11,475	9,180	2,295	150	2,445	8,255
Prince Rupert Area											
- Dundas Island Group	6,700	5,360	1,340	-	1,340	15,900	12,720	3,180	-	3,180	4,520
- Goschen Island Group	32,450	25,960	6,490	2,250	8,740	14,100	11,280	2,820	505	3,325	12,065
	39,150	31,320	7,830	2,250	10,080	30,000	24,000	6,000	505	6,505	16,585
TOTAL	49,200	39,360	9,840	6,050	15,890	41,475	33,180	8,295	655	8,950	24,840

ESTIMATES OF KELP PERMITTED TO BE HARVESTED

Of the four areas surveyed, we do not recommend the Northwestern shore of Graham Island (page 10) and the Estevan Island Group (page 13) as potential sources of kelp. Both these areas are considerable distances from likely processing plant locations in the Masset and Prince Rupert areas. We have, therefore, considered only those areas shown in Table B opposite which are within an economic radius (65 km) of either the Masset or Prince Rupert area. In this table, we have shown the estimated kelp biomass within such economic radius that is likely to be allowed to be harvested by conventional and modified craft. Summarized below are the conclusions we have drawn concerning such volumes.

Conventional craft

Approximately 55,000 tonnes of Macrocystis and Nereocystis in the three areas are accessible by a conventional craft (columns 1 + 4). However, a maximum of only 9,840 tonnes (20%) of the Nereocystis is likely to be allowed by Government regulations to be harvested (column 3). Hence, the present total quantity of Macrocystis and Nereocystis permitted to be harvested is likely to be about 16,000 tonnes (column 5), of which 10,000 tonnes is within 65 km of Prince Rupert and 6,000 tonnes near Masset.

Modified craft

Approximately 42,000 tonnes of Macrocystis and Nereocystis in the three areas are accessible by a modified craft (columns 6 + 9). However, after taking into account the likely harvesting restriction on Nereocystis, we estimate that only 8,950 tonnes of Macrocystis and Nereocystis is likely to

be allowed to be harvested (columns 8 + 9). Of this amount, about 6,500 tonnes is within 65 km of Prince Rupert and 2,450 near Masset.

CONCLUSION

In summary, there appears to be sufficient volume of harvestable Macrocystis and Nereocystis within an economic radius of either the Masset or Prince Rupert area to support a plant processing up to 8,000 tonnes of wet kelp per year. Such volume is almost twice the input required to produce the 500 tonnes of dry kelp meal forecasted to be sold in year 10 (page 23).

SECTION II

MARKET REVIEW

OF

PACIFIC KELP MEAL IN NORTH AMERICA

MARKET REVIEW OF PACIFIC KELP MEAL IN NORTH AMERICA

METHODOLOGY

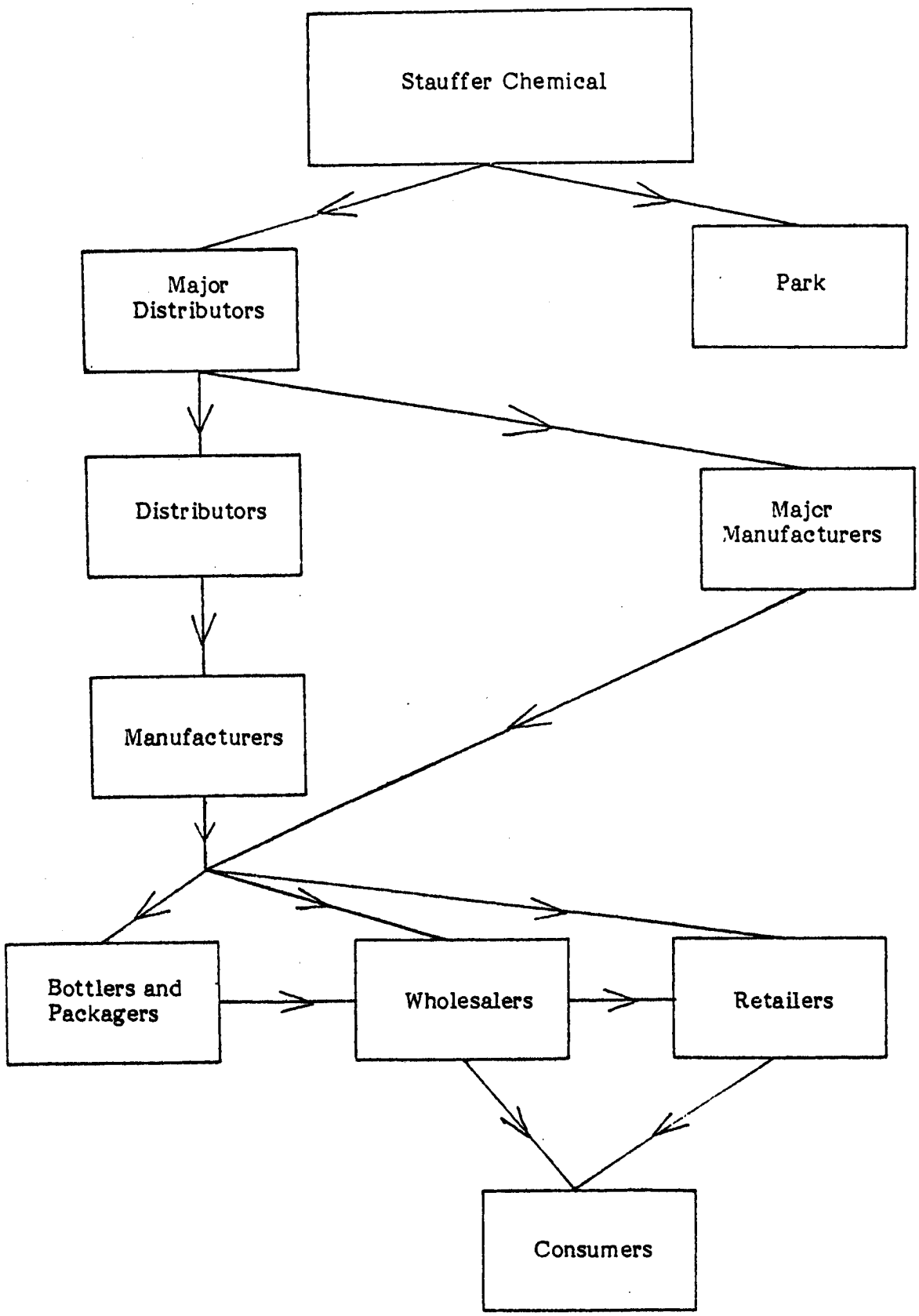
Concurrent with the kelp resource survey, we carried out a market review of Pacific kelp meal in North America. The purpose of this review was to estimate the potential market for B.C. kelp meal in North America based upon our assessment of the wholesale kelp meal distribution system in North America, the volume of product currently traded, and the June 1980 price and pricing structure.

Telephone interviews were conducted with several major distributors. As a result of these initial telephone interviews we found it necessary to contact a number of smaller distributors and health food manufacturers and retailers in order to produce the degree of coverage of the market that would enable us to place confidence in our market findings.

As a result of these interviews, we were able to determine the wholesale kelp meal distribution system, current prices and volumes. As a cross check of these findings, we interviewed some local trade sources and persons employed by Stauffer Chemical - the sole domestic supplier to the market. In addition to the above we contacted a number of local sources to check the freight, duty and brokerage fees that would likely be incurred in selling kelp meal for human consumption in the United States.

TABLE C

MODEL OF THE NORTH AMERICAN KELP MEAL DISTRIBUTION MECHANISM



PACIFIC KELP

Distribution

At present, (June 1980) Stauffer Chemical Co. of Oxnard, California is the only North American source of Pacific Kelp Meal for human consumption. Historically, Stauffer has supplied kelp through several distributors and has also supplied manufacturers directly. More recently, Stauffer has been attempting to deal through a limited number of major distributors, selling only in large quantities (40,000 lbs. or 18.2 tonnes truck load lots). The distributors sell only on their own account and not on a commission basis. There are apparently no volume rebates or discounts paid to or by distributors. The major distributors sell, in turn, to smaller distributors and manufacturers. Stauffer owns the "Park" line of health products and supplies it directly. Manufacturers of health food products either manufacture their own lines of products or make private label products for packaging, wholesaling or retailing organizations.

As illustrated in Table C opposite, the distribution mechanism can be described as a pyramid, with Stauffer at the top, a limited number (approximately 3) of major distributors at the next level, a larger number of small distributors and major manufacturers at the next level, with the smaller manufacturers, packagers, wholesalers and retailers at the bottom.

Volume

The volume of Pacific Kelp currently sold by Stauffer in North America is in the range of 600,000 to 700,000 lbs. per annum (275 to 320 tonnes). Ten years ago the market volume was in the region of 1,100 - 1,400 tonnes per annum and has been in steady decline ever since.

This decline in market volume has been caused by several factors. Apparently, supply has been limited because of poor harvests, caused to some degree by high water temperatures and also pollution in the waters of southern California. In addition, some companies involved only in the harvesting of kelp weed have experienced financial difficulties. Stauffer's reaction to the drop in supply of kelp has been to increase the price in order to maintain revenue levels. This has caused the demand to drop to current levels.

It was further suggested to us that Stauffer may be diverting supplies of available wet kelp to the production of alginates in order to increase their profits. It appears that Stauffer has spare capacity in its alginate plant and, apparently, alginate production is a more profitable way to use the kelp. Stauffer also supplies kelp meal to manufacture its own line of health food products, the "Park" line. Stauffer apparently make no attempt to actively promote the sale of kelp and now prefer to sell only in truckload quantities (40,000 lbs. or 18.2 tonnes) through major distributors).

Elasticity of Demand

Definitive market data on volume and prices for previous years was not available to us. However, our discussions with distributors make it clear that as the price has increased, so demand has dropped back. Several distributors claimed they would be able to sell considerable quantities if the price was lower. While there may be some truth in these claims, we were not able to substantiate them and must regard such comments with caution.

We were not able to estimate what the market volume might expand to if a more generous supply of kelp was made available. We believe there would be some growth but the growth would not be dramatic. We would expect a steady moderate

TABLE D

STAUFFER CHEMICAL
PACIFIC KELP MEAL PRICES AS OF JUNE 1, 1980
(FOB OXNARD, CALIFORNIA)

Volume		Price per lb.		Price per Tonne	
Lbs.	Equiv. Tonnes	U.S.$	CN$	U.S.$	CN$
40,000 and over	18.2 and over	0.84	0.97	1,848	2,134
20,000 - 39,999	9.1 - 18.2	0.88	1.01	1,936	2,222
10,000 - 19,999	4.5 - 9.1	0.98	1.13	2,156	2,486
5,000 - 9,999	2.3 - 4.5	1.00	1.15	2,200	2,530
1,000 - 4,999	0.45 - 2.3	1.05	1.21	2,310	2,662
50 - 999	0.02 - 0.45	1.16	1.33	2,552	2,926

Note:

The US Dollar price has been translated into Canadian Dollars at the approximate rate of U.S.$1 = CN$1.15.

growth of (say) 3% to 5% per annum as populations grow and tastes change toward health-type food products.

Pricing

Table D opposite presents Stauffer's prices of Pacific Kelp Meal as of June 1980. Such kelp is for human consumption, granulated or fine, 30 or 60 mesh. Our discussions with distributors and manufacturers revealed that prices have been increasing steadily over the last few years with the most recent price increase as of June 1, 1980. In the absence of any other market influence and with Stauffer continuing to dominate the North America kelp market, we expect that prices will continue to rise. We have not, however, forecast such price increases. In accordance with our proposal, all revenue and cost estimates in this report reflect 1980 constant dollars, thus providing a standard base which a potential investor may modify according to his own price and cost assumptions.

Quality

Pacific, Atlantic and imported kelp are not interchangeable. There are substantial differences in the trace element composition of the different kelps and the tastes are quite distinct. While each type of kelp apparently has its markets, it is clear that the final consumers of kelp do not consider Pacific to be a substitute for Atlantic and vice-versa.

Some concern was expressed about the increasing content of heavy metals in the Pacific kelp which may be caused by pollution in the waters of southern California. As regards kelp weed growing in coastal waters of northern B.C., a study[1] in March 1980 for the Marine Resources Branch has concluded that heavy

[1] "Assessment of Heavy Metals in Nereocystis Luetkeana and Macrocystis Integrifolia from the North Coast of British Columbia" by J. N. C. Whyte, P. E. Borgman and J. R. Englan, March 1980.

metal accumulation by Nereocystis and Macrocystis is well below the permissible level of 40 ppm as specified in the Food Chemicals Codex. Thus the pollution concern should not apply to B.C. dry kelp meal.

ATLANTIC KELP

Our interviews with distributors of Atlantic kelp indicate that the current market for Atlantic kelp is approximately 270,000 lbs. per annum (123 tonnes) in North America. The North American market for Atlantic dulse is currently approximately 30,000 lbs. per annum (14 tonnes).

As discussed earlier, Atlantic and Pacific kelp are not direct substitutes. We have therefore not included the Atlantic kelp market volume in our estimate of the total North America Pacific kelp meal market. It is possible that, given a large enough price differential between Pacific and Atlantic kelp, some substitution would be made. We have not allowed for any such effects in our calculations of the total market size.

IMPORTED KELP

In the past, kelp has been imported from Chile and Korea but it has often been of poor quality and not an acceptable substitute for Pacific kelp. More recently, high trade prices have apparently encouraged the import of some Norwegian kelp by the U.S.A., but we were not able to ascertain its volume.

Statistics on imported kelp are apparently treated as confidential by American and Canadian authorities and are not available to the public. We contacted the Director of the Import Replacement Division of Industry, Trade and Commerce in Ottawa and while he was unable to give us full details of kelp imports he indicated that no imports into Canada were shown for the first six months of

1979 in the appropriate import classification. We have therefore concluded that it is likely the volume of imports into North America is insignificant and have not included such any figures in our total estimate of the North American market for kelp meal suitable for human consumption.

ESTIMATED MARKET FOR B.C. KELP MEAL

Price

Stauffer Chemical's June 1980 price for an 18.2 tonne order of Pacific kelp meal is the equivalent of Canadian 97¢ per lb. (C$2,134 per tonne) FOB Oxnard, California (Page 18, Table D). Therefore, in order to be competitive with Stauffer's product (assuming equivalent quality and taste), the price of B.C. kelp meal (FOB the kelp plant) should be sufficiently less than Stauffer's price to compensate for whatever additional freight costs customers may incur as a result of buying B.C. kelp meal rather than Stauffer's product.

It has not been possible to estimate the likely range of additional freight costs without knowing the sales order mix and location of potential customers. However, we have estimated that the maximum additional costs would be the freight cost from the B.C. plant to Stauffer's plant in Oxnard, California. Such estimate is based on the assumption that the greatest additional freight cost would be incurred in the unlikely event that B.C. kelp meal had to be shipped to a customer via Oxnard, California. The maximum additional freight cost for a load of 40,000 lbs. (18.2 tonnes) has been estimated as follows:

	$
Freight: Kelp Plant (say Masset) to Vancouver	804
Vancouver to Oxnard	2,440
Custom brokerage fees	100
U.S. Food and Drug form	6
Total for 40,000 lbs.	$3,350
Equivalent per lb.	8¢

Based on the above, Stauffer's present price of CN$0.97 per lb., (FOB Oxnard), would be equivalent to CN$0.89 per lb. (FOB Masset). Thus, in order to be competitive with the latter price, we have estimated that the price of B.C. kelp meal for an 18.2 tonne load should be 85¢ per lb. ($1,870 per tonne), FOB Masset. We consider a slight discount is reasonable in order to introduce the product and promote a switch in suppliers from Stauffer to the proposed B.C. plant.

Volume

Our interviews have clearly indicated that kelp buyers would welcome a kelp source in competition with Stauffer. We were told by distributors and others that Stauffer does not now actively promote the product and that a likely response to competition could be to withdraw from the open market and use any available kelp for either alginate production or the "Park" line of health food products. It is unlikely that Stauffer would reduce kelp price as a response to competition. It would appear that if B.C. kelp meal is brought into the market at a competitive price and is properly promoted, it should be able to win about 50% of the total North Amercian market in two years. Further, if the quality and taste of the B.C.

product is equivalent or better, and its prices lower than Stauffer's, we would expect it could well obtain the entire market in five years.

CONCLUSION

Based on the above information and a sales price of Canada $1,870 per tonne, we estimate the market for B.C. kelp meal will grow as follows:

Estimated Market for B.C. Kelp Meal

	Total Market (Tonnes)	B.C. Share (Tonnes)	% Approx.
Year 1	320	85 - 95	(30%)
Year 2	340	180 - 200	(55%)
Year 3	355	240 - 260	(70%)
Year 4	370	310 - 330	(85%)
Year 5	390	350 - 370	(90%)
Year 10	500	480 - 520	(100%)

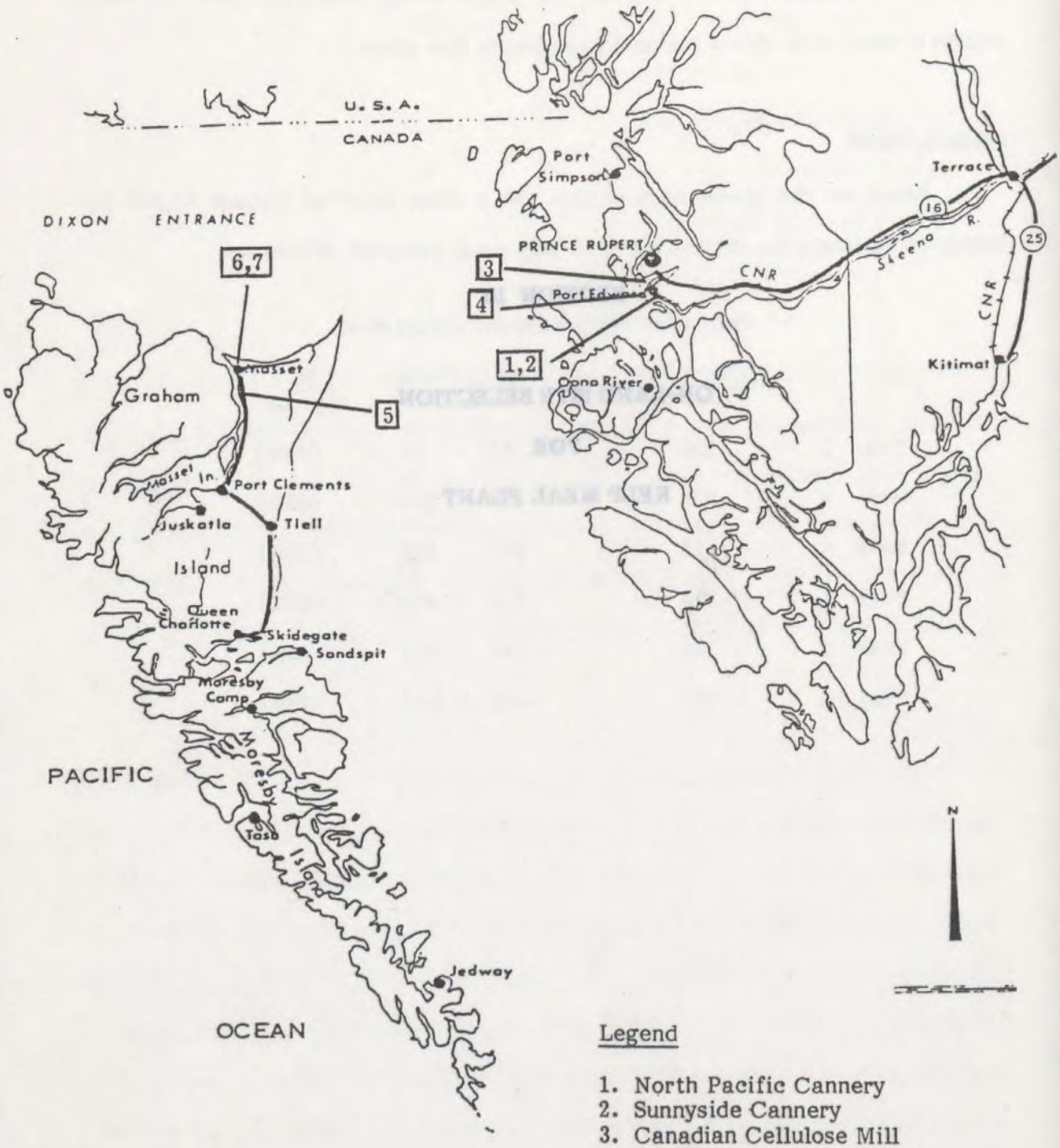
SECTION III

ON-LAND SITE SELECTION

FOR

KELP MEAL PLANT

POTENTIAL SITES FOR KELP MEAL PLANT



Legend

1. North Pacific Cannery
2. Sunnyside Cannery
3. Canadian Cellulose Mill
4. New Site on Ridley Island
5. Old Alginate Plant
6. B.C. Packers Cannery
7. New Site on Masset Harbour

KELP MEAL PLANT

ON-LAND SITE SELECTION

METHODOLOGY

In this second phase of our study, we visited the following potential sites identified in our proposal of December 29, 1978, to review their suitability for a kelp meal processing plant --- see map opposite.

1. North Pacific Cannery, east of Port Edward
2. Sunnyside Cannery, east of Port Edward
3. Canadian Cellulose Mill, Watson Island
4. New site on Ridley Island
5. Old Alginate plant, south of Masset
6. B.C. Packers Cannery, Masset
7. New site on Masset harbour

We did not inspect the site adjacent to the CanCel mill as the mill's management were not prepared to consider selling it.

The key aspects we examined included adequacy of the site area, condition and suitability of existing buildings and docks, utility services available, access to transportation, estimated development costs and site availability.

CONCLUSION

We concluded from our site surveys that only North Pacific Cannery, Sunnyside Cannery and the Old Alginate plant were feasible sites for the proposed

plant. Of these, the Old Alginate plant was selected as the preferred site based on a comparison of preliminary capital and operating cost estimates. The land appeared to be readily available and was suitable for the operation. It had been indicated that the dock and warehouse could be leased or purchased at a reasonable cost. The necessary on-site construction was thereby reduced to the processing plant-office area only and presented the lowest development and operating cost alternative.

However, subsequent to the completion of this phase we were informed by Mr. Reed Clarke (Appendix A) that it appeared the difficulties over highway right-of-way would not be easily resolved and there was no land available between the right-of-way and the high water mark. Therefore, the Old Alginate plant site could not be considered as a viable location for the proposed plant. In light of this, Mr. Clarke directed us not to be confined to a specific site in determining the financial feasibility of the proposed plant. We were given the following specific directives on which we have prepared our pro forma profit (loss) statements in Table F (Page 38):

1. We should use the conditions prevailing at the Old Alginate plant as the basis for our costing.

2. We should ignore the existing dock, road and highway right-of-way.

3. We should consider a theoretical site of the appropriate size for the proposed plant with services presently available and with the soil, foundation and topographic characteristics as at present for both the plant and the dock. We should assume that the site has no encumberances, has a road and other services to the lot line.

In light of Mr. Clarke's directive to assume a theoretical site, the findings from our site surveys and the subsequent site selection process have become redundant. However, we have included the details of this phase of our feasibility study in Appendix V.

SECTION IV

LAYOUT AND SPECIFICATIONS OF

LAND SITE, DOCK, KELP PLANT AND HARVESTER

LAYOUT AND SPECIFICATIONS OF LAND SITE, DOCK, KELP PLANT AND HARVESTER

In our proposal of December 29, 1978, we undertook to examine two basic plant site alternatives. The first alternative was to be an on-land site and the second was a floating barge on which the kelp processing equipment would be constructed. Our capital cost estimates (pages 36-37) have shown that on-land processing would require substantially less capital outlay. Hence, we have focused the balance of the report primarily on the on-land alternative. We have, however, presented relevant details associated with the floating barge concept to enable consideration of this alternative by those interested (Page 34).

LAND SITE AND DOCK

As indicated in Page 25 of this report, we have been directed to assume a land site already equipped with the necessary characteristics for a kelp plant and dock. With this assumption, we have prepared a site layout (Appendix B) comprising a building area of 1206 sq. metres and dock area of 940 sq. metres. The plant would be constructed on a land site with an area of 2,400 sq. metres (0.6 acres), i.e. about twice the building area for parking, roads and vehicle turnaround space. Such a land site has been valued at $14,400, based on the June 1980 market value of $24,000 per acre for industrial land on a site comparable to the Old Alginate Plant.

We have also prepared a cross-sectional sketch of the dock (Appendix C). The dock would be an all-timber structure with creosote-treated piles, pile caps, bracing and joists. The decking would be untreated planks. The dock would extend

into water deep enough to accommodate the draught of the harvesting vessel at all stages of the tide.

KELP PLANT

We have prepared a floor plan and cross-sectional sketch of the kelp plant (Appendices B and E) which indicate the location of its equipment and material flow.

The building would consist of a pre-fabricated steel framed and steel clad structure on concrete foundations and a concrete slab. Its length has been determined primarily by the length of the required dryer. It would have concrete block dado walls about 2 metres high for protection against damage by mobile equipment. The building would be uninsulated and unheated except for the office and employee facilities area. We have assumed electrical power would be available at the site. Lighting would be minimum standards with a low level in the plant and warehouse and a higher level in the office and employee facilities area. Power would be provided for the required motors of about 250 total HP and also for miscellaneous use as per current standards. The plumbing system would include a well for the provision of fresh water and a septic tank for sanitary waste disposal. Hose bibs and floor drains would be provided for washdown.

On days when the harvester delivers larger loads to the plant, it is planned that the equipment would work more hours per day as required. For a production of 350 tonnes per year of dried kelp, the plant would process for four days per week during the season with a ½ day for clean-up and maintenance. At a production rate of 500 tonnes per year, the plant would process six days per week plus clean up and maintenance.

TABLE E

INFEED RATE OF ROTARY DRYER

			Year 5		Year 10
(a)	Tonnes of dry kelp required (page 39)		350 tonnes		500 tonnes
(b)	Tonnes of wet kelp required given input/output = 8.33:1 (Appendix E, Item N)		2,970 tonnes		4,167 tonnes
(c)	Harvesting season (page 6)		100 days		100 days
(d)	Maximum harvesting trips (page 33)	at 2 per week		at 3 per week	
		$\frac{100}{7}$ x 2	29 trips	$\frac{100}{7}$ x 3	43 trips
(e)	Average harvest wet kelp (tonnes)	$\frac{2,970}{29}$	100 t/trip	$\frac{4,167}{43}$	96 t/trip
(f)	Average processing rate working 8 hours/day for 2 processing days/trip i.e. 16 hours	$\frac{100}{16}$	6.25 t/hour	$\frac{96}{16}$	6 t/hour
		Say	6.5 t/hour	Say	6.5 t/hour

The physical size and type of dryer selected has been based on current industry practice. A long dryer is required to maintain the quality of the kelp meal because of the relatively low maximum temperatures permissible in the drying operation. The dryer's length in turn determines, to a large extent, the building's length and also the area adjacent to the dryer which would be used for storing the dry kelp meal.

The equipment within the building would consist of the pre-cutter, hammer mill, dryer, cyclone, hopper, grinder, screen, bagging machine, kelp storage areas, administrative offices and employee facilities.

We have prepared a flow sheet (Appendix E) which shows the various specifications of the equipment and the drying process. Based on the estimated market for B.C. kelp (Page 23), we have assessed that the dryer in the proposed plant should be scaled to permit production of about 350 tonnes of dry kelp meal per year on a one-shift basis and up to 500 tonnes per year on a two-shift basis or by operating more days a week. These production volumes correspond to the forecasted sales in years 5 and 10 respectively. The selected dryer is the smallest that could produce the likely volume of dry kelp required throughout years 10 - 15 of operation. Should a smaller dryer be installed at the outset, it would have to be up-graded before the end of its service life.

To produce the required volumes of dry kelp, a rotary dryer with an infeed rate of 6½ tonnes per hour has been selected, as calculated in Table E opposite. The plant equipment must process the daily harvest within three days of cutting in order to maintain quality and avoid the necessity of special holding facilities and the addition of preservatives. Thus with a full day spent on harvesting, processing must be completed within the following two days.

25 METRE HARVESTER

To operate in conjunction with an on-land processing plant, we have selected a 25 m harvester based on its payload capacity, its seakeeping ability and its speed (light and loaded). These factors have been detailed below:

1. Each day's kelp harvest would range between 75 - 125 tonnes, i.e. an average of 100 tonnes. The 25 metre harvester has a payload capacity of 136 tonnes and would be able to carry the estimated peak load of 125 tonnes. Full capacity loads each trip are not envisaged as long voyages are very weather dependent and exposed cutting areas will reduce cutting effectiveness significantly.

2. The large kelp beds to be harvested are located in exposed areas up to 50 - 65 km from the proposed plant site. Thus, harvesting operations would be subject to tidal currents, operations some distance from the plant and rough water at the kelp beds. The added dimensions and weight of a 25 metre craft (compared with an 18 metre craft) improves its sea-keeping ability and stability during the harvesting operation.

3. To minimize the adverse effects of rough weather conditions, the harvester should have a reasonable average speed (light and loaded) and be sufficiently heavy. With the engines selected, such average speed of the 25 metre harvester would be approximately 8-3/4 knots. When loaded, the craft would likely be able to maintain full speed in fairly rough water because of its weight and steadiness. However, without a load, the harvester may have to reduce its speed in rough water.

We have prepared a floor plan sketch and specifications of the 25 metre harvester and its equipment in Appendices F and H. However, main features of the harvester appear below:

Length overall	25.25 metres
Breadth	10.00 metres
Depth	2.15 metres
Power	2-174 BHP Maritime 2-30 inch propellers
Speed - light - loaded	9 knots (approx.) 8 knots (approx.)
Cutter width	5 metres
Capacities:	
Wet kelp	136 tonnes
Fuel oil	50 tonnes
Fresh water	10 tonnes
Harvesting rate	50 tonnes/hour (para. A below)
Voyage time	12 hours (para. B below)
Crew	1 Master/Engineer) 1 Mate) (para. C below) 2 Deckhands)

A. Harvesting Rate

Kelp harvesting experience in southern California has indicated that large Macrocystis beds may be economically harvested at densities as low as 10 - 15 tonnes per hectare. Nereocystis, on the other hand, may require somewhat higher minimum densities though it should be economically feasible to cut the larger beds having minimum densities of 15 - 20 tonnes. However, such relatively low densities would occur in early spring and late fall when only a minor amount of harvesting would take place. Approxima-

tely 70% of each season's harvesting would occur in July-September when kelp beds had reached medium-maximum densities. Therefore, we have assumed an average bed density of 50 tonnes/hectare for the purpose of this study.

Another factor affecting the harvesting rate is the "cutting speed" of the harvester. Generally, the cutting speed can be increased as the bed density decreases. For example, a harvester would probably travel at 2,000 - 4,000 metres/hour in beds of 20 tonnes/hectare density but only 1,500 - 2,000 metres/hour in beds of 50 -100 tonnes/hectare density. Based on the assumed bed density of 50 tonnes/hectare in the previous paragraph, we have estimated the cutting speed of the harvester at 2,000 metres/hour.

Taking into account the cutter width, the bed density and cutting speed, we have calculated the craft's harvesting rate of 50 tonnes/hour as follows:

$$\text{Harvesting rate} = \frac{\text{Bed density}}{\text{Cutter width x cutting speed}}$$

$$\text{50 tonnes/hour} = \frac{\text{50 tonnes/hectare (10,000 sq. metres)}}{\text{5 metres x 2,000 metres/hour}}$$

B. Voyage Time

Assuming an average trip yield of 100 tonnes (Page 28, Table E - line E) and a maximum distance of 65 km (35 nautical miles) from plant, we have estimated the harvester's voyage time as follows:

Voyage out 35 n. miles - 9 knots	=	4	hours
Harvesting 100 tonnes - 50 tonnes/hour	=	2	hours
Voyage in 35 n. miles - 8 knots	=	4.4	hours
Weather and other allowances	=	1.6	hours
Total		12	hours

C. Number of Harvesting Trips

As each harvesting trip would last 12 hours (above) and the processing of its 100 tonne harvest a further 2 days (page 28), each harvesting/processing operation would take a total of 3 working days. Therefore, in one 5-day work week only a maximum of 2 harvesting trips would be made and this would suffice during years 1 - 5. However, in year 10 the volume of wet kelp required (4,167 tonnes) would necessitate 3 harvesting trips per week with the processing plant operating 6 equivalent work days.

D. Crew Function

Master/Engineer
- pilot vessel underway, operate harvesting equipment and pilot vessel at beds, service machinery at base.

Mate
- back-up to master when underway and harvesting.

Mate/Deckhand
- as mate, assist deck operations at dock and when harvesting.

Deckhand
- perform deck and cooking duties, loading and cutter duties while harvesting.

18 METRE HARVESTER AND 55 METRE KELP PROCESSING BARGE

As indicated in the first paragraph of Page 26, one of the two plant site alternatives was the concept of a floating barge. Such a barge would have the following general features:

1. It would be designed to hold under one roof the production facility, a warehouse, fuel storage tanks, power generation and crew living quarters.
2. It would be either self-propelled or moved from one kelp area to another by tugs.
3. A separate vessel (18 m harvester) would be required to harvest the kelp since the barge would be too cumbersome for efficient harvesting.

We have prepared detailed specifications of the floating processing barge and the harvester to be used with it (Appendices G/H/I and J). Portable plants would likely be required for kelp processing carried out in remote places with severe climates (e.g. the Alaskan Shelf) where power and other services would be unavailable and manpower scarce. It is unlikely that such plants are appropriate for the PR/QC area where sufficient wet kelp is located within an economic radius of potential on-land plant sites. Major operational constraints would likely be the following:

1. The barge would travel slowly and would be expensive to relocate should it not be self-propelled and thus require tug boats. Time spent in periodically relocating the barge would represent lost production time during a 100 day harvesting season and with a full crew on board.

2. Incoming oil shipments, outgoing dry kelp shipments, purchases of food, spare parts and miscellaneous supplies could result in additional costs.

3. In view of the "isolation" aspect of the barge operation, it is probable that labour rates would be higher and it would be necessary to supply living accommodation, food and some form of entertainment.

SECTION V

ESTIMATES OF CAPITAL COSTS

ESTIMATES OF CAPITAL COSTS

In the previous section of this report, we outlined the layout of the plant and specified the equipment required under the following two alternative methods of harvesting/processing wet kelp:

1. A 25 metre harvester and an on-land processing plant.
2. A 18 metre harvester and an off-shore processing barge.

We have prepared below our estimate of the capital costs associated with each alternative method as of June 30, 1980.

25 METRE HARVESTER AND ON-LAND PROCESSING PLANT

25 Metre Harvester (Appendix K)			
Material		$ 465,000	
Labour		282,000	
Engineering Fees		53,000	$ 800,000
On-Land Processing Plant (Appendix L)			
Land ($24,000/acre x 0.6 acres - page 27		$ 14,400	
Building (L)		600,000	
Dock (L-3)		290,000	
Fixed Equipment (L-4)		500,000	
Mobile Equipment (L-4)		55,000	
Office Furniture (estimate)		5,000	
		$1,464,400	
			$2,264,400
TOTAL COST	Say		$2,300,000

18 METRE HARVESTER AND OFF-SHORE PROCESSING BARGE

	18 m Harvester (Appendix M)	Processing Barge (Appendix N)	
Material	$323,000	1,914,000	
Labour	169,000	726,000	
Engineering Fees	33,000	105,000	
	$525,000	$2,745,000	$3,270,000
TOTAL COST		Say	$3,300,000

From solely a capital cost aspect, the 18 metre harvester and off-shore processing barge would require substantially more capital outlay. In addition, we have estimated that the first year's net loss from an off-shore operation would be about $612,000 (Appendix O), with depreciation and interest being the two most significant expenses. In subsequent years, it is also likely that significant losses would occur. Therefore, we have discounted the 18 metre harvester and processing barge as a viable alternative.

In our proposal, we also suggested a third alternative which was to combine the processing barge and harvester into one unit. Upon examination, this third alternative is not practical for operational reasons in terms of manoeuvre-ability in the kelp beds to be harvested, operating flexibility and likely cost.

SECTION VI

PRO FORMA OPERATING RESULTS

TABLE F

PROPOSED KELP MEAL PLANT

PRO FORMA PROFIT (LOSS) STATEMENTS

(Thousands of 1980 Constant Dollars)

Page		Year 1	Year 2	Year 3	Year 4	Year 5	Year 10
	Production/Sales (metric tonnes)	90	190	250	320	360	500
38	**Revenue (@ 85¢/lb. = $1,870/m. tonne)**	$ 168	$ 355	$ 468	$ 598	$ 673	$ 935
	Harvesting Costs						
40	Labour	23	34	44	55	58	58
41	Fuel and lubrication oil	3	4	6	7	7	7
41	Maintenance	10	10	12	12	13	15
42	Depreciation	63	63	63	63	63	63
43	Insurance	11	11	11	12	12	12
43	Royalty	1	2	2	3	3	4
-	Miscellaneous	2	2	2	2	2	2
	Total	$ 113	$ 126	$ 140	$ 154	$ 158	$ 161
	Plant Overhead						
45	Labour	13	18	24	29	31	42
46	Fuel Oil	19	40	53	67	76	106
46	Electricity	1	1	2	2	2	3
47	Maintenance	2	3	4	6	9	15
47	Packaging	2	3	4	5	5	7
47	Foreshore lease	1	1	1	1	1	1
48	Property taxes	4	4	4	4	4	4
49	Depreciation	80	80	80	80	80	80
49	Insurance	13	13	13	13	13	13
-	Miscellaneous	3	3	3	3	3	3
	Total	$ 138	$ 166	$ 188	$ 210	$ 224	$ 274
	General Expenses						
	Administration:						
50	Salaries	43	43	43	43	43	43
50	Office expenses	5	5	5	5	5	5
51	Interest expense	314	344	367	385	392	303
	Total	$ 362	$ 392	$ 415	$ 433	$ 440	$ 351
	Total Expenses	$ 613	$ 684	$ 743	$ 797	$ 822	$ 786
	NET PROFIT (LOSS) BEFORE TAXES	$(445)	$(329)	$(275)	$(199)	$(149)	$ 149

PRO FORMA OPERATING RESULTS

We have prepared, in Table F opposite, annual pro forma profit/loss statements for the first five years of operation and year 10. The pro forma statements have been based on our selection of the 25 m harvester and on-land processing plant and the results of our market review, capital cost estimates and operating cost assumptions. We have summarized below our revenue and cost assumptions as of June 30, 1980.

REVENUE

At the conclusion of our Market Review (page 23), we estimated the market range for B.C. kelp meal in the first five years of operation and year 10 at a price of $1,870 per tonne. This is the price for an 18.2 tonne load which we estimate will be the most likely order size, particularly from distributors. Following is our kelp meal revenue forecast based on the foregoing price and a sales volume equal to the mid-point of each market range.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 10
Sales (metric tonne)	90t	190t	250t	320t	360t	500t
Revenue (Thousand $) at $1,870/metric tonne	$168	$355	$468	$598	$673	$935

HARVESTING COSTS

Volume of Wet Kelp Required

The dryer operation of the plant requires approximately 8.33 tonnes of wet kelp to produce 1 tonne of dry kelp meal (Appendix E, Item N). On this basis, the following amounts of wet kelp need to be harvested:

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 10
Dry kelp (metric tonnes) (Page 23)	90	190	250	320	360	500
Wet kelp (metric tonnes)	750	1,590	2,090	2,670	3,000	4,200

Number of Harvesting Weeks

We have calculated the number of harvesting weeks as follows:

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 10
(a) Harvesting trips/week (Table E, page 29)	2	2	2	2	2	3
(b) Harvesting yield/week at 100 tonnes/trip (Table E, page 29)	200t	200t	200t	200t	200t	300t
(c) Wet kelp required (para. above)	750t	1,590t	2,090t	2,670t	3,000t	4,200t
(d) Harvesting weeks required (c - b)	3.75	7.95	10.45	13.35	15	14
Say (weeks)	6	9	12	15	16	16

The theoretical weeks required have been rounded upwards to allow for mobilizing and demobilizing activities at the beginning and end of each harvesting season.

Labour

We have estimated that the four-man crew required for the harvester (page 31) would be paid for working a 5-day week based on the probable requirements of any collective agreement. The crew's work each week would consist of 2 days harvesting, 2 days cleaning/repairs/maintenance and 1 day general duties as

needed around the harvester or kelp plant. After year 5 when harvesting would take place 3 times a week, the extra day would replace one of the previous non-harvesting days.

Following are the weekly wage estimates of the crew based on current labour agreements for comparable jobs in Prince Rupert:

	Daily Rate $	22% Fringe Benefit $	Board Allowance $	Total Daily Cost $	Total Weekly Cost $
1 Master	128.50	28.25	8.25	165	825
1 Mate	120.25	26.50	8.25	155	775
1 Mate/Deckhand	116.20	25.55	8.25	150	750
1 Deckhand	116.20	25.55	8.25	150	750
					3,100
Total Direct Labour Cost (rounded up)					$3,500/week

In addition to the direct labour cost, we have estimated an average of $2,000/year for food provisions. Thus, the estimated annual labour costs would be as follows:

Year	Direct Labour Cost/Week $	Harvesting Weeks (Page 39)	Total Direct Labour Cost $	Food Provisions $	Total Labour Cost $	Total Labour Cost $ Say
1	3,500	6	21,000	2,000	23,000	23,000
2	3,500	9	31,500	2,000	33,500	34,000
3	3,500	12	42,000	2,000	44,000	44,000
4	3,500	15	52,500	2,000	54,500	55,000
5	3,500	16	56,000	2,000	58,000	58,000
10	3,500	16	56,000	2,000	58,000	58,000

TABLE G

ESTIMATED COST OF FUEL AND LUBRICATION OIL

1	2	3	4	5	6	7	8	
Year	No. of Harvesting Weeks (Page 39) (Note 1)	Trips per Week (Page 33)	Litres of Fuel Oil per Trip	Est. Cost of Fuel Oil per Litre (Note 2)	Est. Total Cost of Fuel Oil (Columns 2x3x4x5)	Est. Cost of Lubrication Oil	Est. Cost of Fuel and Lubrication Oil (Columns 6 + 7)	Say
						$	$	$
1	6	2	900	21¢	2,268	1,000	3,268	3,000
2	9	2	900	21¢	3,402	1,000	4,402	4,000
3	12	2	900	21¢	4,536	1,000	5,536	6,000
4	15	2	900	21¢	5,670	1,000	6,670	7,000
5	16	2	900	21¢	6,048	1,000	7,048	7,000
10	16	3	900	21¢	6,048	1,000	7,048	7,000

Notes:

1. Even though non-harvesting activities have been built into the number of harvesting weeks above, we have assumed that the same volume of fuel oil would be consumed during non-harvesting activities.

2. Estimated cost of 21¢/litre at June 30, 1980 has been based on the 20¢/litre cost as of January 1980.

Fuel and Lubrication Oil

The volume of No. 2 diesel fuel oil per harvesting trip has been calculated according to the following formula:

$$\text{Litres/trip} = \frac{\text{BHP/engine x No. of engines x lbs./BHP/hr. of fuel x hrs./trip}}{\text{lbs./litre}}$$

$$= \frac{\text{174 (Append. F) x 2 (Append. F) x 0.4 (constant) x 12 (Page 33)}}{\text{1.87 (constant)}}$$

$$= 893 \text{ litres}$$

$$\text{Say } 900 \text{ litres}$$

Using the above volume and a $1,000 estimated cost for lubrication oil, we have estimated, in Table G opposite, the cost of both fuel and lubrication oil.

Maintenance

We have estimated that annual maintenance costs for a 20-week season would be approximately $15,000. However, we have determined that the initial harvesting season would be only six weeks and subsequent seasons progressively longer. Therefore, we have estimated that the first year's maintenance cost would be $10,000 as shown below:

Annual drydocking and survey	$ 2,500
Harvesting machinery servicing	4,000
General upkeep	2,500
Tools and spare parts	1,000
Total	$10,000

We have increased the annual cost to $12,000 in years 3 and 4, $13,000 in year 5 and $15,000 in year 10.

Depreciation

We have estimated that the various elements of the harvester would have service lives of 15 and 8 years as shown in Appendix K so long as adequate repairs and maintenance were performed regularly. We have depreciated the cost elements of the harvester in equal annual amounts over their estimated service lives as follows:

Estimated Service Life	Cost (Appendix K)		Annual Depreciation
15 years	$641,862		$ 42,791
8 years	$158,138		$ 19,767
	$800,000		$ 62,558
		Say	$ 63,000

Items such as engines/drives/harvesting motor representing about 50% in value of the harvester's machinery would require complete overhauls after about 8 years of operation. Such overhauls would extend the service lives of the components for a further 8 or so years and their costs would approximate that of new parts. Hence, we have considered the life of the initial items to be 8 years and would capitalize the cost of overhaul. We estimate the annual amortization of such capitalized costs would not be significantly different from the initial depreciation amounts. Therefore, we have assumed the same total depreciation throughout the first 10 years of operation.

Further, we have assumed no salvage value for the harvester and its equipment at the end of their service lives although some assets may have a value depending on their marketability at that time.

TABLE H

ANNUAL INSURANCE COST

	Year 1		Year 2		Year 3		Year 4		Year 5		Year 10	
	Wks	$	Wks	$	Wks	$	Wks	$	Wks	$	Wks	$
Operating Season at $280/week	6	1,680	9	2,520	12	3,360	15	4,200	16	4,480	16	4,480
Off Season at $200/week	46	9,200	43	8,600	40	8,000	37	7,400	36	7,200	36	7,200
TOTAL		10,880		11,120		11,360		11,600		11,680		11,680
Say		11,000		11,000		11,000		12,000		12,000		12,000

Insurance

We have estimated the annual insurance cost on the following weekly basis as recommended by a local insurance company:

Operating Season 3.5¢/$100 of capital cost at $800,000 capital cost equals $280/week

Off Season 2.5¢/$100 of capital cost at $800,000 capital cost equals $200/week

Our estimated annual insurance costs based on the above are shown in Table H opposite.

Harvesting Royalty

The present harvesting royalty payable to the B.C. Government is $1 per wet tonne harvested. Thus the annual royalties payable are as follows:

	Wet Tonnes Harvested (Page 39)	Royalty $	Royalty $ Say
Year 1	750	750	1,000
Year 2	1,590	1,590	2,000
Year 3	2,090	2,090	2,000
Year 4	2,670	2,670	3,000
Year 5	3,000	3,000	3,000
Year 10	4,200	4,200	4,000

At present, the licence fee for harvesting kelp is $50 per licence year but we have not included this expense in view of its insignificance.

PLANT OVERHEAD

Number of Processing Weeks

We have estimated in the table below the number of weeks required for processing each year.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 10
Dry kelp sales (Page 39)	90t	190t	250t	320t	360t	500t
Wet kelp required at ratio input:output of 8-1/3 (Page 39)	750t	1,590t	2,090t	2,670t	3,000t	4,200t
Processing yield per week at 6.5t/hr x 8 hrs x 4 days (yr. 10 equiv. 6 days processing)	200t	200t	200t	200t	200t	300t
No. of weeks processing	3.75	7.95	10.45	13.35	15	14
Say (weeks)	6	9	12	15	16	16

The theoretical weeks of processing have been rounded upwards to allow for mobilizing and demobilizing activities at the beginning and end of each season.

We have assumed that the plant will be shut-down during the off-season, with the only activity being periodic security checks and shipments of sales orders by the Operations Manager.

Labour

We have estimated that the kelp plant would require four employees during the operating season with the foreman working an extra two weeks on pre-shut-down maintenance.

On this basis, we have estimated in the table below the weekly labour costs of the kelp plant. We have increased the 1979 wage rates indicated in Appendix U-5 by 15% to reflect estimated June 1980 rates (inclusive of 22% benefits). As regards hours worked, we have estimated that any collective agreement covering the plant employees would require a wage to be paid based on a standard 35 hour work week irrespective of actual shift hours worked. Therefore, we have assumed 35 hours work will be paid for in years 1 - 5 for 4 days equivalent to 32 hours actual work (i.e. 8 hours/day). During years 6 - 10, when the plant would be operating 6 equivalent days a week, we have estimated that wages will be paid for actual hours worked viz. 48 hours. The labour rates below are different from those estimated during the site selection phase of the study (Appendix V-5) for reasons explained in Appendix V-2, paragraph 1.

Labour Cost Per Week

	Rate/Hour $	Hours Yrs 1-5	Hours Yrs 6-10	Cost/Week Yrs 1-5 $	Cost/Week Yrs 6-10 $
Operating Season					
1 Foreman/mechanic	15.4	35	48	539	739
1 Crane operator	15.4	35	48	539	739
1 Plant operator	11.2	35	48	392	538
1 Plant operator	11.2	35	48	392	538
Total Operating Season				$1,862	$2,554
Pre-shut-down Maintenance					
1 Foreman/mechanic	15.4	35		$ 539	$ 539

TABLE I

ANNUAL KELP PLANT LABOUR COST

	Year 1		Year 2		Year 3		Year 4		Year 5		Year 10	
	Wks	$	Wks	$	Wks	$	Wks	$	Wks	$	Wks	$
Operating season at $1,862 labour cost per week for years 1 - 5 and $2,554 for years 6 - 10	6	11,172	9	16,758	12	22,344	15	27,930	16	29,792	16	40,864
Pre-shutdown maintenance at $539/week	2	1,078	2	1,078	2	1,078	2	1,078	2	1,078	2	1,078
Total		12,250		17,836		23,422		29,008		30,870		41,942
Say		$13,000		$18,000		$24,000		$29,000		$31,000		$42,000

Based on the above rates, the total annual labour amounts have been estimated in Table I opposite.

Fuel Oil

In order to produce dry kelp containing 20% moisture, a 25 mm BTU dryer with 60% efficiency would require approximately 120 litres of No. 2 diesel fuel oil per wet tonne at a cost of 21¢ per litre (page 41, Table G, Note 2) viz. $25.20/wet tonne. The annual cost of fuel oil would, therefore, be as follows:

Year	Wet Tonnes (Page 39)	Cost of Fuel Oil per Wet Tonne $	Total Cost of Fuel Oil $	$ Say
1	750	25.2	18,900	19,000
2	1,590	25.2	40,068	40,000
3	2,090	25.2	52,668	53,000
4	2,670	25.2	67,284	67,000
5	3,000	25.2	75,600	76,000
10	4,200	25.2	105,840	106,000

Electricity

We have estimated that the kelp plant would require approximately 30 kilowatt hours of electricity per wet tonne processed. At a cost of about 2.2¢ per KWh, the cost of electricity per wet tonne would be 66¢. In addition, we have assumed minimal electricity costing $100 will be required during the off-season.

	Operating Season				Off-Season		Total	
Year	Weeks	Wet Tonnes (Page 39)	Cost/ Tonne $	Total $	Weeks	Total $	$	Say $
1	6	750	0.66	495	46	100	595	1,000
2	9	1,590	0.66	1,049	43	100	1,149	1,000
3	12	2,090	0.66	1,379	40	100	1,479	2,000
4	15	2,670	0.66	1,762	37	100	1,862	2,000
5	16	3,000	0.66	1,980	36	100	2,080	2,000
10	16	4,200	0.66	2,772	36	100	2,880	3,000

Maintenance

We have assumed minimal expenditure will be required in the early years of the plant's operation to cover minor repairs, preventive maintenance and spare parts. However, we have estimated that by year 10, about $15,000 would probably be required.

Packaging

The annual requirements of kelp meal bags have been estimated below on the basis that each bag would contain 40 kg of kelp meal; hence 25 bags would be required for 1 tonne of kelp meal.

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Kelp meal (page 38)	90t	190t	250t	320t	360t	500t
No. of kelp bags at 25/tonne	2,250	4,750	6,250	8,000	9,000	12,500
Cost per bag (CIF Masset)	60¢	60¢	60¢	60¢	60¢	60¢
Cost of bags required	$1,350	$2,850	$3,750	$4,800	$5,400	$7,500
Say	$2,000	$3,000	$4,000	$5,000	$5,000	$7,000

Foreshore Lease

We have estimated the lease of the foreshore area to cost $1,000 per year. An accurate assessment of the lease can only be made if the legal description of the land site and its area (measured from the high water mark) are known. As we are dealing with a "hypothetical site", we have been unable to estimate the lease cost more accurately.

Property Taxes

Property taxes have been based on the following formula provided by Mr. Weir (Port Edward Village Clerk):

Property Taxes = Assessed Value x Mill Rate

where "assessed value" is approximately 25% of improved site value (viz. land, building, dock and fixed equipment).

We have calculated the annual property tax as follows using the mill rate of the Old Alginate Plant:

Site Value (Page 36)		$
Land		14,400
Building		600,000
Dock		290,000
Fixed Equipment		500,000
		1,404,400
at 25%	=	351,000
x Mill Rate (.010)	=	3,510
	Say	$ 4,000

Depreciation

We have estimated that the various elements of the kelp plant would have service lives as shown below so long as adequate preventive maintenance was

performed regularly. The various elements have been depreciated in equal amounts over their estimated service lives as follows:

Item	Estimated Service Life	Cost (Page 36) $	Annual Depreciation $
Land	-	14,400	-
Building	25 years	600,000	24,000
Dock	20 years	290,000	14,500
Fixed Equipment	15 years	500,000	33,500
Mobile Equipment	8 years	55,000	6,900
Office Furniture	5 years	5,000	1,000
		$1,464,400	$ 79,900
		Say	$ 80,000

We have assumed that the cost of new mobile equipment and office furniture at the end of 8 and 5 years respectively would not be such as to significantly affect the total depreciation amount above. Further, we have assumed no salvage value for all assets at the end of their useful lives although some assets may have a value depending on their marketability at that time.

Insurance

Based on the total capital cost of the plant, equipment and kelp inventories, we have estimated an annual insurance cost of $10,000 under a fire policy. In addition, we have estimated $3,000 a year under a business interruption policy to cover interest expense which would likely be the only significant on-going expense in the event of an interruption to the business. We have estimated such an

interruption would last a maximum of 6 months before harvesting/processing resumed.

Processing Licence Fee

At present, the licence fee for processing kelp is $200 per licence year but we have not included this expense in view of its insignificance.

GENERAL EXPENSES

Administration

Salaries

As we have assumed that the kelp plant would be owned by a commercial enterprise or "silent" investor, we have assessed that an Operations Manager would be responsible for the plant operation and product marketing, and therefore employed at a full-time annual salary irrespective of the length of the operating season. His salary cost to the operation has been estimated at $35,000 inclusive of benefits. Further, we have estimated that part-time secretarial/bookkeeping/accounting services would cost $8,000 per year.

Office Expenses

We have estimated an annual expense of $5,000 to cover office and equipment rentals, travel and general expenses.

TABLE J

INTEREST EXPENSE

		Year 1 $	Year 2 $	Year 3 $	Year 4 $	Year 5 $	Year 10 $
1.	10 year loan to cover full capital cost of $2.3 million (page 34) at 13% average annual interest	299,000	299,000	299,000	299,000	299,000	299,000
2.	Interest during construction period (Appendix P)	5,400	5,400	5,400	5,400	5,400	4,300
3.	Overdraft interest for working capital requirements - estimated	10,000	1,000	-	-	-	-
	Ordinary Annual Interest	314,400	305,400	304,400	304,400	304,400	303,300
4.	13% average annual interest on accumulated unpaid interest (Appendix P-2, line D)	-	39,000	63,000	81,000	88,000	-
	Total Interest Expense	314,400	344,400	367,400	385,400	392,400	303,300
	Say	$314,000	$344,000	$367,000	$385,000	$392,000	$303,000

Interest Expense

We have prepared, in Table J opposite, a detailed breakdown of the annual interest expense. In summary, it comprises the following elements:

1. An assumed 10 year loan of $2.3 million to finance the entire capital cost (page 36) at 13% average annual interest over the 10 year period. As indicated in our proposal of December 29, 1978, we have assumed that, irrespective of the initial debt/equity ratio, an imputed return to shareholders should be calculated equal to the current cost of capital. This would be equivalent to debt financing of the total capital cost.

2. An interest expense of 15% per annum on total capital cost for an average three months during the construction period (assumed to be six months). Such interest would be capitalized and written off over the estimated lives of the various asset items (Appendix P).

3. We have estimated a $10,000 and $1,000 overdraft interest expense for the operation's working capital requirements in years 1 and 2.

4. As the operation's cash flow based on our pro forma operating results would not be sufficient to meet either the annual principal repayments ($230,000) or a major portion of the interest expense, we have calculated a 13% average annual interest levied on the accumulated unpaid interest (Appendix P-2).

SECTION VII

CONCLUSION

TABLE K

PROPOSED KELP MEAL PLANT
PRO FORMA PROFIT (LOSS) STATEMENTS

(Thousands of 1980 Constant Dollars)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 10
% of total market (approximate)	30%	55%	70%	85%	90%	100%
Tonnes sold	90t	190t	250t	320t	360t	500t
	$	$	$	$	$	$
Revenue	168	355	468	598	673	935
Less:						
Operating expenses	156	197	233	269	287	340
Depreciation	143	143	143	143	143	143
Interest expense	314	344	367	385	392	303
	613	684	743	797	822	786
Net Profit (Loss) Before Taxes	$(445)	$(329)	$ (275)	$ (199)	$ (149)	$ 149

ESTIMATED CASH FLOW ANALYSIS

(Thousands of 1980 Constant Dollars)

	Year 1 $	Year 2 $	Year 3 $	Year 4 $	Year 5 $	Year 10 $
Net Profit (Loss) Before Taxes	(445)	(329)	(275)	(199)	(149)	149
Add:						
Depreciation	143	143	143	143	143	143
Less:						
Cash deficit b/f	-	(532)	(948)	(1,310)	(1,596)	(2,763)
Loan repayment	(230)	(230)	(230)	(230)	(230)	(230)
Cash Surplus (Deficit) Before Taxes c/f	$(532)	$(948)	$(1,310)	$(1,596)	$(1,832)	$(2,701)

Note:

We have assumed in the above analysis that each year's production would be sold and paid for in the same year, and all significant expenses each year would be paid by the year-end.

CONCLUSION

GENERAL

We have concluded that the operation of a kelp meal processing plant at the theoretical site in Masset is not economically viable based on our pro forma operating results and cash-flow analysis shown in Table K opposite.

SENSITIVITY ANALYSIS

The pro forma operating results opposite have shown that low revenue, high depreciation and high interest expense are the main factors contributing to the operating losses in years 1 - 5. For comparative purposes, we have modified our assumptions affecting the foregoing factors and have shown, in the following paragraphs, their impact on the operating results.

Revenue

The estimated revenue in the pro forma results has been based on our estimate of the proportion of the total North American market for Pacific kelp meal that B.C. kelp can reasonably expect to obtain with a selling price of 85¢/lb. ($1,870/tonne). However, if close to 50% or even 100% of the entire market could be obtained in year 1 with the same selling price, 89¢/lb., or 95¢/lb., the impact on net profit/loss would be as follows:

TABLE L

PROPOSED KELP MEAL PLANT

PRO FORMA CASH-FLOW ANALYSIS

ASSUMING ENTIRE MARKET FROM YEAR 1 ONWARDS

(Thousands of 1980 Constant Dollars)

	Year 1 $	Year 2 $	Year 3 $	Year 4 $	Year 5 $	Year 6 $	Year 7 $	Year 8 $	Year 9 $	Year 10 $
Net Profit (Loss) before taxes (Appendix R)	(120)	(9)	88	163	221	239	256	274	291	309
Add back:										
Depreciation	143	143	143	143	143	143	143	143	143	143
Interest expense	314	304	304	304	304	304	304	304	304	304
Cash from Operations	337	456	535	610	668	686	703	721	738	756
Add:										
Cash surplus (deficit) brought forward	-	(207)	(285)	(284)	(208)	(74)	78	247	434	638
Less:										
Interest expense	(314)	(304)	(304)	(304)	(304)	(304)	(304)	(304)	(304)	(304)
Loan repayment	(230)	(230)	(230)	(230)	(230)	(230)	(230)	(230)	(230)	(230)
Cash Surplus (Deficit) Before Taxes Carried Forward	$(207)	$(285)	$(284)	$(208)	$(74)	$ 78	$247	$434	$638	$860

Note:

Net Profit before taxes for years 6 - 9 are estimates which do not appear in Appendix R.

**Net Profit (Loss) Before Taxes
Under Various Market Share and
Kelp Meal Selling Price Assumptions**

(Thousands of 1980 Constant Dollars)

	Year 1 $	Year 2 $	Year 3 $	Year 4 $	Year 5 $	Year 10 $
A. Approx. 50% of market in years 1 (Appendix Q)						
% of market	50%	75%	100%	100%	100%	100%
Tonnes sold	150t	250t	350t	400t	450t	500t
Net Profit (Loss)						
85¢/lb. (App. Q)	(362)	(238)	(105)	(32)	62	155
89¢/lb. (App. S)	(349)	(216)	(75)	3	101	199
95¢/lb. (App. S)	(329)	(183)	(28)	56	161	265
B. 100% of market from year 1 onwards (Appendix R)						
Tonnes sold	320t	400t	450t	500t	550t	600t
Net Profit (Loss)						
85¢/lb. (App. R)	(120)	(15)	88	163	221	309
89¢/lb. (App. S)	(91)	44	127	207	269	362
95¢/lb. (App. S)	(49)	97	187	273	342	442

We have assumed a larger total market under assumption B on the basis that, with 100% of the market from year 1 onwards, the B.C. plant will have a greater influence over the size of the market. As indicated, a net loss would be obtained in year 1 under all options above and also in year 2 under all but the two most favourable options. We believe that none of the above options is likely to occur in year 1. However, if 100% of the market was obtained in the first year as shown in Table L opposite, a cash surplus before taxes would be generated from year 6 onwards rising to $860,000 by the end of year 10. Under this assumption, a potential investor may well consider the proposed plant to be economically viable.

Depreciation

The high annual depreciation expense of $143,000 (Table K, page 52) has resulted from the high estimated capital costs of the plant and harvester ($2.3 million - page 36). In light of this and recognizing the low sales levels of the first 3 years, we have considered the possibility of using a scaled-down plant and the smaller 18 metre harvester. However, our review has indicated that the capital cost reduction by using a 50% smaller capacity dryer would be only 25% of such cost ($65,000). The effect of this cost reduction on annual depreciation and interest would only be approximately $4,000 and $9,000 respectively. A smaller harvester could also not be considered because it would not have sufficient wet kelp storage capacity to sustain the continuous operation of the on-land processing plant. Moreover, we consider that, given the local ocean conditions, a smaller harvester carrying wet kelp may be insufficiently sea-worthy during the return trip from the kelp beds to the on-land plant.

Thus, it is our opinion that unless a Government grant is received or an existing building/vessel with appropriate specifications can be readily adapted for kelp processing, we cannot envision a significant reduction in our estimated capital costs. Nevertheless, even if it was possible to reduce total capital costs by 10%, 20% or 30%, the positive effect on depreciation and interest would only reduce the estimated first year net loss as follows:

Net Profit (Loss) Before Taxes
with Various Capital Cost Reductions

(Thousands of 1980 Constant Dollars)

Capital Cost Reduction (Appendix T)	Year 1 $	Year 2 $	Year 3 $	Year 4 $	Year 5 $	Year 10 $
NIL (Page 50)	(445)	(329)	(275)	(199)	(149)	(149)
10%	(400)	(280)	(221)	(139)	(83)	193
20%	(355)	(231)	(168)	(80)	(19)	238
30%	(310)	(182)	(114)	(22)	46	283

Interest Expense

The high interest expense has resulted from the assumption of 100% debt financing, the estimated 13% average interest rate over the life of the project,and the operation's inability to pay the major portion of its annual interest expense. For comparative purposes, we have presented below the Net Profit (Loss) before taxes assuming interest rates of 10% and 15%. As indicated, the feasibility of the proposed plant would not be significantly altered by such assumptions:

Net Profit (Loss) Before Taxes with Interest Rates of 10%, 13% and 15%

(Thousands of 1980 Constant Dollars)

Interest Rate (Appendix U)	Year 1 $	Year 2 $	Year 3 $	Year 4 $	Year 5 $	Year 10 $
10%	(372)	(242)	(175)	(83)	(20)	219
13% (Table F, Page 38)	(445)	(329)	(275)	(199)	(149)	149
15%	(493)	(389)	(347)	(284)	(248)	(62)

Government and Other Financial Assistance

Three financial assistance programs are currently available to encourage industrial development such as the kelp meal processing plant. These programs are the Agricultural and Rural Development Subsidiary Agreement (ARDSA), the Regional Development Incentives Act (RDIA), and the Low Interest Loan Assistance Program (LILA) offered by the B.C. Development Corporation (BCDC). At present, financial assistance under both ARDSA and RDIA may not be obtained at the same time but an application for either may be combined with the LILA program.

TABLE M

PROPOSED KELP MEAL PLANT
PRO FORMA PROFIT (LOSS) STATEMENTS
WITH ESTIMATED ARDSA/RDIA AND LILA ASSISTANCE

(Thousands of 1980 Constant Dollars)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 10
% of total market (approx.)	30%	55%	70%	85%	90%	100%
Tonnes sold	90t	190t	250t	320t	360t	500t
	$	$	$	$	$	$
Revenue	168	355	468	598	673	935
Less:						
Operating expenses	156	197	233	269	287	340
Depreciation (Note)	126	126	126	126	126	126
Interest expense	192	223	231	230	200	200
	474	546	590	625	613	666
Net Profit (Loss) Before Taxes	$(306)	$(191)	$(122)	$ (27)	$ 60	$269

Note:

Annual depreciation of $126,000 is less than the $143,000 amount in Table K - page 50, due to a reduced capital cost of $2,030,000 resulting from the ARDSA/RDIA forgivable loan/non-repayable grant of $270,000. The reduced depreciation amount has been estimated as follows:

	Capital Cost $		Depreciation $	
Original (Page 34)	2,300,000	(100%)	143,000	(100%)
Reduced	2,030,000	(88%)	126,000	(88%)

However, a prime eligibility condition for ARDSA/RDIA and LILA assistance is the economic viability of the project. Assuming the kelp project was viable and other conditions prescribed by the programs were met, we estimate the eligible assistance available would be as follows:

1. ARDSA

Forgivable loan of $270,000 equal to $30,000 for each of the 9 direct jobs created.

OR

2. RDIA

Non-repayable grant of $270,000 equal to $30,000 for each of the 9 direct jobs created.

PLUS

3. LILA

A $250,000 loan for fixed assets at an interest rate of ½ of the BCDC prime rate (assumed 13%); no interest is payable for the first 6 months.

The effect of the above assistance on the operating results of the proposed plant would be to reduce interest expense and depreciation. Depreciation would be reduced since the amount of such financial assistance could be deducted from the total cost of fixed assets.

We have presented, in Table M opposite, the adjusted operating results taking into account the above assistance. As shown by the Net Profit (Loss) before taxes, financial assistance under the ARDSA/RDIA and LILA programs would not improve the operating results sufficiently to make the proposed operation viable.

SUMMARY

It is our opinion that the proposed kelp meal processing plant in Masset would not be economically viable under the market and financing conditions we have estimated. Further, based on the foregoing sensitivity analysis, the viability of the operation would not be significantly improved by any one of the following assumptions:

(i) A capital cost reduction of up to 30%, or

(ii) A selling price of 95¢/lb. FOB Masset compared with 89¢/lb. which is Stauffer Chemical's present price on a comparable basis, or

(iii) A lower average interest rate of 10%, or

(iv) Possible financial assistance through the ARDSA/RDIA and LILA programs.

We have not considered the cumulative effect of combining the above assumptions as we believe this to be an unrealistic possibility. A potential investor might think otherwise.

Under our pricing, cost and financing assumptions, a potential investor could consider the operation viable only if (a) 100% of the present North American market was obtained in year 1 and (b) the amounts of interest and loan repayments unable to be paid could be deferred (Table L). We do not believe the foregoing is likely to occur. However, under different design and cost assumptions, the project's viability could improve significantly through substantial capital cost reductions and more favourable financing arrangements. This would be possible if,

say, an existing building, vessel and dock could be acquired at a sufficiently low price and modified as necessary.

Finally, the viability of the project would also be affected by future price and cost increases which we have not forecasted. It should be remembered that, under the terms of our proposal, all revenue and cost estimates in this report reflect 1980 constant dollars so as to provide a standard base which a potential investor may modify according to his own price and cost assumptions.

SECTION VIII

APPENDICES

APPENDICES

APPENDIX A

SKEENA-QUEEN CHARLOTTE REGIONAL DISTRICT

INDUSTRIAL DEVELOPMENT COMMISSION

SUITE 2 342-3rd AVENUE WEST PRINCE RUPERT, B.C. V8J 1L5

TELEPHONE 624-3106

December 14, 1979

Mr. N.S. MacKenzie
Partner
Woods, Gordon & Co.
Box 10101, Pacific Centre
Toronto Dominion Bank Tower
700 West Georgia Street
Vancouver, B.C.
V7Y 1C7

Dear Mr. MacKenzie:

The managing Committee for the kelp meal feasibility study has been discussing the situation your research team has encountered with availability of land at the preferred plant site location - the old alginate plant. From my discussions with local Department of Highways personnel it does not appear the difficulties over highway right-of-way will be easily resolved. Further these is no land available between the right-of-way and the high water mark, as the right-of-way extends beyond the high water mark along the beach near the old alginate plant dock.

In view of these difficulties and the concerns surrounding the alternative sites, the Committee suggests that your study team not be constrained to a specific site in working out the feasibility of locating a Kelp Meal plant in this region. However, the Committee further recognizes that in order to cost the facility properly a specific location must be chosen for the proposed plant, permitting you to logically take into account existing services, site preparation, foundation variables and water conditions in terms of dock length and foundation.

Accordingly, the Committee directs you to use the conditions prevailing at the old alginate plant near Masset as the basis for your costing. In this exercise you will ignore the existing dock, road and highway right-of-way and consider a site of the appropriate size for the proposed plant with services as presently available and with the soil, foundation and topographic characteristics as at present for both the plant and the dock. You will assume that the site has no encumbrances, has a road and other services to the lot line. Furthermore, all assumptions made in deriving the pro forma figures are to be footnoted.

By accepting the above direction the study term will have overcome several problems:

a) The team can be site specific in terms of capital costs.

b) Should the proposed plant be feasible at Masset, then the entrepreneur can subsequently negotiate a price and terms with the present owner for the existing facilities in full knowledge of what the current replacement costs are for a conventional plant built on land.

c) No option is required now from the present owners in order to logically undertake the final phase of the feasibility study. You will assume a reasonable value for the land and waterfront lease required, and include real

SKEENA-QUEEN CHARLOTTE REGIONAL DISTRICT

INDUSTRIAL DEVELOPMENT COMMISSION

estate and transfer taxes in calculating to land cost.

d) Should an entrepreneur subsequently choose one of the alternative sites examined or any other site, then he can prepare his capital costs estimates by altering the conventional design used in this study and the assumptions underlying the analysis.

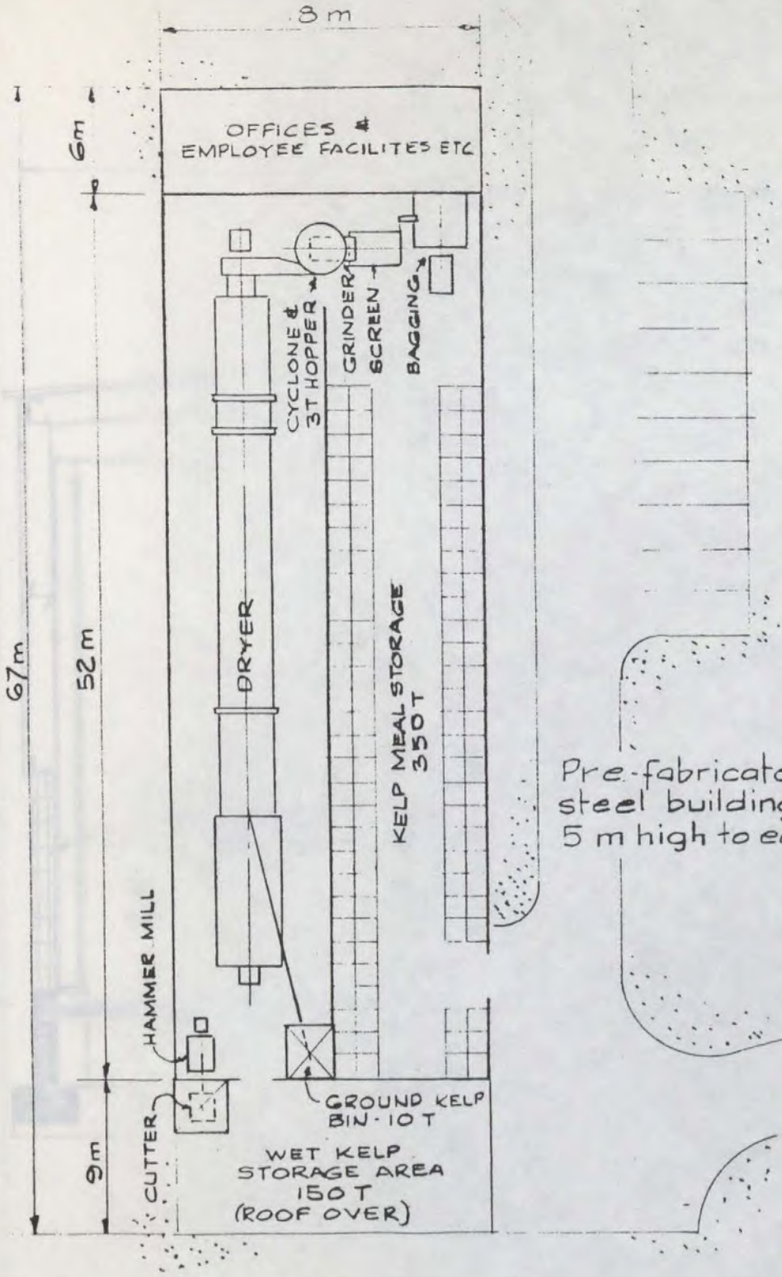
For the above reasons, therefore, the Committee believes that this is the most practical approach to take and directs you to proceed to complete the study following the above assumptions.

Sincerely,

Reed Clarke
Co-ordinator
Industrial Development Commission

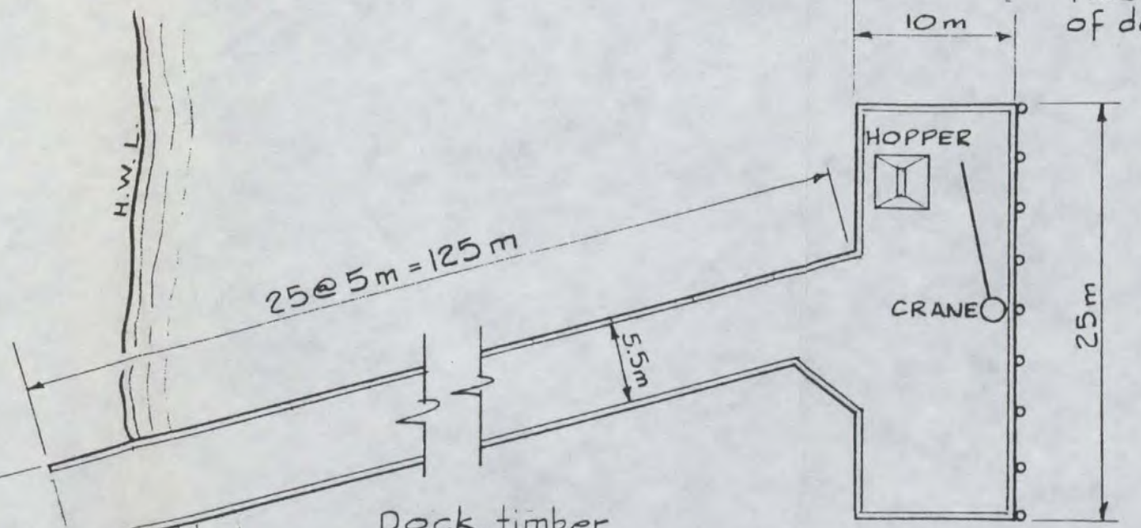
RC/td

APPENDIX B



Pre-fabricated steel building 5 m high to eaves

Building area:- 1206 m²



Min. depth of water at low tide along face of dock, 3 m.

Dock, timber deck, treated timber piles

Dock area:- 940 m²

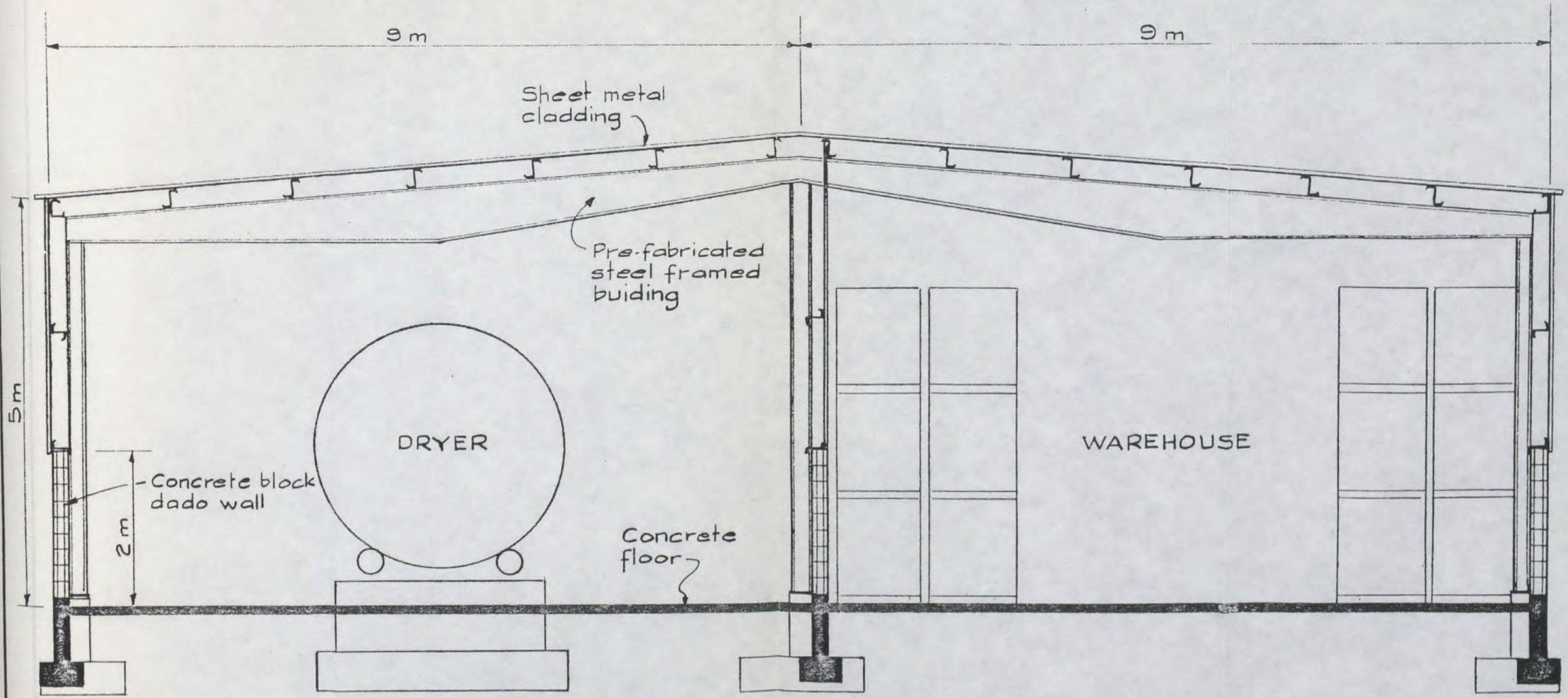
SKEENA-QUEEN CHARLOTTE REGIONAL DISTRICT

PHILLIPS BARRATT ENGINEERS AND ARCHITECTS VANCOUVER B.C.

PROPOSED KELP PLANT NEAR MASSET, B.C.

DR. B.B	CH.	DWG No. 79051-002	REV. A
SCALE 1:360			
DATE ISSUED		DATE REV. ISSUED	

bcil. 68218-PB

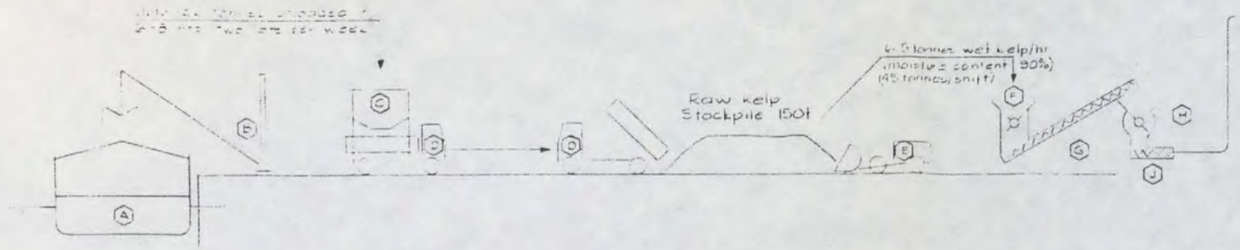


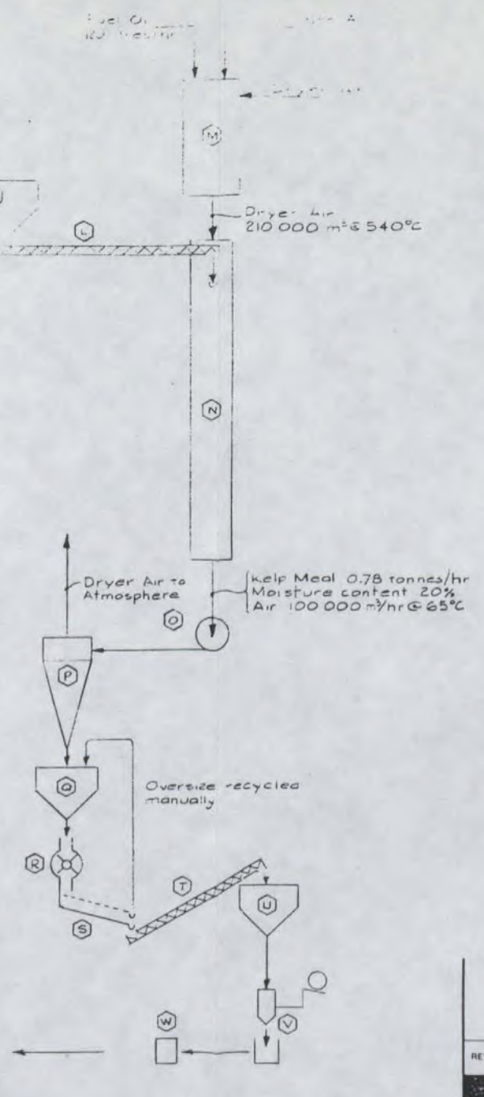
TYPICAL BUILDING SECTION

SKEENA-QUEEN CHARLOTTE REGIONAL DISTRICT			
PHILLIPS BARRATT ENGINEERS AND ARCHITECTS VANCOUVER, B.C.			
PROPOSED KELP PLANT NEAR MASSET, B.C.	DR. BB / CH.	DWG NO. 79051-003	REV. A
	SCALE		
	DATE ISSUED	DATE REV. ISSUED	

bcil 66218 PB

APPENDIX E





EQUIPMENT LIST

(A) HARVESTING VESSEL
harvesting rate 5 to 20 tonnes per hour
Total capacity 35 tonnes
Typical trip 12 hrs

(B) CRANE
Capacity 1 tonne @ 8 m r.
(1 m³ grab)

(C) HOPPER
Capacity 6.5 m³

(D) DUMP TRUCK
Capacity 5 tonnes
6.5 m³ body

(E) FRONT END LOADER
0.5 m³ Bucket

(F) PRE-CUTTER
Reduces kelp to 300 mm max length
Capacity 10 tonnes/hr
Drive 40 hp

(G) SREW CONVEYOR
Capacity: 11 tonnes/hr
Drive: 5 h.p

(H) HAMMER MILL
Reduces kelp to 13 mm max particle size
Capacity: 12 tonnes/hr
Make:- Rietz
Drive 50 h.p

(J) PUMP
Capacity 16 m³/hr max.
Make:- Mayno 2J8
Drive: 7.5 h.p

(K) HOPPER
Capacity: 12 m³ (10 tonnes)

(L) SCREW CONVEYOR
Capacity 6.5 tonnes/hr max
Drive: 5 h.p

(M) AIR HEATING FURNACE
25 MM Btu/hr burner
25 hp combustion air blower
Output: 210000 m³/hr at 540°C
Fuel Consumption 1120 litres/tonne

(N) COCURRENT ROTARY DRYER
Size: 3 m Φ x 30 m long
Capacity: 6.5 tonnes/hr input
0.78 tonnes/hr output
Drive: 25 h.p

(O) FAN
Capacity 100 000 m³/hr @ 65°C
Drive: 60 h.p

(P) CYCLONE

(Q) HOPPER
Capacity: 6.5 m³ (3.15 tonnes)

(R) HAMMER MILL
Reduces kelp meal to pass 40 mesh screen
Capacity: 1 tonne/hr
Make: Jacobson
Drive: 40 h.p.

(S) VIBRATING SCREEN
Capacity: 1 tonne/hr
Screen: 40 mesh
Drive 5 hp

(T) SCREW CONVEYOR
Capacity: 1 tonne/hr
Drive: 2 hp.

(U) HOPPER
Capacity 2 m³ (3.75 tonnes)

(V) AUTOMATIC SCALE complete with feed conveyor & bag holder
Capacity 120 - 40 kg bags/hr.
Drive: 2 h.p

(W) BAG SEWING MACHINE
Make: Bemis
Drive:- ½ hp

(X) PALLET STACKER
Capacity: 1.5 tonnes
Electric power

REV.	DATE	Dwn Chk	DESCRIPTION

PHILLIPS BARRATT
ENGINEERS AND ARCHITECTS
VANCOUVER BC CANADA

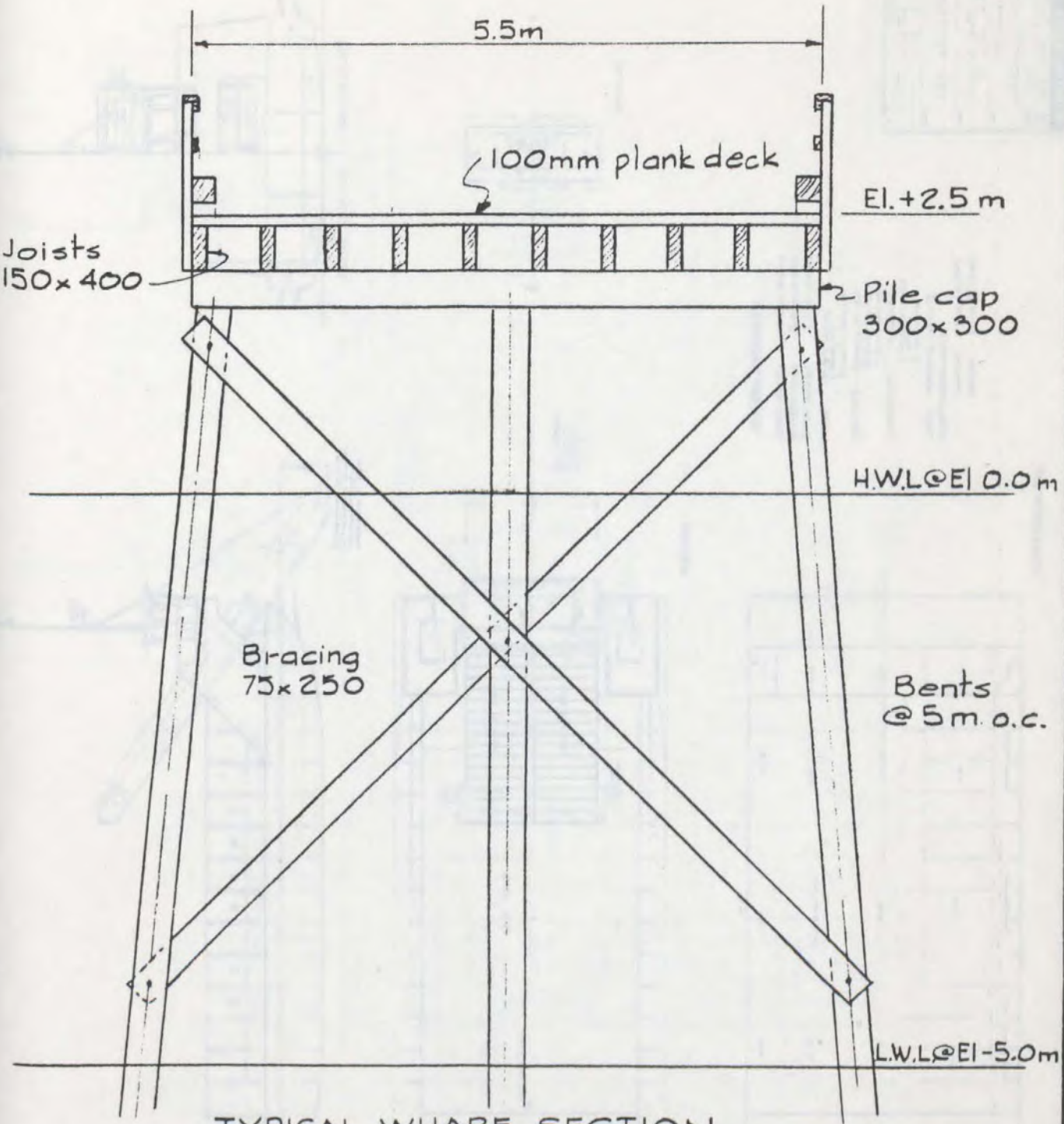
SKEENA - QUEEN CHARLOTTE REGIONAL DISTRICT

PROPOSED KELP PLANT NEAR MASSET

FLOW SHEET

DRAWN B.B.
CHECKED
APPROVED
SCALE
DATE
SEAL

DWG NO 79051-001 A



TYPICAL WHARF SECTION

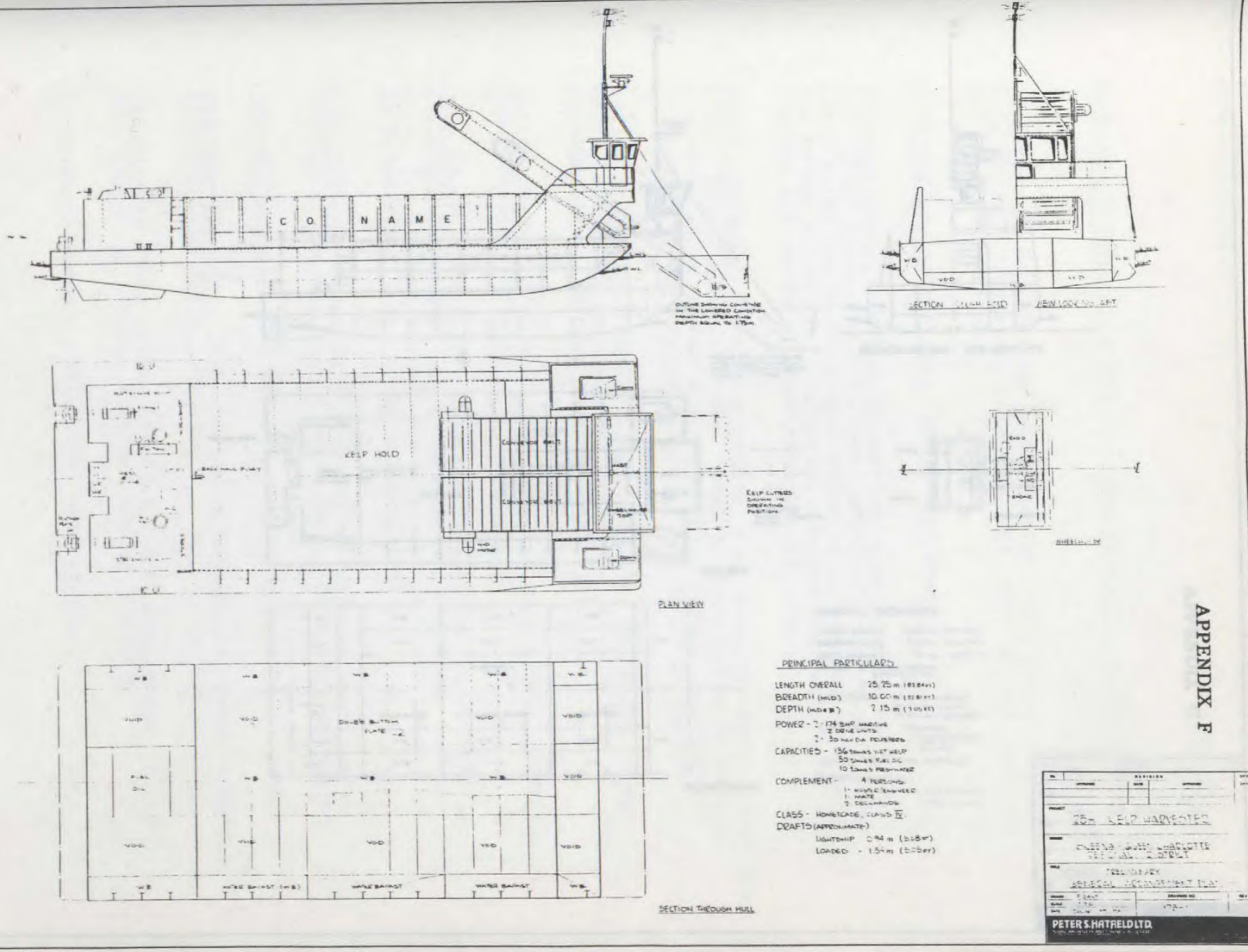
SKEENA-QUEEN CHARLOTTE REGIONAL DISTRICT

PHILLIPS BARRATT ENGINEERS AND ARCHITECTS VANCOUVER, CANADA

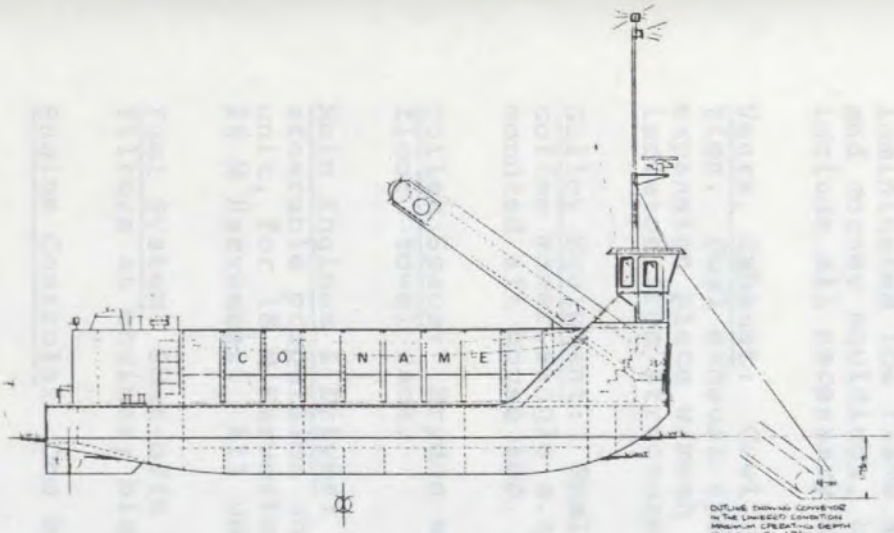
PROPOSED KELP PLANT
NEAR MASSET, B.C.

DR.	CH.	DWG NO.	REV.
SCALE		79051-004	A
DATE ISSUED		DATE REV. ISSUED	

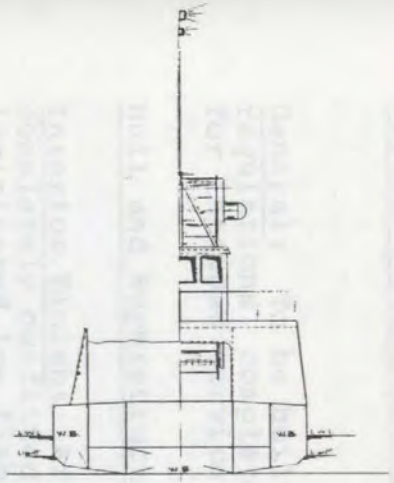
APPENDIX F


C O N A M E
OUTLINE SHOWING CONVEYOR IN THE LOWERED CONDITION MAXIMUM OPERATING DEPTH EQUAL TO 1.75m
SECTION
VIEW LOOKING AFT
KELP HOLD
CONVEYOR BELT
KELP CUTTERS SHOWN IN OPERATING POSITION
PLAN VIEW
W.B.
VOID
DOUBLE BOTTOM PLATE
FUEL OIL
WATER BALLAST (W.B.)
WATER BALLAST
SECTION THROUGH HULL
PRINCIPAL PARTICULARS
LENGTH OVERALL 25.75 m
BREADTH (MLD) 10.00 m
DEPTH 2.15 m
POWER - 2 - 174 BHP MARINE
CAPACITIES - 136 TONNES WET KELP
50 TONNES FUEL OIL
10 TONNES FRESHWATER
COMPLEMENT - 4 PERSONS
1 - MATE
2 DECKHANDS
CLASS - HOMETRADE, CLASS IV
DRAFTS (APPROXIMATE)
LIGHTSHIP
LOADED - 1.54 m
REVISION
PROJECT
25m KELP HARVESTER
PRELIMINARY
DRAWING NO.
PETER S. HATFIELD LTD.

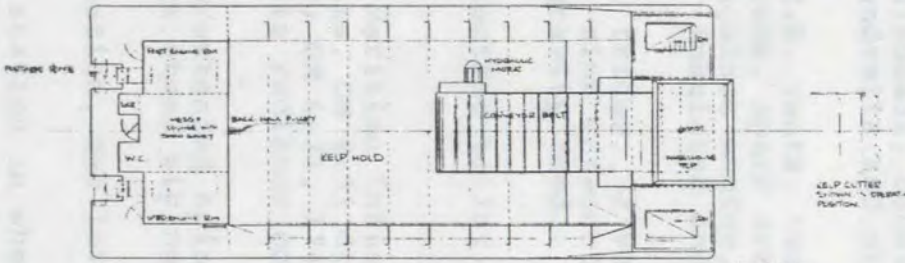
APPENDIX G



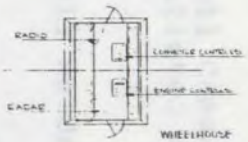
OUTLINE SHOWING CONVEYOR IN THE LOWERED CONDITION MINIMUM OPERATING DEPTH TO BE AT LEAST 1.75m

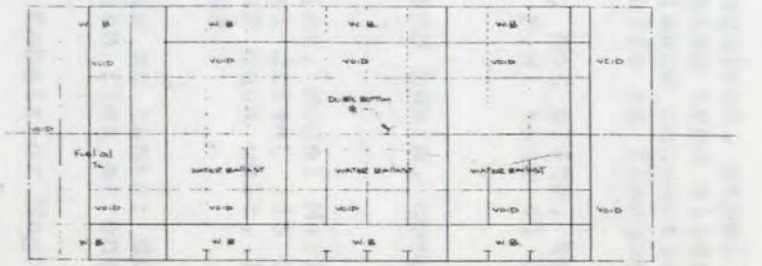


SECTION THROUGH HOLD | VIEW LOOKING AFT



PLAN VIEW





SECTION THROUGH HOLD

PRINCIPAL PARTICULARS

LENGTH OVERALL	18.00 m (59.05 ft)
BREADTH (MLD)	7.20 m (23.62 ft)
DEPTH (MOULDED)	1.90 m (6.23 ft)
POWER - 2	115 BHP MARITIME 2 DRIVE UNITS
2	28 PROPELLERS
CAPACITIES -	68 TONNES WET KELP
	10 TONNES FUEL OIL
	1.1 TONNES FRESH WATER
COMPLEMENT -	3 PERSONS
	1 MASTER/ENGINEER
	1 MATE
	1 DECKHAND
CLASS	HOMETRADE CLASS IV
DRAFTS (APPROX MATE)	
LIGHTSHIP -	0.47 m (1.54 ft)
LOADED -	1.17 m (3.84 ft)

PETER S. HATFIELD LTD.

APPENDIX H

OUTLINE SPECIFICATION FOR 18 M AND 25 M KELP HARVESTER

General: To be built to full Canadian Coast Guard (C.C.G.) regulations, completely outfitted and ready in all respects for intended service.

Hull and Superstructure: All welded steel.

Interior Finish: Aft deckhouse and wheelhouse spaces completely outfitted and insulated, ready for service, pre-lamininated low flame spread arborite on plywood with seam and corner mouldings, bulkheads, counter and table tops. To include all necessary handrails and stairways.

Vents, Exhaust: Cowl, E.R. vents, two required, steel construction. Dual exhaust systems, spark arresting type silencers, expansion piece w/mesh against engine, flange connections; isolated from structure; insulated and muffs at flanges.

Galley Equipment: Small fridge, 32 volt, hot plate, toaster, coffee maker,single s.s. sink w/faucet. F.W. tank 45 G. cap. mounted aft house top, gravity feed.

Toilet Space: Brydon electric toilet, hand basin, composition floor, towel rack.

Main Engines & Drives: Maritime Industries, Model Mariner 120, steerable propulsion units, GM 4:71 diesel drive, 115 BHP each unit, for 18 M Harvester; GM 6:71, 174 BHP each unit, for 25 M Harvester. All units radiator cooled.

Fuel System: Shut-offs w/extended spindles at tanks; dual filters at engines; black steel piping with flex at engines.

Engine Controls: One station, two lever Kobelt or Wagner.

Steering Controls: One station in wheelhouse, power hydraulic with steering angle indicator.

Propellers: Twin screw, 28" diam., 3 bladed bronze for 18 M. Twin screw, 30" diam., 3 bladed bronze for 25 M.

Electronics: Radar, VHF radio, echo sounder.

Electrical System: 32 volt alt. off each engine. Main engines 32 volt electric start. All necessary wiring and fixtures for lights and marine equipment. 2 sets of 32 volt battery packs.

Hydraulic System: Driven by main engines, all necessary pipes, valves, filters, controls and tank as required to be fitted.

Harvesting Equipment: Conveyor belt, 2.25 M wide for 18 M Harvester, 4.5 M wide for 25 M Harvester - 18 M long to be fitted with spikes. Belt to be hydraulically driven. Hydraulic motor to be mounted, port side on aft end of conveyor belt. Cutter mechanism to be hydraulically driven from port side. All of anti-corrosive materials where possible. Back haul system to stow harvested kelp,hydraulic powered.

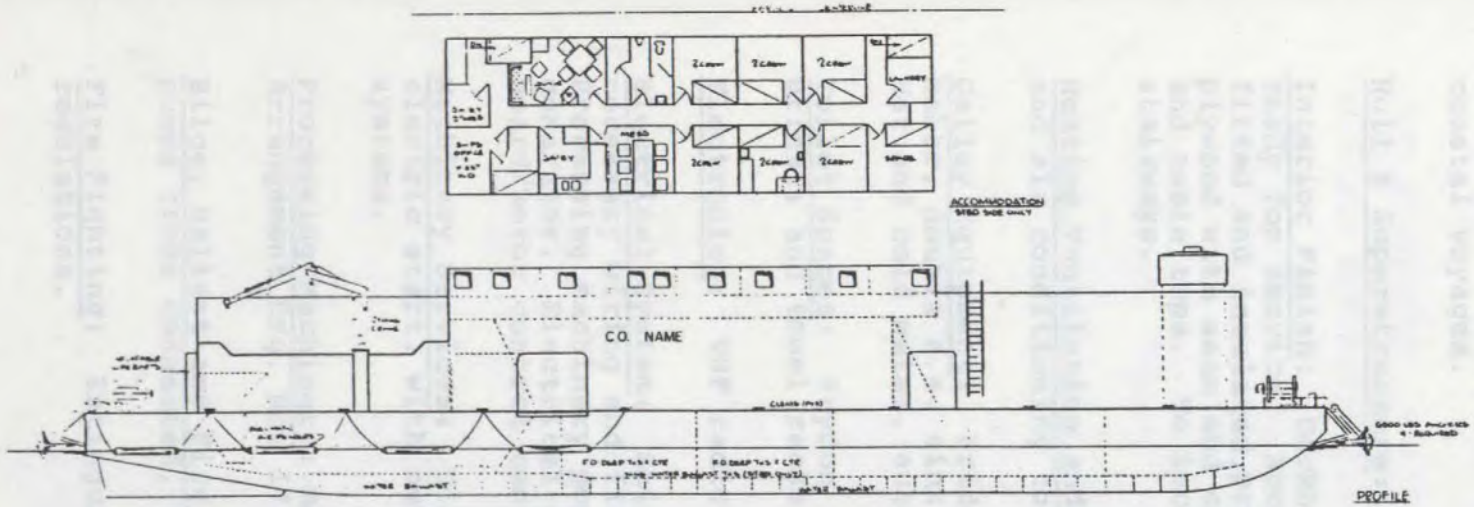
Bilge, Ballast and Fire Systems: 2 pumps - 1 electric driven, 1 main engine driven. Pumps cross connected, and piping steel.

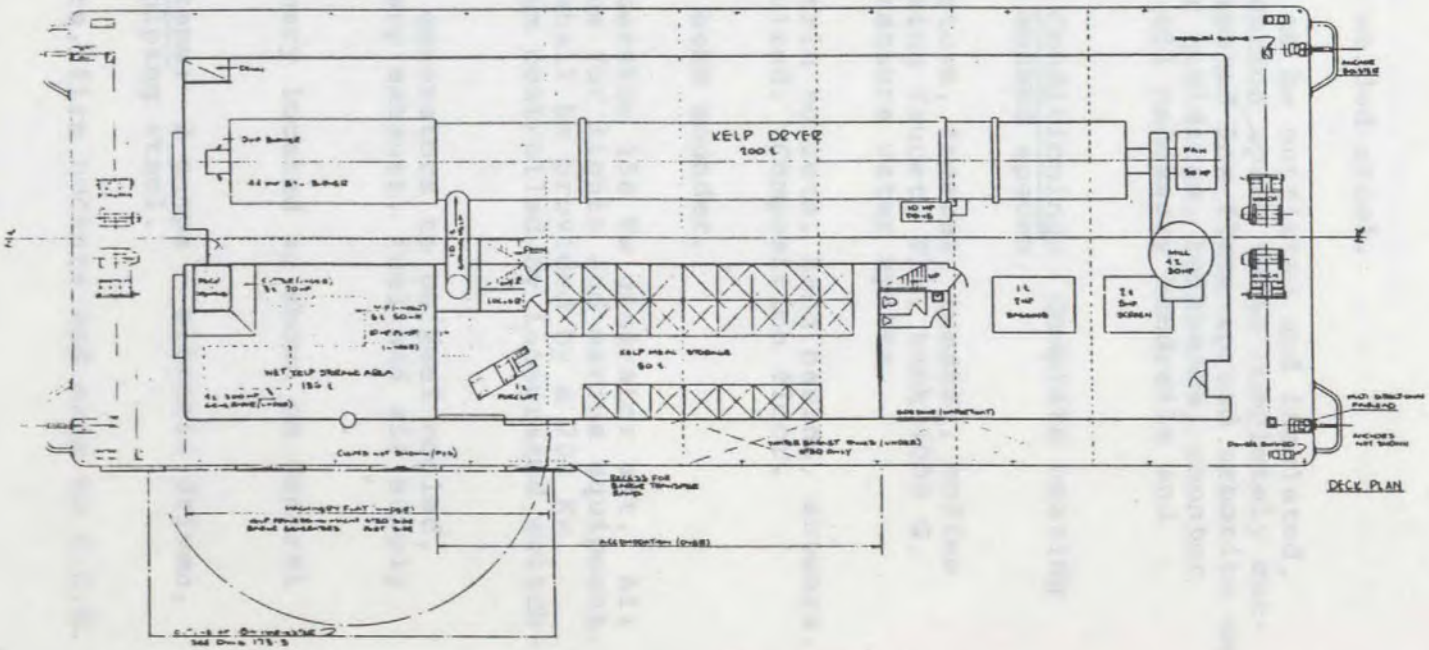
Fire Fighting: Extinguishers, fire buckets and axes to C.C.G. regulations.

Lifesaving Equipment: To comply to C.C.G.

Painting: Steel shall be wheel abraded and primed before fabrication or exterior steel to be sand blasted. Underwater 3 coats anti-corrosive, 2 coats chlorinated rubber anti-fouling. Above water one coat inorganic zinc, tie coat,2 coats enamel finish.

Cathodic Protection: 19 - 10 lbs. zinc anodes.





PRINCIPAL PARTICULARS

LENGTH OVERALL	54.86 m (180.0ft)
BREADTH (mld)	19.81 m (64.0 m)
DEPTH (mld at ⌀)	3.66 m (12.0 m)
DRAFT (max)	2.66 m. 4.86 m)
CAPACITIES - a) FOR KELP PROCESSING	
F.O	100 tonnes
F.W	150 tonnes
b) BOOM SHIPMENT	
F.O	120 tonnes
H.S	176 tonnes
F.O (max)	140 tonnes
c) WET KELP	1800 tonnes
ACCOMMODATION	12 CREW
	1 SPARE

APPENDIX I

55m KELP PROCESSING BARGE

SKEENA - QUEEN CHARLOTTE REGIONAL DISTRICT

PRELIMINARY

GENERAL ARRANGEMENT PLAN

1:75 — 175-2 — C

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APPENDIX J

OUTLINE SPECIFICATION FOR 55 M KELP PROCESSING BARGE

General: To be built to full C.C.G. regulations and to be delivered complete in every respect for service on the intended coastal voyages.

Hull & Superstructure: All welded steel.

Interior Finish: Deckhouse to be outfitted and insulated, ready for service. Accommodation space to be completely outfitted and insulated,prelaminated low flame spread arborite on plywood with seam and corner mouldings, bulkheads, counter and table tops. To include all necessary handrails and stairways.

Heating Ventilation and Air Conditioning: Complete heating and air conditioning to all manned spaces.

Galley Equipment: Fridge, stove, freezer, toaster, coffee maker, double s.s. sink w/swing faucet, F.W. tank 1000 G, Hot and cold water, auto. pressure water system.

Toilet Spaces: Brydon electric toilets, hand basins, showers, urinals and towel racks required. Composition floor.

Electronics: VHF radio and echo sounder.

Electrical System: Ship's service 150 Kw generator set. All necessary wiring and fixtures for lights and marine equipment. Processing machinery power shall be provided by a 200 Kw generator. Electrical system controlled by integrated switchboard/motor control center.

Machinery Services: Diesel generators to be keel cooled, electric start, with necessary exhaust, fuel and air supply systems.

Processing Machinery: Machinery located as shown on General Arrangement Drg. No. 173-2.

Bilge, Ballast and Fire Systems: 2 pumps - electric driven, pumps cross connected, and piping steel.

Fire Fighting: Extinguishers, fire buckets and axes to C.C.G. regulations.

Lifesaving Equipment: To comply to C.C.G.

Anchoring: Four of each of the following required: 6000 lbs. anchor, multi-directional fairlead, horizontal sheave and winch.

Deck Equipment: Cleats and double bollards as required. Anchor bolsters as shown on G.A. Drg. No. 173-2. Two tonne electric hydraulic crane.

Painting: Steel shall be wheel abraded and primed before fabrication or exterior steel to be sandblasted. Underwater 3 coats anti-corrosive, 2 coats chlorinated rubber anti-fouling. Above water one coat inorganic zinc, tie coat 2 coats enamel finish.

Cathodic Protection: 40-22 lbs. zinc anodes.

25 m HARVESTER
CAPITAL COST ESTIMATE

	Service Life Years	Material Cost $ (Note 1)	Labour Cost $	Total Material and Labour $
Steel, Rod, Gas:				
Hull	15	85,008	101,200	186,208
House	15	21,784	43,010	64,794
Outfit:				
Piping systems	15	14,180	25,300	39,480
Joinerwork and furnishings	15	14,761	26,565	41,326
Lifesaving, fire-fighting	8	11,984	12,650	24,634
Electrical:				
Ship's service	15	3,528	7,590	11,118
Navigational aids	15	11,760	1,518	13,278
Machinery:				
Ship's service	50%-15	158,760	4,048	162,808
Harvesting equipment	50%-8	94,080	10,120	104,200
Painting and anodes	15	4,704	20,240	24,944
Launching and trials	15	2,117	4,048	6,165
Contingency	15	42,334	25,711	68,045
Sub-Total		465,000	282,000	747,000
Engineering fees	15			53,000
TOTAL				$800,000

Note:

1. The above costs are based on the assumption of 100% Canadian content and Canadian West Coast construction. Costs are gross and do not include Federal/Provincial taxes and ship construction subsidy allowances.

KELP PROCESSING PLANT
ESTIMATE OF CAPITAL COST

A. BUILDING COST	$
Site clearing and excavation	7,000
Building footings	32,000
Equipment foundations	8,000
Floor	31,000
Block dado walls	27,000
Finishing office and employee facilities	22,000
Electrical	86,000
Plumbing	34,000
Yard work	7,000
Vancouver Based Costs (Note 8)	254,000
Out-of-town labour and materials surcharge (36.5% - Note 8)	93,000
Sub-Total	347,000
Pre-fabricated building erected in Masset	199,000
	546,000
Contingencies - 10% (approx.)	54,000
TOTAL BUILDING COST	$600,000

Notes:

1. Site and foreshore conditions similar to Old Alginate Plant site near Masset.
2. Site more or less level, requiring only clearing and grubbing.
3. Hydro power available on site.
4. Cost of a well on site is included for water supply.
5. Septic tank included for sanitary sewer.
6. Wash down drainage directly to sea.
7. Yard paving to be done when equipment is available in the area.

Notes - Continued

8. Out-of-town Labour and Materials Surcharge - Cost estimates are based on Vancouver prices in June 1980. An allowance for extra labour costs in the Masset area has been calculated below based on a labour mix of 50% Vancouver labour and 50% local labour.

(a) Vancouver Labour

We have assumed:

- Three week average trip
- Six and one-half hours travelling each way, Vancouver to Masset
- Seven and one-half hours per day at straight time
- Two hours overtime per day at double time
- Work Saturdays at double time
- Average charge-out rate $20/hr.
- Living expenses $50/day, or 2½ hours equivalent
- Travel expenses $250 return, or equivalent 12½ hours

Therefore in 1 trip, the hours worked and equivalent hours charged are as follows:

Hours worked	Hours
15 days at 9½ hours/day	142.5
2 travel days at 3 hours work/day	6
	148.5 (A)
Hours charged	
15 weekdays at 7½ hours single time	112.5
15 weekdays at 2 hours double time (i.e. 4 hours)	60
2 Saturdays at 9½ hours double time (i.e. 19 hours)	38
	210.5
Expenses (expressed in equivalent hours)	
19 days at 2.5 hours	47.5
1 return fare	12.5
Equivalent hours for time and expenses	270.5 (B)

Vancouver Labour Surcharge (B - A) $\frac{270.5}{148.5} = 1.82(82\%)$

(b) Local Labour

We have assumed local labour hours will be the same as Vancouver hours and there will be no expenses. Hours worked and equivalent hours charged are as follows:

Hours worked	Hours
6 days at 9½ hours	57 (A)
Hours charged	
5 days at 7½ hours single time	37.5
5 days at 2 hours double time (i.e. 4 hours)	20
1 Saturday at 9½ hours double time (19 hours)	19
	76.5 (B)
Local Labour Surcharge (B - A)	$\frac{76.5}{57}$ = 1.34(34%)

Thus for building labour, the average labour surcharge will be:

$$\frac{1.82 \text{ (Vancouver surcharge)} + 1.34 \text{ (local surcharge)}}{2} = 1.58(58\%)$$

(c) Materials

An allowance of 15% over Vancouver costs has been assumed to cover freight.

Summary

For the building and dock it has been assumed that the total cost of work would break down approximately 50/50 for labour and materials. Therefore:

Labour surcharge	58% x 0.5	=	29.0%
Material surcharge	15% x 0.5	=	7.5%
Total Labour and Material Surcharge			36.5%

B. DOCK COST

	$
Total Cost - Vancouver based (Note 1)	192,000
Out-of-town labour and materials surcharge (36.5% - L-2)	70,000
	262,000
Contingencies - 10% (approx.)	28,000
TOTAL DOCK COST	$290,000

Note:

1. The total cost of $192,000 is comprised of materials ($96,000) and labour ($96,000) per the Summary on L-2. The cost of materials has been estimated as follows:

	Quantity	Unit Price $	Value $
Decking	27,000 FBM	0.8	21,600
Joists and caps	32,000 FBM	1.0	32,000
Bracing	3,000 FBM	0.8	2,400
Handrails	1,600 FBM	0.8	1,280
Bullrails	4,000 FBM	1.0	4,000
Piles	1,350 LF	10.0	13,500
Fenderpiles	600 LF	8.0	4,800
			79,580
Delivery - 15% on Cost			11,937
			91,517
Dock lighting (estimated)			2,100
Water supply (estimated)			2,100
			95,717
TOTAL		Say	$96,000

Legend:

FBM = Foot board measure
LF = Linear foot

C. FIXED EQUIPMENT COST

Reference Appendix E		Materials (Landed Cost Masset) $	Installation Labour $
B	Dock crane	13,000	2,500
C	Hopper	4,500	1,000
F	Pre-cutter	9,000	1,000
G	Screw conveyor	3,500	1,000
H	Hammer mill	22,000	2,000
J	Pump	4,000	2,000
K	Hopper	7,800	1,500
L	Screw conveyor	5,000	2,000
N	Dryer, complete	255,000	40,000
Q	Hopper	4,500	1,000
R	Hammer mill	9,000	1,000
S	Screen	10,000	2,000
T	Screw conveyor	3,500	1,000
U	Hopper	7,800	1,500
W	Bagging equipment	13,000	2,000
	Fuel tank	5,000	1,000
		$376,600	$ 62,500
	Out-of-town labour surcharge (82% - L-1)		51,250
	TOTAL EQUIPMENT COST		490,350
		Say	$ 500,000

D. MOBILE EQUIPMENT COST

	$
Five tonne dump truck	25,000
Front-end loader	20,000
Pallet stacker	10,000
	$ 55,000

Note:

1. We have assumed that the dump truck and loader would be purchased for the processing operation. However, in view of the relatively short production periods, a plant owner may consider leasing the foregoing equipment.

18 m HARVESTER
CAPITAL COST ESTIMATE

	Service Life Years	Material Cost $	Labour Cost $	Total Material and Labour $
Steel, Rod, Gas:				
Hull	15	47,634	55,660	103,294
House	15	13,642	26,565	40,207
Outfit:				
Piping systems	15	9,050	17,710	26,760
Joinerwork and furnishings	15	10,886	16,192	27,078
Lifesaving, fire-fighting	8	5,880	8,602	14,482
Electrical:				
Ship's service	15	2,060	4,048	6,108
Navigational aids	15	11,760	1,265	13,025
Machinery:				
Ship's service	50%-15	148,000	3,542	151,542
Harvesting equipment	50%-8	41,160	5,060	46,220
Painting and anodes	15	2,352	12,140	14,492
Launching and trials	15	1,176	3,036	4,212
Contingency	15	29,400	15,180	44,580
Sub-Total		323,000	169,000	492,000
Engineering fees	15			33,000
TOTAL				$525,000

Note:

1. The above costs are based on the assumption of 100% Canadian content and Canadian West Coast construction. Material costs are gross and do not include Federal/Provincial taxes and ship construction subsidy allowances.

55 m PROCESSING BARGE
CAPITAL COST ESTIMATE

	Service Life Years	Material Cost $	Labour Cost $	Total Material and Labour $
Steel, Rod, Gas:				
Hull	15	409,024	177,000	586,024
House	15	102,200	73,360	175,560
Outfit:				
Piping systems	15	89,376	64,515	153,891
Joinerwork and furnishings	15	146,160	122,705	268,865
Lifesaving, fire-fighting	8	15,288	6,325	21,613
Mooring	15	439,488	7,590	447,078
Electrical:				
Barge service	15	29,400	63,250	92,650
Machinery:				
Barge service	50%-15	30,576	18,975	49,551
Processing equipment	50%-8	446,880	68,250	510,130
Painting and anodes	15	23,520	50,600	74,120
Launching and trials	15	5,880	12,650	18,530
Contingency	15	176,208	65,780	241,988
Sub-Total		1,914,000	726,000	2,640,000
Engineering fees	15			105,000
TOTAL				$2,745,000

Note:

1. The above are based on the assumption of 100% Canadian content and Canadian West Coast construction. Material costs are gross and do not include Federal/Provincial taxes and ship construction subsidy allowances.

OFF-SHORE PROCESSING BARGE AND KELP MEAL PLANT

PRO FORMA PROFIT (LOSS) STATEMENT - YEAR 1

(Thousands of 1980 Constant Dollars)

	Year 1
Production/Sales (metric tonnes)	90
Revenue (@ 85¢/lb. = $1,870/m tonne)	$168
Harvesting Costs	
Labour (0-1 #2)	$ 14
Fuel and lubrication oil	3
Maintenance	10
Depreciation (0-1 #3)	42
Insurance	11
Royalty	1
Miscellaneous	2
Total	$ 83
Plant Overhead	
Labour (0-1 #1)	22
Fuel oil	20
Maintenance (0-1 #2)	31
Packaging	2
Depreciation (0-1 #3)	200
Insurance	15
Miscellaneous	3
Total	293
General Expenses	
Storage (Masset)	5
Administration:	
Salaries	35
Office expenses	4
Interest expense	360
Total	404
Total Expenses	780
NET LOSS BEFORE TAXES	$612

OFF-SHORE PROCESSING BARGE AND KELP MEAL PLANT
MAJOR COST ASSUMPTIONS

Harvesting Costs

1. Number of weeks harvesting:

   6 weeks to coincide with number of processing weeks required (page 37 of report).

2. Labour:

1 Master	$165/day	=	$ 825/week
1 Mate	$155/day	=	775/week
1 Deckhand	$150/day	=	750/week
Total per week			$ 2,350
Total for 6 weeks		=	$ 14,100

3. Depreciation:

Capital cost elements:	Cost (Appendix M)	Annual Depreciation
15 years service life	$ 411,637	$ 27,422
8 years service life	113,363	14,170
	$ 525,000	$ 41,592

Processing Costs

1. Labour:

1 Maintenance engineer	$165/day	=	$ 825/week
3 Plant operators	$420/day	=	2,100/week
1 Crane and forklift operator	$155/day	=	755/week
Total per week			$ 3,700/week
Total for 6 weeks		=	$22,200/week

2. Maintenance:

Annual drydocking and survey	$ 6,000
Processing equipment servicing	20,000
Spare parts	5,000
	$ 31,000

3. Depreciation:

Capital cost elements:	Cost (Appendix N)	Annual Depreciation
15 years service life	$2,443,547	$162,903
8 year service life	301,453	37,682
	$2,745,000	$200,585

4. Interest Expense:

Interest expense on total capital cost of $2.7 million (rounded) has been based on the year 1 interest expense for the 25 m harvester and on-land plant having a capital cost of $2,300,000:

$$\frac{\$2,700,0000 \text{ (App. N)}}{\$2,300,000 \text{ (Pg. 34)}} \times \$314,000 \text{ (pg. 48)} = \$\ 368,000$$

Say $ 360,000

CAPITALIZED INTEREST DURING CONSTRUCTION PERIOD

Cost Element $	Capitalized Interest at 3.75% (Note 1) $	Service Life of Assets (Years)	Annual Amortization of Capitalized Interest Year 1 $	Year 2 $	Year 3 $	Year 4 $	Year 5 $	Year 10 $
Harvester (page 42)								
641,862	24,070	15	1,605	1,605	1,605	1,605	1,605	1,605
158,138	5,930	8	741	741	741	741	741	-
800,000								
Processing Plant (page 49)								
14,400	540	25	21	22	21	22	21	22
600,000	22,500	25	900	900	900	900	900	900
290,000	10,875	20	543	544	543	544	543	544
500,000	18,750	15	1,250	1,250	1,250	1,250	1,250	1,250
55,000	2,063	8	258	258	258	258	258	-
5,000	187	5	37	37	37	37	39	-
$1,464,400								
	Total		5,355	5,357	5,355	5,357	5,357	4,321
		Say	$5,400	$5,400	$5,400	$5,400	$5,400	$4,300

Note:

1. The effective capitalized interest rate of 3.75% has been derived from the following assumptions:

   - The construction period of the plant and harvester would be 6 months.
   - The average interest rate during the construction period would be 15% per year.
   - Interest would be charged for 3 months being the "average period" for expenditure incurred during the full construction period.

   Based on the above, the effective capitalized interest rate would be 15% per year for 3 months equal to 3.75%.

CALCULATION OF UNPAID INTEREST

(Thousands of Dollars)

		Year 1 $	Year 2 $	Year 3 $	Year 4 $	Year 5 $	Year 6 $	Year 7 $	Year 8 $	Years 9 $	Year 10 $
	Revenue (Page 38, Table F)	168	355	468	598	673	727	785	848	916	935
	Less:										
	Harvesting costs (Table F)	113	126	140	154	158	158	159	159	160	161
	Plant overhead (Table F)	138	166	188	210	224	233	243	253	263	274
	Administration - salaries and office expenses (Table F)	48	48	48	48	48	48	48	48	48	48
	Total Operating Expensese	299	340	376	412	430	439	450	460	471	483
	Surplus (Deficit)	(131)	15	92	186	243	288	335	388	445	452
	Add back:										
	Depreciation (Table F)	143	143	143	143	143	143	143	143	143	143
A.	**Cash surplus before loan principal and interest payments**	12	158	235	329	386	431	478	531	588	595
	Less:										
	Ordinary annual interest (Table J)	314	305	304	304	304	304	304	304	304	303
B.	Unpaid interest b/f (line E previous year)	-	302	488	620	676	682	644	554	399	167
C.	**Unpaid interest before interest on interest**	302	449	557	595	594	555	470	327	115	-
	Add:										
D.	13% average annual interest on unpaid interest b/f (line B)	-	39	63	81	88	89	84	72	52	-
E.	**Total unpaid interest c/f**	$302	$488	$620	$676	$682	$644	$554	$399	$167	-

Note:

1. Revenue and costs for years 6 - 10 are estimates which do not appear in Table F, Page 38).

PROPOSED KELP MEAL PLANT

PRO FORMA PROFIT (LOSS) STATEMENTS ASSUMING 50% OF PRESENT MARKET IN YEAR 1

(Thousands of 1980 Constant Dollars)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 10
% of total market	50%	75%	100%	100%	100%	100%
Production/Sales (metric tonnes)	150t	250t	350t	400t	450t	500t
Revenue (@ 85¢/lb. = $1,870/metric tonne)	$ 281	$ 468	$655	$748	$842	$935
Harvesting Costs						
Labour	30	44	57	58	58	58
Fuel and lubrication oil	4	6	7	7	7	7
Maintenance	10	10	10	10	10	10
Depreciation	63	63	63	63	63	63
Insurance	11	11	11	11	11	11
Royalty	2	2	2	4	4	4
Miscellaneous	2	2	2	2	2	2
	$ 122	$ 138	$152	$155	$155	$155
Plant Overhead						
Labour	16	24	30	34	38	42
Fuel oil	36	53	73	85	95	106
Electricity	2	2	2	3	3	3
Maintenance	2	3	4	6	9	15
Packaging	2	4	5	6	6	7
Foreshore Lease	1	1	1	1	1	1
Taxes	4	4	4	4	4	4
Depreciation	80	80	80	80	80	80
Insurance	13	13	13	13	13	13
Miscellaneous	3	3	3	3	3	3
	$ 159	$ 187	$215	$235	$252	$274
General Expenses						
Administration:						
Salaries	43	43	43	43	43	43
Office expenses	5	5	5	5	5	5
Interest expense	314	333	345	342	325	303
	$ 362	$ 381	$393	$390	$373	$351
Total Expenses	$ 643	$ 706	$760	$780	$780	$780
NET PROFIT (LOSS) BEFORE TAXES	$(362)	$(238)	$(105)	$(32)	$ 62	$155

Woods Gordon

PROPOSED KELP MEAL PLANT

PRO FORMA PROFIT/LOSS STATEMENT
ASSUMING ENTIRE MARKET FROM YEAR 1 ONWARDS

(Thousands of 1980 Constant Dollars)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 10
Production/Sales (metric tonnes)	320t	400t	450t	500t	550t	600t
Revenue (@ 85¢/lb. = $1,870 metric tonne)	$ 598	$748	$842	$935	$1,029	$1,122
Harvesting Costs						
Labour	55	58	58	58	65	65
Fuel and lubrication oil	7	7	7	7	8	8
Maintenance	10	10	10	10	10	10
Depreciation	63	63	63	63	63	63
Insurance	11	11	11	11	11	11
Royalty	2	4	4	4	5	5
Miscellaneous	2	2	2	2	2	2
	$ 150	$155	$155	$155	$ 164	$ 164
Plant Overhead						
Labour	29	34	38	42	50	50
Fuel oil	67	85	95	106	120	120
Electricity	2	3	3	3	4	4
Maintenance	2	3	4	6	9	15
Packaging	5	6	6	7	8	8
Foreshore Lease	1	1	1	1	1	1
Taxes	4	4	4	4	4	4
Depreciation	80	80	80	80	80	80
Insurance	13	13	13	13	13	13
Miscellaneous	3	3	3	3	3	3
	$ 206	$232	$247	$265	$ 292	$ 298
General Expenses						
Administration:						
Salaries	43	43	43	43	43	43
Office expenses	5	5	5	5	5	5
Interest expense	314	304	304	304	304	304
	$ 362	$352	$352	$352	$ 352	$ 352
Total Expenses	$ 718	$739	$754	$772	$ 808	$ 843
NET PROFIT (LOSS) BEFORE TAXES	$(120)	$ (9)	$ 88	$163	$ 221	$ 308

NET PROFIT (LOSS) BEFORE TAXES WITH KELP MEAL SELLING PRICE OF 89¢/lb. AND 95¢/lb.

(Thousands of 1980 Constant Dollars)

	Year 1	Year 2	Year 3	Yeasr 4	Year 5	Year 10
50% of Total Market in Year 1						
A. Tonnes sold ((Appendix Q)	150t	250t	350t	400t	450t	500t
B. Revenue - at 89¢/lb. ($1,958/tonne)	$ 294	$ 490	$ 685	$ 783	$ 881	$ 979
- at 95¢/lb. ($2,090/tonne)	$ 314	$ 523	$ 732	$ 836	$ 941	$1,045
D. Expenses (Appendix Q)	$(643)	$(706)	$(760)	$ (780)	$ (780)	$ (780)
Net Profit (Loss) Before Taxes						
E. - $1,958/tonne (B-D)	$(349)	$(216)	$ (75)	$ 3	$ 101	$ 199
F. - $2,090/tonne (C-D)	$(329)	$(183)	$ (28)	$ 56	$ 161	$ 265
100% of Total Market from Year 1 Onwards						
G. Tonnes sold (Appendix R)	320t	400t	450t	500t	550t	600t
H. Revenue - at 89¢/lb. ($1,958/tonne)	$ 627	$ 783	$ 881	$ 979	$1,077	$1,175
I. - at 95¢/lb. ($2,090/tonne)	$ 669	$ 836	$ 941	$1,045	$1,150	$1,254
J. Expenses (Appendix R)	$(718)	$(739)	$(754)	$ (772)	$ (808)	$ (813)
Net Profit (Loss) Before Taxes						
K. - $1,958/tonne (H-J)	$ (91)	$ 44	$ 127	$ 207	$ 269	$ 362
L. - $2,090/tonne (I-J)	$ (49)	$ 97	$ 187	$ 273	$ 342	$ 441

NET PROFIT (LOSS) BEFORE TAXES
WITH VARIOUS CAPITAL COST REDUCTIONS

(Thousands of 1980 Constant Dollars)

	Year 1 $	Year 2 $	Year 3 $	Year 4 $	Year 5 $	Year10 $
A. Revenue	168	355	468	598	673	935
Less:						
B. Operating Expenses	156	197	233	269	287	340
Depreciation:						
C. - 10% capital cost reduction	129	129	129	129	129	129
D. - 20% capital cost reduction	114	114	114	114	114	114
E. - 30% capital cost reduction	100	100	100	100	100	100
Interest expense:						
F. - 10% capital cost reduction	283	309	327	339	340	273
G. - 20% capital cost reduction	253	275	289	295	291	243
H. - 30% capital cost reduction	222	240	249	251	240	212
Net Profit (Loss) Before Taxes						
- 10% capital cost reduction (A-B-C-F)	(400)	(280)	(221)	(139)	(83)	193
- 20% capital cost reduction (A-B-D-G)	(355)	(231)	(168)	(80)	(19)	238
- 30% capital cost reduction (A-B-E-H)	(310)	(182)	(114)	(22)	46	283

APPENDIX T

NET PROFIT (LOSS) BEFORE TAXES WITH INTEREST RATES OF 10% AND 15%

(Thousands of 1980 Constant Dollars)

		Year 1 $	Year 2 $	Year 3 $	Year 4 $	Year 5 $	Year 10 $
A.	Revenue (Table F)	168	355	468	598	673	935
	Less:						
B.	Total expenses less interest (Table F)	299	340	376	412	430	483
C.	Surplus (Deficit)	(131)	15	92	186	243	452
	Less:						
	Interest expense:						
D.	10% (U-1)	241	257	267	269	263	233
E.	15% (U-1)	362	404	439	470	491	514
Net Profit (Loss) Before Taxes							
	10% (C-D)	(372)	(242)	(175)	(83)	(20)	219
	15% (C-E)	(493)	(389)	(347)	(284)	(248)	(62)

INTEREST EXPENSE
WITH RATES OF 10% AND 15%

(Thousands of 1980 Constant Dollars)

	Interest Rate	Column Reference	Year 1 $	Year 2 $	Year 3 $	Year 4 $	Year 5 $	Year 10 $
1. 10 year loan to cover full capital cost of $2.3 million at interest rate shown	**10%**	**A**	**230**	**230**	**230**	**230**	**230**	**230**
	15%	B	345	345	345	345	345	345
2. Interest during construction period estimated	**10%**	**C**	**3**	**3**	**3**	**3**	**3**	**3**
	15%	D	5	5	5	5	5	5
3. Overdraft interest for working capital requirements - estimated	**10%**	**E**	**8**	**1**	**-**	**-**	**-**	**-**
	15%	F	12	1	-	-	-	-
4. Average annual interest on accumulated unpaid interest	**10%**	**G**	**-**	**23**	**33**	**36**	**30**	**-**
	15%	H	-	53	89	120	141	164
Total Interest Expense								
10% (A + C + E + G)			**241**	**257**	**267**	**269**	**263**	**233**
15% (B + D + F + H)			362	404	439	470	491	514

KELP MEAL PLANT

ON-LAND SITE SELECTION

METHODOLOGY

In this phase of our study we inspected seven of the eight potential sites identified in our proposal of December 28, 1978, to review their suitability for a kelp meal processing plant. The sites inspected were as follows:

1. North Pacific Cannery, east of Port Edward
2. Sunnyside Cannery, east of Port Edward
3. Canadian Cellulose Mill, Watson Island
4. New site on Ridley Island
5. Old Alginate plant, south of Masset
6. B.C. Packers Cannery, Masset
7. New site on Masset harbour

We did not inspect the site adjacent to the CanCel mill as the mill's management were not prepared to consider selling it.

In addition to our site inspections, we personally interviewed a number of local sources including:

Mr. Grant Weir, Village Clerk of Port Edward

Canada Manpower Manager, Prince Rupert

Mr. Nick Grosse, Mayor, Masset

Mr. Fred Edgar, Supervisor, Sunnyside Cannery

Ms. Sheila Steeves, Office Manager, North Pacific Cannery

Mr. Claude Lavoie, part-Owner, Old Alginate Plant, Masset

Capt. Bob Kitching, National Harbours Board, Prince Rupert

Rivtow Straits, Masset

B.C. Hydro, Masset

Gulf Island, Masset

Canadian Pacific, Prince Rupert

City Hall, Prince Rupert

Land Commission, Queen Charlotte City

An evaluation of the estimated capital costs associated with each site was then carried out by the study team, based on the availability, suitability and cost of land, plants and wharves. In the case of the undeveloped sites, land cost plus approximate construction cost of new buildings and wharves was estimated. Lease costs were also taken into account as appropriate.

In addition to capital costs, we gave consideration to the following operating factors:

- The availability and cost of electric power, heating fuel and water;
- Waste disposal requirements;
- Labour costs in meal production;
- Property taxes; and
- The cost of moving the finished product to market.

ASSUMPTIONS

In developing our site comparisons, we have made several assumptions outlined below regarding the harvesting season, plant scale, capital costs and operating costs. These assumptions have been based on information available at

the time this phase of the feasibility study was carried out (September 1979). Definitive data and costs have become available during subsequent phases of our study and in several instances have differed from information previously available. However, since the assumptions we have made during this phase have been applied consistently to each site, any inaccuracies have not invalidated the site comparisons.

Plant Scale

Based on the estimated market for B.C. kelp (page 22 of the report), the proposed plant should be scaled to permit production of 350 tonnes dry kelp per year (year 5 design volume). We have assumed such a plant in developing our site comparisons.

We have also assumed that the operation will be based on a deck-loaded 150 tonne harvesting vessel (similar in design to those used by Stauffer & Kelco) and barges which will require off-loading at the dock by means of a crane equipped with a clam-shell grab. The plant will require a dock of approximately 465 sq. metres for unloading, kelp storage bins and the wet milling operation. The drying, fine milling, screening and packaging operation together with the offices would need a 465 sq. metres building. An additional 465 sq. metres would be required for warehousing, a machine shop, and spare parts storage.

Kelp Availability

In the Kelp Resource Survey phase of this study (page 14), we determined that there is ample kelp weed to support a kelp meal processing plant with an output of 350 dried tonnes per annum either in the Masset area or the Prince Rupert/Port Edward area.

The Graham Island kelp near Masset is somewhat closer to the plants under consideration (65 km average round trip) than that in the Prince Rupert - Port Edward area (106 km). However, prevailing winds and currents play an important part in determining fuel consumption and the mainland beds appear to be somewhat more protected than those near Masset. On balance, therefore, we would consider the mainland and island sites equal from the point of view of kelp weed availability and harvestability.

Property Taxes

Tax rates supplied by municipal authorities in each area vary from a low figure of 10 mills (mls.) in unincorporated areas, such as that in the vicinity of the Masset Inlet alginate plant, to 32.77 mls. in the town of Masset, 88.74 mls. in Port Edward and 103.4 mls. in Prince Rupert. These mill rates would be applied to assessed values which we have taken as the total improved site values at all sites.

Fuel Oil/Natural Gas

A processing plant producing dried kelp will require approximately 2 million B.T.U.'s per wet tonne of kelp for drying purposes. This drying can be achieved using fuel oil or natural gas.

We were told that Bunker C fuel is not readily available either on the mainland or island locations. Special arrangements would have to be made involving the buying of approximately 20,000 barrels at a time. This is impractical given our estimate of annual consumption of only 265,000 litres (1,700 barrels) in addition to the storage considerations. Natural Gas is not available at any of the sites visited. We have therefore based our calculations on the use of No. 2 diesel

fuel which is more readily available in smaller order quantities at all the sites under consideration.

We were told that No. 2 diesel fuel needed in the kelp drying process would be barged in from Vancouver. At the time of our enquiry, the delivered price was quoted at 72 cents per gallon (19 cents per litre) regardless of its destination in this general area. Fuel cost for processing is based on the conservative assumption that 265,000 litres of oil will be needed to dry the volume of wet kelp required to produce 350 tonnes of kelp meal per season (a drying efficiency of approximately 60%).

Hydro

Power is available from B.C. Hydro at all sites under review, probably at rates below the cost of power generated at any plant. We have assumed use of B.C. Hydro power at all locations for comparison purposes. Costs are somewhat higher on Graham Island due to the fact that the central power station uses diesel generators. We estimate that the proposed kelp drying facility will require about 28,000 kw hours of power per year. At this level of consumption, the average rate is 1.94 cents per kwh on the mainland and 3.74 cents per kwh in Queen Charlottes. The cost differential for the usage contemplated is therefore minimal.

Labour

The operation of a kelp meal processing plant will provide employment for 8 people. Most of these people would, however, only be required for the duration of the harvesting season, approximately 100 days per year during the summer.

Our interview with the manager of the Canada Manpower office in Prince Rupert revealed that seasonal employment involving only 100 days of work for 8

persons during the summer season should not be a problem in this area in terms of availability of persons with the appropriate skills. A large influx of workers occurs every year at this time due to activity in the lumbering and fishing industries. Competition from these industries for personnel will keep the pay scales slightly higher than would otherwise be the case. Rates will be similar in the Prince Rupert and Queen Charlotte areas. The following representative 1979 rates, excluding benefits, were supplied for the types of personnel needed in the proposed operation:

Plant Manager	- $15/hr. $12,000/season
Boat Captain	- $2,200/month
Boat Engineer	- $2,000/month
Two Deck Hands	- $8/hour
Crane Operator	- $11/hr.
Maintenance Mechanic (Foreman)	- $11/hr.
Two Plant Operators	- $8/hr.

Transportation

Road, rail, air and barge transportation are available in the Port Edward/-Prince Rupert area. Only barge and air transportation are available from the Queen Charlotte Islands. The barge service from Masset to Prince Rupert and Prince Rupert to Vancouver operates on a weekly service.

Rail transport rates from Prince Rupert to Vancouver were supplied by Canadian National Railways. The minimum rate of $2.90 per 100 lbs. ($63.80 per tonne) applies to products similar to kelp meal. This rate is based on siding-to-

siding service, by boxcar, with a minimum load of 60,000 lbs (27 tonnes). The minimum charge is therefore $1,740.00.

Barging rates from Masset and Prince Rupert to Vancouver were supplied by both Rivtow Straits and C.P. trucking which service both areas although the Masset/Prince Rupert trip is operated by Rivtow Straits under contract to the B.C. Ferry Corporation. These rates are based on 'door-to-door' service (involving pick-up and delivery by the carrier) and are for a 45 ft. (15 metre) trailer corresponding to a 40,000 lb. (18.2 tonne) load of kelp meal.

Quoted rates for the above services are:

	Barge		Rail
	Rivtow	C.P. Trucking	C.N.Railways
Prince Rupert to Vancouver	$1,310	$1,290	$ 1,740
Masset to Vancouver	$1,750	$1,525	Not Available

Rail transportation from Prince Rupert to Vancouver is more economical per unit weight. However, because of the large minimum shipment and the fact that some storage facilities would be needed in Vancouver (unless rail transport were to be used for the complete journey from Prince Rupert to the North American customer), we have assumed the use of barge transportation in our calculations.

C.P. trucking rates are the more favourable for barge transportation. We have assumed that loading/unloading costs will be equal for all carriers. Using C.P. trucking rates, the added cost, per load, of a site located in Masset would be approximately $235.

Water

Consumption of water in the proposed plant will not be significant and will be confined to wash-down only. All sites visited had adequate supplies of water. If necessary, some 38,000 litres of water per day could be condensed from the plant dryer exhaust.

Waste Disposal

Waste disposal will not be a problem with the proposed plant since all solids in the kelp weed end up in the product. Disposal will be confined to the removal of kelp weed spillage primarily in the kelp unloading area.

SITE SURVEYS

North Pacific Cannery Site

This plant, owned by the Canadian Fish Co., stands on pilings over open water in the Inverness Passage. The site stretches for approximately half a mile along the seaward side of the Canadian National Railways main line, about four miles south-east of Port Edward. The plant is approximately 50 years old, and of wooden construction. The buildings are currently in use as warehouses and net lofts. In addition, the plant also houses a fish rendering facility that operates 2-3 days per week.

This plant includes large wharves carried on a number of pilings, extensive buildings, also supported over the water, and employee housing on pilings and on dry land. The site covers approximately 18.4 acres (7.5 hectares), almost all of it covered by water at high tide.

Access to the site by road, rail, or water is excellent. Oil is available and storage tanks for oil are in place. The plant has the capability to generate power

although B.C. Hydro is available. Ample water is available from a creek on the property.

A careful inspection of the wharves at this site suggested the need for considerable repairs both to the decks and to the pilings supporting both the wharves and the buildings. Apparently, the pilings suffer damage each year due to floating ice during the spring break-up on Skeena River. Currents in Inverness Passage at this point run as high as 14 knots and high tides may be aggravated with ice in the channel.

Extensive repairs and changes would be necessary if this plant was to be converted to house the kelp meal facility, including new pilings and the establishment of a firm foundation for the kelp meal equipment which will be relatively heavy. In addition, high annual maintenance costs would probably be incurred.

Mr. McLeod, Manager of Canadian Fish Co. (Canfisco) in Prince Rupert, told us that the plant is not on the market at this time although it might be leased or purchased if a suitable offer was forthcoming. Mr. Weir (village clerk for Port Edward) informed us that the assessed value of the North Pacific Cannery is approximately $600,000 in total.

Summary

1. Suitability of Site — This area is large enough to accommodate the proposed plant.

2. Existing Buildings and Docks

   Construction: Timber frame

   Foundations: Timber piling, over water

Age:	Approximately 50 years
Condition:	Although the buildings appear to be in fair condition at first glance, there is considerable rotting of piles and caps. It is also to be expected that a timber building of this age, previously used as a cannery, would have considerable rot in the stringers and floor decking under the concrete overlay. It is understood that there has been no program or regular maintenance on the structure but essential repairs are made as necessary and are relatively expensive.
Suitability:	Structural alterations and up-grading would be required as well as some new construction to support processing equipment.
Fire Protection:	Minimal, no sprinklers
Area:	Total deck area about 11,600 sq. metres Principal buildings all on dock approximately 3,700 sq. metres.

3. Services

Electricity:	Diesel generators on site; power from B.C. Hydro would be available.
Water:	Private supply from nearby creeks.
Natural Gas:	Not available
Fuel Oil:	No. 2 oil available

4. Transportation — Private railway siding, good access to road and barge services.

5. Relative Development Costs — It is anticipated that development costs to up-grade a portion of the old, piled, timber structure to suit a food processing operation would be very expensive. To rebuild an area for processing and to up-grade an area for warehousing, costs could be equivalent to new construction.

6. Availability — Since the buildings are currently in use by Canfisco, it is doubtful if this site would be available in the near future. It would probably take one to two years to transfer existing operations to another site and one could expect the owner to attempt to recoup relocation costs and additional pollution control costs on top of the site acquisition costs.

It is also noted that the Canfisco's North Pacific property contains about 160 acres (65 hectares) behind the railway tracks and that they might not be willing to give up the waterfront area.

Sunnyside Cannery Site

This plant, owned by B.C. Packers Ltd., also stands on pilings over open water, in the Inverness Passage. The site stretches for approximately half a mile along the seaward side of the Canadian National Railways main line, about 5 miles

(8 kilometres) South-East of Port Edward. The plant is approximately 30 years old, and of wooden construction. It is no longer a cannery but is used for net storage and as a warehouse by B.C. Packers. The wharf is utilized as a boat basin.

The assessed value of the plant is approximately $1.1 million. The plant site includes a wharf supported on pilings, storage building also supported over the water and some employee housing on dry land. The site covers approximately 23 acres (9.3 hectares) of land, plus approximately 3 acres (1.2 hectares) on the railway right-of-way which is leased from the CNR. Most of the site is covered by water at high tide.

Access to the site by rail, road, or water is excellent. Oil and hydro power are available. Apparently, a water supply problem exists; however, there is probably an adequate supply for the limited needs of a kelp drying plant.

The Sunnyside Cannery plant is in poor condition, two of its three buildings having been neglected in recent years. The central building is now used as a net loft and for the storage of miscellaneous light weight items. This central building is in fair condition but is rather small for a kelp processing plant. The wharf area on the channel side of the building also appeared to be rather narrow for the envisaged unloading operation.

As with the North Pacific plant, pilings suffer damage from the spring break-up of ice on the Skeena River. The currents in Inverness Passage can be strong and may cause some problems to the barge or harvester unloading operation.

Extensive repairs and changes would be necessary if the plant were to be converted to house the kelp meal processing facility.

Mr. Jones, of B.C. Packers, Head Office, told us that the site might be available if a suitable offer were made.

Summary

1. Suitability of Site — The area is large enough to accommodate the proposed plant.

2. Existing Buildings and Docks

Construction:	Timber frame
Foundation:	Timber piling, over water
Age:	Approximately 30 years
Condition:	It is understood that there is considerable deterioration and rot in the piles, caps, stringers and floors. As with the buildings and docks at North Pacific, deterioration is due to the age of the structures, the timber framing and the previous use as a cannery. Maintenance costs have been very high at this plant and certain areas have been abandoned rather than repaired. The docks have suffered periodic damage due to ice flows on the river.
Suitability:	Structural alterations and up-grading would be required as well as some new construction.
Fire Protection:	Minimal, no sprinklers
Area:	The main cannery building is over 1,800 sq. metres in area.

3. Services

Electricity:	Power available from B.C. Hydro
Water:	Private supply from nearby creeks
Natural Gas:	Not available
Fuel Oil:	No. 2 oil available

4. Transportation — Private railway siding, good access to road and barge services.

5. Relative Development Costs — It is anticipated that development costs to up-grade a portion of the old, piled, timber structure to suit a food processing operation would be very expensive. To rebuild an area for processing and to up-grade an area for warehousing, costs could be equivalent to new construction.

6. Availability — This site may be available as it is currently used only for storage.

Canadian Cellulose Mill Site

We were unable to gain access to this plant to survey the site. Mr. Kreut of Canadian Cellulose told us that Cancel either owns or holds leases on all land on Watson Island, and that they were not prepared to consider the release of any land to other concerns.

New Site on Ridley Island

The new site suggested in the Prince Rupert area is located on the southern tip of Ridley Island. Ridley Island is the site of a proposed deep water port to be developed by the National Harbours Board. Engineering for the project is well advanced, but construction work has not yet started on the site. Acreage here will will be available in 1980, perhaps later. We were told that rail and road service will be available as will water and power. National Harbours Board at Prince Rupert indicated that 5 acres (2 hectares) sites could be furnished on the Porpoise Bay waterfront at a cost which would range from $40,000 to $50,000 for unserviced raw land plus a 12-15% annual lease based on the assessed value. The land is mainly muskeg and gravel fill will be required before building. The maximum current in the Bay at this point does not exceed 5 knots. Wharves in this area should escape ice damage.

As this is a site which will only be available at some time in the future, we believe that this site should not be part of the selection process.

Summary

1.	Suitability of Site	Ample area available, but it is all on peat so that some foundation problems may be expected.
2.	Existing Buildings and Docks	None existent
3.	Services	
	Electricity:	Will be available at property boundary from B.C. Hydro.

	Water:	Service to the site will be installed by N.H.B.
	Natural Gas:	May be available if a major user locates on the island.
	Fuel Oil:	No. 2 oil available.
4.	Transportation	When the island is developed, there will be good access to road, rail and barge services.
5.	Relative Development Costs	Depending upon the sites available and the amount of peat overburden on the site (from 1 m to over 4 m) it will be necessary to either remove the peat or build on piles driven through the peat. The presence of peat would also dictate higher access road costs and maintenance. Buildings and dock would be new construction.
6.	Availability	Probably two years until N.B.H. project has developed far enough for site to be available.

Old Alginate Plant Site

This is the site of the Canada Kelp Co. algin plant, partially constructed in 1966. It is situated on a 30 acre (12.2 hectares) site approximately 2 miles (3.2 kilometres) south of the town of Masset on the east side of Masset Sound. It includes a T-shaped dock, still in good condition, suitable for unloading barges or kelp harvesters. Tides are high in this locality and the current runs about 5 knots at times.

The process buildings are located 120 - 150 metres from the dock on the far side of the island highway. It was originally planned that ground kelp thinned with sea water would be pumped from the dock through a 30 - 40 cm plastic pipeline to two tanks, each with a 1,020 tonne capacity located outside a 4 storey processing building. Kelp transfer cannot be carried out in this way when manufacturing meal, due to loss of soluble materials in the water. The process building is now being converted to house a saw mill which renders it unavailable.

Also included at this site are a smaller boiler building, a warehouse of approximately 1,800 sq. metres and a large oil storage tank whose capacity we estimate to be 568,000 litres. The facility also includes a storage reservoir for clarified water. All buildings are in excellent condition. Approximately one-half of the warehouse is currently leased to the Masset Co-op Association of Masset.

The site and improvements could not easily be adapted to a kelp meal operation, mainly due to the difficulty of transporting wet kelp across the highway without dilution. Screw or Redler conveyors might serve but slime leakage on the highway would constitute a serious problem. To reduce the distance between the wet kelp mill on the dock and the dryer, the dryer equipment could be installed in a new building on the ocean side of this property immediately adjacent to the wharf. We understand from the owner that 13 acres (5.3 hectares) of water-front property are available under crown lease in this area. This space is adequate to set up a building of approximately 279 sq. metres capable of housing the dryer. Crude meal produced here could be stored in an outside bin for later transfer to a final milling-screening packaging station set up inside the existing warehouse. Transfer of the crude meal to this building could be accomplished using fork lift trucks carrying suitable steel or plastic containers, a conveyor system, or by blowing the meal.

The Masset Co-op Association currently has 50% of the kelp plant warehouse on a six-month lease. Our inspection indicated that there was sufficient remaining space to allow the installation of the necessary milling-packaging equipment plus storage for 350 tonnes of product.

This site is available and the owner, Mr. Lavoie, appears willing to transfer the lease. He suggested a price of $100,000 to transfer the lease which would include the dock and the necessary land along the water's edge. Since this installation is on crown land, there would be an annual lease of $1,150 for this property. Mr. Lavoie suggested that 50% of the warehouse space could be leased for $2,500 per year.

Road and water access to the property are excellent, with the Rivtow Straits barge slip being less than one mile away. Hydro and water are available.

Summary

1. Suitability of Site — The site is large enough for the proposed kelp meal plant.

2. Existing Buildings and Docks

Construction:	Buildings - Non-combustible
	Dock - Timber piling and deck
Foundations:	Buildings, concrete
Age:	Ten years
Condition:	Good, only minor repairs required
Suitability:	Dock and warehouse readily adapted to intended use.
Fire Protection:	No sprinklers, but buildings are non-combustible construction.

	Area:	Warehouse 1,116 sq. metres Dock 145 metres long, suitable for berthing vessels up to 75 metres long.
3.	Services	
	Electricity:	Power available from B.C. Hydro
	Water:	Available from system installed for original alginate plant.
	Natural Gas:	Not available
	Oil:	Storage facilities on site for No. 2 and No. 6 oil.
4.	Transportation	Barge service operated for B.C. Government Ferries on a weekly schedule connects to Prince Rupert, from where road, rail and barge connections are available.
5.	Relative Development Costs	Development costs of this site would be significantly lower than for the other sites considered. It would be necessary to construct a new processing building on dry land and to carry out some repairs to the existing dock and warehouse.
6.	Availability	Current owner indicated a willingness to transfer the lease for the waterfront section of the property and to sub-let the warehouse.

B.C. Packers Cannery Site

This site is in the town of Masset on the eastern shore of Masset Harbour. The existing building is about 10 years old and is currently in use as a crab cannery. This building is not available for sale or lease.

The site also includes a vacant area on the waterfront of approximately 1/2 acre (0.2 hectares). This area is not large enough to adequately provide for all initial and future needs to the proposed kelp meal plant. However, if this site were to be considered as a last resort, it would require extensive conveyors for the kelp if the existing dock were to be used for unloading the harvester. Any arrangement by B.C. Packers to allow this is unlikely as the dock area is already very congested with an ice plant and sheds. A new dock, the only other alternative, would have to be about 150 metres long.

Mr. Jones of B.C. Packers, Head Office, told us that the vacant lot would not be available for sale or lease.

The above factors preclude this site from further consideration.

New Site in Masset Harbour

The availability of this site depends upon the extensive redevelopment of Masset Harbour by the Department of Public Works.

Briefly, it would involve the removal of the existing spit of land now used as a seaplane base, in order to widen the harbour. The material so removed would be used to reclaim land on the East shore of the harbour, thereby creating a suitable parcel of land.

This ambitious project is still in the initial planning stage and no firm plans or studies were available.

The above factors preclude this site from further consideration.

TABLE 1

SUMMARY OF SITE CRITERIA

Criterion	North Pacific	Sunnyside	Canadian Cellulose	New Site Ridley Island	B.C. Packers Cannery	Old Alginate Plant	New Site Masset Harbour
1. Suitability of Area	adequate	adequate	-	adequate	not adequate	adequate	unknown
2. Existing Building and Docks	50 years old timber, on piles	30 years old timber, on piles	-	none	10 years old, timber, on piles	10 years old, concrete steel and block	none
3. Services -							
Electricity	available	available	-	available	available	available	probably
Water	available	available	-	available	available	available	probably
Natural Gas	not available	not available	-	possibly	not available	not available	unknown
Fuel Oil	No. 2 oil	No. 2 oil	-	No. 2 oil	No. 2 oil	No. 2, No. 6 oil	No. 2 oil
4. Transportation	rail, road and barge	rail, road and barge	-	rail, road and barge	barge	barge	barge
5. Development Costs	equivalent to new construction	equivalent to new construction	-	new constr. with peat problems	new constr.	partial new construction some repairs	new construction
6. Availability	possible	possible	no	future	no	available	future

COMPARISON OF SITES

Table 1 opposite summarizes the criteria used to assess the sites under review. Based on this assessment, the following sites can be eliminated from further consideration:

1. Canadian Cellulose - Not available
2. New site on Ridley Island - Future development, not available now.
3. B.C. Packers Cannery, Masset - Cannery in use, vacant lot too small and not available.
4. New site in Masset Harbour - Possible future development, not available now.

Estimated Capital Costs

We have prepared, below, the preliminary estimated capital costs of the feasible sites.

Preliminary Estimated Capital Costs

(Thousands of Dollars)

	North Pacific $	Sunnyside $	Old Alginate Plant $
Site acquisition	600	1,100	100
Development	565 - 750	565 - 750	400 - 450
Total Site	1,165 - 1,350	1,665 - 1,850	500 - 550
Equipment	250	250	250
Harvester	250	250	250
Total Plant	$1,665 - $1,850	$2,165 - $2,350	$1,000 - $1,050

TABLE 2

ESTIMATED OPERATING COSTS

(Thousands of Dollars)

	North Pacific $	Sunnyside $	Old Alginate Plant $
Property Leases			
- Crown	-	-	1.15
- Current Owner	-	-	2.50
Property Taxes (Note 1)	33.18	44.19	2.50
Electric Power	0.54	0.54	1.03
Fuel	50.40	50.40	50.40
Labour	97.57	97.57	97.57
Transportation	25.80	25.80	30.50
Depreciation (Note 1)	117.17	150.50	68.33
Total	$324.66	$369.00	$ 253.98

Note:

1. The high amounts for property taxes and depreciation are due to the assumption that the entire sites would have to be purchased (see V-21 Site Acquisition Costs).

Site Acquisition Costs

The figures for North Pacific and Sunnyside are based on the currently assessed values of the entire sites. We have assumed that the land and building in excess of that needed for the proposed plant would have to be purchased in order to obtain the specific site area required. The figure for North Pacific may be rather low as some relocation expenses would be incurred by the current owners. The figure for the Old Alginate plant was obtained during our interview with the owner.

Development Costs

Our estimate of development costs are as follows:

Processing, Offices, etc.	5000 sq.ft. @ $60 =	$300,000
Warehouse	5000 sq.ft. @ $40 =	$200,000
Docks	5000 sq.ft. @ $30 =	$150,000
Site fill, paving, services	say	$100,000
Total		$750,000

It is emphasized that the above costs are for order-of-magnitude comparison only, to assist in the initial site selection. A detailed analysis of the selected site, plant area requirements, and a capital cost estimate appear in Sections IV and V of this report.

In assessing the costs of up-grading existing, very old wooden buildings such as those at North Pacific and Sunnyside, it has been our experience that 75% to 100% of new construction costs can be expended to up-grade to present day standards and building codes. Our estimates of development costs for these sites therefore are in the range of $565,000 to $750,000.

Our estimate of development costs for the Old Alginate plant is in the range of $400,000 to $450,000 to include processing building, site work and repairs.

Equipment and Harvester Costs

In addition to land, wharf and buildings, the kelp meal plant requires a harvesting vessel and certain production equipment. For the purposes of the present comparisons, these were assumed to cost $250,000 each. As these figures would not vary significantly from site to site, all sites were burdened with this amount to give a preliminary indication of capital cost at each site under consideration.

Estimated Operating Costs

Table 2 opposite summarizes the estimated operating costs for the proposed plant at each of the feasible locations. These costs have been derived as follows based on the assumptions outlined in pages V-1 to V-7.

Property Lease

The Old Alginate plant site is the subject of a crown lease. The lease for the foreshore area, including the wharf and dolphins, costs $1,150 per year.

Property Taxes

The figures are based on the following formula (provided by Mr. Weir, Port Edward village clerk):

Total improved site value x Mill Rate x 25%.

We have assumed that future assessment will reflect the improved site value, including equipment.

The calculations are as follows:

North Pacific:	$1,507,500	x	0.088049	x	25%	= $33,183
Sunnyside:	$2,007,500	x	0.088049	x	25%	= $44,190
Old Alginate Plant:	$ 998,000	x	0.010	x	25%	= $ 2,495

Site value of Old Alginate plant is based on the fact that crown land lease rates are 5% of assessed value, therefore assessed value of land alone is $23,000. The current owner told us that the dock cost $300,000 to construct. This, together with the improvement and equipment gives a total site value of $998,000.

Electric Power

These costs are based on a consumption of 250 kw hours per day of power during the processing season. The B.C. Hydro rates at this level of consumption are 1.94¢ and 3.74¢ per kwh for Port Edward and Masset respectively. We have assumed that approximately 10 kwh per day will be required for the remainder of the year for lighting and some heating. These figures give a total consumption of approximately 27,650 kwh per year.

Fuel

Fuel costs are based on the requirement for approximately 75 million B.T.U.'s of heat per day for the proposed plant. Assuming a drying efficiency of 60%, it represents a consumption of 3,000 litres a day at 15.84¢ per litre.

Labour

The costs of labour are calculated using the labour rates indicated on page V-5. All employees except the foremen would be required only for the 100 day operating season. The foreman would be needed for the whole year to provide on-site security and general running maintenance.

The calculations are as follows:

		100 Day Season
Plant Manager	$15/hr.	$12,000
Boat Captain	$2,200/month	11,000
Boat Engineer	$2,000/month	10,000
2 Deck Hands	$8.00/hr.	12,800
Crane Operator	$11.00/hr.	8,800
Foreman/Maintenance Mechanic	$11.00/hr.	8,800
2 Plant Operators	$8.00/hr	12,800
Total Season Operators		$76,200
Plus Foreman for remainder of year, say 190 days		16,720
Total Labour Cost		$92,920

We have added 5% to the total labour cost to cover benefits:

Transportation

This figure is based on C.P. trucking rates for barge service from Masset to Vancouver and Prince Rupert to Vancouver. As discussed in page V-5, the finished

kelp meal product will be trucked from Vancouver to delivery points in Canada and the United States. As the proposed plant will have an output of approximately 350 tonnes per year, twenty 45 feet (15 metre) trailer loads will be barged to Vancouver per year.

Depreciation

This figure is calculated on a straight-line depreciation of the harvester, equipment, building, wharf and improvements over a 15 year period. We have used the total plant investment figure from page V-20 in those calculations.

Other

We have not included costs for running repairs and other indidentals as these will be similar for each site and will not affect the comparison.

SITE SELECTION

Of the sites considered, the Old Alginate plant site at Masset was the logical first choice as a location for the proposed Kelp Meal Plant. The land appeared to be readily available and was suitable for the operation. It had been indicated that the dock and warehouse could be obtained at reasonable cost or lease. The necessary on-site construction was thereby reduced to the processing plant-office area only and presented the lowest development and operating cost alternative.