
TO: Division Engineer

U. S. Army Engineer Division, North Pacific

1. Reference is made to the following:

a. Letter dated 31 December 1947, subject, "Review of reports, Skagit River, Washington," from the Seattle District, and second endorsement thereof. The basic letter stated that improvement of the river Skagit River for navigation, as originally desired by local interest, is infeasible; but that recent developments indicate the possible feasibility of improving the river for navigation between Mt. Vernon and Concrete, and that additional funds in the estimated amount of $5,450 would be needed for the study. By 6th Indorsement dated 16 July 1949, the Office, Chief of Engineers, approved expenditure of about $20,000 and a revised study cost estimate of $30,000 to clarify the necessary for a more detailed investigation or to provide data for completion of an index public report.

b. First Indorsement dated 21 July 1947, subject, "Study Cost Estimate (73-6) - Skagit River, Wash. (Navigation)," in which the Division Engineer approved increasing the study cost estimate to $30,000.

2. History of Study. - The Skagit River navigation study was authorized by resolution of the House of Representatives Public Works Committee adopted 13 May 1947, as follows:

"Resolved by the Committee on Public Works of the House of Representatives, United States, That the Board of Engineers for Rivers, and Harbors be, and is hereby, requested to review the reports on Skagit River, Washington, contained in House Documents Numbered 311, Seventieth Congress, First Session; and 127, Seventy-third Congress, Second Session, with a view to determining if any modification of the existing project is in the interest of navigation is advisable."

3. By 2d Indorsement dated 6 June 1947, subject, "Review of Reports on Skagit River, Washington (Letter from Committee on Public Works, House of Representatives, to OEC dated 13 May 1947)," the Office, Chief of Engineers directed submission of a report. At a public hearing held

at Mount Vernon, Washington, on 12 April 1949, and attended by 80 people, navigation interests requested improvement of the lower Skagit River for navigation by dredging and maintaining a channel 100 feet wide and 6 feet deep through the entrance bar (see map, enclosure No. 1) and upriver to Mount Vernon, and thence 4 feet deep to Hamilton. In accordance with Presidential policy on curtailment of noncritical project studies during the Korean War, work on the study was suspended before a preliminary report could be prepared.

4. Informal conferences were held with local navigation and flood control groups in September 1954, September 1955, and January and April 1956, relative to the channel improvement, particularly the shoaling problem on the Skagit River delta. With an allotment of $3,000 by the Office, Chief of Engineers in May 1956, the study was resumed.

5. A preliminary report was submitted and a detailed survey was authorized in 1957.

6. Funds were allotted and the detailed survey was initiated in FY 1958. Hydrographic surveys, stream gauging, hydraulic studies, and cost and benefit estimates were accomplished. Results of this work indicated that improvement of the lower part of the river for navigation was not economically justified because of the excessive cost of maintaining the channel through the entrance bar, and the limited and declining amount of navigational use. An unfavorable report was under preparation in September 1959 when local interest was expressed in improvement of the channel above Mount Vernon to Concrete. Upon a reconnaissance of this reach of the river and a preliminary evaluation of benefits, there appeared to be a reasonable possibility that improvement of this reach would be feasible. However, the latest detailed survey of the river is 50 years old and not suitable for estimating dredging requirements under present conditions. The letter report described in paragraph 1a was therefore submitted for the purpose of obtaining $45,440, additional funds needed to complete the study. Funds in the amount of $10,400 were received to accomplish feasibility studies, and work was resumed in FY 1962. In additional sum of $20,000 was received in FY 1962 to be applied to completion of the study.

7. The results of the studies to date and a recommendation for a more detailed investigation are contained in the remainder of this report. Evidence of strong local interest in the proposed navigation improvement is evidenced by 39 letters received by Senator Warren G. Magnuson from local interests, and transmitted by him to the Chief of Engineers by letters dated 22 August, 14 November, 13 and 16 December 1960, and 23 January 1961.
8. Description — Skagit River is the largest stream tributary to Puget Sound. It rises in British Columbia 73 miles north of the International Boundary, and flows southwestward 135 miles to Skagit Bay, an arm of the Sound. (See map, Inclosure No. 2). About 7 miles above the mouth, the river divides into two main distributaries, the North and South Forks. Both Forks have been used for navigation, but in recent years traffic has been confined mainly to the North Fork. The major portion of the basin lies in the mountainous central area of Skagit, Snohomish Counties, and is largely occupied by National Forest lands. The upper reaches of the Skagit River and its tributaries are in precipitous mountain valleys which broaden, but maintain their steep mountain walls in their lower reaches. The main river flows in a valley one to three miles wide from Rockport to Snohomolly. Below Snohomolly to salt water, the valley widens to a flat, fertile outwash plain.

9. The Skagit River is considered navigable for the 73 miles from Marblemount to its mouth. Before rail and highway transportation were available, small steamers plied the Skagit to the mouth of the Sound during ordinary high water and to a point a few miles above Marblemount during extreme high water stages. Log rafts were towed from Marblemount as late as the early 1950’s. Popular river freighter service to Mount Vernon, and towns of log rafts from above Mount Vernon ceased about two years ago. During the period 1951 through 1961, vessel traffic varied from a maximum of 15,200 tons in 1954 to a minimum of 2,300 tons in 1960. Rafted traffic declined from 402,000 tons in 1951 to 26,000 tons in 1960, and to 4,000 tons in 1961. This drop is due to the gradual cessation of all rafted traffic above Mount Vernon and to a temporary closing of a log dump at Mount Vernon because of forest management requirements of a private timberland owner. This dump is being maintained, and the owner expects to raft a sustained average of 90,000 tons of logs annually from Mount Vernon.

10. Skagit County, in which most of the lower Skagit basin area is situated, had a population of about 43,000 in 1950 and 51,300 in 1960. Corresponding populations of principal cities in the basin are as follows:

<table>
<thead>
<tr>
<th>City</th>
<th>1950</th>
<th>1960</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mount Vernon</td>
<td>5,200</td>
<td>7,900</td>
</tr>
<tr>
<td>Sedro Woolley</td>
<td>3,300</td>
<td>3,700</td>
</tr>
<tr>
<td>Burlington</td>
<td>2,350</td>
<td>2,600</td>
</tr>
<tr>
<td>Concrete</td>
<td>760</td>
<td>840</td>
</tr>
</tbody>
</table>
11. The principal industries of Skagit County are farming, processing of farm products and logging. In 1935, farm products sold were valued at $15,900,000. In 1936, 117,000,000 board-feet of lumber were harvested in Skagit County, largely from the Skagit River valley. Half of this harvest was from Federal forest lands within Skagit County. However, Federal forest lands in the Skagit River valley include extensive areas outside Skagit County for which logging data are included with statistical reports for adjacent counties. Harvest records are not published for Federal lands in the Skagit River valley, but approximately 120,000,000 board-feet annually will be harvested on a sustained yield basis from all Federal forest lands in the valley.

12. Navigation Requirements. — Contacts with local interests indicate that the following traffic would develop on the Skagit River if a suitable channel were provided:

a. Barges of 1,000 tons capacity would be towed from Concrete to Seattle, Washington. These barges would be approximately 50 feet wide, 150 feet long, would have a draft of 5 feet, and would require a 6-foot deep channel when fully loaded. Tugs would draw 3 1/2 to 4 feet of water, and would require a 42-foot minimum channel depth for safe navigation.

b. Log rafts (flat type) would be towed from log dumps at convenient locations on the Skagit River system from Concrete to Puget Sound ports. The rafts would consist of 100 to 200 thousand board-feet of timber, and would require a channel 25 to 4 feet deep. The tugs used for towing the rafts would draw about 2 1/2 feet of water.

c. Lumber, fabricated steel products and machinery would be barged from Sedro Woolley to Puget Sound ports, and steel supplies would be barged in from Seattle to Sedro Woolley. The lumber would be moved in 500-to 1,000-ton loads, and steel supplies in 200-ton loads, requiring channel depths of 4 to 6 feet. Fabricated steel and machinery items would involve loads of 60 to 125 tons.

13. Tug operators who have had experience on the Skagit River advise that a 100-foot channel width and a 6-foot depth would be sufficient for foreseeable navigation requirements. Except for minor shoaling, the channel below Mount Vernon is navigable in its present condition. Traffic would follow the North Fork to Skagit Bay, and would leave over the entrance bar at high tide. Tidal effects extend to the vicinity of Mount Vernon at low river stages.

14. Proposed Improvement. — The proposed improvement would provide for a barge channel 6 feet deep and 100 feet wide through bars in the Skagit River between Mount Vernon, about mile 14, and Concrete, Washington.
about mile 24. The estimated bottom and a typical section of the proposed channel are shown on enclosure No. 3. The channel depth would be measured below the water surface profile for a flow of 9,000 cubic feet per second. Channel side slopes would be 1, vertically, on 6, horizontally. The channel would be in the deepest part of the natural streambed. spoil would be deposited within the banks of the high water channel, but as far outside the dredged channel as possible. No attempt would be made to maintain the channel at a fixed location, but as streambed conditions change, maintenance dredging would be accomplished along the most favorable alignment. After project completion, barges and log rafts towed from upriver points would be assembled in the vicinity of Mount Vernon or in the North Fork until site conditions are favorable. The tours would then be moved through the North Fork and out over the entrance bar at high tide. Minor shoals below Mount Vernon would be dredged to the extent necessary to permit barges to reach the lower part of the North Fork in time to move out at high tide.

15. From visual inspections and past experience in minor dredging along the Skagit River, the material to be dredged is known to vary from sand, in the vicinity of Mount Vernon, to heavy gravel and cobbles above Lynn, about mile 35. A few large boulders would have to be removed by blasting. No ledge rock is expected within the area to be dredged. About 4,000,000 cubic yards of material, including the material from one foot of overdepth dredging, would be removed in providing the proposed channel.

16. The dredging quantity estimate was based on a hectorimeter survey of the thalweg. Vertical control was obtained at profile points which had been established along the river at intervals of one to four miles. The river profile for a flow of 9,000 cubic feet per second was based on water surface elevations observed when the boat with the bathymeter passed these points. The thalweg, observed water surface, estimated 9,000 cubic feet per second water surface and proposed channel bottom profiles are shown on enclosure No. 3. The proposed channel bottom is seven feet below the 9,000 cubic foot per second profile, which allows for a one-foot lowering of the water surface and a 6-foot channel after dredging.

17. The estimated water surface profile and the dredging quantities, based on these surveys, are not sufficiently accurate for a survey report recommendation where the benefit-cost ratio is near unity. However, the surveys are considered to be sufficiently accurate to indicate the possibility of a feasible project when, as in this study, a favorable benefit-cost ratio is indicated.

18. Maintenance of channel depths. - From an inspection of daily hydrographs of the Skagit River near Concrete, for the period 1925 through 1959 (Exhibit No. 1), average daily flows of less than 9,000 cubic feet per second may be expected for periods of about three months each year. Releases from power dams on the Skagit and Eakor Rivers produce, typically,
Double peaks each day during low flow periods. The effect of these peaks is that during average daily flows of less than 7,000 cubic feet per second, very small plugs of water of 0.02 cubic feet per second would be carried upstream from Concrete. Torpedo operations could utilize these plugs for the transport of barges downstream. The timing of empty barges could be made to coincide with a channel depth of four feet. A study of records from previous floods at the Dales (Concrete), for the low flow period of the summer of 1951, indicated that a four feet channel depth would be available during average daily flows of about 6,000 cubic feet per second. Partially loaded barges from Concrete, log rafts, and the necesitated and partially loaded barges from Selma (Sorley) could also be handled in streams with channel depths of four feet. Therefore, there would be no extended interruptions of river traffic, except for the period of channel rock and sand from Concrete, provided that the channel was not reduced to the designed bottom profile. The basic form of the channel would carry a normal supply of gravel and sand to the river, and would not be endangered by a clogging of stream bed during floods. In years of normal or better than normal low water conditions, navigation in the proposed channel would not be severely impaired, even if the channel were shallowed as much as two feet.

In the Silingual, no kilometer accurate method for estimating the amount of annual maintenance dredging to be expected for the proposed East River channel, using the Schelten formula, the estimated amount of battalion carried annually by the Skagit River is about 700,000 cubic yards. There is no practical means of checking the accuracy of this estimate. However, it has been found that extensive deposits of sand and gravel particles are formed at the mouth, and that only sand and gravel particles move through the lower reaches of the stream. The channel in the upper reaches above most of the proposed dredging would be clear of coarse gravel and cobbles. As these large particles are not carried into the lower reaches, they obviously cannot be transported as part of the incised meander. Consequently, the major portion of the load must be fine particles eroded from river banks, washed into the stream from adjacent land, and derived from the washing away of coarser particles. Only minor quantities of the fine material could be expected to be carried in the reach of the stream under study. Estimated values of up to 2.5 feet per second are expected in the steeper portions of the stream where bank floods occur during high flows, coarse material would be carried in the incised channel slopes and from natural stream banks and deposited in the dredged channel. A natural paving of coarse gravel would form in the stream channel would minimize this problem in normal years. However, extreme floods could result in relatively extensive channel development. In 1952, 1953 and 1954, channels were dredged under the project "Puget Sound and Its Tributary Waters, Wash." Channel depths were based on "approximate low water profile," quantities dredged...
were 123,000, 23,000, 5,070, and 12,000 cubic yards, respectively. A
channel change has since been made with the exception of one foot in the
area of the dredged bank. In addition to the above excavation, an
operation was planned to clear and to cut the channel to the bottom
which was accomplished at the time of the initial channel study.

The old spoil banks along the edge of the bank were made uniform on
the basis of the foregoing figures, allowing 12,000 cubic yards per year
are assumed to average about 750,000 cubic yards - equivalent to 24 feet
of the initial dredging.

20. Although extended low water stages sometimes occur during the
winter, such stages are normally expected during the middle of
January, September and October. Cost of the channel should be based upon
factors in the period October through June. With these results the design
operation would normally be required every year. Operations would have to
begin in April or May and be completed before the ice leaves to ensure
suitable navigation depths in August. In all cases, the channels might
be required to complete the work on time. It is possible, however, that in April
through mid-July are normally high enough to complete at least 75% of the
proposed channel lines sufficient for ease to pass the winter without enter-
ing into the dredging operations, except at locations where ice must
be diminished on one side of the river and the channel connected to
a steel bank. Fisheries interests would be examined prior to completion of
the survey studies relative to acceptable methods of operation.

21. Cost Estimates:

a. Dredging: 1,520,000 cu. y. at $5.00

b. Removal of boulders

2,000

c. Contingency 15%

230,000

d. Total direct cost

1,770,000

e. Engineering:

(1) Design Data:

Surveys (29 river miles) 65,000
Foundation explorations
(19 river miles) 50,000
Hydraulics & Hydrology 4,000
Preliminary Planning &
examination 4,000
Designs and estimates 9,000
Economic studies 2,000
Real estate checking 2,000
Report 1,000

Total Design Data 124,000
subject: feasibility report, skagit river, washington (navigation)

(2) plans and specs $65,000

(3) engineering during construction $20,000

(4) total engineering $205,000

g. supervision and administration:

(1) dredging surveys (72 bars) $3,000

(2) inspection and district office costs $29,000

(3) overhead $49,000

(4) total supervision & administration $72,000

g. total cost $2,872,000

22. annual charges:

a. interest at 2-7/8% and amortization
   for 50 years $72,000

b. annual maintenance:

(1) dredging 380,000 c.y. at $6.00 $2,280,000

(2) contingency, 15% $420,000

(3) total direct cost $2,700,000

(4) engineering $23,000

(5) supervision and admin. $30,000

(6) total annual maintenance $2,793,000

c. total annual charges $2,793,000

23. summary: discussions of benefit calculations and derivation of the estimated benefits are contained in paragraphs 24 through 29. prints of benefit computations are included.
24. Demand and cost analysis -

a. The Lone Star Cement Corp. was the first to produce cement at Concrete with a capacity of 1,735,000 tons. However, the costs of producing cement at Concrete have been high due to the relatively remote location of the plant. Transportation costs, including rail and river transportation, account for a significant portion of the total cost of production. Lone Star Cement has been able to maintain its competitive position by focusing on high-quality cement and by maintaining close relationships with its customers.

b. The company desires improved access to the Skagit River to reduce transportation costs. Lone Star Cement has an option on a 28-acre site on the Skagit River downstream from Concrete for a future plant expansion. The company has purchased a 32-acre site at the mouth of the Skagit River for a future plant expansion. The company plans to construct a new plant at the Skagit River site to reduce transportation costs and improve its competitive position. The company has recently purchased a 2,500-ton capacity cement plant at Concrete to increase its production capacity.

The company has also been able to improve its marketing strategy by focusing on high-quality cement and by maintaining close relationships with its customers. The company has a long-term contract with the U.S. Army Corps of Engineers for the supply of cement for a federal project. The company has also been able to increase its sales by focusing on the production of high-quality cement and by maintaining close relationships with its customers.
rock hauled from Concrete as its sole source of supply or as a combination of the other two plans. Eliminating one or more plants at Concrete and Seattle, and hazing of concrete rock to Seattle, would save transportation costs and reduced the construction of new facilities. This also has the effect of saving the construction within 5 or 10 years, of a new rail line at Concrete or Seattle to carry its entire production. Location of the plant would depend upon whether the Umatilla River will be used as a water supply.

Cost analysis indicates a considerable saving in the construction costs for conversion of production at Concrete, because of its vast tonnage. The ten of concrete rock yields about 2.66 ton of cement, which can be transported to Seattle at a cheaper rate than the ten of rock. The existing Concrete plant is old, but capable of producing cement competitively with newer plants. The Seattle plant enjoys and operates would be the essential storage and distribution center, without penalty time, and the plant could be placed in a steady output and marketed on a short notice in the future.

We have been informed that Lone Star would continue the planning and design of new facilities as soon as a project for improvement of Umatilla River is authorized, and that about five years would be needed. The design would be completed. A new plant would cost 10 to 15 million dollars.

c. For the purpose of estimating benefits, the report assumed that Lone Star would continue operations, using the existing plant, that initially, all production would be transported at Concrete, and the net saving could thereby be realized, that the Seattle plant would supply a large share of the demand for storage and distribution until production needs exceed the capacity of the plant. The Seattle plant will eventually be used in cement production of the Concrete plant, and the new plant capacity would be constructed at Concrete when demand exceeds the capacities of the existing plants. The company has not yet fully determined the extent, but a 3-year study, a 6-month strike in the Seattle and Concrete Plants in 1957. They hope to recover and double present production in about 5 or 10 years.

For benefit determinations, Lone Star is assumed to retain its present portion of the northeast cement market, and that cement consumption will increase at the same rate as population in the Puget Sound region, where the major portion of its sales are made. Based on a 50-year projection, the population of the four major counties of the region will be 248 percent, and of the ten smaller counties will be 130 percent of the present population. An analysis of cement use in the United States indicates that rapidly-growing areas use more cement per capita than do slowly-growing areas. On the basis of this analysis, the rapidly-growing four major counties would use cement at a rate of 2.2 barrels per capita, and the other counties at a rate of 1.6 barrels per capita. Applying these rates to present and future populations, the cement use in the Puget Sound Region (where Lone Star's production) 50 years hence will be 263 percent of the present cement.

d. Existing rail transportation rates were taken from public tariffs. Costs for rock from Texas Island and at Concrete were estimated.
SUBJECT: Feasibility Report, Skagit River, Washington (Mariculture)

On the basis of information received from the Lone Star Cement Corp., estimated barge transportation rates were furnished by Pacific Towing Co., which has made a thorough study of the problem and has furnished three rates to Lone Star Cement Corp. on a firm basis. The annual saving which Lone Star would enjoy immediately after completion of the proposed Skagit River improvement is valued at $120,000. Under 10 years, the estimated annual saving would increase to the amount of $300,000. Assuming straight line growth and interest at 6-7/8 percent, the average annual benefit of this increase would be $173,700. Therefore, the gross average annual benefit to Lone Star totals $373,700.

Before the company could enjoy these benefits, it would have to construct facilities at Concrete for loading barges; a small mill for storing cement prior to loading barges; and a cement conveyor from the plant to the silo. The total estimated cost of these facilities is $225,000. Interest and amortization on this investment plus maintenance is estimated at $20,000 annually, and would be a charge against annual benefits. The net annual benefit to Lone Star would, therefore, amount to $373,700.

25. Intramural:

a. Sources of information used in the study:

(1) "Forest Statistics for Skagit and Whatcom Counties, Washington," Forest Survey Report No. 133, dated September 1959 and prepared by the Pacific Northwest Forest and Range Experiment Station, of the U. S. Forest Service, Department of Agriculture.


(3) District Administrator, Washington State Department of Natural Resources, Route 2, Sedro Woolley, Washington.


(5) Mr. Bob Shelden, and others of the Scott Paper Co., Everett, Washington.


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mavieetion projoct, the average timber harvest from the tributary areas 
would be equal to the harvest which could be sustained forever without 
depletion of the resources. 

b. Log transportation benefits were derived by computing only 
the costs for movement by water and movement by truck, as rail transpor-
tation of logs from Skagit Valley has virtually ceased. Log moving 
above Mount Vernon has also ceased. Timber movements were considered 
only for forest areas in the Skagit River valley where moving from 
river would result in appreciable reductions in truck haul distances. 
The assumption is made that over the life of the proposed Skagit River 
navigation project, the average timber harvest from the tributary areas 
would be equal to the harvest which could be sustained forever without 
depletion of the resources. Estimates of annual timber harvests on a 
sustained yield basis were obtained from personal interviews in paragraph 
lb, c, d and e of the preceding paragraph. Estimations were made from 
these sustained yields to allow for timber which could be more easily 
trucked out through adjacent river valleys; for timber which could be 
used by local mills; and for special timber which for various reasons 
would be trucked direct to mills located on salt water sites. Such 
timber would include special polder logs, long logs and logs required 
in special emergencies when delays for water movement of logs can be 
acceptable to mill owners. On this basis, a net of 36,000,000 board-
foot annually, out of a total sustained yield of 90,000,000, could move 
down the Skagit River to salt water, if significant savings in trans-
portation and handling costs could be obtained.

90,000(3.25) = 341,000

c. All timber would be transported from the forests on trucks. 
Timber to be rafted down the river would be dumped at the nearest log 
dump after the truck reaches the Skagit valley highway below Concrete. 
Under present practice, logs are trucked direct to mills on Puget Sound 
or on estuaries adjoining the Sound; or they are trucked to salt water 
dumps from which they are towed in rafts to mills. With insignificant 
exceptions, the logs are dumped into water where they are easily sorted, 
scaled and rafted. The costs for dumping, sorting, scaling and rafting 
are about the same under present practice as they would be for logs 
rafted down river, if the channel were improved. Larger operators would 
probably provide their own riverside dumps. Dunlap Towing Co. has stated 
it would construct dumps, as needed, for small and medium operators, 
charging the same rate as salt water dump owners. Therefore, the only 
costs that need to be considered in determining benefits from log trans-
portation on the proposed Skagit River channel improvement are the 
reduction in trucking costs, less the cost of equivalent log raft towing.

d. Prospective log dump sites along the Skagit River were 
selected on the advice of men who, in past years, have towed logs down

To simplify the computations, three river mileage points were chosen to represent the means of log-chute sites in a major timber producing area. The percentages of various river fees of each area to the four principal salt water towing locations were based on estimates by the timber managers for each major timber area. Towing costs which would be eliminated by metalizing the river were based on a rate of $0.155 per thousand board-foot per mile (source: table d(6)).

26. Skagit Corp. on interior valley

a. The Skagit Corp. (formerly Skagit Steel and allied mills) manufactures heavy log-handling machines and equipment for loading and unloading containers from ships. Special steel supplies are received by vessel from the East Coast, unloaded at Seattle and transported by truck to Sedro Woolley. Other steel supplies are trucked from a mill at Seattle. The trucks are owned and operated by Skagit Corp. If the Skagit River channel is improved, Skagit Corp. plans to purchase two barges which will be used for transporting supplies and products, mainly between Seattle and Sedro Woolley. In addition, the barges will be used for ferrying steel used in the plant, thus reducing trucking costs. The barges would be towed by the Dunlap Towing Co. which furnished estimated barge transportation rates.

b. Ship container container shipments. - In average of 18 ship container loaders, weighing 125 tons each, are manufactured annually. They are transported to Seattle by trucks and loaded aboard ships for transportation to West Coast, Gulf and East Coast ports for installation on vessels. Some are installed on vessels at Seattle. Rail transportation to Seattle is generally not competitive with ocean transport. The container loaders are placed aboard ships in parts weighing from 20 to 60 tons. These parts must be disassembled before they are loaded on trucks and reassembled, inspected and tested before placing
If the Skagit River were improved, the Skagit Corp.
would move the container feeder parts, without disassembly, on the
plant docks about a mile to a wharf at Sedro Woolley. The parts
would be placed by crane aboard a barge, moved to ship at Seattle,
and loaded aboard ship. An overall saving is anticipated on
freight and shipping, consisting of disassembly, reassembly, handling
and testing costs amounting to about $3,750 per ship containing 100
tons.

An annual saving of $45,000, attributable to the proposed improvement of
the Skagit River, can therefore be realized.

c. Steel materials — No transportation saving could be
expected from barging steel produced by the Seattle mill, because of
the high cost of handling and trucking steel from the mill to the barge at
Seattle. However, about 1,250 tons annually of steel used for commer-
cial items are received from vessels at Seattle and trucked to Sedro
Woolley. This steel could be loaded directly aboard the Skagit Corp.
barge and moved to Sedro Woolley at an estimated annual saving of $2,000.
This saving would be attributable to the proposed Skagit River improv-
ment.

d. In-handling machine shipments to Vancouver, B. C. — An
average of six log-handling machines, annually, are sold to customers
who take delivery aboard barges at Vancouver, B. C. The machines weigh
about 60 tons each, and must be disassembled and loaded aboard trucks
for transportation to Vancouver, B. C., reassembled, inspected and tested
before loading aboard the barge. If the Skagit River were improved, the
machines could be moved aboard a Skagit Corp. barge at Sedro Woolley
without disassembly, and under their own power, transported to Vancouver,
B. C., and moved aboard the customer's barge. Therefore, an annual sav-
ing of $1,000, attributable to the proposed Skagit River improvement,
would be attainable.

e. In-handling machine shipments to Alaska — An average of
3 log-handling machines, annually, are shipped to Alaska. The machines
are disassembled, loaded on trucks and moved to Seattle where they are
reassembled, inspected and tested before loading aboard vessels bound for
Alaska. If the Skagit River were improved, the machines could be loaded
aboard a Skagit Corp. barge at Sedro Woolley without disassembly, and
under their own power, moved to Seattle, and loaded aboard the vessel.
Therefore, an annual saving of $1,000 would be possible.

f. The savings described above would require the purchase and
maintenance of two barges having a capacity of about 300 tons, and the
assumes for handling cargo. The initial investment in this equipment is
estimated at $25,000. Interest and amortization on this investment, plus
maintenance is estimated at $9,000 annually. As the equipment would be
used for other purposes than for transporting the items described above, only $5,000 of this amount is considered as an annual charge against the estimated Skagit Corp. benefits. The net benefit to Skagit Corp. from the proposed improvement of Skagit River is $42,000, summarized as follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
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<tbody>
<tr>
<td>Ship container loader shipments</td>
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<tr>
<td>Steel receipts</td>
<td>$2,000</td>
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<tr>
<td>Log-handling machine shipments</td>
<td>$2,000</td>
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<tr>
<td>Gross annual saving</td>
<td>$48,000</td>
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<tr>
<td>Less annual charges on barges and cranes</td>
<td>$6,000</td>
</tr>
<tr>
<td>Net annual benefit to Skagit Corp.</td>
<td>$42,000</td>
</tr>
</tbody>
</table>

27. Sedro Woolley Lumber Shipment - Two mills at Sedro Woolley sell annually, an average of 10,000,000 board-feet of lumber to the U.S. Navy. The lumber is then shipped to a port where it is loaded aboard ships. If the Skagit River channel were improved, the lumber would be loaded aboard barges at Sedro Woolley, barged to American, and loaded aboard ships from the barges. Use of barges would result in annual savings of $24,000 through reduced transportation, handling, and inspection costs.

28. Benet summary - A small barge terminal would be required at Sedro Woolley to permit lumber shipments and receipt of commodities to the Skagit Corp. A suitable terminal could be constructed at a cost of $113,000. Interest and amortization on this investment, plus annual maintenance, would equal to an estimated $3,000 annually, and would be a cost chargeable against all benefits from Sedro Woolley operations. Benefits are summarized as follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skagit Corp. at Sedro Woolley</td>
<td>$42,000</td>
</tr>
<tr>
<td>Lumber shipments at Sedro Woolley</td>
<td>$2,000</td>
</tr>
<tr>
<td>Total gross benefits at Sedro Woolley</td>
<td>$46,000</td>
</tr>
<tr>
<td>Less barge terminal charges at Sedro Woolley</td>
<td>$3,000</td>
</tr>
<tr>
<td>Net annual benefits, Sedro Woolley</td>
<td>$592,000</td>
</tr>
</tbody>
</table>
29. Comparison of benefits and costs — The ratio of annual benefits ($692,000) to annual costs ($471,000) is 1.45.

30. Funds required for study completion. —

   a. Study completion costs:

      (1) Surveys: Vertical control and cross-sections, including computing and drafting
          $22,500

      (2) Geological investigation
          1,000

      (3) Hydrology and hydraulics
          2,500

      (4) Designs and estimates
          4,000

      (5) Completion of economic studies
          2,000

      (6) Report preparation
          4,000

      (7) Contingency, supervision and overhead
          3,000

      (8) Total funds required to complete study
          45,000

   b. Estimated funds available for FY-1963
      20,000

   c. Balance required to complete study
      25,000

Surveys would require about 3-1/2 months and should be completed before the end of June 1963 to permit accomplishment before the low water season which usually starts in July, and to permit effective use of District field personnel before the heavy seasonal workload starts in the late spring season. Funding requirements to meet this schedule and provide for necessary supervision and miscellaneous studies are as follows:

   a. Estimated funds available for FY-63
      $20,000

   b. Additional funds required before 1 Mar. 1963
      10,000

   c. Funds required in FY-1964
      15,000

   d. Total funds required to complete study
      45,000

51. Recommendations - The Skagit River navigation study has been authorized and intermittently underway since 1954. In view of this fact, the favorable benefit-cost ratio based on limited field surveys, and the importance of the proposed project to the local economy, an effort should be made to complete the study as soon as practical. Therefore, the District Engineer recommends that a minimum of $16,000, in addition to funds presently available, be allocated to the Skagit River navigation study not later than 1 March 1963, and the remaining $15,000 needed to complete the study be allocated early in Fiscal Year 1964.

5 Incl
1. Map, File No. E-6-6-175
2. * * * * E-6-6-24
3. * * * * E-6-6-143
   (in 4 sheets)
4. Exhibit No. I (Hydrographs)
5. Benefit Computations

cc: Burley

ED P&R Br