CITY of NENANA

VEGETABLE INDUSTRY REPORT

Totchaket
Agricultural Development
Project

by

Little Goldstream Associates

Contract No. AG-103

VEGETABLE INDUSTRY REPORT

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CITY OF NENANA CONTRACT NO. AG-103

"Research, survey and recommend a course of action
to establish an economically viable vegetable industry project."

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INTRODUCTION

Soon after commencing this project, it became apparent that Alaska's population might not be sufficient to support a vegetable processing facility. In-state consumption was investigated with the idea of supplying all possible markets, even including meals served to travelers enroute from Alaska. To this extent, this analysis can be considered an idealized "best case" situation. Penetrating the foreign export market does not appear likely, due to competition from lower cost producers in the contiguous United States. Also, to make a significant entry would require a quantity of processed vegetables equal to several times the consumption in Alaska.

Interest rates have been calculated at low rates similar to those found in other state guaranteed programs. Fairly extensive production data is included. Individual farm expense estimates are predicated on a concept of accelerated farm development. In some cases, material and cost summaries are developed for the Railbelt area as a whole to provide additional information on the magnitude and possibilities of the industry. It should be remembered that these totals reflect the 'best case' market figures mentioned earlier.

As a note to those who compare figures, quantities of produce are calculated in retail amounts when discussed from the market end, and in farm-equivalents when discussed from the farmer's side. Both figures are given in the summary tables in the market chapter.

CONCULSIONS

- Based on the projected Alaskan market, a potato processing plant in the Totchaket region would not show a profit by the year 1990.

- While a vegetable processing facility approaches profitability in 1990, the relatively low price paid the farmer by a processor would not cover the cost of production of most vegetables.

- Potatoes and carrots stored and marketed year-round, and fresh lettuce in season, would produce a profit from farms initiated as part of the Totchaket agricultural development project. However, questions concerning the storage requirements and 'keeping ability' of Alaskan vegetables preclude this alternative.

- Enough land already exists in private hands to supply Alaska's vegetable needs. Thus, the Totchaket project is not supplying an opportunity that does not exist elsewhere in the state, as is the case for large grain farms.

- This is not to indicate that vegetable growing is not economical in Alaska. It shows, rather, that with present knowledge and under existing conditions, the relatively labor and capital intensive vegetable business is not as amenable to 'instant' development as are the larger scale, more extensive agronomic enterprises.

- The climate, soils, and, when the road is built, accessability of the Totchaket region appear equal to, or better than, other agricultural areas in the state. If land is allocated to allow competition in Alaska's small farm evolvement, fifteen 80-acre and fourteen 240-acre parcels are suggested, based on acreage required to supply in-state needs by 1990. Required funding to develop Alaska's vegetable industry, in 1980 dollars, is $2,638,000 for initial capitalization of farms, based on 75% financing of machinery and farm related improvements, and $1,696,000 in revolving operating loans, based on 75% of annual expenses. An additional two to three million dollars will be needed for storage, handling and marketing facilities, whether in one large central co-operative, or by individuals.

  Additional research and development recommendations are included at the end of the report.

PROSPECTIVE VEGETABLE MARKETS

Introduction

This part of the study treats only present and prospective markets for vegetables, including potatoes, that could be supplied by commercial producers in the Nenana area. The selected market area encompasses that region commonly called "the Railbelt". Products treated include only those vegetables suited to commercial production within perceived climatic and environmental constraints of the proposed agricultural project. Market assessments include fresh, frozen, and canned vegetables directed to resident, visitor, and traveler consumption. Greenhouse vegetables have been treated only to the extent of modest-technology production of tomatoes, cucumbers, and lettuce.

Even with the collective omniscience of Alaskan and 'outside' expertise, public and private, there would be little probability of precisely defining present and future vegetable markets (demand) in Alaska. Reported national markets are the collective historical expression of consumer tastes and preferences, consumer incomes, food distribution institutions, transportation, and available vegetable supplies, as affected by changing technology and delivery of public institutional and agency services. Alaskan market identification is further confounded by immature and undeveloped marketing institutions, voids in statistical data sources, and a dearth of critical technology and services directed to final consumer products.

Lest we despair too soon, prospective markets can be approximated with quite simple methodology, which will suffice development project

planning needs. Even the most sophisticated methodology is dependent on population data, per capita consumption data, and alternative-source supply data. Moreover, observations by 'people in the trade', producers and scientists, have been used to develop a more perceptive estimate in most instances. Such estimates were further refined by definitive separation between 'markets for vegetables in Alaska' and 'markets that could be supplied from Alaskan-produced vegetables'.

Population Projections

Any approach to estimating present or future markets for vegetable products is in some manner predicated on population estimates and projections. Since Bureau of Census data are only in a 'preliminary' stage of release, available data from Borough Clerk's and the Alaska Department of Labor were used to develop population estimates (Table 1). "Resident" population estimates were taken from most recent available data. "Visitor" data were obtained from Division of Economic Enterprise study reports. "Traveler" data were calculated from other publications of the same agency. Population estimates for 1990 were calculated as constant rates of increase from the 1970 base period. While recognition was given to probable increased rates of population growth resulting from energy-related and other resource development, those estimates were not included.

Consumption Estimates

Per capita consumption data were selected from USDA Economics, Statistics, and Cooperative Service publications; Consumer and Food Economics Institute information; and other published sources. Fresh, frozen, and processed vegetable products include only those identified as being probably commercial crops in the Nenana area. Consumption

estimates (Table 2) do not reflect probable promotional efforts, merchandising schemes, or price considerations calculated to affect seasonal or annual per capita consumption. Thus, market disappearance may, at any point in time, due to a variety of factors, be above or below market estimates.

'Alaskan-Produced' Supply Constraints

One must again reiterate that Alaska does not have a commercial vegetable industry, and consequently does not have many, if not most, of the needed technology, institutions, services, and experience to immediately embark on such commercial industry development in a new-lands settlement-development project. Alaska does have a few excellent, specialized truck-farmers, in some communities, which probably could provide the nucleus for staging additional commercial vegetable production - if public and private institutional efforts were directed to resolving both production and marketing constraints.

While claims of "agency files bulging with information" may be substantiated for home-garden vegetable production, they are grossly exagerated when made regarding commercial vegetable production - for other than potatoes. Good to excellent research has been done on varietal selection, fertilizer responses, photoperiod suitability, and irrigation, with specific reference to the Alaska environment, but the same cannot be said for commercial harvest criteria, packing-shed technology, grading specifications, storage technology and practices, product shelf-life, or consumer determined attributes of "quality". Recognition has not been given, at institutional administrative levels, of Alaskan commercial producer or trade needs. Moreover, that unique information presupposed in "bulging files" is not readily available for commercial grower utilization.

Table 1. Population by region in Alaska's Railbelt food distribution area [a/]

Region	Jan,	Feb,	Mar,	April	May	June	July	Aug,	Sept,	Oct	Nov,	Dec,	ANNUAL
Resident													
North Star Borouth [b/]	55,500	55,500	55,500	55,500	55,500	55,500	55,500	55,500	55,500	55,500	55,500	55,500	55,500
Fairbanks Southeast [b/]	5,300	5,300	5,300	5,300	5,300	5,300	5,300	5,300	5,300	5,300	5,300	5,300	5,300
Mat-Su Borough [c/]	23,177	23,177	23,177	23,177	23,177	23,177	23,177	23,177	23,177	23,177	23,177	23,177	23,177
Anchorage Borough [c/]	204,328	204,328	204,328	204,328	204,328	204,328	204,328	204,328	204,328	204,328	204,328	204,328	204,328
Kenai-Cook Inlet [b/]	22,300	22,300	22,300	22,300	22,300	22,300	22,300	22,300	22,300	22,300	22,300	22,300	22,300
Valdez-Chitan-Whittier [b/d/]	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000	5,000
Sub-total	315,605	315,605	315,605	315,605	315,605	315,605	315,605	315,605	315,605	315,605	315,605	315,605	315,605
Visitor													
Anchorage [e/]	15,197	15,197	15,197	15,197	15,197	27,861	39,646	47,659	39,349	15,197	15,197	15,197	276,091
Fairbanks [e/]	1,151	1,151	1,151	1,151	1,151	2,140	7,803	3,891	2,623	1,151	1,151	1,151	25,665
Tok [e/]	1,842	1,842	1,842	1,842	1,842	5,715	6,936	3,891	1,967	1,842	1,842	1,842	33,245
Other [f/]	1,151	1,151	1,151	1,151	1,151	7,144	8,670	9,726	6,558	1,151	1,151	1,151	41,306
Sub-total	19,341	19,341	19,341	19,341	19,341	42,860	63,055	65,167	50,497	19,341	19,341	19,341	367,307
Travelers													
Air - departures [e/]	102,075	102,449	102,823	103,197	103,571	103,945	104,319	104,693	105,067	105,440	105,814	106,187	1,349,580
Air - through [e/]	80,667	81,090	81,513	81,937	82,360	82,783	83,206	83,629	84,052	84,475	84,898	85,321	995,931
Ship - cruise [e/]					3,039	6,002	10,197	8,989	6,078	3,039			37,344
Sub-total	183,409	183,539	184,336	185,134	188,970	192,730	197,722	197,311	195,197	192,954	190,712	191,508	2,282,855
People/Month	518,355	518,485	519,282	520,080	523,916	551,195	576,382	578,083	561,229	527,900	525,658	526,454	2,965,767

[a/] The "Railbelt" has been defined, for the purpose of this study, as those areas served by the Parks, Glenn, and Richardson highways.

[b/] Alaska Population Overview, Alaska Department of Labor, December 1979. [c/] Data provided by Borough Clerk. [d/] Data incomplete.

[e/] Visitor Census & Expenditure Survey, Division of Economic Enterprise, March 1978. [f/] Approximates cruise ship visitor numbers.

Facetious comments regarding 'the one day of spring' may well illustrate one of the severe constraints on commercial vegetable production in Alaska. There is no spring, and no fall, for the commercial vegetable producer. Extreme variability among years and microclimate locations is further compounded by vagaries in heat budget, light level and quality, rainfall, and wind. Risk factors engendered by such natural phenomenon are reflected not only in yield, quality, and harvest dates, but are also reflected in "credibility" of the grower and access to credit. The nature and time element of alternative supply sources, and unavailability of alternative markets, precludes certain stratagems which might partially address or offset risks of natural origin.

Particular constraints are imposed on the Alaskan grower by "market". Traditional market institutions do not exist. Generally, the product must be delivered in final packaged form to the retail outlet. The sales function is "eyeball to eyeball" negotiation. Most Alaskan growers are not culturally attuned to the art of vegetable marketing; a cultural environment where higher value may be placed on exhibited skills of the "bargainer" than actual results of the sale, and buyer confidence is reinforced by knowledge of alternative supply.

Market Assessments

The first parameter which must be established when assessing present and future vegetable marketing possibilities is that portion of estimated consumption which could be supplied by Alaskan producers (Table 3). Market estimates were adjusted to reflect seasonality of harvest and probable quantities to suffice each identified use; with further adjustments to reflect most probable time periods of fresh or processed product sale.

Table 2. Estimated vegetable consumption within Railbelt area, farm marketing equivalent*, 1980

Item	Unit	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Total
Potatoes - fresh	cwt.	18,616	18,616	18,617	18,617	18,620	19,447	20,220	20,300	19,740	18,623	18,622	18,622	228,660
frozen	cwt.	13,174	13,174	13,174	13,174	13,179	13,882	14,539	14,607	14,131	13,182	13,182	13,182	162,580
canned	cwt.	710	710	710	710	710	741	771	774	750	710	710	710	8,716
chips & strings	cwt.	5,507	5,507	5,507	5,507	5,507	5,753	5,982	6,005	5,840	5,507	5,507	5,507	67,636
Peas - fresh[a/]	cwt.	27.5	27.5	27.5	27.5	27.5	29	30.4	30.5	29.5	27.5	27.5	27.5	339.4
frozen[b/]	cwt.	807	807	807	809	813	851	890	894	866	810	809	809	9,972
canned	cwt.	1,136	1,136	1,136	1,138	1,144	1,197	1,252	1,258	1,218	1,140	1,138	1,138	14,031
Carrots - fresh	cwt.	1,851	1,851	1,851	1,852	1,852	1,950	2,057	2,067	2,001	1,852	1,852	1,853	22,889
frozen	cwt.	272	272	272	272	272	285	299	300	291	272	272	272	3,351
canned	cwt.	205	205	205	205	205	216	228	229	221	205	205	205	2,534
Broccoli - fresh	cwt.	380	380	380	380	380	401	420	421	407	380	380	380	4,689
frozen	cwt.	497	497	499	499	501	527	554	556	536	501	501	501	6,169
Cauliflower - fresh	cwt.	250	250	250	250	250	264	276	277	268	250	250	250	3,085
frozen	cwt.	155	155	155	155	155	164	171	173	164	155	155	155	1,912
Brussels sprouts-fresh	cwt.	14.5	14.5	14.5	14.5	14.5	16	17.4	17.5	16.5	14.5	14.5	14.5	183.4
frozen	cwt.	104	104	104	104	105	113	116	116	112	106	106	106	1,296
Beets - fresh	cwt.	59	59	59	59	59	65	70	71	64	59	59	59	742
canned	cwt.	209	209	209	209	209	231	249	252	227	209	209	209	2,631
Cabbage - fresh	cwt.	2,586	2,586	2,586	2,586	2,587	2,725	2,855	2,868	2,774	2,588	2,588	2,587	31,916
sauerkraut	cwt.	582	582	582	582	582	613	642	645	624	582	582	582	7,180
Beans (snap) - fresh[a/]	cwt.	444	444	444	444	444	468	491	493	477	444	444	444	5,481
frozen[b/]	cwt.	296	296	296	296	296	312	327	328	317	296	296	296	3,652
canned	cwt.	1,743	1,743	1,743	1,743	1,743	1,837	1,927	1,935	1,872	1,743	1,743	1,743	21,515
Turnips - fresh	cwt.	70	70	70	70	70	73	77	77	75	70	70	70	862
frozen (greens)	cwt.	60	60	60	60	60	63	67	67	64	60	60	60	741
Lettuce - fresh	cwt.	6,729	6,729	6,730	6,731	6,734	7,104	7,451	7,486	7,326	6,738	6,736	6,736	83,230
Tomatoes - fresh	cwt.	3,366	3,366	3,366	3,366	3,366	3,555	3,731	3,749	3,621	3,366	3,366	3,366	41,584
Cucumbers - fresh	cwt.	924	924	924	924	925	974	1,019	1,023	991	926	925	925	11,404

*/ Excludes quantities produced in home gardens. Conversion factors (Food Consumption, Prices, and Expenditures, AER 138) used to obtain retail weight from farm weight. a/ Probably over-estimated due to short season of harvest, and difficulty of shipping this product. b/ Probably under-estimated due to substitution for canned and perceived quality of Alaskan-product.

Table 3. Prospective vegetable markets for Railbelt producers, farm equivalent*, 1980

Item	Unit	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Total
Potatoes - fresh	cwt.	18,616	18,616	18,617	18,617	18,620	19,447	20,220	20,300	19,740	18,623	18,622	18,622	228,660
frozen	cwt.	13,174	13,174	13,174	13,174	13,179	13,882	14,539	14,607	14,131	13,182	13,182	13,182	162,580
canned	cwt.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
chips & strings	cwt.	5,507	5,507	5,507	5,507	5,507	5,753	5,982	6,005	5,840	5,507	5,507	5,507	67,636
Peas - fresh[a/]	cwt.	0	0	0	0	0	0	6	30	7	0	0	0	43
frozen	cwt.	807	807	807	809	813	851	890	894	866	810	809	809	9,972
canned	cwt.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carrots - fresh	cwt.	1,851	1,851	0	0	0	0	0	690	2,001	1,852	1,852	1,853	11,950
frozen	cwt.	272	272	272	272	272	285	299	300	291	272	272	272	3,351
canned	cwt.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Broccoli - fresh	cwt.	0	0	0	0	0	0	280	421	305	0	0	0	1,006
frozen	cwt.	497	497	499	499	501	527	554	556	536	501	501	501	6,169
Cauliflower - fresh	cwt.	0	0	0	0	0	0	138	277	201	0	0	0	616
frozen	cwt.	155	155	155	155	155	164	171	173	164	155	155	155	1,912
Brussels sprouts-fresh	cwt.	0	0	0	0	0	0	0	4.4	16.5	0	0	0	20.9
frozen	cwt.	104	104	104	104	105	113	116	116	112	106	106	106	1,296
Beets - fresh	cwt.	0	0	0	0	0	0	35	71	64	0	0	0	170
canned	cwt.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cabbage - fresh	cwt.	2,586	2,586	0	0	0	0	1,428	2,868	2,774	2,588	2,588	2,587	20,005
sauerkraut	cwt.	582	582	582	582	582	613	642	645	624	582	582	582	7,180
Beans (snap) - fresh	cwt.	0	0	0	0	0	0	0	247	239	0	0	0	486
frozen	cwt.	296	296	296	296	296	312	327	328	317	296	296	296	3,652
canned	cwt.	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Turnips - fresh[b/]	cwt.	0	0	0	0	0	0	52	77	75	70	70	70	414
frozen (greens)	cwt.	60	60	60	60	60	63	67	67	64	60	60	60	741
Lettuce - fresh	cwt.	d/	d/	d/	d/	d/	d/	3,725	7,468	3,663	d/	d/	d/	14,856
Tomatoes - fresh[e/]	cwt.	d/	d/	d/	3,366	3,366	3,555	3,731	3,749	3,621	3,366	3,366	d/	28,120
Cucumbers - fresh	cwt.	d/	d/	d/	d/	d/	d/	510	1,023	d/	d/	d/	d/	1,533

*/ Excludes quantities produced in home gardens. Does not imply market penetration or market-share, only that the market could have been penetrated and supplied if an Alaskan vegetable industry were in place. a/ Probably over-estimated, and fresh pea consumption is declining nationwide. b/ Data inconclusive. d/ While greenhouse production is possible, that level of technology was not included in this study. e/ Projected as greenhouse production even though field production may be possible.

It must be noted that all quantities have been cited as amounts leaving the farm.

MARKET CONSTRAINTS

The initial constraint may well be confusion regarding the term "market". "Market" projections (as in this report) are generally estimated "demand" for a given geographic area, projected some years ahead. The grower perceives "market" as the buyer(s) to whom he sells. Buyers, wholesale or retail, may perceive "market" as either price/quantity availability or that portion of the consuming public which they supply. In a very broad and long-term sense, market may be viewed as total production disappearance associated with per capita consumption. Communication regarding "market" may be profoundly confused if the focus of discussion is not defined. Further confusion may be engendered by conversion of statistical producer-sales data to "market", particularly when unidentified production short-fall is significant or producer sales efforts have been ineffective.

For the Alaskan vegetable grower, market constraints may be viewed as 'outside' competition, cyclical changes in store management, vagaries in military procurement, disparities in quality demands by buyers between "Alaskan-produced" and 'outside' supply sources, and the 'bargained' price. Recognition is also being given, in some instances, that unavailable packing-shed and storage technology may well be a significant constraint for some products. An additional significant constraint, particularly for the newer producer, may well be recent sales-effort-experiences.

From a prospective 'industry' outlook, market constraints may be viewed as limited numbers of consumers, lack of alternative markets, insufficient numbers of producers and geographic distribution to provide predictability of supply within and among years, very short distribution season for fresh vegetables other than potatoes, carrots, and possibly cabbage, and high capitalization and storage costs for frozen vegetables. Additional constraints may be viewed as too few buyers, insufficient research and service support, transitional nature of consuming population, too few and too small production units to absorb the costs of needed overproduction to assure predictable supply, insufficient price differential for quality of products, inadequate alternative supply information systems, voids in substantiative information to validate claims of superiority in Alaskan-grown vegetables, and a dearth of research and technical effort directed to product shelf appearance and shelf-life.

ESTIMATED VEGETABLE MARKETS - 1980

Estimated markets for 1980 were initially identified as being those quantities identified from consumption estimates (table 2). Those estimates were subsequently refined to identify quantities relevant to Alaskan producers (table 3). Estimates were then obtained regarding total marketings within the region. Since 1980 data were not yet available, 1979 data were used to identify probable 'market share' for in-state production (Table 4). Additional perspective regarding in-state production's 'market share' could probably be gained from recent year's data.

Observations and discussions regarding Alaskan-produced vegetables, from a retail distribution perspective, indicated recognition of desired

quality attributes, recurring short-fall in supply, seasonal constraints which could be ameolerated with storage - if economic, and what may be described as 'structural' and 'technical' problems of producer distribution to retail outlets. Quality attributes associated with "freshness", "flavor", and "texture" rank very high for most vegetables; however, those associated with 'shelf-life', 'harvest maturity', "greening" in potatoes, packing-shed technology and product quality control, and certain consumer 'visual perceptions' of quality need public research and service program attention.

Table 4. Commercial vegetable sales, Railbelt area, 1974-79.

Item	1974	1975	1976	1977	1978	1979
			(cwt.)			
Potatoes	70,600	82,000	72,500	70,000	64,000	67,000[a/]
Lettuce	8,600	9,300	9,300	10,400	11,000	13,400[a/]
Cabbage	3,200	2,700	3,700	3,200	4,000	3,700[a/]
Carrots	1,400	1,900	2,400	2,750	1,450	2,200[a/]
Other*	1,900	1,500	2,500	2,300	2,800	3,500[a/]

*/ Includes radishes, cauliflower, broccoli, peas, green onions, spinach, collard greens, turnip greens, mustard greens, turnips, squash, etc.

a/ Estimated from available data.

Source: Alaska Agricultural Statistics

The above mentioned short-fall in supply of Alaskan-produced vegetables, as perceived by produce buyers, probably reflects supply constraints imposed by natural phenomenon, too few producers - both in numbers and geographic distribution, inadequate or insufficient packing

shed and/or storage capacity, and general lack of producer perception regarding scope and nature of the "real" markets. The conclusion might be drawn that Alaskan vegetable growers are severly handicapped in their forward planning by alternative-source supply information, and too few to effectively penetrate much of the available market. Moreover, the lack of alternative markets, coupled with limited production, precludes effective collective action with regard to both market penetration and price.

Those factors described as "structural and technical" problems of producer-merchandising encompass (a) pre-planting determination of 'market', (b) identified product 'specifications' to meet retail trade needs, (c) functional aspects of 'standardization' and 'inspection', (d) and 'lead time' in notice to buyers and the buying public regarding availability of Alaska-produced vegetables. Specific concerns mentioned by vegetable buyers included: hydro or vacuum coolers to reduce moisture and extend shelf-life of lettuce - also radishes, greater lead time in notice of when crops will be ready for harvest, harvest crops at stage of physiological maturity that will give best storage and shelf-life, broccoli heads that meet standards of the trade for size and color, short supplies of vegetables - particularly carrots, broccoli, and cauliflower, and 'standard' packing size for cabbage.

Wholesale pricing of Alaskan-produced vegetables was approached via delivered prices at the retail store. Representative prices for the 1980 season were reported as follows:

Cabbage	2 doz. heads	$10.50	Lettuce, head	2 doz.	$10.50
Cabbage (red)	20-24 heads	10.50	Lettuce, leaf	2 doz.	10.50
Carrots	per bunch	.40	Lettuce, red-tip	2 doz.	10.50
Carrots, bulk	per pound	.35	Lettuce, romaine	2 doz.	10.50
Collard greens	2 doz. bunch	9.50	Spinach, bunch	2 doz.	9.50
Mustard greens	2 doz. bunch	9.50	Onions, bunch	1 doz.	3.60
Turnip greens	2 doz. bunch	9.50	Squash, zuchinni	pound	.35
Turnips, bulk	25 pounds	8.50	Potatoes, bag	5 lbs.	1.20
Radishes, bunch	per doz.	3.36	Potatoes, bag	10 lbs.	2.25
Radishes, bulk	per pound	.40	Potatoes, baker	50 lbs.	16.50
Broccoli	per pound	.45	Potatoes, No. 2	20 lbs.	2.25
Cauliflower	per pound	.45			

FROZEN

French Fries	per pound	.45
Peas	per pound	.511
Cauliflower	per pound	.84
Carrots	per pound	.485
Broccoli	per pound	.71
Brussels Sprouts	per pound	.785
Stew Vegetables	per pound	.538
Spinach	per pound	.508
Mixed Vegetables	per pound	.547

To gain further perspective on the retail market, shelf appearance and price surveys were conducted in some 15 stores, in Anchorage, Fairbanks, Wasilla, Palmer, and Eagle River. Some stores were surveyed

in each of three consecutive weeks. Twenty two fresh vegetable items, and twenty two frozen ones, were observed (if available) in each store. Observations reinforced often expressed conclusions that Alaskan consumers will most often place quality considerations over price. This appears particularly the case in fresh vegetables. Moreover, these observations suggest some reversal of retail-store-consumer frozen vegetable consumption trends identified by Saunders and Marsh in 1970-71.

Even during this mid-winter season, fresh vegetable counters contained carrots (bagged and bulk), cabbage (green and red), broccoli (excellent large heads), cauliflower (excellent), lettuce (head and leaf), radishes, turnips, tomatoes (large and cherry), cucumbers (slicing and European), potatoes (red, white, and bakers - in bulk, and 5#, 10#, 15# U.S. No. 1's and 20# bags of U.S. No. 2's), brussels sprouts, peas (in the pod) - 1 store, and, of course, a full range of vegetables not identified in this study. Probably the most noticable price comparison was between the regular slicing and European cucumbers, 39¢ to 59¢ for regulars and $1.39 to $1.69 each for modest sized European type. Prior to the "grocery price war", 'outside' and 'local' potatoes, in 5# and 10# balers were selling for approximately the same price in a number of stores. Potatoes were the only 'local' vegetable being sold, even though produce managers perceive this as still being the 'season' for Alaskan-grown carrots and cabbage.

Frozen vegetable shelf appearance and price surveys were less informative regarding 'market' in some respects than were those for fresh produce, other than for potatoes. First, in most all stores, potato products occupied at least one-half of frozen vegetable counters. The

common packaging for french fries in the Fairbanks market was the 1 lb. (16 oz.) and 2 lb. (32 oz.) packs, while in Southcentral most observed sizes were 20 oz., 2 lb. (32 oz.), and 5 lb.; crinkle cuts in 20 oz. and and 2 lb. (32 oz.), hashbrowns in 2 lb., shoestrings in 2 lb., tater tots in 2 lb. and occasionally 4 lb. packs, tater treats in 2 lb., dinner fries 24 oz., random sliced 24 oz., golden crinkles in 2 lb. and 5 lb., small whole potatoes 2 lb., crispers in 20 oz., 24 oz., 32 oz., and stew packs in 2 lb. Other vegetables appeared to be packaged commonly in 10 oz., 16 oz., 20 oz., 24 oz., and 32 oz. units depending on the individual store, and probably on the nature of the particular buying clientele. Broccoli was identified in 10 oz., 16 oz., 20 oz., and 24 oz. packaging. Cauliflower was commonly found in 10 oz., 16 oz., and 20 oz. packaging. Peas were found in similar sizes, including 32 oz. Brussels sprouts were found in most stores, as were green beans, but zuchinni was not common other than 10 oz. sizes. Crinkle cut carrots were common, but diced carrots were rare.

The frozen vegetable market may well be considered the "food service" market, since a major portion goes to the food service and institutional trade. Certain changes have taken place since Saunders and Marsh identified the "institutional" share as 76 percent for potatoes, 71 percent for carrots, 62 percent for mixed peas and carrots, 53 percent for frozen peas, 50 percent for cauliflower and brussels sprouts, and 38 percent for broccoli. A rank ordering of vegetables for some food services should be of interest.

Airline Flight Kitchens	Restaurants
1. broccoli	1. potatoes
2. green beans	2. peas
3. carrots	3. corn
4. peas	4. green beans
5. potatoes (off & on)	5. broccoli

While food-service-use quantities of frozen foods were up by some ten percent nationwide in the 1970's, Alaska's food services have probably increased their use of frozen vegetables by more than 25 percent in the same period. Potato products have maintained their steady climb, and continue in the dominant position of frozen foods marketings. More than 75 percent of frozen potato marketings go to the "institutional" or food service trade. This area of market is certainly open to Alaskan-produced, if quality and service equal or exceed that from 'outside'. Also, this area of market is Alaska located, thus directly accessible. The same cannot be said for the retail supplyer market. Four retail store groupings dominate the retail grocery trade in Alaska, with only one being functionally accessible within Alaska.

The frozen pea market is generally recognized as the second largest in terms of frozen vegetables. Reminiscence of the 'pea project', and the perceived quality of Alaskan-grown frozen peas, creates images of almost unlimited markets. Many projections of market, including the one included in this study, reflect the mystique of that earlier period. National per capita consumption of frozen peas has been experiencing a sustained annual decline of near 2.5 percent. Projected over a twenty year period, the frozen pea marketing situation could become severe. However, if the 'mystique' could be recaptured and maintained, the situation could be quite satisfactory. This would take particular attention to quality of product and service of the market. Those public services needed to accomplish the

task are not in place. Moreover, it would necessitate significant effort over an extended period to get them in place and functionally operational.

Broccoli is certainly third ranked in the Alaskan frozen vegetable market, and rapidly gaining on peas. It is not inconceivable that the frozen broccoli market may be approaching the Saunders & Marsh projection for 1980 (618,000 lbs.), but the even more dramatic change that has taken place is the percentage going to the institutional or food service market. Their identification in 1971 was 38 percent; which might be estimated at this time near the 60 percent mark. National trends in per capita consumption for broccoli would certainly reinforce projections regarding broccoli consumption and the rapid increase in food service utilization.

Frozen carrot consumption is more difficult to identify in the Alaskan environment, since a significant portion of marketings go into the food service trade. Retail store shelf appearance surveys would indicate an even larger percentage going to the institutional trade than the 71 percent identified by Saunders and Marsh. This conclusion may be influenced, however, by the use of carrots in mixed vegetable and convenience food packagings where they are not readily visible. One should also note that carrots are third-vegetable-priority in airline flight kitchen menus.

Cauliflower and brussels sprouts both are increasingly observed in not only frozen food counters, but are certainly evident in fresh vegetable counters throughout the year. It is quite probable that Alaskan consumption of cauliflower is both above national average and that the Saunders & Marsh estimate of a nearly equal split between institutional and

retail markets still holds. National data shows a sustained increase in per capita consumption, and shelf appearance surveys would certainly substantiate increasing consumer interest in Alaska; however, the void in commercial cauliflower production in Alaska would cast some doubt in planning for processing at this time. While home garden and research experience certainly indicate commercial production suitability, grower experience and technology may not be readily available.

Green beans, in the Nenana area, may well be worthy of consideration as a crop for freezing. Consumption estimates, and shelf appearance observations, would indicate a market equal to or greater than for frozen carrots. Green beans show as a priority vegetable of both airline flight kitchens and restaurants. Testing and experience will be needed to ascertain if a quality image can be created and maintained.

Caution must be exercised in using both fresh and frozen vegetable market projections since the transitional nature of populations, and regional tastes and preferences cannot be accounted for in a study of this limited scope and time. Produce handler perceptions indicate Alaskan consumer's selective demand for 'quality' vegetables. Price competition in canned goods would indicate extreme caution in developing this activity - even if technical problems identified elsewhere in the report could be overcome. Thus, the frozen vegetable market appears the unquantified variable in the Alaskan vegetable industry development equation.

From a market standpoint only, the frozen vegetable industry development possibilities appear quite good within the time frame that would be realistic for development of such a 'mini' industry. Resident

population numbers should exceed 600,000 before the end of this decade. Visitor numbers are reported growing at almost twice the rate of resident population. Traveler numbers may be growing at an ever faster rate. Retailers appear anxious for significantly increased supplies of fresh vegetables that exhibit both the possible quality and the 'Alaskan-grown' mystique. Distributors that supply food services in Alaska are located here, so are available and accessible. Aggressive and knowledgeable penetration of this market should be successful.

PROSPECTIVE VEGETABLE MARKETS - 1990

Projecting vegetable markets for even 10 years ahead is a task that should be approached with caution. As previously noted, even the term 'market' can pose almost insurmountable problems in communication. Cultural transition during the past decade has been manifested in the changed tastes and preferences regarding 'fresh' vegetables. The changing energy situation could significantly affect the competitive advantage of food production and processing in Alaska. Rapidly growing resident, visitor, and traveler populations, along with the burgeoning food service markets engendered by experience gained during the pipeline and transportation growth periods bodes well for sustained market growth. Yet, the crystal ball grows cloudy when looking ten years ahead.

A most conservative scenario has been used in projecting markets for the year 1990. It encompasses assumptions of constant per capita consumption at the 1980 rate, straight line projections of population growth, and no significant changes in relative economic conditions or changes in tastes and preferences relating to foods. These estimates (Table 7) are for only that portion of total consumption that could

realistically be served by Alaskan producers. No assumptions are made regarding what portion of these markets could be penetrated by Alaskan producers. This can only be determined by the industry in action.

Table 5. Estimated annual vegetable consumption, Railbelt area, 1980.

Item	Unit	Fresh		Frozen		Other		Total	
		farm	retail	farm	retail	farm	retail	farm	retail
Potatoes	ton	11,433	10,999	8,125	3,244	3,818	1,174	23,376	15,417
Peas	ton	17	15	499	473	702	665	1,218	1,153
Carrots	ton	1,148	1,113	168	163	127	123	1,443	1,399
Broccoli	ton	235	227	309	298	-	-	544	525
Cauliflower	ton	154	149	96	89	-	-	250	238
Brussels sprouts	ton	9	8.4	65	59	-	-	74	67.4
Beets	ton	37	35	-	-	131	123	168	158
Cabbage	ton	1,596	1,492	-	-	359	243	1,955	1,735
Beans (snap)	ton	274	257	183	171	1,075	1,009	1,532	1,437
Turnips	ton	43	36	37	31	-	-	80	67
Lettuce	ton	4,162	3,856	-	-	-	-	4,162	3,856
Tomatoes	ton	2,079	1,765	-	-	-	-	2,079	1,765
Cucumbers	ton	570	516	-	-	-	-	570	516

Table 6. Estimated vegetable markets available to Railbelt producers, 1980.

Item	Unit	Fresh		Frozen		Other		Total	
		farm	retail	farm	retail	farm	retail	farm	retail
Potatoes	ton	11,433	10,999	8,125	3,244	3,382[a/]	830[a/]	22,940	15,073
Peas	ton	2.15	2.04	499	473	b/	b/	501	475
Carrots	ton	598	580	168	163	b/	b/	766	743
Broccoli	ton	50	48	309	298	-	-	359	346
Cauliflower	ton	31	30	96	89	-	-	127	119
Brussels sprouts	ton	1.0	.92	65	59	-	-	66	60
Beets	ton	9	8	-	-	b/	b/	9	8
Cabbage	ton	1,000	934	-	-	b/	b/	1,000	934
Beans (snap)	ton	25	23	183	166	b/	b/	208	189
Turnips	ton	21	19	37	31	-	-	58	50
Lettuce	ton	743	688	-	-	-	-	743	688
Tomatoes	ton	1,405	1,193	-	-	-	-	1,405	1,193
Cucumbers	ton	77	70	-	-	-	-	77	70

a/ Chips & strings - canned products have been eliminated.

b/ Small quantities preclude further consideration for canning.

Table 7. Estimated vegetable markets available to Railbelt producers, 1990.

Item	Unit	Fresh		Frozen		Other		Total	
		farm	retail	farm	retail	farm	retail	farm	retail
Potatoes	ton	18,596	17,890	13,221	5,281	5,501	1,350	37,318	24,521
Peas	ton	3.5	3.3	811	770	a/	a/	814.5	773.3
Carrots	ton	1,064	1,032	273	264	a/	a/	1,337	1,296
Broccoli	ton	82	75	502	462	NA	NA	584	537
Cauliflower	ton	51	49	156	143	NA	NA	207	192
Brussels sprouts	ton	2	2	105	97	NA	NA	107	99
Beets	ton	14	13	-	-	a/	a/	14	13
Cabbage	ton	1,622	1,514	-	-	b/	b/	1,622	1,514
Beans (snap)	ton	40	38	297	279	a/	a/	337	317
Turnips	ton	34	31	60	54	-	-	94	85
Lettuce	ton	1,209	1,120	NA	NA	NA	NA	1,209	1,120
Tomatoes	ton	2,285	1,941	NA	NA	NA	NA	2,285	1,941
Cucumbers	ton	125	113	NA	NA	NA	NA	125	113

a/ Small quantities precluded further consideration for canning.

b/ Processing cabbage into sauerkraut would probably only be considered if canning facilities had primary utilization for other crops.

PROCESSING

The perishable nature of most green vegetables limits the market that can be serviced by Railbelt farmers during Alaska's short six week to two month harvest season. It has long been felt that to develop a significant vegetable industry will require the establishment of a processing plant to capture a large portion of the year-round consumption in Alaska. The feasibility of a vegetable freezing industry was investigated for the Matanuska Valley area in 1968-1971, and was found marginally viable. Apparently, the results were excessively marginal, as no one followed up the study with an operational plant. For this report, several processes were reviewed for application to Alaska's needs.

Food preservation is achieved through application of one of two principles. The first method is destruction of microorganisms in the food, and prevention of recontamination. A typical example of this is heat sterilization of canned goods. The second principle of preservation is to alter the environment so as to retard or prevent the growth of undesirable organisms. Freezing is the most common example of this approach. In addition to maintaining desired microorganism levels, chemical and physical changes in the food due to the processing procedure must be considered. The less appealing texture and appearance of canned vegetables, as opposed to frozen vegetables, is an inescapable result of the heat sterilization process. Because of this quality "edge", and other reasons, freezing soon became the obvious choice for processing vegetables in Alaska. The processes are reviewed here to establish their relevance to the industry in the state.

CANNING

Excluding potatoes, Americans consume about four times as many pounds of canned vegetables as they do frozen. This would seem, from a volume standpoint, an excellent method with which to establish a processing industry in Alaska. Unfortunately, there are several drawbacks. One is the retail price of canned food is about one-half that of the equivalent frozen product. Even with this price advantage, canned goods are losing market share to both frozen and fresh vegetable sales. One would hesitate to invest quickly in a process that as a whole is losing dominance in the industry. Also, several commonly grown vegetables are not amenable to canning, namely cauliflower and broccoli. Potatoes are by far the largest selling vegetable in the state, but 94.5% of all potato sales are either fresh of frozen. A goodly portion of the remaining 5.5% are chips and strings. In addition to these probelems, there is the expense of importing cans. Reforming cans is considered a potential health hazard due to scratching of the lining. To ship in set-up cans would be prohibitive.

RETORT POUCH

The retort pouch is a plastic aluminum-foil laminate package that replaces the tin-plate can. The method of food preservation is the same as the "tin can" - thermal destruction of harmful microorganisms and prevention of reinfection. The advantages to the flexible pouch are quicker heat transfer to the interior of the container, thus maintaining better texture, flavor and nutritional quality of the enclosed food, and energy savings in sterilization. The retort pouch process offers considerable savings in water, as the packaged material is not surrounded by fluid as are canned vegetables. Energy savings accrue from not

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having to heat this excess water during sterilization. The contents of retort pouches exceed canned goods in flavor, appearance and texture, but do not attain the quality of frozen products. Retort pouch-preserved products are stable and require no freezing. An additional attraction from an Alaskan viewpoint is the ease of shipping the empty container.

At this time, retort pouches are not everyday items in the United States. Development of the system was promoted by the military as a means of replacing the C-rations with a more palatable meal. The process is geared more toward heat and serve 'convenience' foods rather than a replacement for canned or frozen staples. The first order for twelve million MRE's (Meals Ready to Eat) was placed by the Department of Defense Procurement Center in 1979 for delivery in 1980 (price - $4.00 each). In the civilian market, several large companies are doing market testing on the pouches. As of this writing, the Food and Drug Administration had not certified the process for general use, though approval seems imminent.

For purposes of processing vegetables in Alaska, the retort pouch technique seems less than satisfactory for several reasons. Marketing problems may arise from consumer resistance to an unfamiliar product. Certain expenses would be incurred for a promotional campaign to overcome this resistance. Both the quality of the contents and the unfamiliarity of the packaging would indicate a retail price range below that of frozen vegetables. The state-of-the-art technology required may involve unnecessary risks and high capital costs.

FREEZING

The principle advantage to the freezing method of preservation is the high quality of the packaged product. Frozen vegetables benefit from recent increases in market share, and from the consumer's perception of a 'premium' product. Packaging materials, mainly polyethylene bags, are light and space efficient for economies in transportation. The critical advantage for Alaska, however, is that freezing allows processing of potatoes. Potatoes must be included in any integrated processing facility to obtain the volume needed to capitalize the high plant and machinery costs. In more established vegetable growing regions, potato processing and the processing of other vegetables are separate industries. Alaska is more likely to develop the necessary market to maintain a potato plant before sufficient volume is available to support processing of other vegetables. Potatoes comprise 72% of frozen vegetable consumption in Alaska and 56% of all processed vegetable consumption in the state. Balanced against these volume figures is lesser initial cost of a vegetable plant - about 1/3 of the potato plant. The major disadvantage of freezing preservation is the necessity of refrigerated storage. Here, Alaska may have some advantages. Reduction in storage costs could be effected by promoting the large wintertime frozen food sales. Even with this, a maximum amount of storage will be needed for the interval between the end of the processing season and cold (0°F) winter temperatures.

Since the harvest season is approximately six weeks, most of the vegetables must be processed during a short period of time. Potatoes and carrots can be stored before processing, but the other vegetables must be processed immediately - often within six hours of harvest to maintain highest quality. In large agricultural regions, processing plants are

generally operated 24 hours a day during the harvest season. To supply Alaska's needs, even a small plant at the low end of today's efficiency scales would be operated only eight hours per day, six days per week. Anticipating being able to service 2/3 of the Railbelt consumption results in a market potential of 1,380 tons of mixed vegetables and 3,522 tons of frozen potato products by the year 1990.

Except for the freezer unit, nearly all the equipment used in potato processing is different from that used in the vegetable line. For this reason, the potato processing costs were estimated separately. Some savings would result from combining the lines. These will be discussed later. The plant and machinery expenses were estimated by Key ElectroSonics of Milton-Freewater, Oregon. Their budget quote and engineering proposal are included at the end of this chapter. The smallest potato plant they recommend to prospective customers is based on an input of 24,000 to 30,000 lb./hr. of raw product, with finished products estimated at 14,500 lb./hr. of french fries and 1,500 lbs./hr. of hash browns. At this rate, the 3,522 tons projected in 1990 would be processed in 440 hours. This is 55 working days. To meet 2/3 of the present market (2,164 tons) would require only 270.5 hours, or 34 8-hour working days. A summary of prospective annual costs is given below for both 1980 and 1990. 1990 estimates are based on a doubling of the wholesale price of frozen potato products, as well as a doubling of the variable expenses.

Table 8. Frozen Potato Products Processing Plant-Annual Expenses and Revenue Summary

	1980	1990
Debt Repayment - $16.5 million 20 years @ 5%	$1,306,800	$1,306,800
65 Employees x 270.5 hours @ $6.00	105,499	
65 Employees x 440 hours @ $12.00		343,200
Raw Materials: 5,419 ton potatoes @ 8¢/lb.	867,040	
8,818 ton potatoes @ 16¢/lb.		2,821,760
Packaging @ 3¢/lb. Material @ 6¢/lb.	129,840	422,760
Marketing and Transportation @ 4¢/lb.	173,120	
@ 8¢/lb.		563,680
Supplies, including oil 1.5¢/lb.	64,920	
3.0¢/lb.		211,380
Manager and Warehouse staff - 12 months	70,000	140,000
Repairs and Maintenance @ 4% of Machinery	323,742	647,484
Insurance 1.2% (1.8% in 1990)	198,000	297,000
Utilities	116,000	232,000
Annual expenses	$3,354,961	$6,986,064
Annual revenues 2,164 tons @.45	$1,947,600	
Annual revenues 3,522 tons @.90		$6,339,600
		~~$6,339,600~~
Profit or (loss)	($1,407,361)	($ 646,464)

Other vegetables have been estimated at a through flow of three tons per hour finished product. At this rate, 2/3 of the Railbelt's frozen vegetable consumption in 1980 (853 tons) would be processed in 285 hours, or 36 8-hour working days. To supply the same share of the market in 1990 would require 58 days. Individual lines of the rated capacity were quoted. Some savings can be expected by combining certain pieces of equipment within the cauliflower, broccoli, and brussels sprouts lines. The pea and carrot lines are not as interchangeable. Some initial savings might also arise from combining freezer capacity. Using any piece of

equipment on more than one line decreases the flexibility of the system, however. The savings in machinery cost must be balanced against the necessity of handling large volumes in a short season. As can be seen in the potato summary, the increased volume in 1990 greatly increases the viability of the industry. The same economies of scale are apparent in the frozen vegetable business. By 1990, the processing plant is approaching the break even point. Unfortunately, the raw material price is based on the standard percentage paid to farmers by processors, which is considerably lower than the fresh market price the farmer can obtain. As shown in the production section, this price will not cover the cost of production in Alaska for many vegetables.

Table 9. Frozen Vegetable Plant-Annual Expenses and Revenue Summary

	1980	1990
Department Repayment 6.45 million 20 years @ 6%	$ 510,840	$ 510,840
28 employees x 460 hours @ $6.00	77,280	
@ $12.00		154,660
Raw materials - 905 tons @ .25/lb.	452,500	
- 1,470 tons @ .50/lb.		1,470,000
Packaging Materials @ 3¢/lb.	51,180	
@ 6¢/lb.		165,600
Supplies @ 0.5¢/lb.	8,530	
@ 1.0¢/lb.		17,060
Manager, bookeeper, warehouse staff 12 months	70,000	140,000
Repairs & maintenance - 4% financing	145,200	290,400
Insurance @ 1.2%	77,351	116,027
Utilities	77,372	154,744
Total	$1,470,253	$3,019,331
Revenue - 853 tons @ 55¢ average	938,300	
1,380 tons @ $1.10 average		3,036,000
Profit or (loss)	($ 531,953)	($ 16,669)

KEY

Applied Magnetics
Key ElectroSonic

P. O. Box 8
Milton-Freewater
Oregon 97862

(503) 938-5556
TWX 510-753-3060
Cable KEY

January 23, 1981

Little Goldstream Associates
3031 Riverwood Drive
Juneau, Alaska 99803

KEY ELECTRO SONIC PLANT ENGINEERING STUDY $51,450.00

For the amount shown, Key Electro Sonic agrees to do the following engineering study for Little Goldstream Associates

1. Provide complete plan view of processing lines with equipment size specified.
   a. Processing lines to be designed in such a manner so that machines are compatible to the customer's labor requirements.
   b. Plan view will provide sufficient dimensions of processing areas so that the building design can be finalized.
   c. Elevation views will also be provided.

2. Provide full data on utility requirements (electrical, water, steam and air) for the processing equipment.
   a. Key will show the connection points and loads via drawings
   b. Key will provide suggested water, steam and air line schematics as it relates to the processing equipment.
   c. Electrical wiring and conduit size are the responsibility of the local contractor since Key is not familiar with local codes.
   d. Key will provide a fundamental design for the motor control center. It will include motor starter sizing, stop/start stations and necessary interconnections.
   e. Key cannot provide full information for all utilities such as may be necessary for personnel use, etc.

3. Provide estimated manpower requirements for each piece of equipment or each section of a processing line.

4. Provide recommendations for worker and machinery access areas.

5. Key Electro Sonic will send the project engineer to the proposed plant site once to evaluate the location and discuss the line with the local contractor. In addition, the project engineer will visit the other major vendors to discuss interfacing solutions and gather necessary data.

Applied Magnetics
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6. Prepare an equipment list for all Key Electro Sonic items which we can provide, along with an equipment list of those items not manufactured by Key Electro Sonic, but which are part of the processing line.

7. Provide a final descriptive quote for all of the processing equipment to be furnished by Key Electro Sonic.

8. Work with Little Goldstream Associates, other vendors and with the installation contractor to outline the "Scope of Work" to be performed by the various companies involved in the total project. "Conditions of Sale" are also to be finalized.

9. Key will credit this engineering fee against equipment purchased. The credit/rebate will be computed as 1.5% of FOB factory value of equipment purchased from Key, up to a maximum of the fee quoted. (e.g. if $300,000 of equipment is purchased, the rebated amount will be $4,500.00.)

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Little Goldstream Associates

French Fry Line

SCHEDULE I

1.	French Fry Processing Line Equipment, consisting of these sections:	
	Section A. - Receiving Pit Area	$80,000.00
	Section B. - In Plant Receiving and Peeling	350,000.00
	Section C. - Trimming and Cutting, Wet Grading	340,000.00
	Section D. - Blanching and Drying Conveying Dextrose	270,000.00
	Section E. - Fryer System	534,000.00
	Section F. - Defatting & Precool Drip Chain	125,000.00
	Section G. - Freeze Tunnel System	1,000.000.00
	Section H. - Frozen Grading and Distribution	220,000.00
	Section I. - Packaging and Casing	560,000.00
	SUB-TOTAL	$3,479,000.00
1-A	Hash Brown Line	1,000,000.00
2.	Estimate Spare Parts for all items in processing lines	348,000.00
3.	Estimated personnel platforms, machinery platforms, machinery support stands and pedestals, catwalks, stairways, transfer chutes	520,000.00
4.	Suggested Contingency for unexpected expense price increases, etc.	520,000.00
ESTIMATED PROCESS LINE EQUIPMENT: BUDGET TOTAL		$5,867,000.00

Applied Magnetics
Key ElectroSonic

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Cable KEY

January 23, 1981

Little Goldstream Associates

SCHEDULE II

Building Requirements -	50' x 600' or 100' x 300' Sq. Ft.
. Main Process Building -	30,000 Sq. Ft.
. Dry Storage, Utilities Restroom, Restaurant, shop, oil storage, engine room, etc.	15,000 Sq. Ft.
. Boiler Room - 50' x 60'	3,000 Sq. Ft.
. Loading dock, covered etc., 100' x 40'	4,000 Sq. Ft.
PROCESSING TOTAL	52,000 Sq. Ft.
Estimated cost computed at $30.00 per square foot.	$1,560,000.00
Cost Storage for 2000 tons potatoes -	20,000 Sq. Ft.
Plus 700 tons vegetables	10,000 Sq. Ft.
	30,000 Sq. Ft.
X 1.15 for Aisles, etc.	35,000 Sq. Ft.
@ $50.00	$1,725,000.00
Sewage System - Clarifier Spray Field	$2,000,000.00
ESTIMATED BUDGET TOTAL SCHEDULE II	$5,285,000.00

KEY

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SCHEDULE III

Auxiliary Items and Installation Expenses

Estimates based on percentage of Process Line Equipment (less spare parts and freezer)

These Items should be considered in overall plant cost:

* Plumbing Installation (by local contractor) $695,000.00
  . 20% of Process line equipment, includes material and labor

* Electrical Installation (by local contractor) $1,043,700.00
  . 30% of Process line equipment
  . Switch gear, wiring, labor, etc.

* Mechanical Installation (by local contractor) 626,000.00
  . 18% of Process line equipment
  . Miscellaneous sheet metal, labor, etc.

* Auxiliary Items (by local contractor) $2,226,560.00
  . 64% of Process line equipment
  . 3,000 gallon oil reservoir (day tank)
  . Exhaust scrubber for fryer stack
  . Truck scales
  . Waste scrubber for fryer stack
  . Waste system (plant-dry)
  . Inplant clean-up system
  . Chlorinator
  . Fire protection system - Class 8
  . Rail siding
  . First aid equipment and supplies
  . Pallets and totes for cold storage, etc.
  . Gutter and flume covers
  . Janitorial equipment
  . Office furniture
  . Quality control equipment (lab)
  . Exhaust stacks transfer hoppers, plant misc. sheet metal work
  . Taxes, paint, freight, etc.

* Steam Generating System (by local contractor) 350,000.00
  . 75,000 lbs/hr. steam at 250 PSI Gas Fired
  . Steam boiler
  . Chemical feed
  . De-areator
  . Blowdown separator

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Cable KEY

- Installation of boiler equipment, labor, etc.

ESTIMATED AUXILIARY BUDGET TOTAL	$4,941,260.00
BUDGET TOTAL	$16,093,260.00

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GENERAL QUESTIONNAIRE

POTATO/FRENCH FRY PROCESSING

1. How will potatoes be harvested?
2. How will potatoes be delivered to the plant and in what type of container?
3. What potato varieties will be available?
   A. Natural color of raw product?
   B. Size range of raw product?
      from _____mm long to _____mm long
      from _____mm diameter to _____mm diameter
   C. What size will be used for french fries?
   D. Will other products be considered? If so, what will they be?
   E. Average percent solids of the potato.
   F. Average specific gravity of the potato
   G. Are potatoes high or low in sugars?
4. What type of long term storage will be used?
5. What finished product capacity is required? (pounds per hour; kilograms per hour)
6. How many different packages will be used?
   A. What is size of each package?
   B. What type of packaging material will be used?
   C. Will product be sold for institutional use, retail use, or both?

6A. Will plant run 8, 16, or 24 hours per day?

7. Plant site elevation: _____
8. Weather conditions during plant operation. High _____, Low _____, Average _____ temperatures. High _____, Average _____ humidity.
9. Will plant be air conditioned? Does plant have/need air makeup system w/scrubbers.
10. What are the utility requirements? Electrical V_____, HZ _____, PH_____. Air, steam, water, gas, diesel?
11. Water availability? Use once and discard or is it necessary to reclaim the water?
12. Desired methods of operation, labor intense or machine automated? Where use labor?
13. Materials of construction for process equipment. How much stainless steel, aluminum and mild steel and where?
14. Type of drive motors. TENV, TEFC, Super Cannery?
15. How do they plan/want on handling and storing the waste?
16. Type of oil to be used in fryer?
17. Size and sketch of area available for process equipment (ft^2)? (If equipment will be installed in an existing building)
18. Will cold storage be built?
19. Will equipment need to be in metric system?
20. What type of peeling is to be used? (steam, caustic, abrasive)
21. What type of ecological restrictions are going to be placed upon the plant?

Vegetable Freezing Plant Budget Estimate

Engineering study estimate		$ 34,400
Cauliflower	$ 240,000	
Broccoli	240,000	
Brussels Sprouts	225,000	
Peas	300,000	
Carrots	445,000	
Spare Parts	286,000	
Stands, etc.	450,000	
Refrigerator & Freezers	1,400,000	
Sub Total	$3,630,400	$3,630,400
Misc., Price Increase, etc.		500,150
Total Equipment Estimate		$4,164,950
Buildings - 25,000 sq. ft. @ $30.00/sq. ft.	750,000	
Plumbing	382,000	
Electrical	573,000	
Mechanical	343,000	
50,000 lb./hr. steam	233,000	
	$2,281,000	$2,281,000
Budget Estimate		$6,445,950

VEGETABLE PRODUCTION

Environmental Factors

The basic physical parameters of climate and soils must first be examined before crop production can be estimated. Weather statistics from Nenana, about 14 miles east of the proposed agricultural development site, provide a basis for comparing growing conditions with other agricultural areas in the state. Over a period of twenty years, Nenana has averaged more growing degree days per year than either the Matanuska Experiment Station, the Fairbanks Experiment Station, or Big Delta. Average monthly temperature for the growing season is nearly identical between Nenana and the Fairbanks Experiment Station. The average monthly maximum and the average monthly minimum show greater extremes and more variability in Nenana. Comparing length of growing season based on probability of freezing temperatures indicates a slightly shorter season in Nenana than at the Fairbanks Experiment Station. Complete climate data are found in Appendix II.

AVERAGE NUMBER OF GROWING DEGREE DAYS

Location	Growing Degree Days	Recording Period
Nenana	1,897	1951-1971
Fairbanks Exp. Sta.	1,852	1936-1965
Big Delta	1,791	1943-1965
Matanuska Exp. Sta.	1,763	1936-1965

Except for the month of May, precipitation in Nenana during the summer months averages slightly more than Fairbanks, but only by several hundredths to two-tenths of an inch. In May, Nenana averages .2 inches less rain. However, as with the temperature, the average maximum and average minimum precipitation show greater variability in Nenana than in

Fairbanks. Most rainfall occurs in August, with July close behind. August averages 2.5 inches with a 20 percent possibility of 3.6 inches or more.

Wind velocity in Nenana is very similar to that of the Fairbanks airport. Only in June and September is the wind significantly stronger in Nenana than it is in Fairbanks. Wind is one factor, along with fall frost dates, that may vary considerably between the Nenana recording station and the actual project site. Once away from the river, the winds may well decrease. The increase in elevation of 150 to 200 feet in the Totchaket region might have a delaying affect on early frosts.

Soils in the two townships (T4S, R10W & R11W, FM) to be sold in the initial phase of the Totchaket project appear excellent for crops. A majority of the soil is Nenana silt loam, level, undulating or rolling. These soils are designated on the soil survey map as numbers 17, 18 and 19. Irrigation will probably be a necessity for efficient crop growth, and water may be expensive, as the water table is undetermined in these soils.

It should be noted that localized differences in climate are very pronounced and can be significant to the success of any agricultural project. Slight hollows may be frost pockets, slight rises with southern exposures increase the incident radiant energy absorbed, hills rising on the north side of a field provide reflection and re-radiation of long-wave energy. These microclimates can vary within one mile, and even within several hundred yards. The plots chosen for vegetable farms should be selected with this localized climate effect firmly in mind. Indeed, the difference between a successful farm and a marginal one could be totally dependent upon the original site considerations.

CROPS AND YIELDS

The environmental factors listed previously indicate the Totchaket region to be capable of producing any crop currently grown elsewhere in the state. Continuity of climate with attendant predictability of light budget will allow more accurate forecasting of harvest and delivery dates than is probable in some other regions of Alaska. This reliability would certainly increase retailer acceptance of Alaskan-grown vegetables. A greater number of growing degree days, combined with the factors listed above, give the Totchaket site certain definate advantages over the Matanuska Valley. One disadvantage relative to the Matanuska Valley is total season length, expecially in the fall. The vegetables to consider for commercial production are listed below, along with specific variety recommendations:

Table 10. Recommended vegetable crops and varieties for commercial production in interior Alaska

Climatically Well Adapted:

Broccoli
- Green Duke
- Gem

Brussels Sprouts
- Jade Cross

Cabbage
- Earlianna
- Tastie
- Hybrid 15

Carrots
- Nantes Special Long
- Spartan Bonus

Cauliflower
- Snowcrown
- Dominant

Peas
- Green Arrow
- Frosty
- Sparkle

Potatoes
- Kennebrec
- Bake King
- Alaska Red
- Alaska 114

Radishes
- Cherry Belle
- Champion
- French Breakfast

Rutabagas
- York
- American
- Purple Top

Snap Beans
- Provider
- Oregon 1604

Lettuce - Crisphead
Minilake
Ithaca

Leaf Lettuce
Dark Green Cos
Ostinator

Spinach
Melody

Turnips
Tokyo Cross

Climatically Marginal - Require various aides, i.e., clear plastic ground cover, soil heat, etc.

Cucumbers
Saladin

Summer Squash
Zucchini Elite
Greenzini

Winter Squash
Hybrid R
Golden Hubbard

Sweet Corn
Earlivie
Polorvee

Green Peppers
Cadice

Statistics published by the Alaska Crop and Livestock Reporting Service show yields on most vegetables grown in Alaska to be lower than the national average yields. Less than national average yields in Alaska are more indicative of the rudimentary status of the industry rather than a reflection on the potential of the state. Authorities on vegetable growing in Alaska feel that the U.S. average yields can be equaled or surpassed for most climatically adapted vegetables. Results of many years of variety testing at the Fairbanks Experiment Station show yields surpassing the national average by several hundred percent for some vegetables. Despite the proven possibilities, average yields in the Tanana Valley, as reported by the Alaska Crop and Livestock Reporting Service, are considerably lower than the Matanuska Valley average yields. This is probably primarily due to a lack of irrigation. For most calculations in this report, United States average yields will be used.

Table 11. Average Yields for vegetables lbs./acre

	FBKS. EXP. STATION*[1]	U.S. AVERAGE[2]	Alaska Average 1979[3]
Potatoes	35,000	22,800	18,500
Peas	7,500	2,380	+
Carrots	79,000	26,000	9,600
Broccoli	13,000	6,300	+
Cauliflower	20,000	8,700	+
Brussels Sprouts		11,500	+
Beets		24,500	+
Cabbage	35,000	21,800	13,333
Beans	26,500	5,080 [4]	+
Turnips	20,000	20,000	+
Lettuce	21,000 [5]	22,700 [6]	15,111
Cucumbers	87,000	9,800	+

* Average of up to 10 years

\+ Unknown

1 Depends on variety - see Appendix

2 Ware & McCollum, 1975

3 Alaska Crop and Livestock Reporting Service

4 Certain areas in the West average 14,000 lbs./acre

5 Average of head and leaf types

6 Head type

ACREAGE REQUIREMENTS

The total market available to Railbelt producers for each vegatable has been estimated in the marketing section. Subtracting present vegetable production from the total market available to Railbelt producers gives the remaining available market upon which to base acreage requirements. Dividing the remaining farm-equivalent market demand by yield per acre of each vegetable gives the needed acreage. This has been done for 1980 and 1990, tables 12 and 13. Acreage has been calculated using both U.S. average yields and yields from the Fairbanks Agricultural

Experiment Station. The fresh vegetable acreage is listed, as well as the combined fresh and processed acreage.

Acreage figures do not consider estimated obtainable market share. For the fresh vegetable industry to expand to meet its fullest potential by 1990 would require quantum increases in local storage technology and equal advances in distribution sophistication.

As can be seen from the tables, if all realistically possible markets are satisfied by local producers, the actual cropland acres required by 1990 will be 5,337. Of this, the fresh market will require 1,683 acres. These figures indicate that processing facilities will expand the acreage greatly. The largest increases in acreage would be in potatoes, peas, beans, broccoli and cauliflower. Lettuce, cabbage, and cucumbers will be unaffected by a freezing plant. Even though the total acreage under cultivation would triple with an Alaska-based freezing facility, the industry as a whole would only double in revenues. Most of the added acreage would be in potatoes, due to the 50% to 55% loss during processing of french fries. A comparison of relative value of frozen vegetables versus fresh vegetables based on 1990 estimated markets indicates the value to the Alaskan producer to be about equal for each type. One must also consider the processing costs and decrease the farmer's selling price accordingly. It is highly unlikely that the farmer's return from selling his crop at substantially reduced prices to a processor would cover his costs of production.

Table 12. Acres Required to Supply Available Vegetable Markets - 1980

Crop	Fresh and Processed Vegetables							Fresh Market O
	Market Available to Railbelt Producers (tons)	Present (1979) Production (tons)	Remaining Available Market (tons)	Yield lbs./acre		Acres		
				Fbks. Exp. Farm[1]	U.S. Average[2]	Fbks. Exp. Yields	U.S. Average Yields	Acres Neede Based On U.S. Averag Yields
Potatoes	22,940	3,350	19,590	35,000	22,800	1,120	1,719	709
Peas	501	*	501	7,500	2,380	134	421	2
Carrots	766	110	656	79,000	26,000	17	51	38
Broccoli	359	*	359	13,000	6,300	53	114	16
Cauliflower	127	*	127	20,500	8,700	13	30	8
Brussels sprouts	66	*	66		11,500	12	12	0.2
Beets	9	*	9		24,500	1	1	1
Cabbage	1,000	185	815	35,000	21,800	46	75	75
Beans	208	*	208	26,500	5,080[3]	16	82	10
Turnips	58	*	58	20,000	20,000	6	6	2
Lettuce	743	670	73	21,000[4]	22,700[5]	7	7	7
Cucumbers	77	*	77	87,000	9,800	2	16	16
				Total Acres		1,427	2,534	885

* Unknown and/or insignificant
1 Depends on variety - see Appendix
2 Ware & McCollum, 1975
3 Certain areas in the west average 14,000 lbs./acre
4 Average of leaf and head types
5 Head type

Table 13. Acres Required to Supply Available Vegetable Markets - 1990

Crop	Fresh and Processed Vegetables: Market Available to Railbelt Producers (tons)	Present (1979) Production (tons)	Remaining Available Market (tons)	Yield lbs./acre: Fbks. Exp. Farm[1]	Yield lbs./acre: U.S. Average[2]	Acres: Fbks. Exp. Yields	Acres: U.S. Average Yields	Fresh Market Only: Acres Needed Based On U.S. Average Yields
Potatoes	37,318	3,350	33,968	35,000	22,800	1,941	3,952	1,338
Peas	814	*	814	7,500	2,380	217	684	3
Carrots	1,337	110	1,227	79,000	26,000	31	95	74
Broccoli	584	*	584	13,000	6,300	90	186	26
Cauliflower	207	*	207	20,500	8,700	21	48	12
Brussels Sprouts	107	*	107		11,500	19	19	0.5
Beets	14	*	14		24,500	2	2	2
Cabbage	1,622	185	1,437	35,000	21,800	83	132	132
Beans	337	*	337	26,500	5,080[3]	24	134	16
Turnips	94	*	94	20,000	20,000	10	10	4
Lettuce	1,209	670	539	21,000[4]	22,700[5]	52	49	49
Cucumbers	125	*	125	87,000	9,800	3	26	26
				Total Acres		2,493	5,337	1,683

* Unknown and/or insignificant
1 Depends on variety - see Appendix
2 Ware & McCollum, 1975
3 Certain areas in the west average 14,000 lbs./acre
4 Average of leaf and head types
5 Head type

well as quality produce. To this end, a larger number of farms is desirable to provide a dampening effect on the influence of any one operator. While diversity is certainly healthy, the units must also be capable of supporting a family. One very real disadvantage to establishing a vegetable enterprise in the Totchaket is the unavailability of seasonal or part time jobs that might supply income during the meager formative years.

An absolute absence of production cost data from similar existing mixed crop vegetable farms in Alaska, and a nearly equal lack of research data on the subject, as well as the unusual situation of estimating, essentially, the success or failure of entrepreneurs who have yet to lay eyes on the site, is a unique challenge. By gathering information from personal interviews, reviewing production data in other states, Alaska Experiment Station publications, especially "The Agricultural Potential of the Middle Kuskokwim Valley" by Lewis and Lewis, and from personal experience, the economic success of the venture has been evaluated. Several trials resulted in splitting the 345 acres of mixed vegetables into 15 farms of 23 cropland acres each. Admittedly, these are idealized situations where each farm grows an equal percentage of the total acreage of each vegetable. In reality, the farms would most likely quickly specialize in one or two of the higher revenue crops, and the less efficient producers would drop out.

Only the fresh market is considered in this analysis. The five major vegetable crops are used to calculate expenses and revenues per acre. Machinery cost is based on 75% of the equipment being financed by the

agricultural revolving loan fund for 7 years at 6%. Buildings and improvements are 75% financed through the farm development fund over 20 years at 6%, also, table 16. Seed, fertilizer and chemical expenses are summarized in table 17. Land cost is assumed to be $100/acre in 80 acre tracts, paid over 20 years at 5%. This is the prevailing rate for agricultural rights. No clearing expense is included, as the Mayor of Nenana indicates that the land will be cleared before disposal. 80 acres is suggested as a unit to allow for fallow edge effect, farmstead, roads and a percentage of less than optimum land. All costs and revenues are based on 1980-81 prices. Acreages and quantities of materials are based on 1990 consumption rates. This assumes that the wholesale price of the vegetables will remain constant in relation to the farmer's expense. A rather large assumption, perhaps.

Table 15. Estimated annual expenses 23 acres mixed vegetables

Seed, fertilizer, chemicals	$ 8,622.00
Seedling production	7,650.00
small tools	1,057.00
supplies	2,050.00
Labor - owner not counted	
2 people 5 months @ 9.00/hr.	18,514.00
5 people 2 months @ 8.00/hr.	16,457.00
equipment payments	8,619.00
farm development loan	1,668.00
fuel oil - including irrigation	3,840.00
repairs @ 3% equipment cost	1,966.00
depriciation on equipment - straightline 10 years	6,555.00
depreciation buildings & imp. - straightline 20 years	1,202.00
TOTAL	$78,200.00

The average cost of production per acre is $3,400.00. Not counting depreciation, annual per acre expense is $3,062.00. This does not include any marketing or transportation costs, which are substantial. At this stage, several crops can be eliminated by listing the possible income per acre by type of vegetable. The overall per acre revenue for this hypothetical "average" farm in $5,392.00. However, it is clear that not all crops are profitable.

	$/lb	Gross Return/acre	Acres	Gross Return	Net Return/acre
Broccoli	.45	$2,835	1.7	$ 4,820	$ (569)
Cabbage	.20	4,360	8.8	38,368	960
Cauliflower	.45	3,915	0.8	3,132	515
Carrots	.30	7,800	4.9	38,220	4,400
Lettuce	.275	6,242	3.3	20,599	2,842
Other			3.5		
			TOTAL	$105,139 for 19.5 acres Average $5,391.74	

Total for 23 acres at $5,391.74/acre = $124,010.02

Clearly, marketing costs on anything other than a direct roadside sale would eliminate cauliflower, as well as broccoli. Marketing costs are examined after the section on potato farms. Carrots are penalized to some extent by being included in this farm scenario, as they are generally cultivated in a more extensive fashion at a lower per unit cost.

POTATO FARMS

As developed earlier, the fresh potato market will be able to absorb another 1,338 acres of production by 1990. From discussions with local potato farmers, and preliminary calculations, this acreage was split into 14 farms of approximately 100 acres each. Different methodology was used for production cost estimating due to the relative simplicity of evaluating a single crop as compared to the mixed vegetable farms. A schedule of

Table 16. Machinery complement - 23 acres mixed vegetables

40-50 hp. Tractor	$16,950.00
Roto-tiller, 60 inch	4,348.00
Transplanter - 2 row	3,500.00
Seeder - 4 row	1,800.00
Furtilizer Spreader	1,200.00
Cultivator - toolbar, shovels, etc.	1,444.00
Sprayer	2,320.00
Moldboard Plow 2-W, 3 bottom	2,400.00
Meeker Harrow	1,100.00
Disc	3,090.00
Plastic Spreader	950.00
Wagon	1,450.00
1-ton Truck	16,000.00
Irrigation Equipment	9,000.00
TOTAL	$65,552.00

Buildings and Improvements

Storage Building - 30x40	$ 8,000.00
Fencing	4,546.00
Well	7,500.00
General improvements - fuel tank, etc.	4,000.00
TOTAL	$24,046.00

Table 17. Seed, Fertilizer and Chemical Requirements to Supply Available Railbelt Fresh Vegetable Market in 1990

	Broccoli	Cabbage	Cauliflower	Carrots	Lettuce	Potatoes	Total Cost
Acres	26	132	12	74	49	1,338	
Seed	1/2 seeded @ 1-1/2 lbs./A 1/2 transplants @ 3 oz./A			2-1/2 lbs./A	2-1/4 lbs./A	1,500 lbs./A	
	40 lbs. @ $90/lb. $3,600	223 lbs. @ $68/lb. $15,164	20-1/4 lbs @ $127/lb. $2,572	185 lbs. @ $28/lb. $ 5,180	110 lbs. @ $12/lb. $1,320	1,004 tons @ $500/ton $502,000	$529.836
Fertilizer	1,300 lbs./A 10-20-20 110.5 tons @ $400/ton $44,200			1,100 lb/A 10-20-20 40.7 tons @ $400/ton $16,280	1,000 lb/A 10-20-20 24.5 tons @ $400/ton $9,800	1,300 lb/A 10-20-20 870 tons @ $400/ton $348,000	$418,280
Herbicide & Insecticide	Sevin or Diazinon @ $40/A $ 6,800.00			Lorox @ $40/A $ 2,960	Sevin @ $40/A $1,960	Premerge @ $40/A $ 53,520	$ 65,240

operations was developed to establish the variable costs per acre, table 19. The fixed costs were then added in the annual cost summary. Machinery and improvements were calculated at the same loan rates as for the mixed vegetable farms, table 20. 240 acres is assumed to be the total farm size for each tract to allow for variable quality, fallow, etc. Again, there is no charge for clearing. Standard agricultural rates of $100/acre for 20 years at 5% apply.

Table 18. Estimated Annual Expenses - Potatoes - 100 acres

Variable Production Costs, table 19	$ 85,913
Machinery payment	15,229
Farm development loan	2,549
Repairs - 4% of purchase price	4,632
Small tools and supplies	3,500
Land charge	1,901
Cost of maintaining fallow	1,248
Depreciation on Equipment - 10 years straightline	11,582
Depreciation on Buildings - 20 years straightline	1,975
Insurance	1,737
TOTAL	$130,266

At a yield of 22,800 pounds per acre this is 5.7¢/lb. This does not include storage, marketing or transportation costs to market. This does include, however, a charge for hauling the potatoes to a storage facility.

MARKETING

Cooperative marketing appears the only alternative available to farmers establishing an instant industry. Certainly no private concern will enter a wilderness situation and build a packing-house distribution center

Table 19. Variable costs of Production - Potatoes - 100 Acres

Operation	Times	Per Acre Inputs: Acres/Hr.	Fuel (Gal.)	Machinery Hrs.	Labor Hrs.	Materials	Per Acre Costs: Fuel @ $1.50/gal.	Labor @ $8.00/hr.	Materials	Total
Plow	1	2.5	2.56	.40	.44		$ 3.84	$ 3.52		$ 7
Disc	2	6.0	2.13	.34	.38		$ 3.20	$ 3.04		6
Herbicide	1	6.0	1.07	.17	.19	Premerge or Sencor $40/A	$ 1.60	$ 1.52	$ 40.00	42
Fertilize & Plant	1	4.0	1.60	.25	(2) .55	1,300 lbs./acre 10-20-20 1,500 lbs./acre Seed	$ 2.40	$ 8.80	$260.00 $375.00	646
Hill	2	6.0	1.07	.17	.19		$ 1.60	$ 1.52		3
Irrigate	4	.71	7.14		1.4		$10.71	$11.20		21
Harvest	1	1.1	11.0	.91	4.0		$16.50	$32.00		48
Fall Disc	1	6.0	1.07	.17	.19		$ 1.60	$ 1.52		3
					734 hrs.					$ 779
Truck Rental (Haulage)			11.4 T/Acre		assume 2 hr./acre @ $40/hr. = $80.00					80
										$ 859
								Total for 100 Acres		$85,913

Table 20. Machinery complement - 100 acres of potatoes

Tractor 30-40 hp.		$ 15,000
Tractor 80 hp.		26,000
Moldboard Plow 4 bottom 2-way		3,200
Disc, tandeny 15'		6,500
Spayer - 20'		2,319
Potato Planter 4-row, w/fertilizer		3,900
Cultivator - toolbar, shovels, etc.		1,900
Potato digger w/conveyor		6,000
Large Potato Wagons (2)		6,500
Seed & fertilizer broodcaster		1,500
Irrigation equipment	2-1/4 mile tows	7,000
	1/4 mile man line	4,500
	pump - diesel 6 inch	7,500
2-1/2 ton Truck		18,000
Misc. Conveyors and handling equipment		6,000
		$115,819

Buildings and Improvements

Storage Shed 40 x 80	$24,000
Well & Pump Building	10,500
General Improvements	5,000
	$39,500

timed to coincide with development of 'projected' farms. In order to have a central marketing and distribution center available for the farmers' crops when the first harvest is in, will require parallel evolution that can only be guaranteed by the farmers themselves. In areas where vegetable farms are maturing over a longer period, the opportunities for an aggressive entrepeneur are greater, due to more gradual investment increments, and reduced risk from the supply sector. Cooperatives can expect to realize several economies of size through joint marketing. First, it allows stronger market penetration, due to pooled production. Buyers are reluctant to deal in small quantities and are attracted by large volume purchases. Second, by sharing equity capital, farmers are better able to secure the necessary financing. Also, to some extent, harvesting costs may be lowered by concentrating production of a particular vegetable in one area.

A central, relatively low technology, ventilated storage and packing facility will be investigated. The trend in the contiguous United States has been to build these structures above ground, due to warm below surface temperatures. The storage temperatures are maintained to a great extent by circulating cool night air to lower the temperature, and decreasing ventilation to raise the temperature by heat of respiration. In Interior Alaska, below ground storage would seem an obvious choice. Stable year round temperatures near the desired storage temperature are available a few feet beneath the surface. Respiratory heat in this situation would be enough to counteract heat loss to the soil and warm at least part of the ventilation air. Capacity of the facility, based on the three storable vegetables, is as follows:

Potatoes - 11 months - 13,976 tons = 582,778 cu. ft. - equivalent to 48,565 sq. ft. bulk storage 12 ft. deep

Carrots - 6 months - 818 tons = 39,227 cu. ft. - equivalent to 3,269 sq. ft. in pallet bins 12 ft. high

Cabbage - 6 months - 1,078 tons = 51,695 cu. ft. - equivalent to 4,308 sq. ft. in pallet bins 12 ft. high

It must be noted that long storage life applys only to well-matured crops. Carrots grown until the tops are dying, and potatoes with withered vines are signs of the prerequisite maturity. Due to the abbreviated season in Interior Alaska, these conditions may not occur every year. Storage life of Alaskan-grown vegetables is an area in need of further research.

In season, fresh lettuce will also be handled through this plant. Additional labor is included during the harvest season to handle the fresh sales of all vegetables, as well as storage needs. The labor force will decrease as storage becomes depleted.

Table 21. Ventilated Storage and Packing House estimated annual expenses

Building Requirements		
Storage	56,142 sq. ft.	
Loading Dock 60 x 40	2,400 sq. ft.	
Drystore & Boiler	3,000 sq. ft.	
Packaging & Handling	6,000 sq. ft.	
Office, Restrooms, etc.	1,000 sq. ft.	
	68,542 sq. ft.	
	x $35	
	$2,398,970	
30 years @ 6% = annual payment of		$172,726
Equipment - conveyors, forklift, packaging, scrubbers, etc.	350,000	
7 years @ 6% = annual payment of		61,362
Utilities		48,000
Insurance		33,000
Repairs & Maintenance		14,000

Labor:		
Manager - full time	$35,000	
Sales Rep. - full time	30,000	
Book keeper - full time	20,000	
3 packing & warehouse - 2 months	9,257	
4 packing & warehouse - 7 months	43,200	
4 packing & warehouse - 12 months	74,057	
		$211,514
Packaging materials		
Cabbage .015/lb.	$ 45,420	
Carrots .03/lb.	61,920	
Potatoes .0045/lb.	161,010	
Lettuce .01/lb.	44,800	
	$313,150	$313,150
Total Annual Expenditure		$853,752

The handling and storage cost for all four vegetables is 1.9 cents per pound. Transportation from the Totchaket region is a considerable expense, as the major share of the market is in Anchorage, some three hundred miles distant. Assuming the packing house will retail directly to supermarkets, freight costs will be approximately three cents per pound. Long-term storage will result in substantial loss through decay, even under ideal conditions. A factor of ten percent for potatoes and carrots, and twenty percent for cabbage must be entered. Since costs are being calculated on a cents-per-pound basis, storage loss can be entered as a deduction of 10% and 20%, respectively, from the sales price.

Table 22. Profit or loss of storable vegetables

	Potatoes	Carrots	Cabbage	Lettuce
Production Cost ¢/lb.	5.7	13.1	15.6	15.0
Handling & storage	1.9	1.9	1.9	1.9
Transportation	3.5	3.5	3.5	3.5
Storage Waste Allowance	1.5	3.0	5.0	
	12.6	21.5	26.0	20.4
Wholesale Price	15.0	30.0	20.0	27.5
Net per lb.	2.4	8.5	(6.0)	7.1
Per acre income (or loss)	$547.20	$2210	($1308)	$1611.70

COMPETITION AND RISK FACTORS

It is interesting to observe that the vegetables showing a profit on paper are also the predominant crops presently being grown. The success of the packing house is due in some measure to the assumption that it will supply all the additional demand for fresh potatoes, lettuce and carrots in Alaska in 1990, as well as that portion of the present market that is not being met by in-state production. Reducing by one-half the quantity of produce handled by the storage facility would not make lettuce and carrots non-profitable in a good year, but it would reduce the number of acres by one half, and perhaps the number of farms as well. At one-half the volume, potatoes would be marginal. Certain benefits accrue to the Totchaket region from its climate, soil and land availability, but it must be remembered that there are already enough acres of land in private hands in areas closer to population centers to supply Alaska's vegetable needs for quite some years to come. One can hardly expect these acres to lie fallow in favor of a centrally planned project further from the markets.

Recommendations

Observations and assessments of different segments of the present Alaskan vegetable and potato "industry" would indicate a primitive state of development, even though there are some excellent individual growers. Looking to significant development of vegetable production in the Nenana area, or elsewhere in the state, lends urgency to addressing certain problems. The following recommendations are made in the most constructive vein, but are deemed necessary for success in settlement-development in a new lands situation.

1. That controlled environment storage, utilization research facilities, and retail display type research facilities be provided the U. of A. Agricultural Experiment Station, along with comensurate staff and budget, to activate and carry out an aggressive program to determine consumer and retail needs and the technology with which to meet them.

2. That work immediately be directed to ascertain and implement quality control programs for Alaskan-produced vegetables; functional, service oriented, inspection and grading programs are conspicuous by their absence. The void in functional educational and promotional programs for commercial vegetable production is profound.

3. That a horticultural research program be initiated which directs concerted attention to functional aspects of commercial production which will meet retail and consumer requirements for final products in the retail store.

Appendix I. Vegetable crops suited to the Nenana area and production requirements for stated yields

Crop and Variety	Transplant	Seeded	Fertilization Kind	Rate/a (lb)	Harvest Season	Herbicide or Insecticide	Yield lb/a	Culture Requirements*
Cabbage								
Earlianna	x		10-20-20	1100	7/10-9/15	Sevin or Diazinon +4	22,000	FB, FS, R, C2
Earlianna		x	10-20-20	1100	7/25-9/15	Sevin or Diazinon +5	20,000	FB, FS, R, C2
Tastie	x		10-20-20	1500	7/15-9/15	Sevin or Diazinon +5	45,000	FB, FS, R, C2
Tastie		x	10-20-20	1500	7/25-9/15	Sevin or Diazinon +5	40,000	FB, FS, R, C2
Hybrid 15	x		10-20-20	1500	7/25-9/15	Sevin or Diazinon +5	45,000	FB, FS, R, C2
Hybrid 15		x	10-20-20	1500	8/1 -9/15	Sevin or Diazinon +5	40,000	FB, FS, R, C2
Broccoli								
Green Duke	x		10-20-20	1500	7/10-9/7	Sevin or Diazinon +4	12,000	FB, FS, R, C2
Green Duke		x	10-20-20	1500	7/25-9/7	Sevin or Diazinon +5	14,000	FB, FS, R, C2
Gem	x		10-20-20	1500	7/12-9/7	Sevin or Diazinon +4	12,000	FB, FS, R, C2
Gem		x	10-20-20	1500	7/25-9/7	Sevin or Diazinon +5	14,000	FB, FS, R, C2
Cauliflower								
Snowcrown	x		10-20-20	1200	7/15-9/10	Sevin or Diazinon +4	17,000	FB, R, C2
Snowcrown		x	10-20-20	1200	7/25-9/10	Sevin or Diazinon +5	17,000	FB, R, C2
Dominant	x		10-20-20	1500	7/27-9/10	Sevin or Diazinon +5	23,000	FB, R, C2
Dominant		x	10-20-20	1500	8/10-9/10	Sevin or Diazinon +6	25,000	FB, R, C2
Crisphead Lettuce								
Minilake		x	10-20-20	1000	7/20-9/10	Sevin	24,000	FB, R, C1
Ithaca		x	10-20-20	1000	7/25-9/10	Sevin	26,000	FB, R, C1

* Culture Requirement Code

Fertilizer:

Broadcast	FB
Sidedress	FS
Liquid Feed	FL

Land Preparation:

Rotatill	R
Plow	P
Disk and Harrow	D

Cultivation:

Cultivate once	C1
Cultivate twice	C2
Hill	H1

Source: Dr. Donald H. Dinkel, Professor of Horticulture, University of Alaska, Agricultural Experiment Station, Fairbanks, December 1980.

Appendix I. (Cont'd.) Vegetable crops suited to the Nenana area and production requirements for stated yields

Crop and Variety	Transplant	Seeded	Fertilization King	Rate/a (lb)	Harvest Season	Herbicide or Insecticide	Yield lb/a	Culture Requirements*
Leaf Lettuce								
Dark Green Cos		x	10-20-20	1200	7/15-9/10	Sevin	21,000	FB, R, C1
Ostinator		x	10-20-20	1200	7/15-9/10	Sevin	18,500	FB, R, C1
Carrots								
Nantes Special Long		x	10-20-20	1100	8/20-9/15	Lorox	84,000	FB, R
Spartan Bonus		x	10-20-20	1100	8/20-9/15	Lorox	75,000	FB, R
Potatoes								
Kennebec		x	10-20-20	1100	8/20-9/15	Premerge or Sencor	30,000	P, D, H2
Baking		x	10-20-20	1300	8/30-9/15	Premerge or Sencor	36,000	P, D, H2
Alaska Red		x	10-20-20	1500	8/25-9/15	Premerge or Sencor	40,000	P, D, H2
Alaska 114		x	10-20-20	1500	8/30-9/15	Premerge or Sencor	40,000	P, D, H2
Green Pea								
Green Arrow		x	10-20-20	750	8/1 -9/7	Premerge	8,000	P, D, FB
Frosty		x	10-20-20	750	7/25-9/7	Premerge	7,000	P, D, FB
Sparkle		x	10-20-20	750	7/25-9/7	Premerge	7,500	P, D, FB
Snap Beans								
Provider		x	10-20-20	1000	8/15-9/1	Premerge	22,000	P, D, FB
Oregon 1604		x	10-20-20	1000	8/15-9/1	Premerge	31,000	P, D, FB
Spinach								
Melody		x	10-20-20	500	7/1 -9/1	--	9,000	R, FB, C1
Turnip								
Tokyo Cross		x	10-20-20	1000	7/10-9/10	Diazinon	20,000	R, FB, C2

Appendix I. (Cont'd.) Vegetable crops suited to the Nenana area and production requirements for stated yields

Crop and Variety	Transplant	Seeded	Fertilization Kind	Rate/a (lb)	Harvest Season	Herbicide or Insecticide	Yield lb/a	Culture * Requirements	4' Poly. Liniar ft/a
Summer Squash									
Zucchini Elite	x		10-20-20	1500	7/20-9/1	Premerge	120,000	R, FB	+ 8712
Greenzini	x		10-20-20	1500	7/20-9/1	Premerge	120,000	R, FB	+ 8712
Cucumbers									
Saladin	x		10-20-20	1500	7/15-9/1	Premerge	87,000	R, FB, FL	+ 8712
Winter Squash									
Hybrid R	x		10-20-20	1500	8/25-9/7	Premerge	30,000	R, FB, FL	+ 7260
Golden Hubbard	x		10-20-20	1500	8/25-9/7	Premerge	42,000	R, FB, FL	+ 7260
Green Peppers									
Cadice	x		10-20-20	1500	8/1 -9/1	Premerge	5,500	R, FB, FL	+ 8712
Sweetcorn									
Earlivie		x	10-20-20	1500	8/15-9/1	Atrazine	20,100	R, FB	+ 8712
Polorvee		x	10-20-20	1500	8/10-9/1	Atrazine	14,000	R, FB	+ 8712

Appendix II. Freeze Dates in Spring and Fall (recorded in the period 1951-71 at Nenana, Alaska).

Probability	Temperature		
	24°F or lower	28°F or lower	32°F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	May 19	May 31	June 11
2 years in 10 later than--	May 15	May 27	June 7
5 years in 10 later than--	May 6	May 19	May 30
First freezing temperature in fall:			
1 year in 10 earlier than--	August 29	August 19	July 27
2 years in 10 earlier than--	September 4	August 25	August 4
5 years in 10 earlier than--	September 14	September 3	August 21

Appendix II (Cont'd.) Temperature and Precipiation (Recorded in the period 1951-71 at Nenana, Alaska)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have--		Average number of growing degree days[1]	Average	2 years in 10 will have--		Average number of days with 0.10 inch or more	Average snowfal
				Maximum temp. higher than--	Minimum temp. lower than--			Less than--	More than--		
	°F	°F	°F	°F	°F	Units	In	In	In		In
January	-1.6	-20.6	-11.1	37	-59	0	.55	.17	.85	2	7.7
February	7.0	-15.5	-4.2	40	-51	0	.56	.14	.88	2	7.4
March	20.2	-8.2	6.0	48	-48	18	.39	.10	.61	1	5.4
April	38.0	15.5	26.8	62	-21	21	.29	.08	.45	1	3.2
May	57.1	33.6	45.4	79	17	200	.60	.24	.88	2	.2
June	69.2	44.6	56.9	86	30	507	1.56	.62	2.31	5	.0
July	70.0	47.2	58.6	88	33	577	2.27	1.23	3.11	6	.0
August	64.5	43.2	53.9	81	26	431	2.50	1.13	3.60	6	.0
September	52.7	32.8	42.8	71	12	127	1.32	.40	2.05	4	.8
October	30.8	15.2	23.0	56	-18	16	.66	.31	.95	2	6.7
November	12.5	-4.2	4.2	44	-40	0	.59	.16	.93	2	8.6
December	-.1	-17.7	-8.9	38	-58	0	.63	.18	.98	2	8.6
Yearly:											
Average	35.2	19.3	26.5	---	---	---	---	---	---	---	---
Extreme	---	---	---	89	-61	---	---	---	---	---	---
Total	---	---	---	---	---	1,897	11.92	9.10	14.58	35	48.6

[1] A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40°F).

Appendix II (Cont'd.) Growing Season (recorded in the period 1951-71 at Nenana, Alaska and 1931-60 at Fairbanks Experiment Station).

Probability	Daily Minimum Temperature					
	NENANA			FBKS. EXP. STATION		
	Higher than 24°F	Higher than 28°F	Higher than 32°F	Higher than 24°F	Higher than 28°F	Higher than 32°F
	Days	Days	Days	Days	Days	Days
9 years in 10	109	87	53	110	91	45
8 years in 10	116	94	63	117	99	68
5 years in 10	130	107	82	134	114	88
2 years in 10	144	120	101	149	128	108
1 year in 10	151	127	111	158	135	120

Mean Monthly Wind Speed and Prevailing Direction-Speed in Knots

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annaul
NENANA	ENE 5.3	E 4.7	ENE 9.2	NW 5.8	NW 5.8	SW 9.1	SW 4.6	SW 4.4	ENE 9.0	ENE 5.2	ENE 4.8	ENE 4.3	ENE 5.0
FBKS	N 2.4	N 3.2	N 4.1	N 5.3	N 6.2	SW 5.8	SW 5.3	SW 4.9	N 4.9	N 4.4	N 3.2	N 2.5	N 4.3

Appendix II (Cont'd.) Growing Season (recorded in the period 1951-71 at Nenana, Alaska and 1931-60 at Fairbanks Experiment Station).

Probability	Daily Minimum Temperature					
	NENANA			FBKS. EXP. STATION		
	Higher than 24°F	Higher than 28°F	Higher than 32°F	Higher than 24°F	Higher than 28°F	Higher than 32°F
	Days	Days	Days	Days	Days	Days
9 years in 10	109	87	53	110	91	45
8 years in 10	116	94	63	117	99	68
5 years in 10	130	107	82	134	114	88
2 years in 10	144	120	101	149	128	108
1 year in 10	151	127	111	158	135	120

Mean Monthly Wind Speed and Prevailing Direction-Speed in Knots

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
NENANA	ENE 5.3	E 4.7	ENE 9.2	NW 5.8	NW 5.8	SW 9.1	SW 4.6	SW 4.4	ENE 9.0	ENE 5.2	ENE 4.8	ENE 4.3	ENE 5.0
FBKS	N 2.4	N 3.2	N 4.1	N 5.3	N 6.2	SW 5.8	SW 5.3	SW 4.9	N 4.9	N 4.4	N [illegible]	N 2.5	N 4.3

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