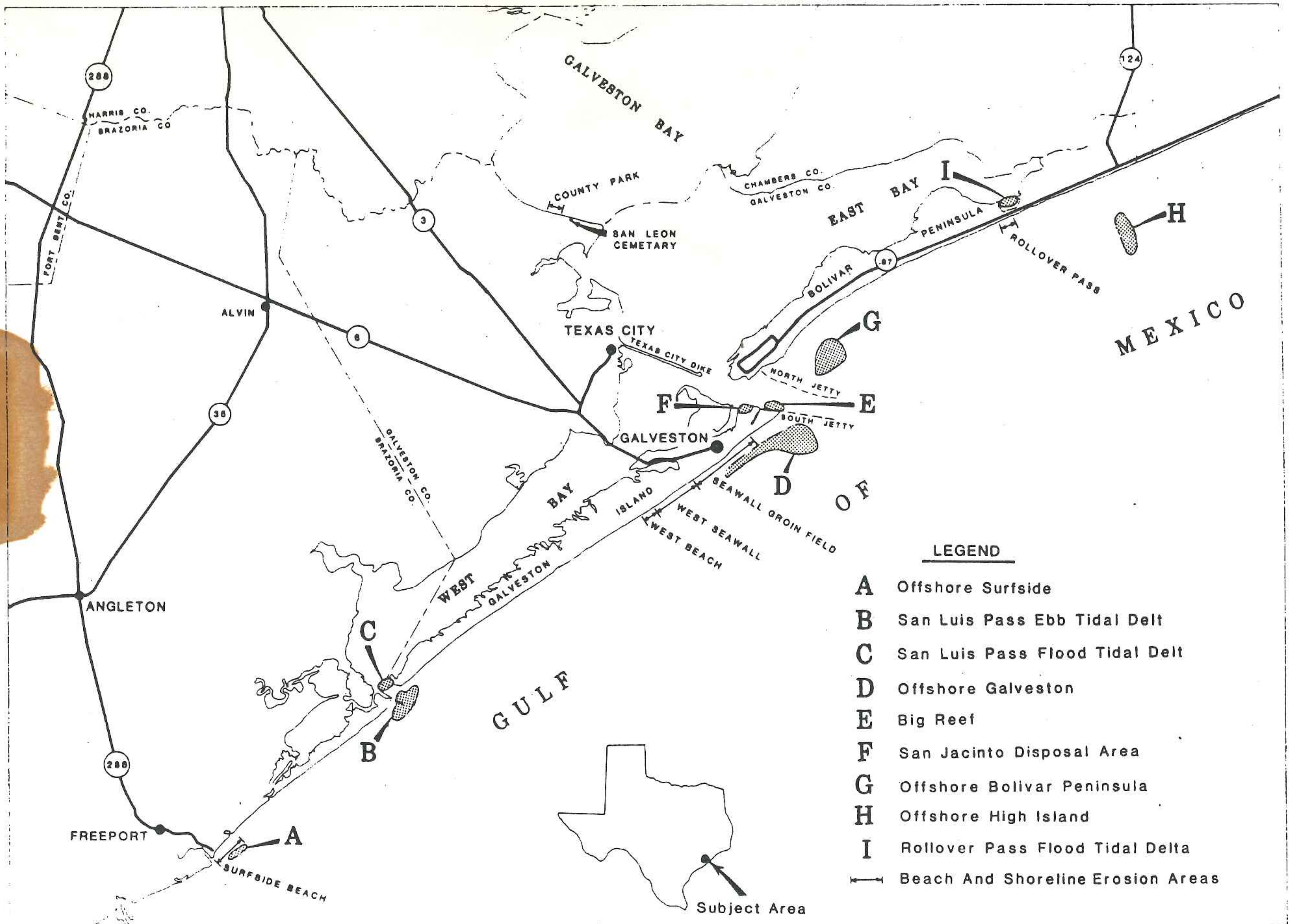
SUMMARY

BORROW AREAS STUDIED FOR
BEACH RENOURISHMENT

LOCATION MAP

GALVESTON COUNTY SHORE EROSION STUDY



FIGUP

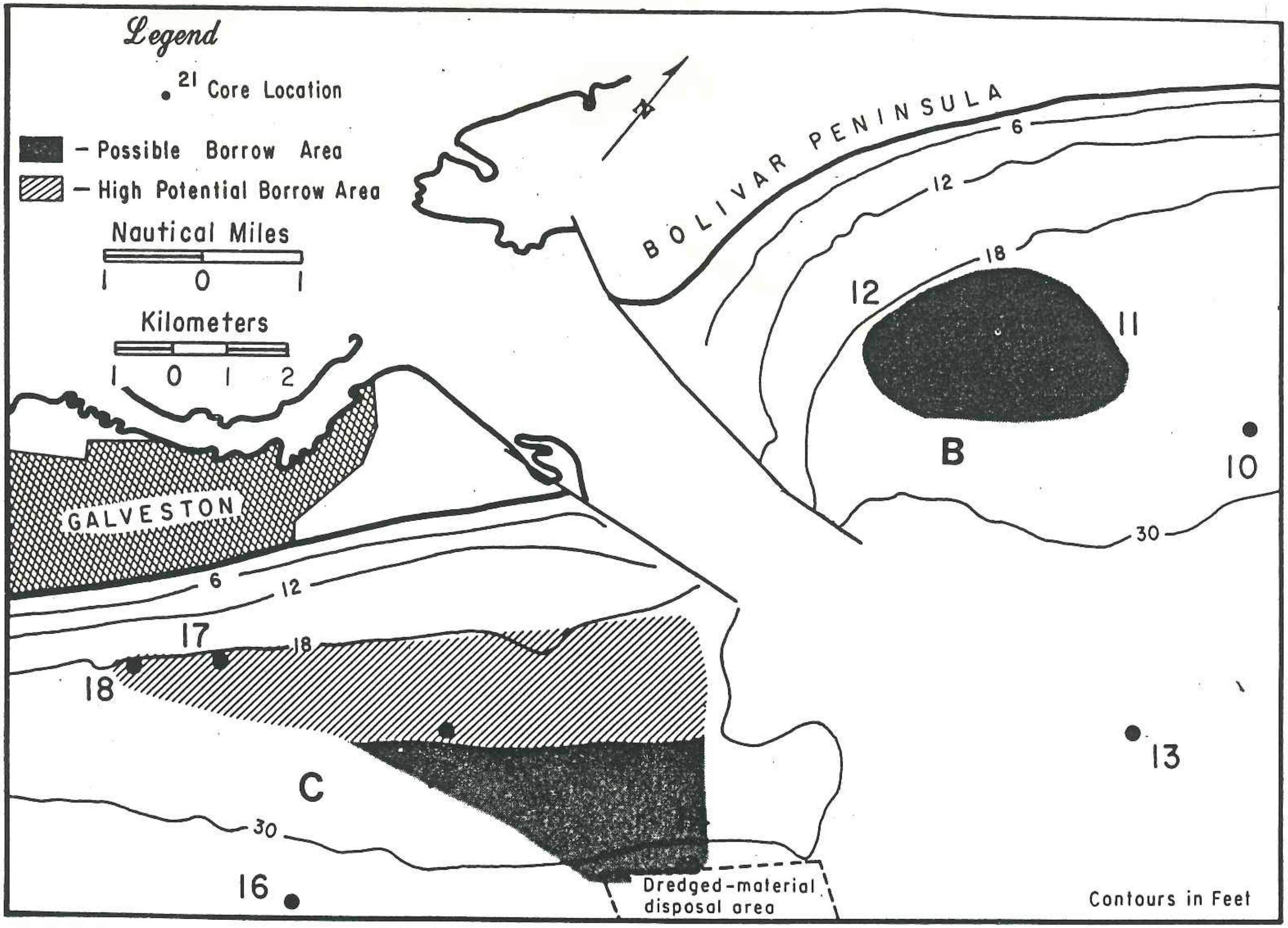


Figure 17. Map of possible borrow site B, and site C which has a high potential inshore area.

DISCUSSION

OF

BORROW AREAS

"D" SOUTH JETTY

"E" BIG REEF

Galveston South Jetty

Under normal conditions, a littoral barrier causes shoreline erosion on its downdrift side. On the contrary, there has been extreme accretion of East Beach since construction of the Galveston jetties around 1907. According to Morton (1979); the accretion to the present 4-foot depth contour fronting a 10,000-foot shoreline amounted to about 34 million cubic yards over the 107-year period between 1867 and 1974, an average rate of about 320,000 cy/yr or about 32 cy/yr/ft. This accretion rate was somewhat larger than the accretion on the updrift shore north of the North Jetty where accretion to the present 10-foot depth contour fronting a 9,000-foot shoreline totaled about 28 million cy during the same time period, an average rate of about 260,000 cy/yr or about 30 cy/yr/ft.

The primary effect of the Galveston South Jetty has been to provide a wave shelter convenient for sediment accretion. Waves diffracting around the jetty tend to create a local littoral drift converging toward the jetty. It is quite likely that historically the littoral drift bypassing the Galveston inlet from Bolivar Peninsula has played a small role in the evolution of the Gulf shoreline on Galveston Island. It is a general consensus among leading geologists that Galveston Island formed during the Holocene transgression with sediment contributions mainly from the shelf. Consequently, the construction of the jetties at the Galveston Inlet have not exactly created a state of sediment deficit on their downdrift shoreline.

Part of the material which contributed to the accretion of East Beach apparently has been derived from the adjacent downdrift shore. The sediment budget analysis indicated that the majority of this material has arrived from offshore, at an average rate of 17.6 cy/yr/ft of shoreline.

as shown in Figure 44. The sites are divided into two types: "possible borrow areas," A, B, part of C, and E (areas where data show that sand is available but may be of low quality due to the presence of silt and clay size sediments, or seismic records show that the sand deposits vary considerably in thickness and areal extent); and "high priority borrow areas," part of C and D (areas located on the shoal south of Galveston Entrance and in the vicinity of the ebb tidal delta at San Luis Pass). Information on the characteristics of the potential borrow areas is summarized in Table 10.

TECHNIQUES FOR EVALUATING POTENTIAL BORROW MATERIAL

This section presents discussions of techniques for evaluating compatibility of borrow material for use in beach nourishment. Much of the discussion that follows on evaluation techniques is from U. S. Army, CERC (1977) and James (1975).

The distribution of particle sizes present on a stable beach represents an equilibrium condition between the supply and loss of material of each size. Coarser particles are generally supplied to or removed from the beach at a slower rate than finer particles, which are usually more abundant and are more rapidly moved alongshore and offshore. A borrow material with a grain size distribution (gsd) similar to, or slightly coarser than the native beach gsd is usually suitable as fill material and the volume required for beachfill is that determined directly from design dimensions. However, when potential borrow material is finer than native material, significant loss of borrow material takes place following placement.

#1

2.3.10 Big Reef is a 224-acre, mostly beach and dune area at the east end of Galveston Island, in Bolivar Roads, and adjacent to the South Jetty. The area consists of essentially marine sand of similar texture to existing beach sand along Galveston Island. This, in combination with its close proximity to the beaches to be restored, makes this area the most economical source of texturally suitable sand within the study area (see Gulf Study Site Report). A 66-acre portion of the eastern end of Big Reef has been chosen as the sand source for the beach nourishment portion of this project. The sand will be excavated to a depth of -20 feet NGVD over project life. A strip of emergent sand 150 feet wide by 2,300 feet long will be left on the ship channel side of the South Jetty to protect the structural integrity of the jetty.

2.3.11 Two methods of transporting sand from Big Reef to the two Galveston beach nourishment sites were considered. One was pumping the material through a pipeline using a hydraulic dredge for excavation. The second was truck hauling the sand along Seawall Boulevard using draglines to excavate the sand and load the trucks. Using the dredge, a 30-inch pipeline would be laid from Big Reef to the base of the Galveston Seawall at 10th Street where the groin field starts. As sand is deposited and spread on the beach the pipeline would be lengthened to gradually nourish the beach over approximately a 12-month period to 61st Street. During the last six months of the 1.5-year construction period the pipeline would be lengthened along the base of the seawall to West Beach which would then be nourished. Diesel-engine driven booster pumps would be installed in the pipeline as the dredge could not pump sand the entire length of the beaches. One pump would be in the pipeline between the dredge and the discharge while working in the groin field and two additional pumps would be added while nourishing West Beach. This method of excavating and transporting sand was dropped from further consideration because, at this time, it is assumed the truck haul method would have more public support than a pipeline system fronting the seawall.

2.3.12 The truck haul and dragline method is recommended to move sand from Big Reef to the groin field and West Beach. This method could utilize up to 37 diesel dump trucks of 12 cubic yard capacity and two draglines of 1.25 cubic yard capacity. The average round trip to the groin field will be 10 miles and 36 minutes long whereas trips to West Beach will average 18 miles and take 59 minutes. It will take approximately 132,000 round trips to haul the approximately 1,577,000 cubic yards of sand along Seawall Boulevard or on the beach fill itself from Big Reef to the nourishment sites. The trucks will be working 16 hours per day, seven days per week, eight months per year for a total of three years (two years at the groin field and one year for West Beach).

2.3.13 In summary, the recommended project would consist of nourishing the groin field with 1,344,000 cubic yards of sand and West Beach on Galveston Island with 233,000 cubic yards of sand to be truck-hauled from Big Reef. The groin field project has a 1.7 to 1 benefit-to-cost ratio with a $12,176,000 first cost. The West Beach project has an estimated construction cost of $3,212,000. The project cost would be equally shared between the Federal Government and Galveston County, the project local sponsor, except the portion of the on-beach parking in the groin field project, which will be borne entirely by the local sponsor. Immediately after nourishment is finished, wave action and longshore currents will begin to erode the restored beaches. For this reason an additional 50 feet of advance nourishment is provided at each project site.

TABLE 11

EVALUATION OF POTENTIAL BORROW AREAS
FOR GALVESTON STUDY SITES

Borrow Areas	R_A Values	R_J Values	Construction Volume (CY)	Renourishment Volume (CY)
Offshore South Jetty	4.0	2.5	7,800,000	14,100,000
Big Reef	1.6	1.3	3,100,000	2,210,000
Fort San Jacinto	2.3	1.9	4,400,000	5,300,000
Offshore Bolivar Peninsula	1.5	0.1	2,900,000	1,500,00*

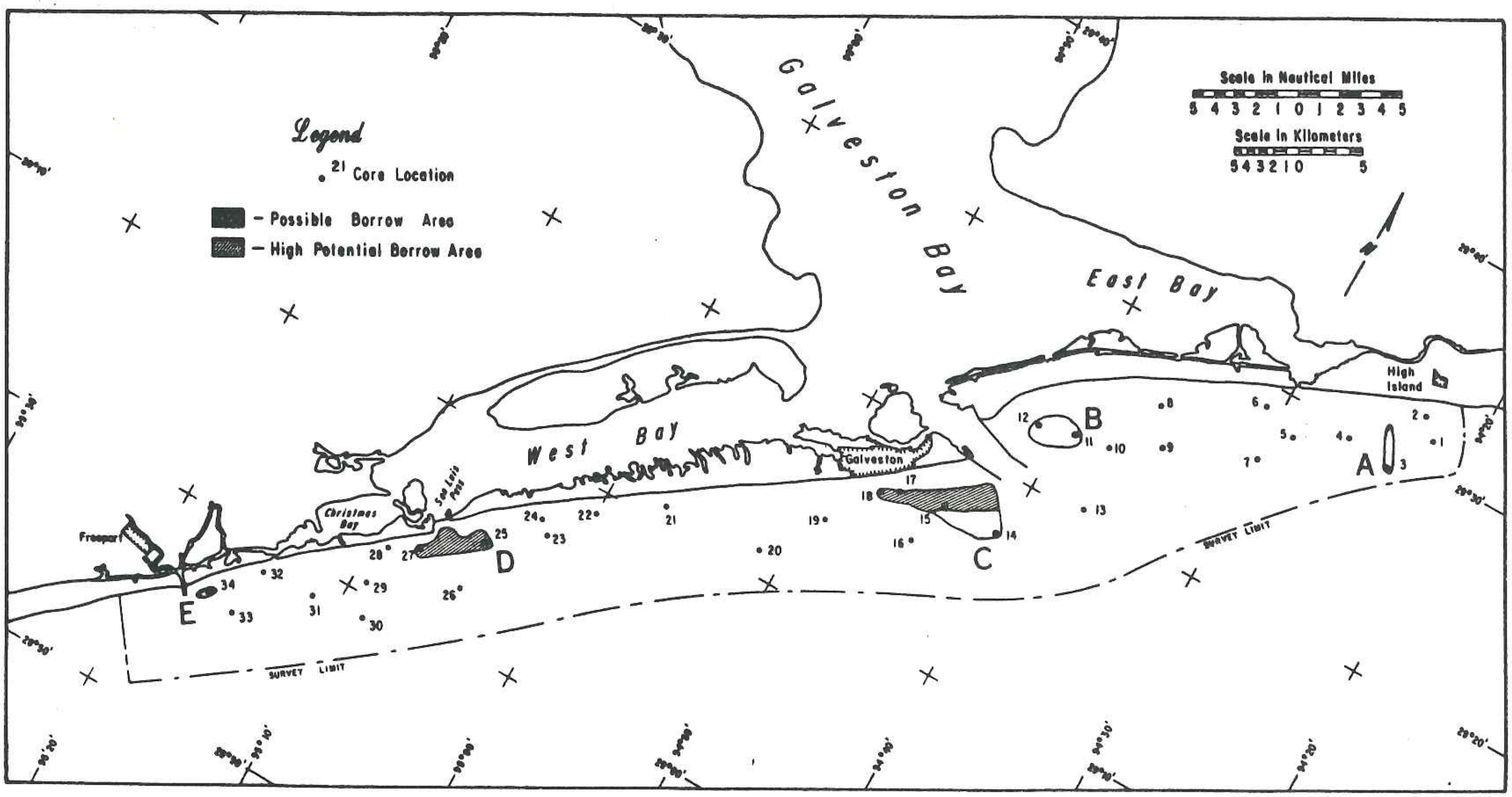
* R_J value indicates no renourishment would be needed during life of project; however, one renourishment was assumed necessary because of the frequent occurrence of hurricanes and tropical storms in the study area.

MATERIAL

SUB-SURFACE

INVESTIGATIONS

GALVESTON BOLIVAR

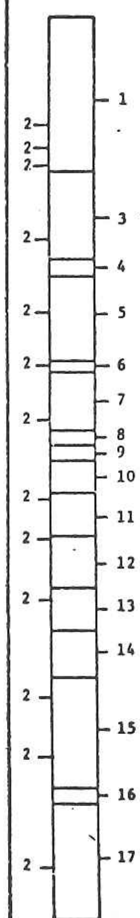


MAP OF FIVE POTENTIAL OFFSHORE BORROW AREAS

TABLE 10

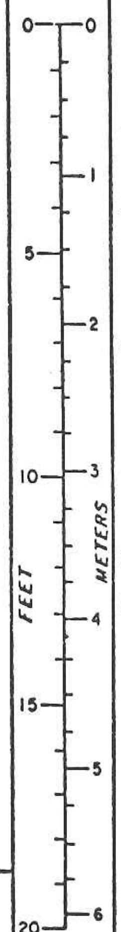
CHARACTERISTICS OF POSSIBLE OFFSHORE BORROW SITES

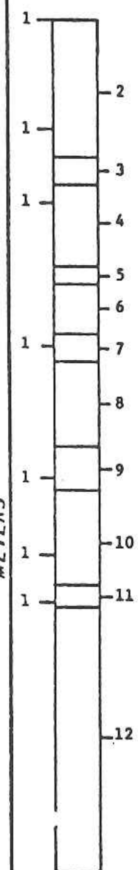
Designation	Core Number	Water Depth (ft)	Thickness (ft)	Mean Grain Diameter (mm)	Standard Deviation (phi units)	Mud Overburden (ft)	Area ($10^6 ft^2$)	Estimated Volume ($10^6 yds^3$)	Remarks
Offshore High Island (Site A)	3	20-33	8-27	0.11 to 0.16	0.5 to 1.0	None	31.2	8.9	Sand is interbedded with mud as channel fill. Buried 20-inch gas line crosses site.
Offshore Bolivar Peninsula (Site B)	11	18-28	6	0.16 to 0.23	0.42 to 1.04	4	106.6	12.9	Sand in core 11 occurs as basal channel fill and Pleistocene erosion surface. Sand in core 12 occurs in two layers separated by 3 feet of mud and sandy mud.
	12		3	0.16 to 0.23	0.50 to 1.39	3			
Offshore South Jetty (Site C)	14	18-32	7	0.12 to 0.19	0.51 to 1.06	None	297.1	26.9	Sand in core 14 is interbedded with muddy sand in dredge disposal area. Sand in core 15 occurs in two layers separated by 5 feet of mud and sandy mud. Sand and cores 17 and 18 is interbedded with muddy sand.
	15		2	0.12 to 0.19	0.53 to 1.02	1			
	17		18-30	0.13 to 0.17	0.40 to 0.81	2			
	18		13	0.10 to 0.16	0.43 to 0.78	None			
San Luis Pass Ebb Tidal Delta (Site D)	25	5-30	5-30	0.13 to 0.24	0.37 to 0.60	None	135.6	30.3	
	27			0.15 to 0.17	0.57 to 1.24	None			
Offshore Freeport (Site E)	34	18-23	8	0.10 to 0.12	0.61 to 0.88	1	8.6	2.7	Muddy sand in core 34 possibly part of the relief Brazos River Delta.



1. Grayish-brown, soft mud on top grading to muddy sands; gray, moderately well sorted, fine sand at 70 to 100 cm
2. Sediment textural analysis (App. B)
3. Dark-gray, moderately sorted, fine sand
4. Dark-gray, soft, cohesive clay
5. Dark-gray, moderately well sorted, fine sand
6. Dark-gray, soft mud with sandfilled burrow holes
7. Gray, moderately well sorted, fine sand
8. Gray muddy sand
9. Gray, well-sorted, fine sand
10. Gray, soft mud
11. Gray, moderately well sorted, fine sand (321 to 326 cm); gray, sandy mud with thin sand layers
12. Gray, well-sorted, fine sand (350 to 358 cm); gray, sandy mud with thin sand layers
13. Gray, well-sorted, fine sand (388 to 392 cm); gray sandy mud
14. Gray, slightly sandy, soft, cohesive mud
15. Gray, slightly muddy, fine sand, mud content decreases with depth
16. Dark-gray, soft, sandy mud
17. Gray, moderately well sorted, fine sand

CORE # 17-207
WATER DEPTH 6.1m (20 ft)
RECOVERY 6.1m (20 ft)



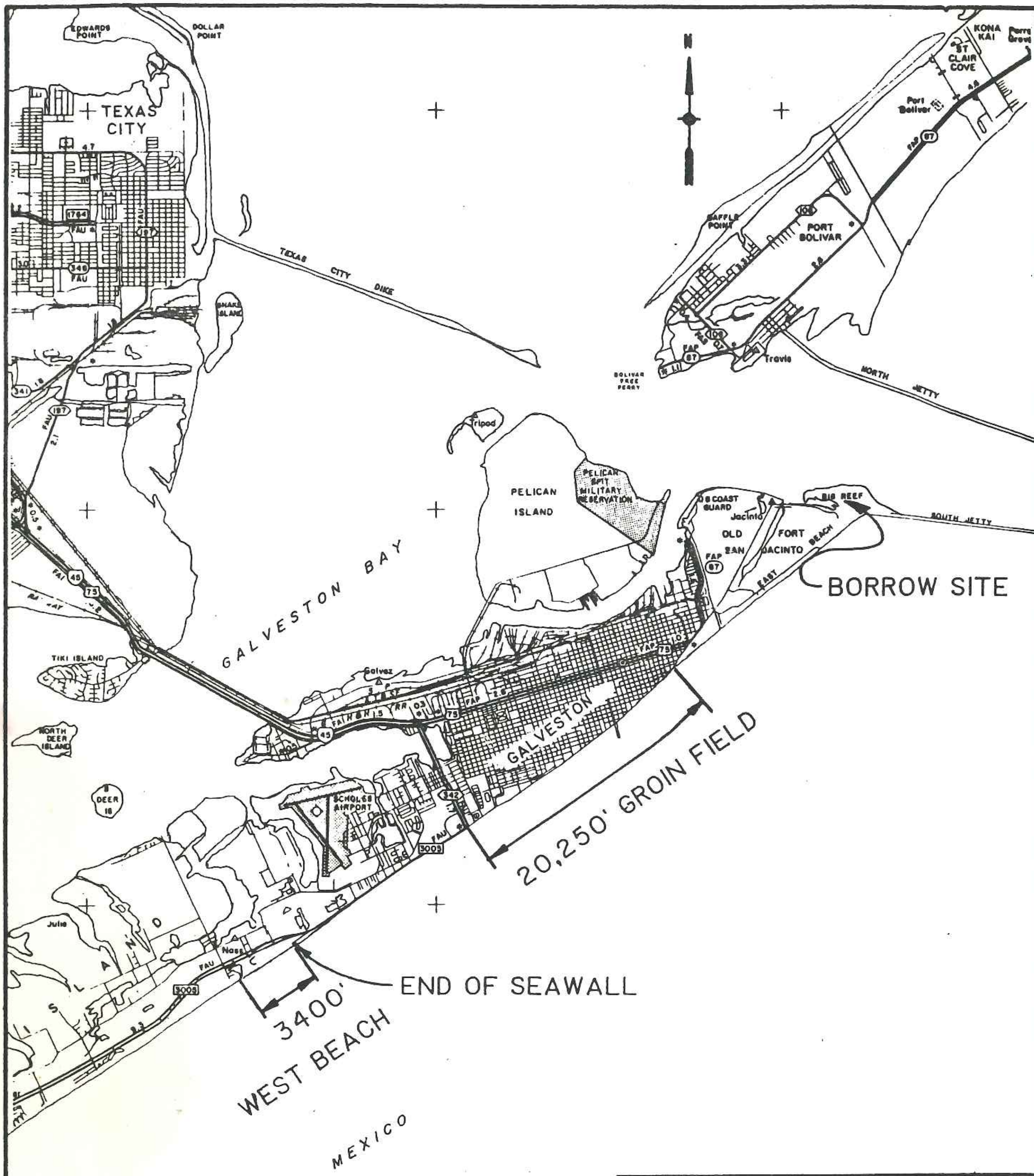


1. Sediment textural analysis
2. Gray, moderately well sorted, fine sand
3. Gray, soft, sandy mud
4. Gray, moderately sorted, fine sand; gray, sandy mud at 135 to 145 cm
5. Gray, muddy, sandy shell hash
6. Gray, interbedded mud and sand
7. Gray, well-sorted, fine sand; mud at 245 to 250 cm
8. Gray, interbedded mud and sand
9. Gray, moderately well sorted, fine sand
10. Gray, interbedded mud and very fine sand
11. Gray, very fine to fine, moderately sorted sand
12. Gray, muddy sand and sandy mud with thin sand lenses

CORE # 18-209
WATER DEPTH 6.1m (20 ft)
RECOVERY 5.8m (19 ft)

PROPOSED

BEACH NOURISHMENT AREA



GALVESTON COUNTY SHORE EROSION STUDY

SELECTED PLANS

U.S. ARMY ENGINEER DISTRICT, GALVESTON, TEXAS

FIGURE 52

US Army Corps
of Engineers
Galveston District

INFORMATION ON SOILS IN BORROW AREAS

GALVESTON COUNTY SHORE EROSION STUDY

FEASIBILITY REPORT
ON
BEACH EROSION CONTROL

VOLUME 2

GULF SHORELINE STUDY SITE REPORT

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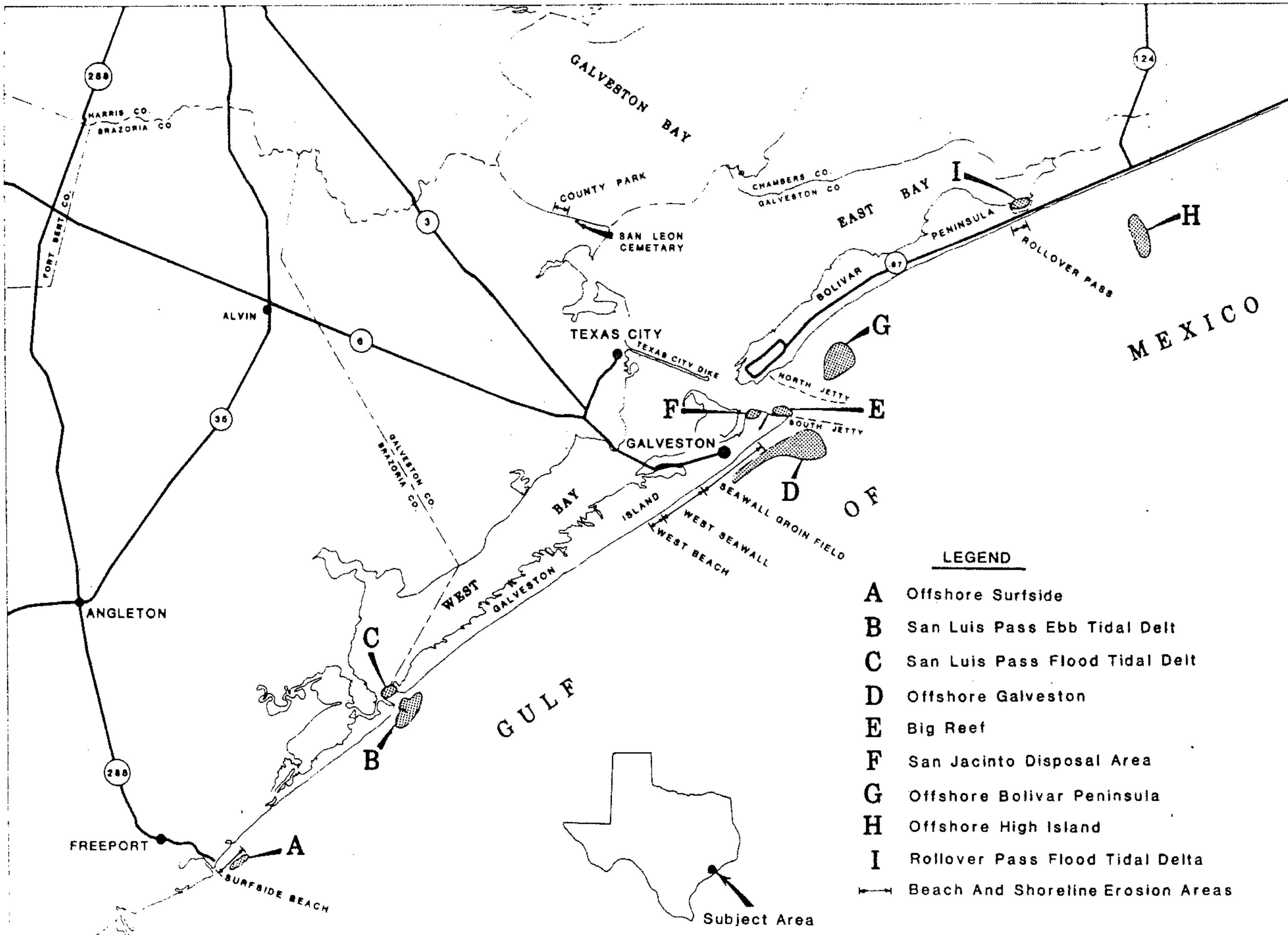

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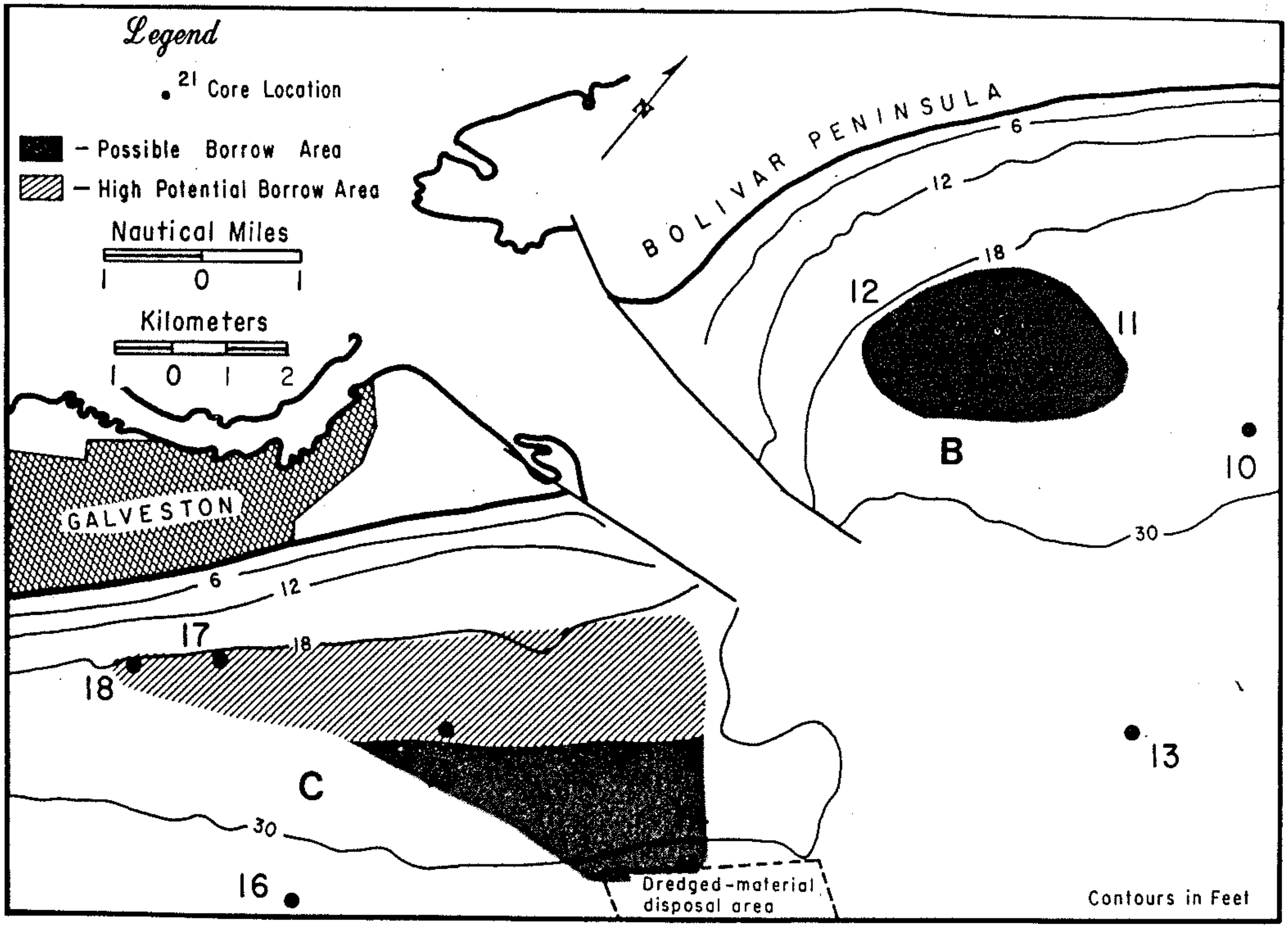

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