Table 5.4
Corps of Engineers Samples of Native Beach Material from Atlantic Beach, NC
Prior to disposal of navigation material on Atlantic Beach
Sample date 1972 and
Composite Native Beach Characteristics Based on Combined COE and CSE Samples

	Profile 70+00			Profile 140+00			Profile 219+00			Profile 290+00		
Sample	Mean (M)	Std.Dev. (s)	Variance	Mean (M)	Std.Dev. (s)	Variance	Mean (M)	Std.Dev. (s)	Variance	Mean (M)	Std.Dev. (s)	Variance
Elev. Mlw	phi units	phi units	(s^2)	phi units	phi units	(s^2)	phi units	phi units	(s^2)	phi units	phi units	(s^2)
Top Berm	2.53	0.30	0.09	2.28	0.45	0.20	2.45	0.30	0.09	2.18	0.38	0.14
6	2.37	0.38	0.14	2.57	0.52	0.27	2.33	0.40	0.16	2.03	0.46	0.21
4	2.58	0.27	0.07	2.38	0.35	0.12	2.50	0.31	0.10	1.94	0.70	0.49
2	2.25	0.44	0.19	2.18	0.40	0.16	2.13	0.36	0.13	1.97	0.41	0.17
0	1.66	0.87	0.76	1.83	0.75	0.56	1.72	0.52	0.27	0.34	1.37	1.88
-2	1.80	0.86	0.74	1.91	0.81	0.66	1.61	0.80	0.64	1.76	0.82	0.67
-4	2.59	0.39	0.15	2.19	0.59	0.35	2.71	0.46	0.21	2.48	0.51	0.26
-6	2.38	0.47	0.22	2.15	0.57	0.32	2.57	0.55	0.30	2.85	0.43	0.18
-8	2.57	0.38	0.14	2.52	0.40	0.16	2.37	0.54	0.29	2.56	0.56	0.31
-10	1.56	0.78	0.61	2.97	0.34	0.12	2.92	0.35	0.12	3.08	0.37	0.14
-12	1.31	0.60	0.36	3.10	0.35	0.12	3.02	0.42	0.18	3.01	0.48	0.23
-14	2.52	0.45	0.20	3.10	0.35	0.12	3.07	0.36	0.13	3.02	0.42	0.18
-16	2.36	0.52	0.27	3.07	0.39	0.15	3.11	0.37	0.14	3.08	0.42	0.18
-18	2.49	0.49	0.24	3.08	0.38	0.14	3.09	0.40	0.16	3.05	0.44	0.19
-20	2.45	0.50	0.25	3.05	0.41	0.17	3.12	0.38	0.14	3.06	0.43	0.18
-22	2.47	0.52	0.27	3.00	0.42	0.18	3.06	0.43	0.18	3.02	0.46	0.21
-24	2.86	0.34	0.12	3.01	0.41	0.17	3.00	0.49	0.24	2.79	0.68	0.46
-26	2.67	0.43	0.18	3.04	0.39	0.15	2.77	0.75	0.56	2.85	0.72	0.52
-28	2.59	0.52	0.27	2.33	1.05	1.10	2.25	1.21	1.46	2.59	0.87	0.76
-30	2.18	0.52	0.27	2.49	0.54	0.29	2.73	0.78	0.61	2.58	0.90	0.81

Composite Characteristics of COE Samples between -2 feet and -20 feet

Samples from -2 to -20 feet

composite Mean = M 2.62 phi 0.16 mm

s^2 = 0.26

s = 0.51 phi

A = 1.31

B = 3.12

composite variance = $s^2_{comp} = s_c^2 = s^2 + ((B-A)^2)/12$

s^2_{comp} = 0.53

s_{comp} = 0.73

Weighted Average for CSE & COE Samples

CSE average of 3 samples collected from foreshore of each sample station
COE average of 10 samples collected between -2 feet and -20 feet

Weighted Mean = $((M_{CSE} \times 3) + (M_{COE} \times 10))/13$ = 2.40 phi
0.189 mm

Weighted Var = $((s^2_{CSE} \times 3) + (s^2_{COE} \times 10))/13$ = 0.536 $(phi)^2$
Weighted Standard Deviation = 0.732 phi

for the relocated channel included consideration of the size characteristics of the existing ebb tide channel, numerical model studies of tides and currents in the inlet, and channel shoaling/stability criteria. An added feature of the overall design of the channel relocation project is the closure of the existing channel by constructing a sand dike in the vicinity of The Pointe. Numerical modeling was also used to evaluate the impacts of closing the existing channel on flow patterns in the system and to assess the impacts of the proposed inlet modifications on flow circulation throughout the inlet complex.

6.1. Design of Channel Cross-Section. The existing ebb channel through the inlet follows a circuitous route (Figure 1.2) from Dudley Island past The Pointe and across the ebb tidal delta. The cross-sectional area of the existing ebb channel also varies markedly. As a result of the variable dimensions of the existing channel, the proposed cross-sectional area of the relocated channel will have a variable cross-section as it projects seaward across the ebb tidal delta. The variable cross-section will be accomplished by varying the bottom width of the channel at given depths. Two sets of variable bottom widths were evaluated (Table 6.1), one with a maximum width of 400 feet and the other with a maximum width of 500 feet.

Table 6.1
Proposed Variable Channel Bottom Widths

Stations (feet)	Maximum Bottom Width 400-feet	Maximum Bottom Width 500-feet
0+00 to 25+00	150 feet	150 feet
25+00 to 35+00	Width increased from 150 feet to 400 feet	Width increased from 150 feet to 500 feet
35+00 to 55+00	400 feet	500 feet
55+00 to 60+00	Width decreases from 400 feet to 200 feet	Width decreases from 500 feet to 200 feet
60+00 to End	200 feet	200 feet

Due to the shallow depths that exist across the ebb tidal delta, the only practical way to relocate the channel is with an ocean certified cutter-suction pipeline dredge. These dredges have a minimum operational depths of approximately 12 feet. Therefore, the minimum channel depth considered was 13.5 feet below NGVD (-12.0 feet MLW) with incremental depths of 15.5 feet NGVD and 17.5 feet NGVD also evaluated. The side slopes of the channel specified for construction will be 1 vertical to 5 horizontal (1V:5H), however, as discussed below, the ultimate side slopes that the new channel will assume will be much flatter.

Repositioning of the inlet channel combined with the closure of the existing channel next to The Pointe, either by the deposition of naturally transported littoral sediment or

through direct placement of dredged material, will reduce or completely eliminate flows in the existing channel. The remnants of the existing channel will shoal and a new sand spit will develop off the west end of Emerald Isle. With a properly sized channel, the flow diverted from the existing channel will be funneled through the new channel and the flow areas across the ebb tidal delta will adjust to areas comparable to the existing flow areas. The adjustments likely to occur following the construction of the new channel would include the flattening of the channel side slopes from 1V:5H to between 1V:20H and 1V:50H, which are comparable to those of the existing channel. Construction slopes flatter than 1V:5H are not practical given the operational constraints associated with an ocean certified pipeline dredge. The formation of a channel side slope during construction is generally the result of material sloughing as the dredge undercuts the bank. As a result of the post-construction adjustments, the new channel would assume the same characteristics as the existing bar channel. Figure 6.1 shows a hypothetical sand spit that is expected to form off the west end of Emerald Isle, the general location of the proposed sand dike and the seaward portions of the existing channel that would naturally shoal following channel relocation.

6.2 Sand Dike Alternatives With the new channel assuming the majority of the flow, the final adjustments in the inlet's cross-sectional area will be the same with or without the sand dike across the existing ebb channel. However, the time required for the adjustments to occur will be somewhat longer without the dike as residual flow would continue to occur in the existing channel thus slowing the rate of shoaling. There is also some degree of uncertainty that the new channel would become the dominant channel if the existing channel is not closed immediately.

Without the sand dike, the existing channel would eventually be filled with sediment derived from the west end of Emerald Isle and the collapse of the ebb tide delta. A total of 1,493,000 cubic yards of sediment would be needed to completely fill the existing channel over a period of four to six years. This volume represents approximately 72% of the sediment expected to be eroded from the west end of Emerald Isle or transported onshore from the collapse of the ebb tide delta. If a sand dike is constructed across the existing channel in the vicinity of cross-section 35+00 as shown on Figure 6.1, 1,006,000 cubic yards would initially be deposited in the channel area seaward of the dike with an additional 184,000 cubic yards eventually working its way to the channel area landward of the dike. With closure of the existing channel, longshore transport would be essentially unimpeded by tidal currents as would the onshore movement of the abandoned ebb tide delta material. In this case, the existing channel is expected to be almost completely filled in two years with the sand spit rapidly forming off the west end of Emerald Isle.

Model simulations found the following conclusions regarding the sand dike:

- The new channel alignment will increase flow through the center of the inlet complex. However, without a closure of the existing channel, there will still be a substantial concentration of flow adjacent to Emerald Isle. The concentration of flow near the southern bank of Dudley Island will remain.