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MASTER PLAN AND REPORT

FOR

PORT DEVELOPMENT

AT

BETHEL, ALASKA

GENERAL CARGO DOCK
PETROLEUM PRODUCTS DOCK
RIVERBANK STABILIZATION

Prepared For

THE CITY OF BETHEL

Prepared By

Harold H. Galliett, Jr.
Consulting Engineer
Anchorage, Alaska

George C. Silides
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PORT OF BETHEL IMPROVEMENTS

I. CONCLUSIONS AND EXECUTIVE SUMMARY

1. The economic and cultural development of the City of Bethel and of the Bethel Service Area depends largely on the successful retention and development of the Bethel waterfront.

2. Without the immediate undertaking of a sustained program of riverbank stabilization, the Bethel waterfront, including the present location of the bulk fuel tank farm and the future location of the general cargo dock and industrial area, will be lost.

3. The evidence gathered from our studies since 1970, and from 1974 general cargo dock construction, show that port improvements and their protective appurtenances result in permanent, or very long-term riverbank stabilization.

4. Construction should commence in 1981 if possible, or in 1982 at the latest, to prevent the loss of the bulk fuel storage tank farm, and to relieve the expensive congestion at the general cargo handling facility.

5. Once begun, the entire program of port development/riverbank stabilization should be wholly completed with all reasonable dispatch to lessen the penalties of inflation, and to lessen the

chance of losing the partially completed improvements from any eccentricities of the Kuskokwim River.

6. The benefits to Southwest Alaska from Bethel port improvements and bank stabilization exceed the cost of facility construction.

7. Funding of the Bethel port development/riverbank stabilization program is in keeping with legislative fiscal policy of development.

8. That an adequate sum to fund at least the 1981-1982 construction phase should be appropriated from the general fund to the Department of Transportation and Public Facilities for use by the City of Bethel, as per the master plan for port development, upon submission by the City of Bethel of the necessary design and construction plans and specifications.

9. In all phases, time is of the essence.

II. PORT OF BETHEL SERVICE AREA

The City of Bethel occupies a central location in Southwest Alaska. As the upper limit for oceangoing vessels, the Port of Bethel is the deep water entry port of Southwest Alaska.

The Port of Bethel presently serves a huge region of over 100,000 square miles. The City of Bethel has developed into the center of trade, transportation, distribution, communications, administration, education, health care and cultural activity for over sixty communities located on Kuskokwim Bay and the Kuskokwim River.

The region's complexity and isolation makes water transporation the most cost effective means of moving general cargo and bulk petroleum products in and out of Bethel. These are unloaded at the Port of Bethel and transshipped to other communities by tugs and barges better suited to ply river and shallow coastal waters.

When the Yukon River and the Kuskokwim River are joined together by the Yukon-Kuskokwim Crossing[1], now being investigated for the Senate Transportation Committee, the Port of Bethel will be the deep water

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1 Preliminary Engineering Report Yukon-Kuskokwim Crossing, Galliett & Silides, December 31, 1980.

terminus of a major river transportation system, on a par with those of the Mississippi and the Amazon systems in terms of length and relative importance to the area served. At that time it will become feasible to ship goods to and from the Yukon River system through Bethel, to the advantage of communities along both rivers.

In addition to general cargo and bulk fuel, it is anticipated that the Port of Bethel will then also handle diverse shipments such as timber harvested along the Yukon and Kuskokwim Rivers, the grain and red meat output of the Nenana Agricultural Project, and NGL's and refined crude oil products from the Fairbanks area. At that time, the Port of Bethel will increase its fuel service area toward Bristol Bay, the Alaska Peninsula, and to Norton Sound. Ties to the Asian Pacific Rim will be established for the shipment of grain, red meat and timber.

Without a plan of development, and a concerted effort to accomplish that plan, the Port of Bethel will never fulfill its future potential. Indeed, unless steps are taken to protect and expand the existing facilities, the port will fail to meet even its present obligations to its service area.

III. THE PROBLEM

The problems facing the Port of Bethel can best be described as;

A. INADEQUATE SIZE

1. The general cargo dock and staging area are too small.

The first, and last, permanent improvement to the Port of Bethel was made in 1974 to accommodate receipt and efficient handling of incoming cargo. Volume of general cargo had increased from 9000 tons in 1967 to 12,000 tons in 1972. About 25% of this cargo was transshipped.

An important additional consideration for port construction in 1974 was the abatement of riverbank loss.

General cargo volumes in 1980 were in the vicinity of 20,000 tons, plus approximately 40,000 tons of gravel. Bulk fuel handlings were 16.5 million gallons (1075 barrels/day), up from 6 million gallons in 1967 and 11 million gallons in 1977. Over half of the incoming bulk fuel is presently redistributed, resulting in the handling of approximately 24 million gallons annually through the Port.

General cargo is now off-loaded at several locations because of the inability of the dock staging area to receive all of this cargo. The extra cost of re-handling the cargo is presently about $20/ton. This extra handling penalty will increase as the dock becomes more congested.

Further, because of the size and frequency of incoming oceangoing barges, the transshipping barges must be anchored offshore when the ocean barges are unloading. This displacement effectively halts loading for transshipping. In 1980, thirty-six days of river navigation period were lost. It is necessary to provide separate mooring facilities for the transshipping vessels.

2. The construction of the present general cargo dock and staging area is composed of four circular sheet steel pile cells and wing walls, giving a working frontage of approximately 240 feet. By the end of the 1980's decade, the Port of Bethel will require a general cargo dock and staging area having a frontal working area of 1000 feet for oceangoing vessels, plus several hundred feet of mooring facility in Brown's Slough for the activities related to the tugs and barges engaged in transhipping.

3. It is proposed that, during the 1981 and 1982 construction seasons, the river frontage of the dock be extended westward by the addition of two circular cells. Working frontage would thus be increased from the present 240 feet to approximately 360 feet, and offer greater security to the dock from loss by erosion.

To enable the simultaneous mooring and working of the transshipping vessels and the oceangoing barges, it is proposed, during 1981 and 1982, to widen Brown's Slough and construct 400 feet of

wall type bulkhead. The proposed improvements in Brown's Slough will also provide adequate, safe moorage for the numerous small boats that are so important to the lives of the residents of Bethel, and of the visitors to Bethel from nearby villages.

It is proposed that the additional 675 feet of general cargo dock along the river front be constructed as rapidly as funding permits to, a) provide adequate space, b) to combat inflation, and c) to provide positive protection from erosion.

4. Essential Warehousing immediately adjacent to dock side is non-existent. When warehouse financing becomes available, the obviously best location would be at the general cargo dock, or in the immediately adjacent industrial area. No such warehousing and industrial area can be safely developed until the cargo handling facility is enlarged, and some further steps taken toward stabilizing the adjacent eroding riverbank.

5. Construction Cost Estimates for the expansion and more efficient utilization of the Port of Bethel General Cargo Handling Facility, expressed in 1982 dollars, are as follows;

Extend Dock from 240' to 360'	$ 3,640,000
Extend Dock from 240' to 1,000'	13,720,000
Construct Warehouse	1,000,000

These figures do not include the total cost of land acquisition which is subsequently discussed.

B. RIVERBANK EROSION

1. Absent the necessary sustained expansion of the general cargo handling dock and staging area as proposed in the 1971 Bethel Port Study Report[2], a permanent petroleum dock, warehousing and industrial area, and appurtenant bank stabilization installation, the riverbank available for these improvements is suffering serious loss from erosion. That erosion has reached a crisis stage, threatening property improvements having a replacement value of between 35-50 million dollars. Relocation costs are estimated at about $25 million.

2. The area of immediate, crucial concern is the bulk fuel storage tank farm. A sudden, massive bank loss just upstream of the tank farm, plus lesser but substantial losses downstream makes it evident that if steps are not taken during 1981-82 to avoid a total $9 million loss, the tank farm must;

a) Relocate, temporarily, further from the riverbank (the plant has moved twice before), or

b) Relocate at some locale other than Bethel.

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2 Medium Draft Port Facility At Bethel, Alaska, Galliett & Silides, November 1971

The cost of a temporary relocation is estimated at $3 million, exclusive of land acquisition costs. The estimated 1981-1982 cost of the riverbank stabilization program designed to provide the Port of Bethel with a petroleum dock and to secure the safety of the bulk fuel storage facility, is estimated at $3,230,000. The 1981-1982 facilities are envisaged as a permanent circular cell type dock, wing walls, bulkhead, and articulated concrete mat.

To assist in maintenance, repair, and monetary contribution to following Phases of port development and bank stabilization, the City of Bethel is considering the imposition of a wharfage fee of between 1¢ to 3¢ per gallon handled over the petroleum dock. Such a fee, added to the cargo dock lease and wharfage fees, will spread the maintenance cost to all of the people in the Bethel service area, and provide a dedicated fund for matching funds to State participation in subsequent phases.

Relocation of the bulk fuel tank farm to a locality other than at Bethel will add approximately 25¢ per gallon lighterage fee to all fuel brought to Bethel and the upriver communities. At the 1980 volume

brought in and stored at Bethel, the added cost to the consumer would be $4 million each year.

3. Industrial Expansion of marine oriented industry is severly inhibited by continuous danger posed by the unstabilized riverbank. The prime example of this is the fishing and fish processing industry.

Currently the value of fish sold at Bethel has an average wholesale value of between $6-$10 million. The majority of the fish are exported either semidressed (gutted) or in the round. Most were exported by air. Although barge companies have indicated a willingness to stage freezer vans for backhaul in Bethel, there is no place on the waterfront for such staging.

The value of the locally caught fish product would be substantially increased if finished pack processing could occur at Bethel. However, fish processing facilities require direct access to the river system. Before such fish processing facilities can become a reality, riverbank stabilization and dock space must occur. Lacking such stabilization and space it is impossible to attract long-term capital investment to waterfront industry. Nevertheless, development of such industry is essential to Bethel and its service area.

4. Causes of Erosion. Basically, riverbank erosion is caused by permafrost degradation, rain, wind, water run-off, and wave action generated by wind and passing boats. The erosion is not caused

directly by breakup and attendant high water. What happens is that the permafrost melts, the thawed soil sluffs to the toe and is only then removed by the river which acts as a carrier during high water periods, or when the sluffed soil is carried into the river by wave action. When that soil is removed a new layer is exposed and the process repeats itself.

5. Remedial Measures. It appears that the best method of halting the erosion process is to interpose a covering structure between the soil and the action of the wind, sun, rain, and wave. The structure(s) should have as high a utilitarian value as practical. Once begun, the entire program of port development/riverbank stabilization should be wholly completed with all reasonable speed to lessen the chance of loosing the partially completed portion from eccentricities of the river.

Expansion of the general cargo dock and staging area, development of a warehousing and industrial area, and the construction of a petroleum dock and appurtenances are de facto permanent, or very long-term, methods of riverbank stabilization and utilitarian use of the waterfront.

Our experience to date has shown that the safest, longest life construction is that of circular cells, such as those which comprise the existing general cargo dock. This type of

construction is also the most expensive. It is most cost effective when used for dock purposes to accommodate large oceangoing cargo vessels and fuel barges, and to absorb the impact of mooring or of very heavy cargo handling equipment.

For the mooring of the smaller transshipping vessels, and for the stabilization of the warehousing/industrial area, it is proposed to design and install an adequate wall type bulkhead. Given the soil structure at Bethel, and the uncertainties of river bottom migration, wall type construction does not provide the assurance of cellular construction. However, the cost per linear frontage foot is only 40% of the cost of cellular construction. Expressed in 1982 dollars our extimate for a 1200 foot long wall type bulkhead, extending from Lot 11, Block 20 to the West side of Main Street, is $6,420,000.

Less certain, but, we believe, highly useful and of adequate life expectancy, is an articulated, concrete mat. We propose that such a protective concrete mat be installed between the bulk fuel storage tank farm and Main Street. In 1982 dollars, the estimated installed cost is $4,759,000. The cost per linear frontage foot of articulated mat construction is approximately one-tenth the cost of circular cells and one fourth that of wall type bulkhead. However, it has little utilitarian use beyond the abatement of riverbank loss and small riverboat tie-up.

6. Alternative To Riverbank Stabilization. Failure to undertake an adequate riverbank stabilization program such as outlined above will result in loss past First Street by the year 2000, including likely isolation of the cargo docking facility. Loss of the tank farm is an early certainty. By the year 2030 erosion will have reached Second Avenue in some places, and will include loss of the dock. Economic and cultural losses from non-development are not calculable.

C. LAND OWNERSHIP, DESIGNATION, AND ACQUISITION

1. Ownership and Present Use

Present ownership and land use within the port development/bank stabilization area is a mixture of sometimes unrelated activity. The economic future of Bethel and the Bethel Service Area would benefit greatly from the logical resorting of these activities and land uses.

2. Needed Area Designation and Allocation

The port development/bank stabilization area described below, and shown on the plats accompanying this report, should be rezoned to port development use. It should be resubdivided, if necessary, and space for specific uses, i.e., docking, staging, warehousing, industrial, should be allocated. A dedicated street should be provided immediately adjacent to pierside for universal public access, and for dock/bulkhead/articulated mat construction, maintenance, and use. All

property within the designated area needed for construction, or which is not in conforming port development use, should be acquired by the City.

3. General Description of Port Development Area

The area that should be designated for port development/ bank stabilization purposes is described as follows;

a) Vacated Second Avenue East of Bridge Avenue, and

b) Between Brown's Slough and Main Street, all property south of Second Avenue and Bridge Avenue, and

c) West of Main Street, all of Tract E, Tract B lying south and east of Mission Lake Road except Lots 33 through 41 of Block 3, all property south of First Avenue to U. S. Survey No. 4000 (PHS property), and

d) All of U. S. Survey No. 4000 south of the State Highway, and

e) Tracts 42, 43, and 44 west of U. S. Survey No. 4000.

4. Land Acquisition

a) 1981-1982 Construction. For the 1981-1982 general cargo dock and staging area expansion, the City must acquire the following;

- Lots 3, 4, 5, 6, 7, and 8, Block 20
- Lots 1, 2, and 3, Block 19, and
- Vacation of Second Avenue east of Bridge Avenue.

For the petroleum port and construction to protect the bulk fuel storage tank farm an entry permit will be needed from the Public Health Service.

b) Future Construction and Development

It is proposed that the City purchase or otherwise acquire such property within the port development/riverbank stabilization area (project) that is necessary for construction and/or is not being used in conformity with this Master Plan.

The City should immediately seek the acquisition of all vacated Public Health Service property within the designated project area for use in connection with the petroleum products port and probable secondary general cargo port facilities. Such public lands should be transferred free of cost. The acquisition of any private property necessary to future construction and development can be aided through the use of part of the petroleum dock gallonage fee and general cargo wharfage fees.

5. Land Costs

The cost of land acquisition for proposed 1981-1982 general cargo dock expansion and Brown's Slough widening and moorage is included in the construction estimates shown herein. Total cost of land

acquisition for port development depends greatly on the cooperation pf all present inholders and potential beneficiaries. Therefore, this total land acquisition cost must await the 1982-1983 annual updating of the Port Development Master Plan and the City of Bethel Comprehensive Plan.

IV. MAXIMUM TERM CONSTRUCTION SCHEDULE

The following schedule of improvements is the maximum reasonably allowable term of construction to first protect vital existing facilities, and then to develop the economic potential of the Port of Bethel. An accelerated construction program would lessen the chance of the entire problem becoming moot through loss of existing and partially completed improvements from eccentricities of the Kuskokwim River.

A. 1981 - 1982

1. Petroleum Dock And Tank Farm Protection

    a) One 60 foot diameter circular cell

    b) 200 feet of wall type bulkhead

    c) Approximately 700 feet of concrete mat

2. Transshipping vessel moorage

    a) Widen Brown's Slough

    b) 400 feet of wall type bulkhead

    c) Dredging and backfill

3. Enlarge General Cargo Dock

    a) Two 60 foot diameter circular cells

    b) Acquire land

4. Industrial Area Protection

a) Acquire land

b) Construct warehouse

B. 1982 - 1983

1. Tank Farm Protection

a) 1000 feet of articulated concrete mat

2. Industrial Area Protection

a) 400 feet of wall type bulkhead commencing at Main Street and proceeding upstream toward general cargo dock.

C. 1983 - 1984

1. Industrial Area

a) 800 feet of wall type bulkhead, proceeding upstream to Lot 11, Block 20, to complete industrial area protection.

D. 1985 and 1986

1. General Area Bank Stabilization

a) Approximately 3,200 linear feet of articulated concrete mat, to complete bank stabilization other than industrial and cargo dock areas.

E. 1987 - 1990

1. Protection and Completion of General Cargo Dock and Staging Area

   a) Incrementally extend general cargo dock and staging area to the SW Corner of Lot 11, Block 20 through the construction of eight additional 60 foot diameter circular cells.

F. 1981 - 1990

1. Designate Port of Bethel development area limits, to include all of the lands described in Section III C 3, General Description of Port Development Area.

2. Acquire all vacated Public Health Land for use and lease in connection with the petroleum products docking and storage facility and secondary general cargo dock.

3. Acquire all other available vacated Federal lands within the Port of Bethel development area.

4. Resubdivide and allocate lands within port development area for specific uses.

5. Acquire such property that is presently in non-conforming, port development, use.

V. CONSTRUCTION COST ESTIMATES

A. NOTES

1. Inflation. The following construction cost estimates for alternatives A - D include a 15% annual increase attributable to inflation in material and labor costs.

2. Design. Estimates are based on existing state-of-the-art. Technical advances and innovative design may reduce the costs shown. For example, in 1972 we were told that, "nothing can be done at Bethel." The existing medium draft cargo handling facility refuted that contention.

3. Effect of Accelerated Schedule. Accelerated construction schedules can reduce costs by taking advantage of economies of scale, and by offsetting the penalty of annual inflation. Moreover, quick completion reduces potential loss of existing and partially completed facilities, from riverbank erosion, prior to completion of the total port facility/bank stabilization program described herein.

B. ESTIMATES (In Thousands)

1. Alternative A		$ 1982	$ Future
1981-1982	General Cargo Dock	3,640	3,640
	Petroleum Dock and Protection	3,230	3,230
	Warehouse	1,000	1,000
	1981-1982 Project	7,870	7,870
1982-1983	1000 linear feet mat protection	1,286	1,479
	400 linear feet wall bulkhead	2,140	2,460
	1982-1983 Project	3,426	3,939
1983-1984	800 linear feet wall bulkhead	4,280	5,564
1985	1600 linear feet mat protection	2,058	2,984
1986	1600 linear feet mat protection	2,058	3,293
1987	2 circular cells	2,520	4,410
1988	2 circular cells	2,520	4,788
1989	2 circular cells	2,520	5,166
1990	2 circular cells	2,520	5,544
TOTAL PROGRAM		$29,772	$43,558
1981-1990			

Recapitulation of Alternative A, By Allocation

(In Thousands)	$ 1982	$ Future
1. General Cargo Dock	$13,720	$23,548
2. Petroleum Dock & Tank Farm Protection	$ 3,873	$ 3,969
3. Waterfront Industrial Area Protection	$ 6,420	$ 8,024
4. General Area Riverbank Protection	$ 4,759	$ 7,017
5. Warehouse 1982	$ 1,000	$ 1,000
	$29,772	$43,558

Alternative A gives maximum benefit per dollar invested. It allows cargo handling facilities and industrial area to reach fullest potential while simultaneously providing for bank stabilization.

Construction cost savings can be realized by shortening completion period. Accelerated construction will take advantage of economies of scale and offset inflation.

2. Alternative B

1981-1982 Cargo Dock	$ 3,640
1981-1982 Petroleum Dock & Protection	3,230
1982-1983 1200 feet bulkhead	7,382
1983-1984 8000 feet mat protection	13,376
	$27,628

Alternative B continues to provide the needed industrial area and bank protection. It does not allow the general cargo handling facilities to reach their needed size and, therefore, will add to cargo handling costs.

3. Alternative C

1981-1982 Cargo Dock	$ 3,640
1981-1982 Petroleum Dock & Protection	3,230
1982-1983 9000 feet mat protection	13,311
	$20,181

Alternative C provides the minimum reasonable alternative. Though it provides bank stabilization for an indeterminate period, possibly 25 years, it provides only temporary relief to the increasing problem of efficient cargo handling. Under this alternative, expansion of the general cargo dock will require removal of earlier construction.

4. Alternative D

1982-1983 10,000 linear feet of mat protection $13,825

Alternative D is an emergency measure to safeguard existing facilities only. It provides the minimum acceptable alternative.