CHAPTER 73

COASTAL PROCESSES AT OREGON INLET, NORTH CAROLINA

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INTRODUCTION

Coastal processes in the vicinity of Oregon Inlet, North Carolina were studied in connection with the design of a dual jetty system for that inlet. Oregon Inlet is the northernmost breach through the "Outer Banks" of North Carolina and is situated approximately 40 miles (64 km) north of Cape Hatteras and 90 miles (145 km) south of the ocean entrance to Chesapeake Bay, see Fig. 1. The improvements planned for this inlet are part of an overall plan of development directed at enhancing the fisheries industry of North Carolina through the provision of a modern fisheries center at the village of Wanchese, located on Roanoke Island, see Fig. 1. The general layout of the proposed jetty system is shown on Fig. 2. Certain aspects of this design will be referred to later in this paper.

In addition to their structural and functional aspects, a major part of the design of the jetties concerns the structure-shore interaction and means whereby adverse shore processes will be prevented in operating the project. Obviously, the construction of jetties or any other type of littoral barrier at an inlet would disrupt the normal movement of and processes associated with longshore sediment transport. Therefore, artificial means of moving littoral materials around a stabilized inlet must be employed to assure that the adjacent beaches are maintained in at least the same state existing prior to any navigation related improvements. The need for a reliable sand bypassing method at Oregon Inlet is accentuated by the fact that the inlet is bounded on the north by the Cape Hatteras National Seashore and on the south by the Pea Island Wildlife Refuge, both of which are Federally owned beach areas managed for the purpose of preserving the natural quality of the Outer Banks environment.

The design of a sand bypassing system must be based on a knowledge of the existing shore and inlet processes, particularly as they relate to the rate and directional distribution of longshore sediment transport. When the existing conditions are known, it is possible to estimate the sediment transport rates with the structures in place and, thus, predict the amount and direction in which material will have to be bypassed. This paper describes the approach taken to evaluate the existing and future longshore sediment transport in the vicinity of Oregon Inlet and briefly discusses the proposed bypassing system for the stabilized inlet.

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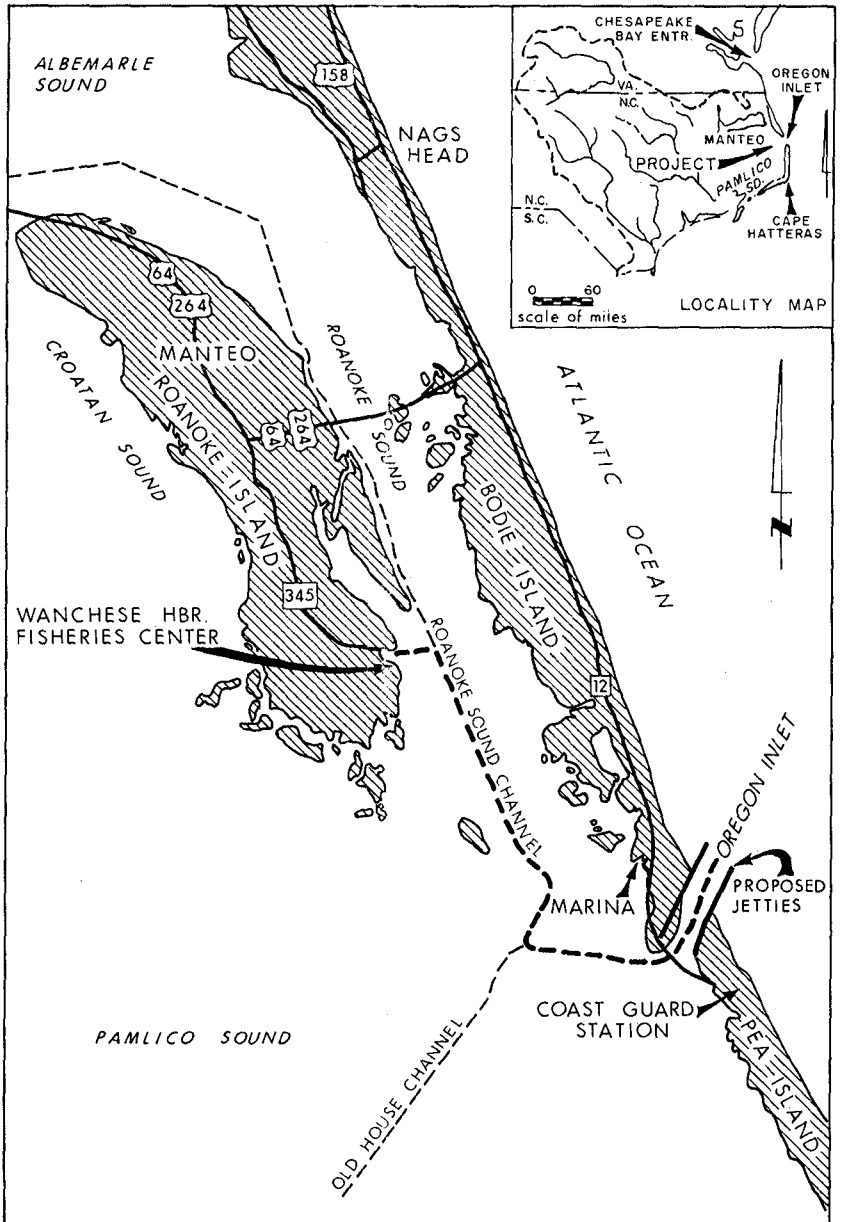


FIGURE 1 - OREGON INLET PROJECT MAP

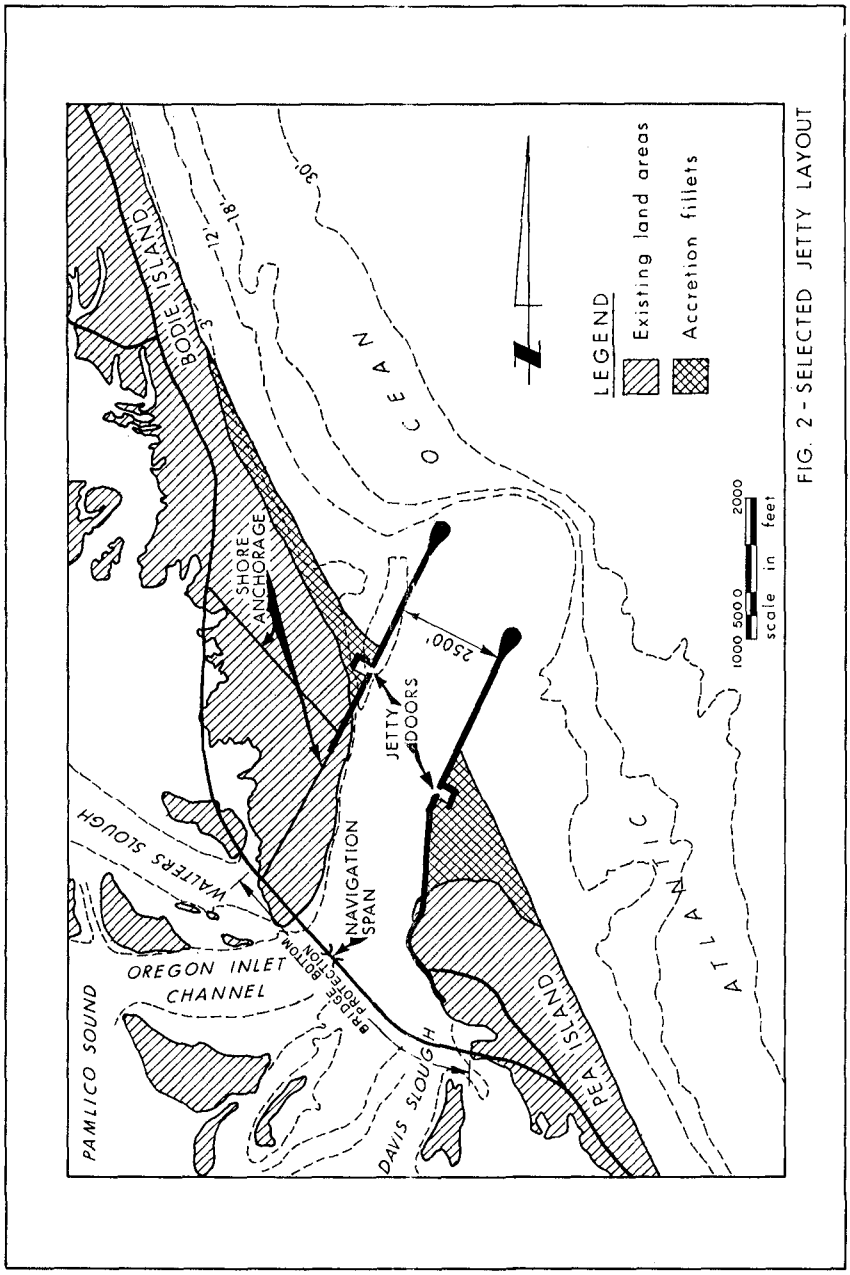


FIG. 2 - SELECTED JETTY LAYOUT

EXISTING LONGSHORE SEDIMENT TRANSPORT RATES

The estimate of the existing rate and directional distribution of longshore sediment transport in the vicinity of Oregon Inlet was accomplished through a sediment budget analysis which involved (1) an estimate of volumetric changes from the beaches and in the inlet for a selected time period, (2) wave refraction analysis to determine the variation of longshore energy flux along the shorelines north and south of the inlet, and (3) an estimate of the transport quantities by correlating the beach and inlet volume changes with the computed longshore energy flux distribution. The time period chosen for this analysis extended from 1965 to 1975, primarily because relatively accurate wave data was available for this period.

Beach Changes.

Changes in the shoreline position for the beaches adjacent to Oregon Inlet were determined from nearshore beach profiles surveyed in 1937 and 1964 and from a comparison of 13 sets of aerial photographs made between 1940 and 1975. As a result of these shoreline comparisons, the study area was divided into six segments or littoral cells, as shown on Fig. 3, based, in part, on the behavior of the beaches during the analysis period and on the relative orientation of the shoreline cells. Also indicated on Fig. 3 are the shoreline changes for the 1965-1975 period selected for the sediment budget analysis.

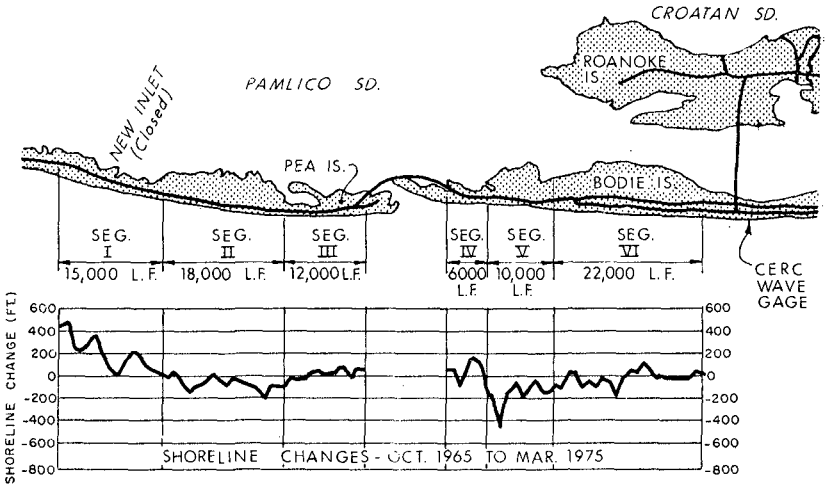


Fig. 3 - Shoreline Segments (or Littoral cells) and 1965-1975 Shoreline Changes

In order to perform the sediment budget analysis, the linear shoreline movements were converted to volumetric changes. This was accomplished by assuming that the entire active profile, i.e., that portion of the nearshore area influenced by wave action, moves at the same rate as the shoreline. In making this assumption, the beach volume changes were directly related to the total vertical distance of the active profile measured from the crest of the berm to some limiting depth. The identification of the limiting depth is difficult without comparative surveys; however, a reasonable estimate of this depth appears to be the deepest depth contour that maintains parallelism with the shoreline. In the case of the immediate study area, outside the influence of tidal currents flowing through Oregon Inlet, the -30 foot (-9.1 m) mean low water (MLW) depth contour satisfied this criterion. The crest elevation of the berm is about +8 feet (+2.4 m) MLW, thus the total vertical distance of the active profile was taken as 38 feet (11.5 m). This resulted in a volumetric equivalent factor (C) of 1.41 cu.yds/lin. ft. of shoreline/foot of erosion or accretion of the shoreline (11.5 m^3/m shoreline/m of shoreline change). The equivalent volumetric changes obtained by applying this factor to the 1965-1975 shoreline movements within each segment are given in table 1. Note that no volume changes are given for Segment IV since changes in this segment are included in the estimated volume changes for Oregon Inlet.

TABLE 1

Beach Volumetric Changes, 1965-1975

Segment	Length of Segment (ft)	(m)	Estimated Total Volume Change[1/] (cy/yr)	(m^3/yr)	Offshore Losses Due to Rising Sea Level (cy/yr)	(m^3/yr)
I	15,000	(4,572)	+155,000	(+118,513)	21,000	(16,057)
II	18,000	(5,486)	-188,000	(-143,745)	25,000	(19,115)
III	12,000	(3,658)	+ 10,000	(+ 7,646)	17,000	(12,998)
IV	Volume change included in Oregon Inlet					
V	10,000	(3,048)	-264,000	(-201,854)	14,000	(10,704)
VI	22,000	(6,706)	-127,000	(- 97,104)	31,000	(23,703)

[1/] + = accretion, - = erosion

The total volume changes given in table 1 include the affects of longshore movements of material and additions or losses associated with material moving normal to the beach such as the amount of sediment transported bayward when the beach is overtopped or onshore-offshore movements by wave activity. During the 1965-1975 analysis period, no overtopping of any consequence occurred along the study area. However, there was undoubtedly some losses offshore. Offshore losses from the littoral cells were estimated by a procedure developed by Bruun (1) in which shoreline erosion is related to sea level rise. These losses are also given in table 1.

Inlet Changes.

The recent history of Oregon Inlet dates from 1846 when the present-day inlet was opened by a hurricane. Prior to 1846 New Inlet, which was located 8 miles (12.9 km) south of Oregon Inlet (see Fig. 3),

was the only inlet through the North Carolina Outer Banks north of Cape Hatteras. Since its opening, Oregon Inlet has migrated an average distance of 10,000 feet (3,050 m) to the south as indicated by the superposition plots of the inlet shoreline positions shown on Fig. 4. This southward migration of the inlet has been accompanied by alternate widening and narrowing of the inlet in response to varying weather patterns. For example, between 1953 and 1962, the Oregon Inlet area experienced one of the most active storm periods of record. Included during this period was the Ash Wednesday Storm of March 1962 which caused considerable damage along the northeastern coast of the United States. As a result of these storms, Oregon Inlet, which has a normal width of about 2,100 feet (640 m), had attained a width of 7,150 feet (2,180 m) following the March 1962 storm. Since 1962, no severe storms have affected the Oregon Inlet area; consequently, the north shoulder of the inlet migrated rather rapidly to the south in the form of an elongated spit as shown by the 1975 shoreline in Fig. 4.

Changes in the volume of material in Oregon Inlet associated with its migratory history were determined from hydrographic surveys made in 1937, 1962, and 1975, and from dredging records associated with the construction and maintenance of the interior bay channels and the ocean bar channel.

Between 1937 and 1962, the ocean bar at Oregon Inlet lost a total of 3,343,000 cubic yards (2,556,000 m^3) of material. Since the March 1962 storm occurred just prior to the 1962 survey, it appears that the comparison of the 1937 and 1962 ocean bars reflect more on the losses resulting from the 1962 storm than on the general trend prior to this storm. For example, during the latest time period, 1962-1975, which has been relatively storm-free, the ocean bar has accumulated a gross amount of 2,835,000 cubic yards (2,168,000 m^3). This represents an annual accumulation rate of about 218,000 cubic yards/yr (167,000 m^3/yr). In addition to the buildup of material on the ocean bar between 1962 and 1975, the volume rate of accumulation associated with the development of the north spit following the Ash Wednesday storm amounted to 452,000 cu.yds./year (345,000 m^3/yr). Thus, the total volume rate of change on the ocean bar and north spit between 1962 and 1975 was 670,000 cu.yds/yr (512,000 m^3yr).

With respect to volumetric changes in the bay area, the 1937 survey showed that the main channel connecting Oregon Inlet and Roanoke Sound passed through Walters Slough, see Fig. 1. As Oregon Inlet migrated southward, Walters Slough shoaled to such an extent that it had to be abandoned and a new channel excavated to connect Oregon Inlet with Old House Channel. This new channel, designated as the Oregon Inlet Channel, was dredged in 1960 and followed essentially the same alignment as exists today. As was evident from the comparison of the hydrographic surveys and aerial photographs of the inlet, most of the volume changes in the bay associated with the migration of Oregon Inlet actually occurred prior to 1965. Since 1965, very little net change has taken place in the bay with the average accumulation estimated to be only 20,000 cu.yds/yr (15,000 m^3/yr).

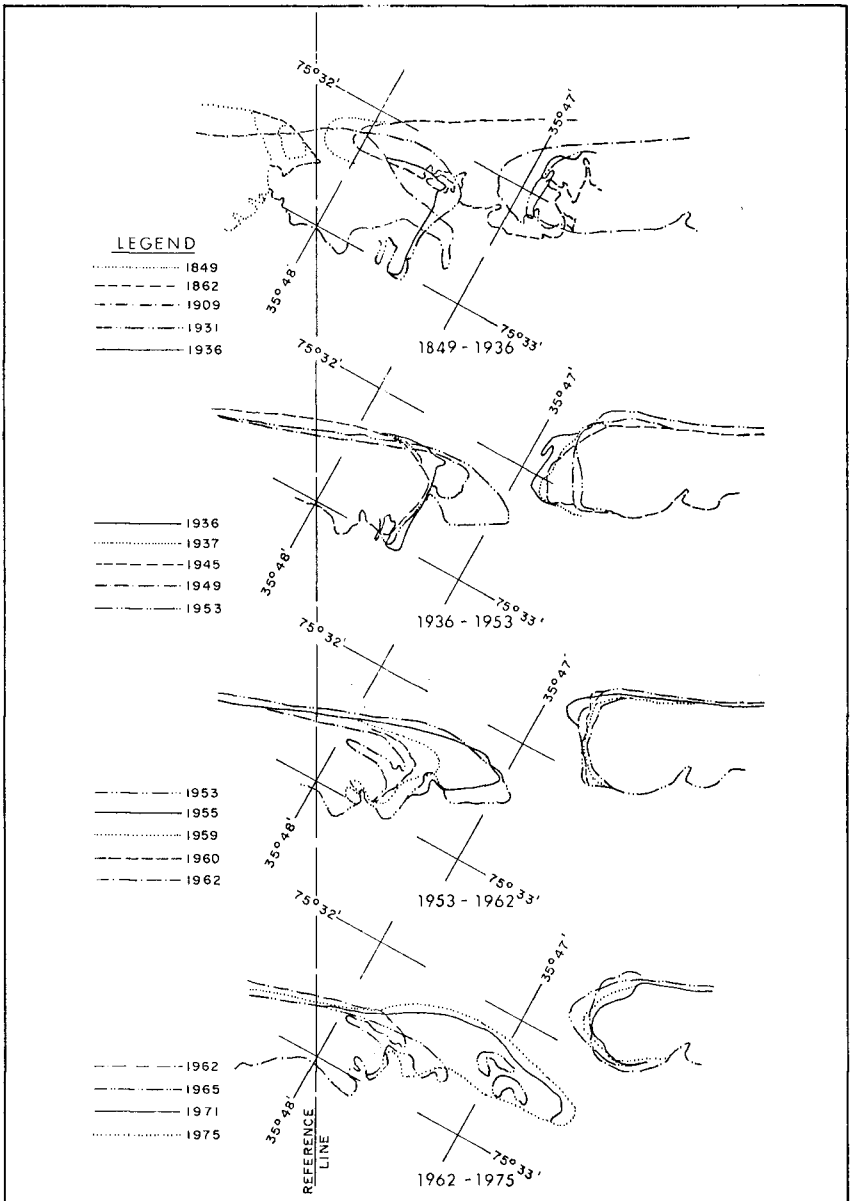


FIG. 4 - OREGON INLET SHORELINE POSITIONS 1849 - 1975

Based on these observed volume changes in Oregon Inlet, a volume rate of accumulation of 690,000 cu.yds/yr. (527,000 m^3/yr) was assumed to be representative of the volume changes in Oregon Inlet during the 1965 to 1975 period selected for the sediment budget analysis.

Wave Refraction-Longshore Energy Flux Analysis. The amount of material that moves parallel to the shoreline is directly related to the longshore component of wave energy flux in the surf zone. The computation of longshore energy flux at a particular site requires information on (a) the wave climate at the site, and (b) the effects of wave refraction on the distribution of the longshore energy flux along the shoreline as waves propagate toward shore from deep water.

Wave Climate. The wave characteristics used for this analysis were obtained from a Coastal Engineering Research Center (CERC) wave gage, located on an ocean fishing pier 9 miles (14.5 km) north of Oregon Inlet, see Fig. 3. A summary of the observed waves for the period July 1964 to April 1976 is given in table 2. The wave characteristics measured by this gage represent essentially 100 percent of all the waves (and, consequently, the wave energy flux) reaching the study area at the gage site. However, since the gaged data is non-directional, it was impossible to determine differences in the wave height-period distribution for the various directions of wave approach. Therefore, the same relative height-period distribution was used for all wave directions.

With the gaged wave data representing 100 percent of the wave energy flux from all possible directions at the gage location, this total energy flux was proportioned to the various directions of wave approach based on visual wave observations made by U.S. Coast Guard personnel at the Diamond Shoals (Cape Hatteras) and Chesapeake Bay light towers. The relative directional distribution of the wave energy applicable to the study is tabulated in table 3.

Longshore Energy Flux (P_{ls}). The method used to compute the distribution of longshore energy flux along a given reach of shoreline has been given previously in reference (2) and will not be repeated here. In essence, the computational procedure requires the refraction of a large number of wave rays toward the study area. In this analysis, 101 wave rays were refracted toward shore for each combination of wave period and direction applicable to the study area, resulting in the generation of 7,272 wave rays. For each wave ray pair, the value of the longshore energy flux was computed at the breaking point of eleven wave heights ranging from 0.5 ft. (.15 m) to 11 ft. (3.35 m). The results of each individual longshore energy flux computation for all combinations of wave height, period, and direction was interpolated at specific intervals along the coast and summed to yield the total downcoast and upcoast distributions of longshore energy flux. The resulting longshore energy flux distribution is shown on Fig. 5.

Computation of Littoral Transport Rates. The relationship between longshore sediment transport and longshore energy flux has the form:

$$Q_s = \beta P_{ls} \quad \text{where:} \qquad (1)$$

Q_s = the volume of sediment transported per year

β = constant

P_{ls} = annual longshore component of wave energy flux.

TABLE 2

Nags Head Wave Data
Summary of Percent Observations From CERC Wave Gage
Period of Record (Jul 1964 to Apr 1976)

Wave Period (secs)	Significant Wave Height (ft)												Total
	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	10-11	11-12	
0-1.9	0.04												0.04
2-2.9	0	0.11	0.01										0.12
3-3.9	0.09	1.42	1.10	0.25									2.86
4-4.9	0.01	0.84	1.63	0.94	0.27	0.01							3.70
5-5.9	0.09	1.63	2.73	2.72	1.54	0.62	0.27	0.01					9.61
6-6.9	0.15	1.94	2.76	2.50	1.95	1.26	0.59	0.20	0.05				11.40
7-7.9	0.26	3.09	2.27	1.43	1.19	1.04	0.47	0.33	0.16	0.05			10.29
8-8.9	0.87	9.11	5.40	2.38	1.58	0.95	0.51	0.41	0.25	0.09		0.04	21.59
9-9.9	0.41	5.67	3.49	1.83	1.00	0.52	0.29	0.37	0.16	0.05			13.79
10-11.9	0.41	3.80	3.12	2.02	0.91	0.83	0.63	0.27	0.24	0.08			12.31
12-13.9	0.31	2.69	2.01	1.31	1.03	0.74	0.62	0.40	0.16	0.08	0.04		9.39
14-15.9	0.22	1.25	0.78	0.36	0.33	0.21	0.32	0.27	0.16	0.04			3.94
>16	0.04	0.38	0.15	0.11	0.07	0.07	0.05	0.05	0.04	0			0.96
Total	2.90	31.93	25.45	15.85	9.87	6.25	3.75	2.31	1.22	0.39	0.04	0.04	100.00

TABLE 3

Relative Distribution of Offshore Wave Energy
for the Oregon Inlet Area

	Wave Direction							
	North	NNE	NE	ENE	E	ESE	SE	SSE
% Wave Energy	22.65	20.56	15.24	9.83	5.85	7.78	8.46	9.64

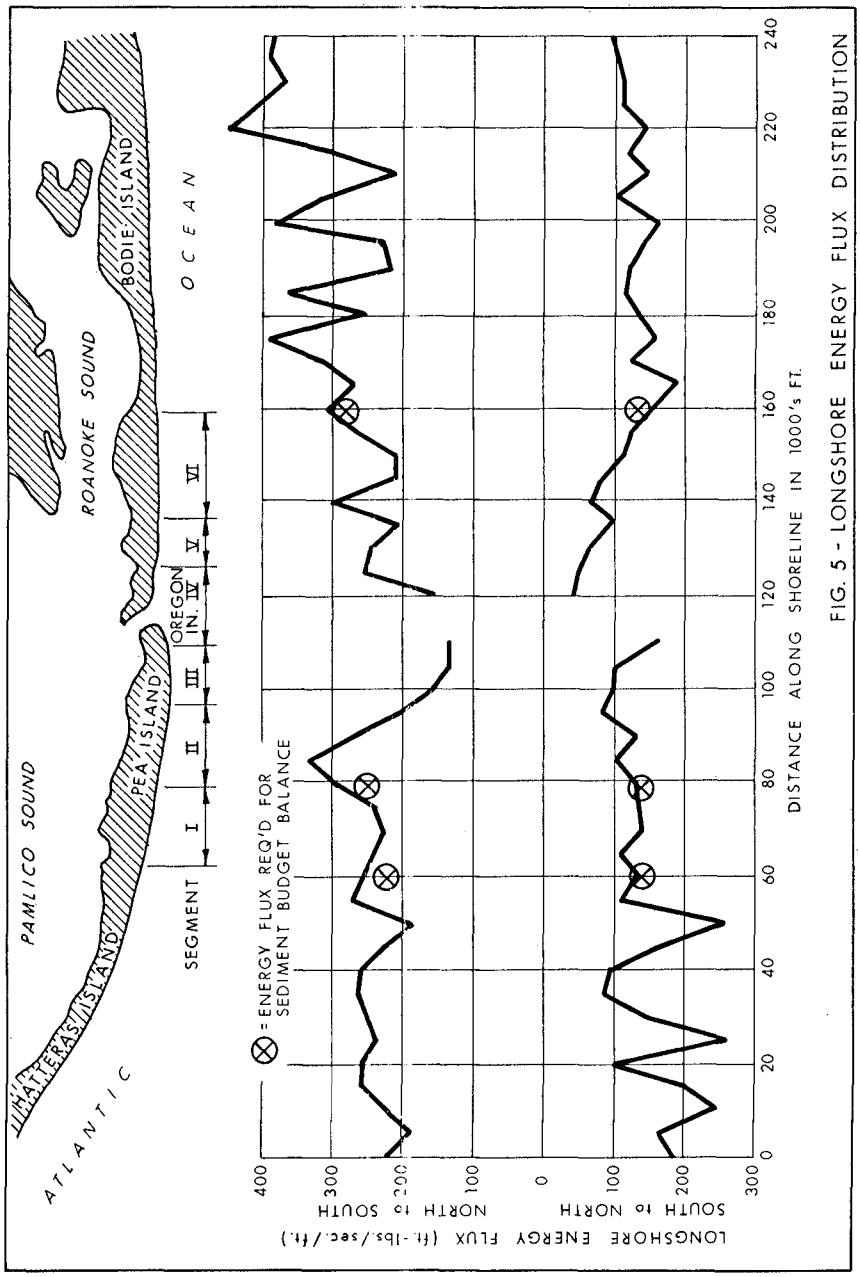


FIG. 5 - LONGSHORE ENERGY FLUX DISTRIBUTION

Although values of β have been proposed based on field and laboratory measurements, in this analysis, β is assumed to be unknown. Also, since the longshore energy flux analysis is not applicable to the immediate area of the inlet, due to the complex bottom and tidal current-wave interactions, two unknowns in addition to β are introduced into the sediment budget analysis to represent the amount of natural bypassing of sediment across the inlet in the downcoast (SB) and upcoast (NB) directions. Thus, with three unknowns, three conditions must be established to solve for these values. This was accomplished by balancing the sediment budget between the inlet cell and the two littoral cells immediately adjacent to the inlet as shown schematically on Fig. 6. It is remarked that the relative longshore transport values expressed as $(P_{ls})\beta$ in Fig. 6 were determined from the results of the longshore energy flux computations at the boundaries of the littoral cells. The solution of the sediment budget for the condition shown in Fig. 6 resulted in a value of β of 6,018 for sediment transport expressed in cu.yds/yr. This gave computed natural bypassing quantities of 1,232,000 cu.yds/yr (942,000 m^3/yr) to the south (SB) and 133,000 cu.yds/yr (102,000 m^3/yr) to the north (NB).

With the value of β determined, the sediment budgets of the other shoreline segments (or littoral cells) was computed. However, in order to balance the amount of sediment moving into and out of each cell, the assumption was made that the estimated volume rates of change within each cell are absolute and that any adjustments required to obtain a complete sediment balance would be made in the computed values of the longshore energy flux at the cell boundaries. For the most part, the amount of adjustment required to obtain a sediment balance was less than 12 percent. The adjusted values of P_{ls} required to balance the sediment budget for all littoral cells are indicated on Fig. 5, whereas the final results of the longshore transport analysis for the 1965 to 1975 time period is summarized schematically on Fig. 7.

SHORELINE ADJUSTMENTS AND LONGSHORE TRANSPORT RATES FOLLOWING JETTY CONSTRUCTION

Changes in the shoreline configuration and sediment transport rates adjacent to the proposed jetties at Oregon Inlet were estimated based on the assumption that sediment transport would vary in direction proportion to changes in the breaker angle ($\Delta\alpha_b$) relative to the pre-jetty shoreline. If α_b is the average breaker angle relative to the pre-jetty shoreline associated with a longshore transport rate Q_s, then the transport rate along a shoreline reach having an average breaker angle of $(\alpha_b + \Delta\alpha_b)$ would be:

$$Q_{sn} = \psi_n Q_s \qquad (2)$$

where:

Q_{sn} = transport rate along reach n

$$\psi_n = \frac{\sin 2 (\alpha_b + \Delta\alpha_{bn})}{\sin 2\alpha_n}$$

$\Delta\alpha_{bn}$ = change in average breaker angle within reach n.

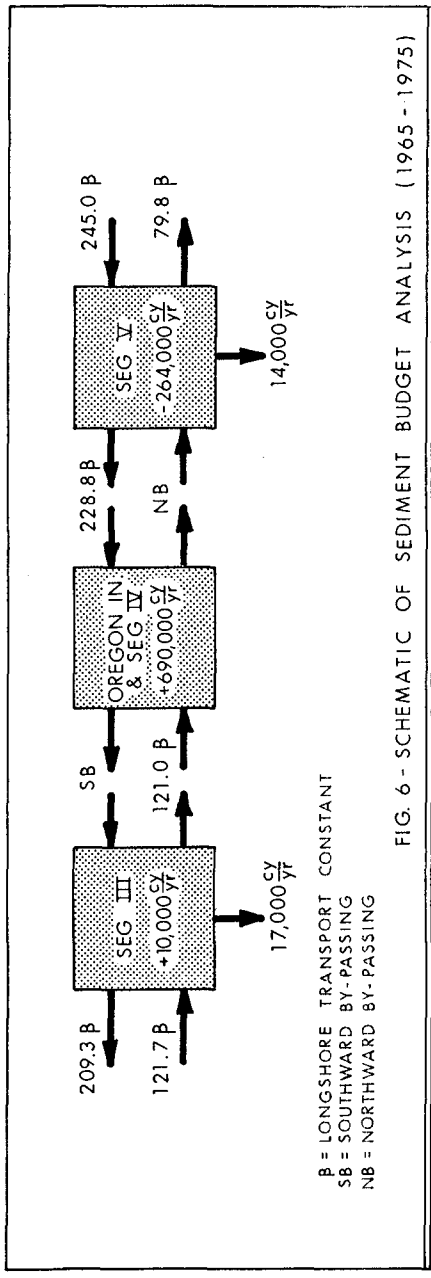


FIG. 6 - SCHEMATIC OF SEDIMENT BUDGET ANALYSIS (1965 - 1975)

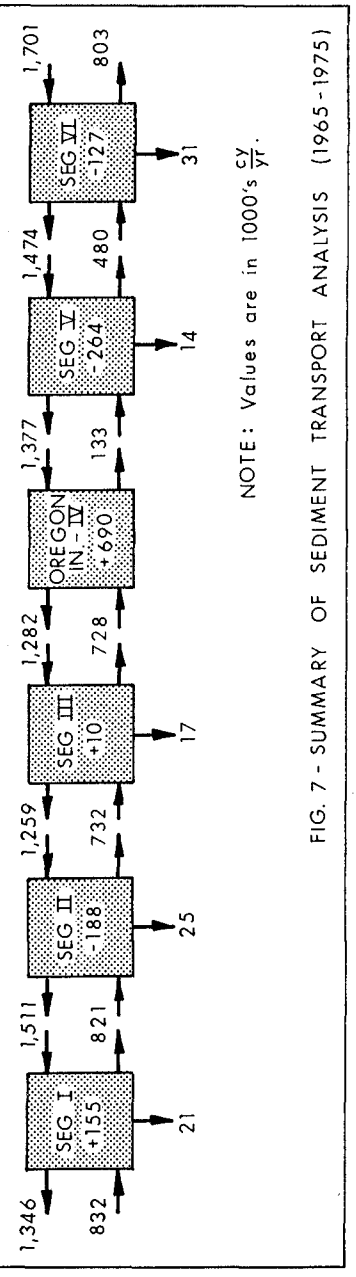


FIG. 7 - SUMMARY OF SEDIMENT TRANSPORT ANALYSIS (1965 - 1975)

In setting up the procedure to compute the shoreline adjustments adjacent to the jetties, the shoreline was divided into reaches of various lengths (L_n) as shown on the definition sketch in Fig. 8, where L_n does not have to be the same for each reach. The midpoint of reach n, measured from the intersection of the pre-jetty shoreline with the jetty, is designated as X_n.

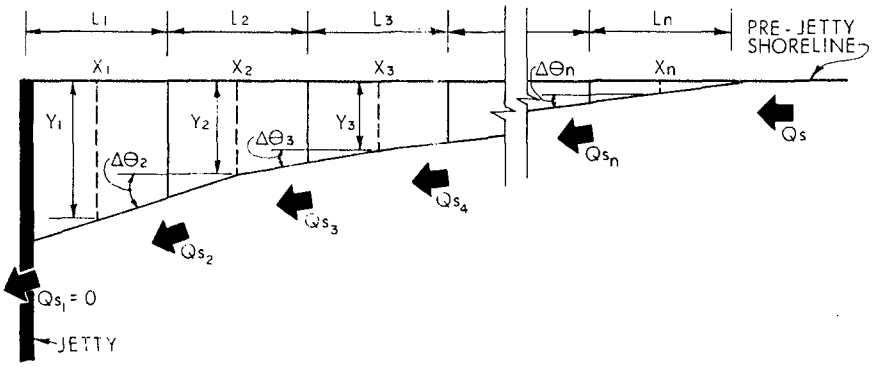


Fig. 8 - Definition Sketch for Shoreline Adjustment Computations

If the volume of material in a reach changes by an amount ΔVOL, during some time interval Δt, then the average seaward or landward movement of the reach, measured at its midpoint, would be:

$$\Delta Y_n = \frac{\Delta VOL}{L_n \, C} \tag{3}$$

where:

ΔY_n = average movement of reach n occurring during a time interval Δt

L_n = length of reach n

C = volumetric equivalent factor relating volume changes to linear movements (see previous discussion)

$\Delta VOL = (Q_{sn} - Q_{sn-1})t \, \Delta t$

$(Q_{sn} - Q_{sn-1})t$ = difference in the volume rate of longshore transport at the downdrift and updrift boundaries of the reach at time step t.

Δt = time interval between shoreline position computations

At the end of some time period t, the midpoint of reach n would have moved through a total distance Y_n measured from the pre-jetty shoreline. If the rate of longshore transport varies from reach to reach, then the amount of movement of the various reaches would not be the same. This would result in a change of shoreline orientation between the reaches relative to the original shoreline by an angle given by:

$$\Delta\theta_n = \tan^{-1}\left(\frac{Y_{n-1} - Y_n}{X_{n-1} - X_n}\right) \quad (4)$$

Therefore, for the simplified case in which the effects of changes in wave refraction are ignored, the breaker angle in reach n at time t would be:

$$(\alpha_{bn})t = \alpha_b + \Delta\theta_n \quad (5)$$

and the associated longshore transport within this reach during time step t would be computed as:

$$(Q_{s_n})t = Q_s\left(\frac{\sin 2(\alpha_b + \Delta\theta_n)}{\sin 2\alpha_b}\right) \quad (6)$$

Equation (6) is valid as long as wave angles, relative to the bottom contours are small and the waves are not diffracted by the structure. However, if diffraction does occur, the angle at which the diffracted wave would break relative to the original shoreline (designated as α_b') would differ from the average breaker angle associated with Q_s. Furthermore, the height of the waves in the diffraction zone would be reduced by the diffraction coefficient K', which in turn would reduce longshore transport by an amount proportional to $(K')^2$. If the shoreline within the diffraction zone has also undergone an angular change ($\Delta\theta_n$), then the transport rate in the shadow zone of the structure would be:

$$Q_{s_n}' = \psi_n' \, Q_s \quad (7)$$

where:

$$Q_{s_n}' = \text{transport rate in the diffraction zone} \quad (8)$$

$$\psi_n' = (K')^2\left(\frac{\sin 2\,(\alpha_b' + \Delta\theta)}{\sin 2\alpha_b}\right)$$

In applying the above procedure to Oregon Inlet, an average breaker angle (α_b) of 12°, determined from the wave refraction analysis, was used for the longshore transport rates along the pre-jetty shoreline in both the north and south directions. North of the inlet, the pre-jetty shoreline transport rates (Q_s) used were 1,377,000 cu.yds/yr (1,053,000 m^3/yr) to the south and 480,000 cu.yds/yr (367,000 m^3/yr) to the north, whereas south of the inlet, the pre-jetty shoreline transport rates were 1,259,000 cu.yds/yr (963,000 m^3/yr) south and 728,000 cu.yds/yr (557,000 m^3/yr) north. These annual longshore drift rates correspond to the rates computed for Segment V and III, respectively, as shown on Fig. 7.

Since the shoreline adjustments and sediment transport rates adjacent to the jetties are time dependent, realistic results can only be obtained if the time increment (Δt) between shoreline position computations is relatively small. For this analysis, the time increment varied from about 1 to 2 weeks, with the amount and direction of longshore transport occurring during a particular time increment being based on a simulated yearly time distribution of the longshore drift as developed from the wave gage and light tower wave records.

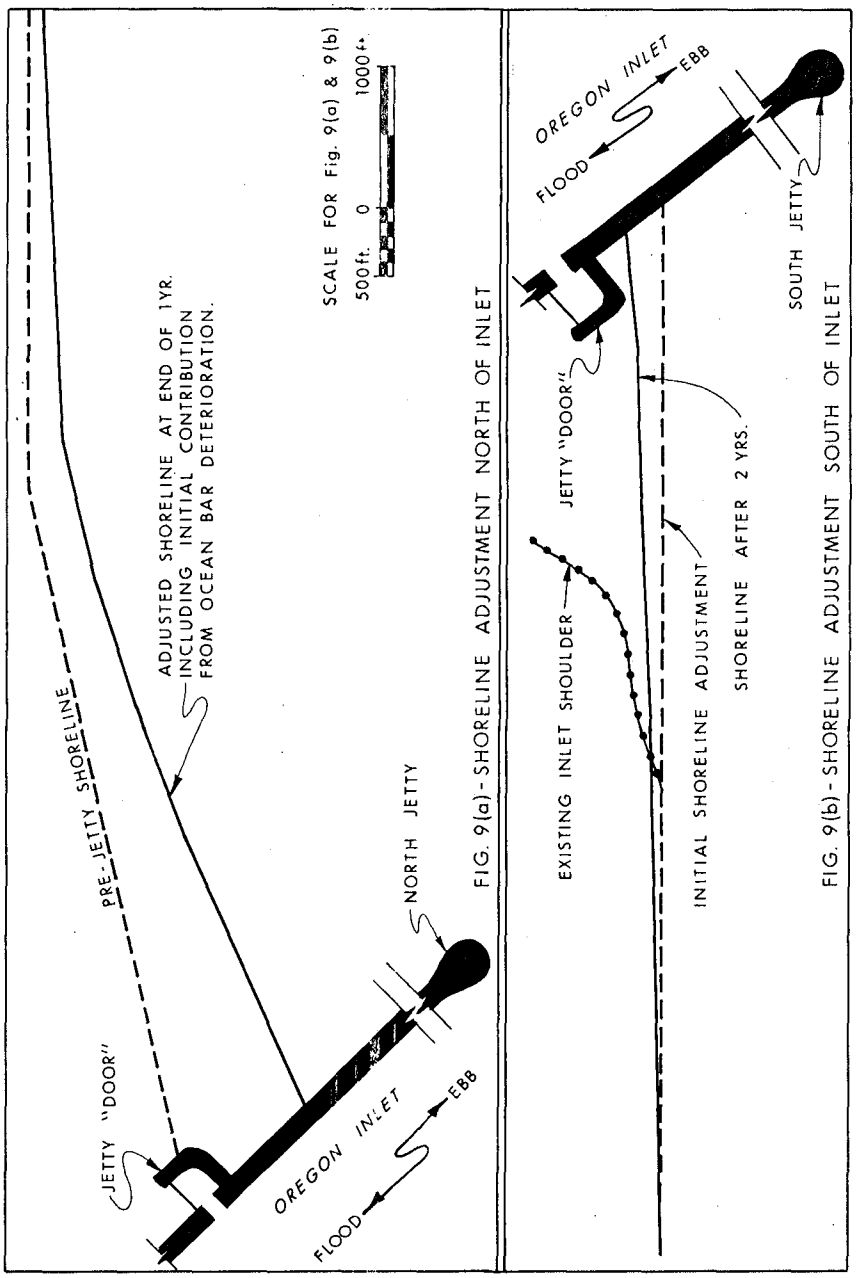
For the shoreline updrift of the north jetty, wave diffraction effects associated with waves approaching from the southern quadrants were estimated by using an average angle of wave incidence relative to the north jetty of 60°. This angle of wave incidence was based on the seaward refraction of a wave having an 8.5-second period (approximately the average period for the study area) and a breaker angle of 12°, out to the head of the proposed north jetty. On the south side of the inlet, wave diffraction would be of minor importance as the average angle of wave approach from the northern quadrants is less than the angle the proposed south jetty makes with the shoreline.

The predicted shoreline changes north and south of Oregon Inlet, following jetty construction, are given on Fig. 9(a) and 9(b), respectively. As noted on these figures, the total shoreline changes include some initial adjustments associated with the redistribution of the ocean bar deposits toward shore once tidal flow over these shoal areas is eliminated. On the north side, a total of 3,600,000 cu.yds. (2,753,000 m^3) of material was distributed along the shoreline in a shape predicted by the shoreline evolution theory developed by Pelnard-Considere (3). This 3,600,000 cu.yds. (2,753,000 m^3) of fillet material represents approximately 75 percent of the estimated total volume of material north of the inlet that would be subject to redistribution once the jetties are built. This percentage of the total volume was assumed to move onshore next to the jetty since approximately 75 percent of the gross drift in this area is to the south. On the south side of the inlet, the initial shoreline adjustment simply involved the projection of the shoreline alignment of Segment III from the existing south shoulder of the inlet to the point of intersection with the south jetty. The volume of material required to straighten this portion of the shoreline would be about 1,200,000 cu.yds. (918,000 m^3), whereas the total volume of material south of the inlet that may eventually be redistributed is estimated to be in excess of 9,400,000 cu.yds. (7,187,000 m^3). The time required for these initial adjustments to occur is not known; however, since the construction of the jetties will take 3 to 4 years, most of these initial adjustments will probably take place during this period.

With respect to the deposition of the net southward drift of 897,000 cu.yds/yr (686,000 m^3/yr) along the shoreline north of the inlet, the shoreline adjustment computations indicated that approximately 50 percent would be deposited within about 5,500 feet (1,676 m) of the north jetty. The balance of the net drift would be spread over about 14,500 feet (4,422 m) of shore further north. On the south side, most of the 531,000 cu.yds/yr (406,000 m^3/yr) deficit would be felt within a 6,500-foot (1,981 m) segment immediately south of the jetty. Obviously, in order to maintain a stable shoreline south of Oregon Inlet, an average of 531,000 cu.yds/yr (406,000 m^3/yr) would have to be placed along this beach.

SAND BYPASSING AT OREGON INLET

The bypassing plan being developed for Oregon Inlet will require a cutter-suction pipeline dredge to operate on the accretion fillets immediately adjacent to the jetties. In order to limit the dredge to a minimum amount of wave exposure, special openings or "doors," as shown


JETTY "DOOR"
PRE-JETTY SHORELINE
ADJUSTED SHORELINE AT END OF 1YR.
INCLUDING INITIAL CONTRIBUTION
FROM OCEAN BAR DETERIORATION.
SCALE FOR Fig. 9(a) & 9(b)
500ft. 0 1000ft.
NORTH JETTY
OREGON INLET
EBB
FLOOD
FIG. 9(a) - SHORELINE ADJUSTMENT NORTH OF INLET
OREGON INLET
EBB
FLOOD
JETTY "DOOR"
EXISTING INLET SHOULDER
INITIAL SHORELINE ADJUSTMENT
SHORELINE AFTER 2 YRS.
SOUTH JETTY
FIG. 9(b) - SHORELINE ADJUSTMENT SOUTH OF INLET

on Fig. 2, have been designed near the landward ends of both jetties to permit a dredge to cut its way onto the bayside of the fillets. Note that these openings have been included in both jetties to allow for bypassing from either side of the inlet if conditions so dictate. Although most of the material to be bypassed can be removed from the subaerial fillet accumulations, a certain amount will have to be taken from the normally turbulent nearshore zone in order to prevent the movement of material around the seaward end of the jetty. During this nearshore phase of the bypassing operation, a floating breakwater will be positioned seaward of the borrow area in order to increase the production time of the dredge. A schematic representation of the bypassing operation is shown on Fig. 10. As a result of the bypassing operation, a deposition basin will be created in the fillet area adjacent to the jetty, which would serve to entrap littoral materials for subsequent bypassing operations.

In an attempt to determine the feasibility of this bypassing arrangement, at least from the sediment transport aspects, a simulated sediment trap was imposed on the shoreline immediately adjacent to the north jetty as shown on Fig. 11. The size of this trap equaled a two-year bypassing requirement for the south side of the inlet. By applying the shoreline adjustment procedure outlined above, an estimate was made of the shoreline configuration in the vicinity of the sediment trap at the end of three months, one year, and two years following the bypassing operation. These shorelines are also shown on Fig. 11.

On the basis of this analysis, bypassing directly from the fillet appears feasible in that the sediment trap was essentially filled at the end of the two-year period. Just as important, however, was the indication that material would not be transported around the seaward end of the jetty and that a stable beach would be created for a considerable distance updrift. Some verification of the functional aspects of the fillet deposition basin should be available following movable-bed hydraulic model tests which will be conducted in the near future.

References

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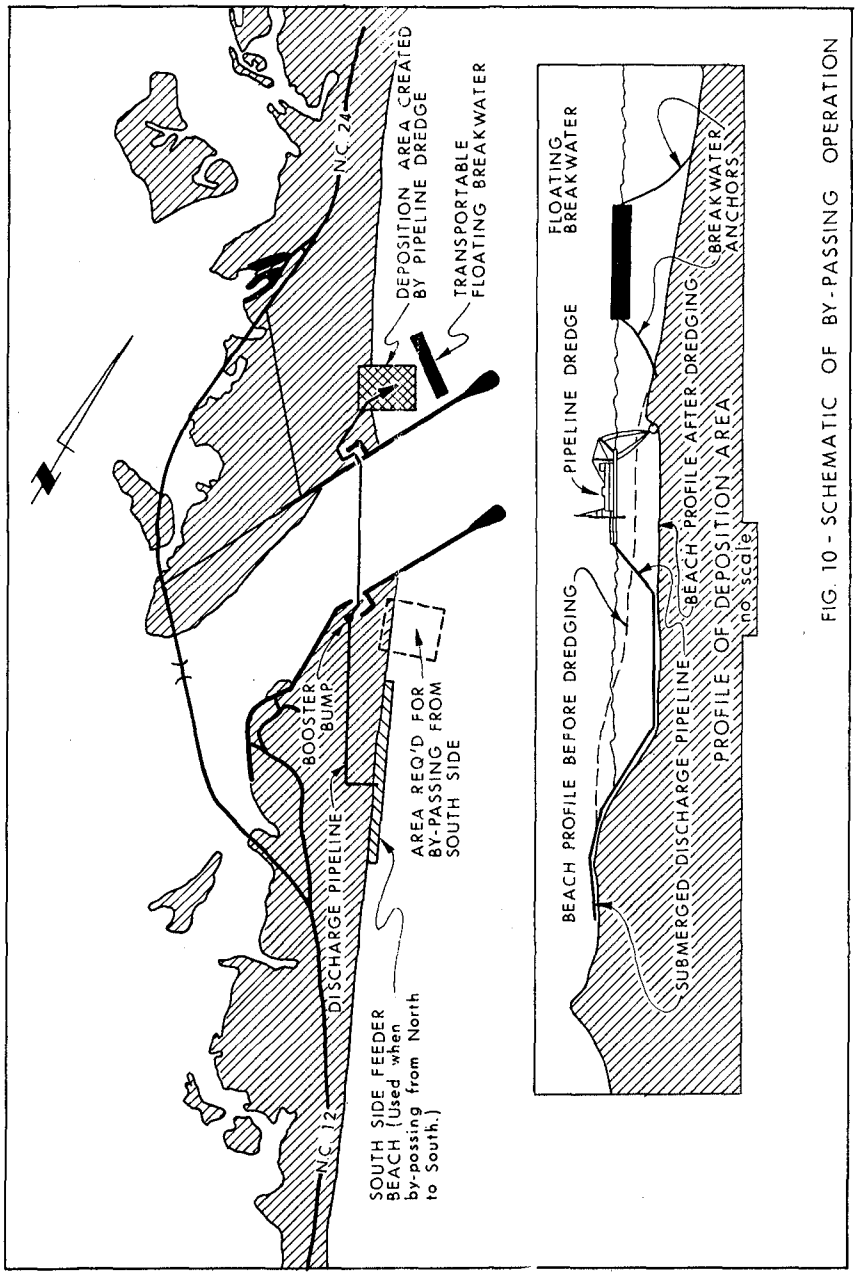

FIG. 10 - SCHEMATIC OF BY-PASSING OPERATION

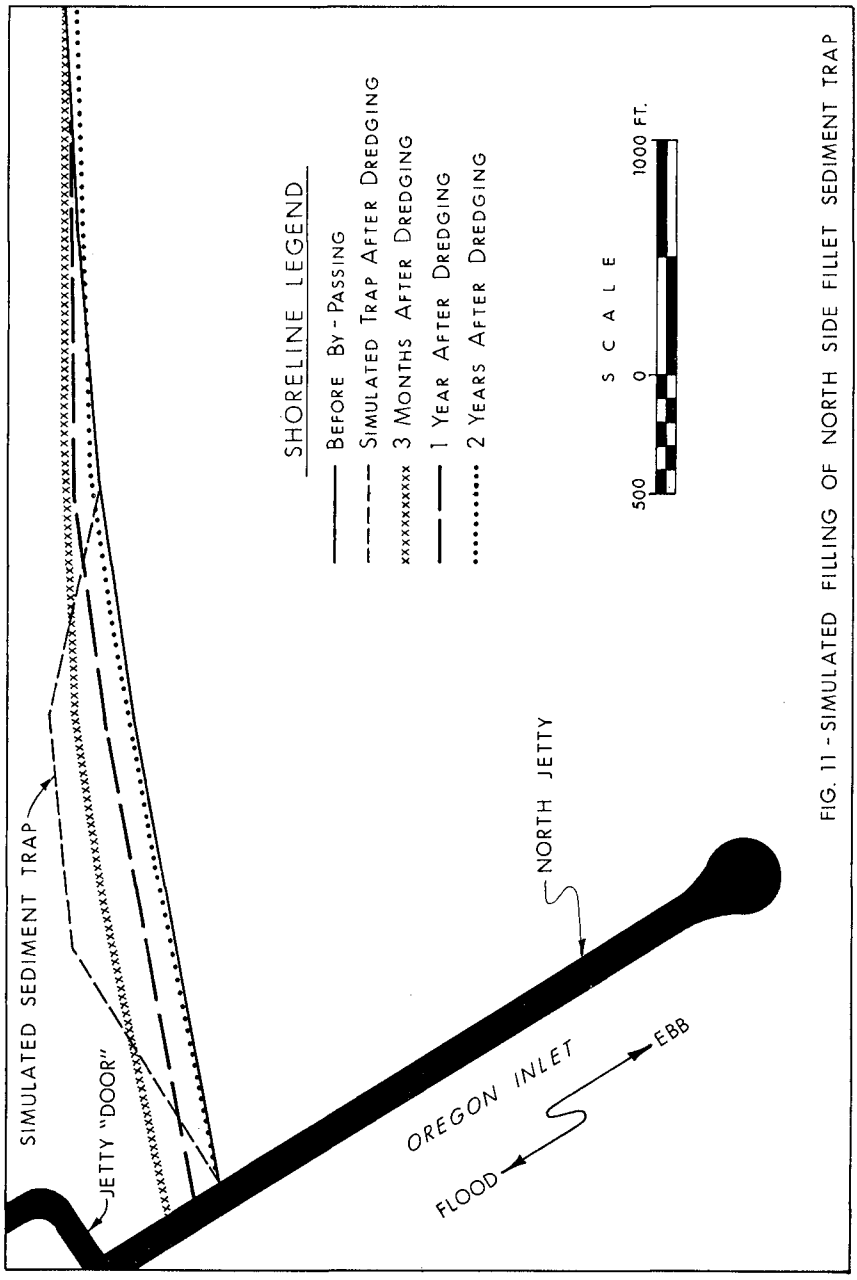

FIG. 11 - SIMULATED FILLING OF NORTH SIDE FILLET SEDIMENT TRAP