

Appendix B

Long Beach Island – Holgate Spit – Little Egg Inlet Historical Evolution

Introduction

The undeveloped southern end of Long Beach Island (LBI) is referred to as the “Holgate spit” as it adjoins the southernmost developed LBI community of Holgate, which is part of the municipality of Long Beach Township. The Holgate spit, including Little Egg Inlet (LEI) to the southwest, has a well-documented history of maps, nautical charts, and aerial photography that extends back at least to 1874. The present configuration of the Holgate spit and LEI is shown on Figure 1 with other relevant geographic features noted. The length of the spit in 2015, measured from the terminal groin in Holgate to its southwest end, is 16,600 feet. The present axis of LEI is shown by the straight red line, and the present shoreline of Holgate spit is outlined in red. This summary presents an overview of the historic evolution of the Holgate spit and LEI from 1874 until present (2015).

Longshore Transport

The dominant longshore transport direction along LBI, including the Holgate spit and LEI, is toward the southwest (SW). Although the dominant SW transport has been documented by a number of investigations over the past several decades, there is little consensus over the magnitude of the net transport. Regardless of the potential variability of the net SW transport *rate* over time, all evidence qualitatively points to the dominant long-term transport direction as *toward the SW*. This transport has manifested itself in the progressive growth of the Holgate spit in the SW direction.

Map, Survey and Photo Historic Sequence

Figures 2 through 6 present a time series of images showing the Holgate spit – LEI configuration beginning with the 1874 nautical chart. Each of the images has been georeferenced in ArcMap to display the identical area registered on the LBI-LEI base map (Figure 1). For comparison with existing conditions, each image also includes the straight red line representing the present axis of LEI and the red outline of the present Holgate spit shoreline.

1874 US Coast Survey, Figure 2. The Holgate spit is attached to the SW end of LBI, but in a position seaward of the present spit shown by the red outline. Although only a single opening exists between the adjacent barrier islands of LBI and Little Beach Island, the chart names two “inlets” within the present extent of LEI. These features are named “Tuckers Cove Inlet” and “Little Egg Harbor Inlet” with the former trending to the E and closer to the Holgate spit, and the latter closer to Little Beach Island and trending SSE. Although not legible at the presentation scale of Figure 2, the 1874 survey includes the notation “Old Inlet” shown at the green arrow east of the Holgate spit. It is inferred that at some point prior to 1874 an additional inlet (a breach of Holgate spit) was present that closed by 1874.

1894 USGS quad sheets, Figure 3. The USGS quad sheets indicate growth of the Holgate spit toward the SW by about 4,000 feet since 1874, as the tip of the spit is closer to the present axis of LEI (red line). This survey refers to the Holgate spit as “Tuckers Beach” and refers to the present LEI as “New Inlet”.

1920 Aerial Photograph, Figure 4. The B&W photo shows further elongation of Holgate spit to the SW, with its SW tip crossing the axis of the present LEI (red line). The photo also shows the existence of a breach (green arrow) that occurred as a result of a February 1920 coastal storm, approximately at the location of the (closed) “new inlet” shown on the 1874 survey. The 1920 breach was named Beach Haven Inlet.

1940 USCGS Nautical Chart, Figure 5. This chart indicate the widening of the 1920 breach (Beach Haven Inlet) in both the NE and SW directions such that its width was about 8,000 feet. The widening of Beach Haven Inlet to the SW encroached on the remainder of the Holgate spit, which was reduced to an island, shown as “Tuckers Island”, about 6,000 feet long. Note that in 1940 there were two distinct inlets (Beach Haven and Little Egg) within the present footprint of the Holgate spit – LEI complex.

1956 Aerial Photograph, Figure 6. By 1956 there were no longer two distinct inlets. The SW growth of the “new” Holgate spit attached to the SW end of LBI had effectively merged Beach Haven and Little Egg Inlets into a single opening approximately 13,000 feet wide, effectively eliminating the 1940 “Tuckers Island” in the process.

1956 to present. Nautical charts since 1956 have continued to include the names “Beach Haven Inlet” and “Little Egg Inlet” where there is in fact a single opening between the adjacent islands (LBI and Little Beach Island). However, from the standpoint of geomorphic and coastal engineering conventions, in 1956 - as at present - there is a single inlet. The SW growth of the Holgate spit has continued since 1956, with the SW tip of the spit presently about 6,600 feet farther SW than it was in 1956. For the 1956-to-2015 period this represents a long-term average southwestward growth of the spit by ~100 feet per year, although the rate of growth has varied over time.

Summary. This abbreviated history of the evolution of the Holgate spit and Little Egg Inlet supports the following principal conclusions:

(1) Spit growth and breaching. The *dominant* longshore transport direction along this portion of the NJ coast is to the southwest. The SW transport moves sand along the shoreline of LBI, past the developed community of Holgate, and toward the Holgate spit. The spit elongates in the SW direction over time until a breach of the spit occurs. Breaches of the Holgate spit are evident on the 1874 survey, which includes the

notation “old inlet” indicating a breach that opened and subsequently closed by 1874, and again on the 1920 aerial photograph.

(2) Multiple inlets where there is only one inlet at present. At the time the Holgate spit is beached, there are in fact two inlets, where “inlet” is defined here using the convention of “an opening between adjacent barrier islands.” The breaches of the Holgate spit (pre-1874 and 1920) severed the connection of the spit to LBI, transforming the “spit” into an “island” with inlets at either end. Most recently these inlets have been named Beach Haven Inlet and Little Egg Inlet, as illustrated in the sequence from 1920 through 1940.

(3) Spit growth and merging of inlets. Over a period of years to several decades, the net SW transport along LBI begins to “grow” the Holgate spit. As longshore transport extends the SW end of the spit, the two inlets (Beach Haven and Little Egg) eventually merge into a single, larger inlet as evident on Figure 6 from 1956. It is plausible that the present configuration of Holgate spit will be transformed in the future by a breach that creates a new inlet. Hurricane Sandy in October 2012 breached the spit in several locations, but none was sufficiently large to evolve into a new inlet. Hence at present Holgate spit extends continuously about 16,600 feet from the terminal groin in Holgate to its SW terminus adjacent to LEI.

(4) Dynamic system. The text and figures of this presentation document the dynamic nature of the system comprised of Long Beach Island, the Holgate spit and its adjacent inlet, which is referred to herein as Little Egg Inlet. The “system” is controlled by the more-or-less continuous input of littoral sediment toward the SW, from LBI and Holgate onto the Holgate spit. Over time the spit grows longer until such time as it is breached, converting the spit into an island bordered by two inlets. This dynamic system is indicative of the large quantities of sand that are transported alongshore, and indicates that a configuration that exists at any given time is subject to the type of transformations documented herein, and is subject to large potential changes over periods of years to decades.



Figure 1. Holgate spit - LEI location map

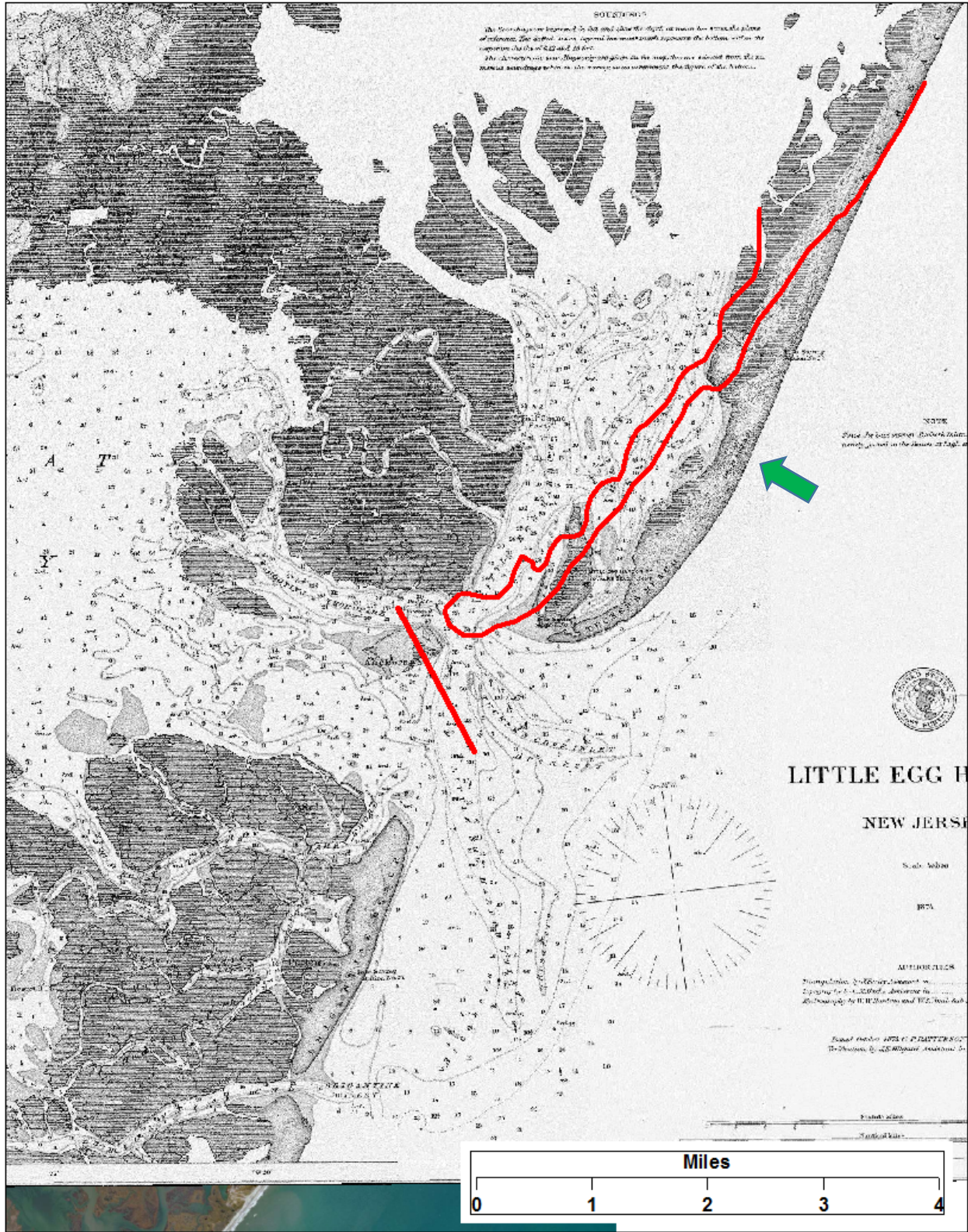


Figure 2. 1874 US Coast Survey

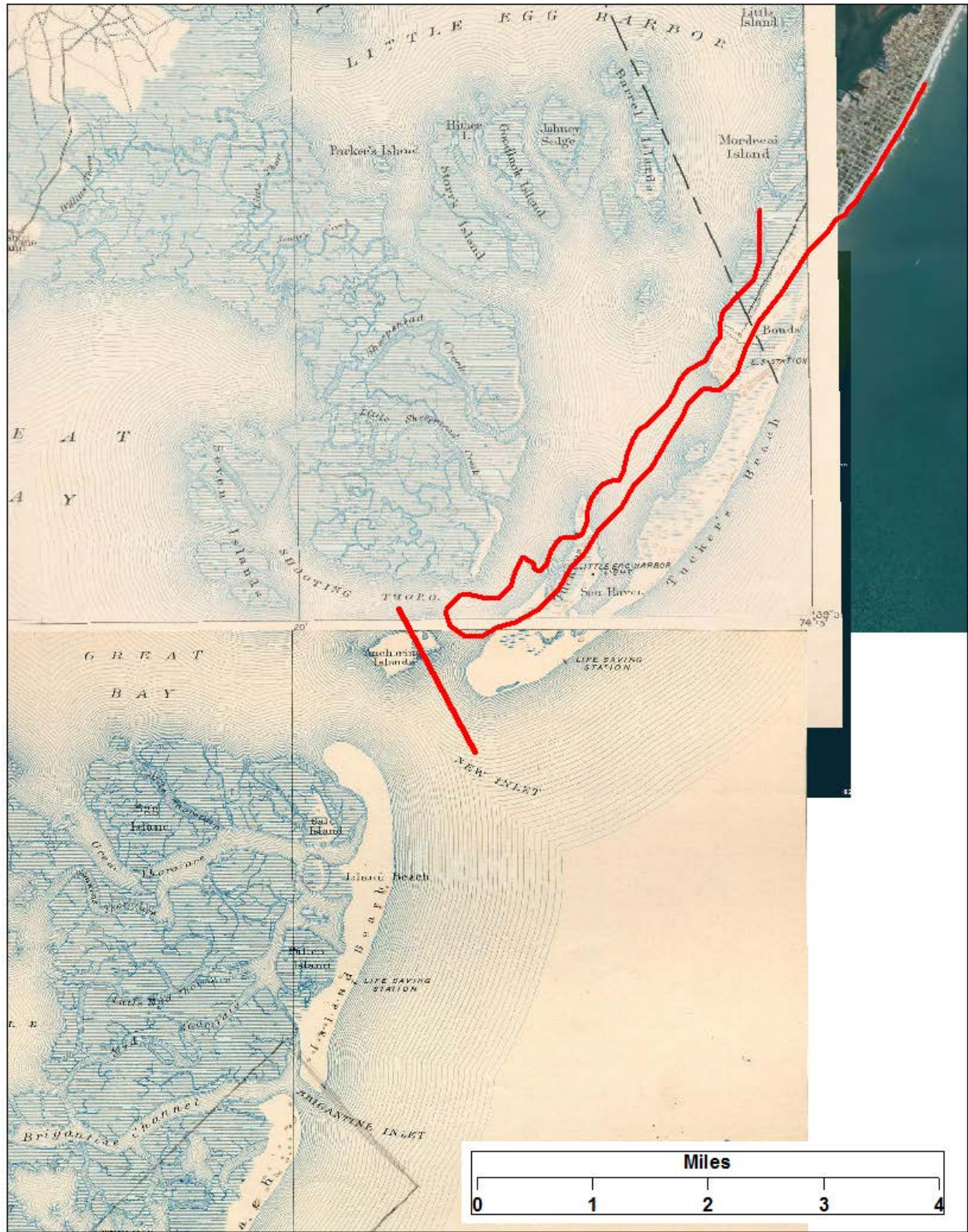


Figure 3. 1894 USGS

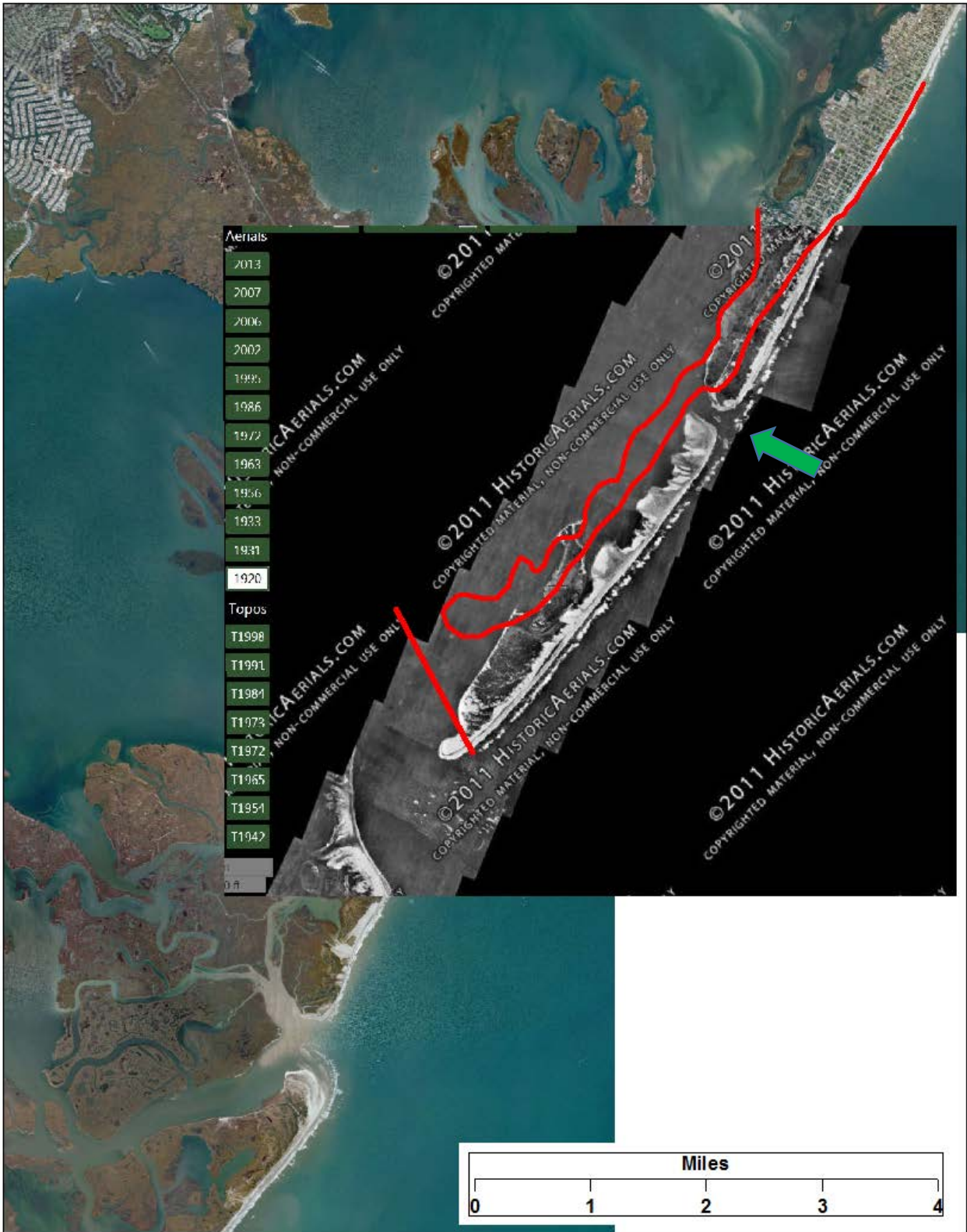


Figure 4. 1920 Aerial photo (B&W inset)

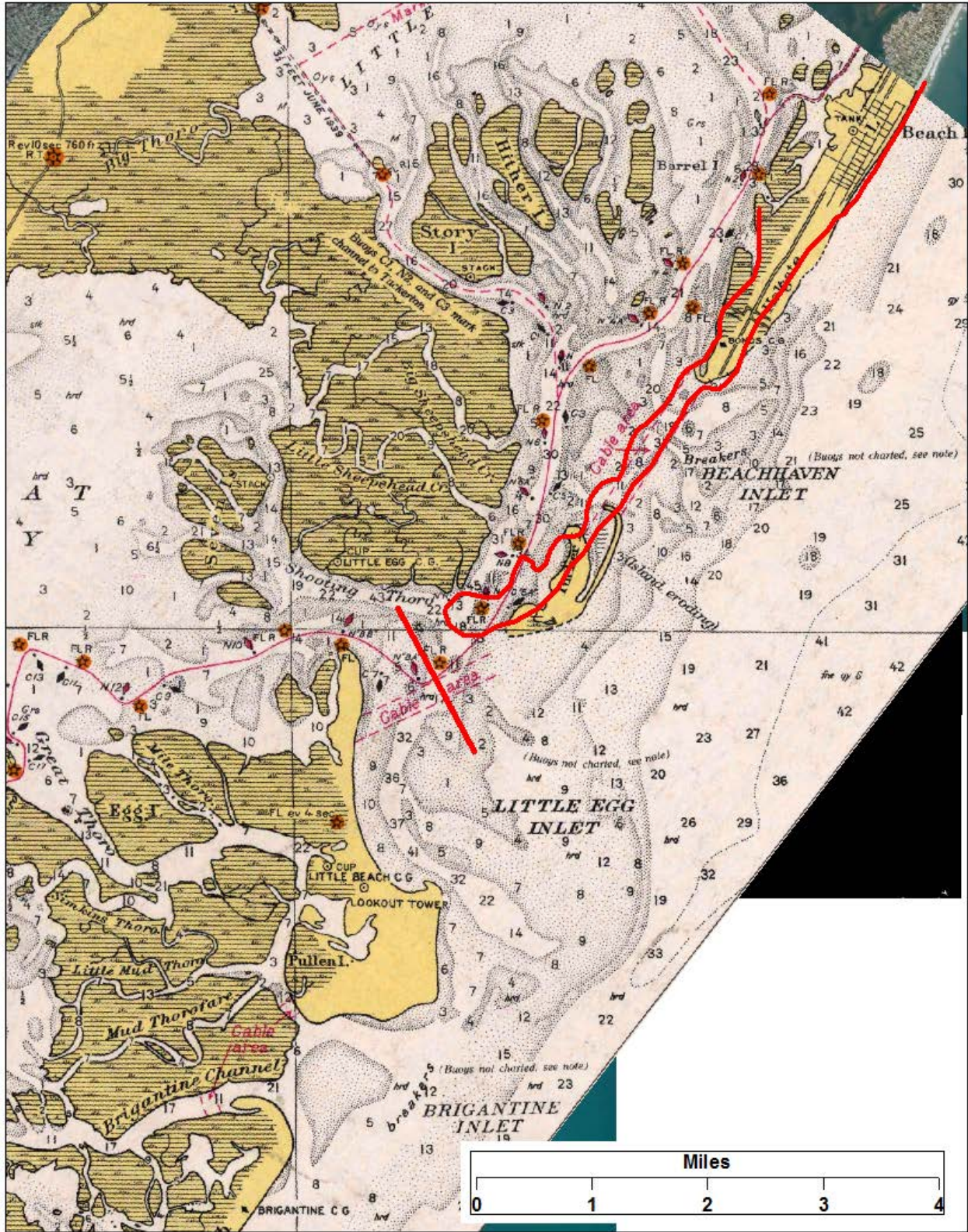


Figure 5. 1940 Nautical chart

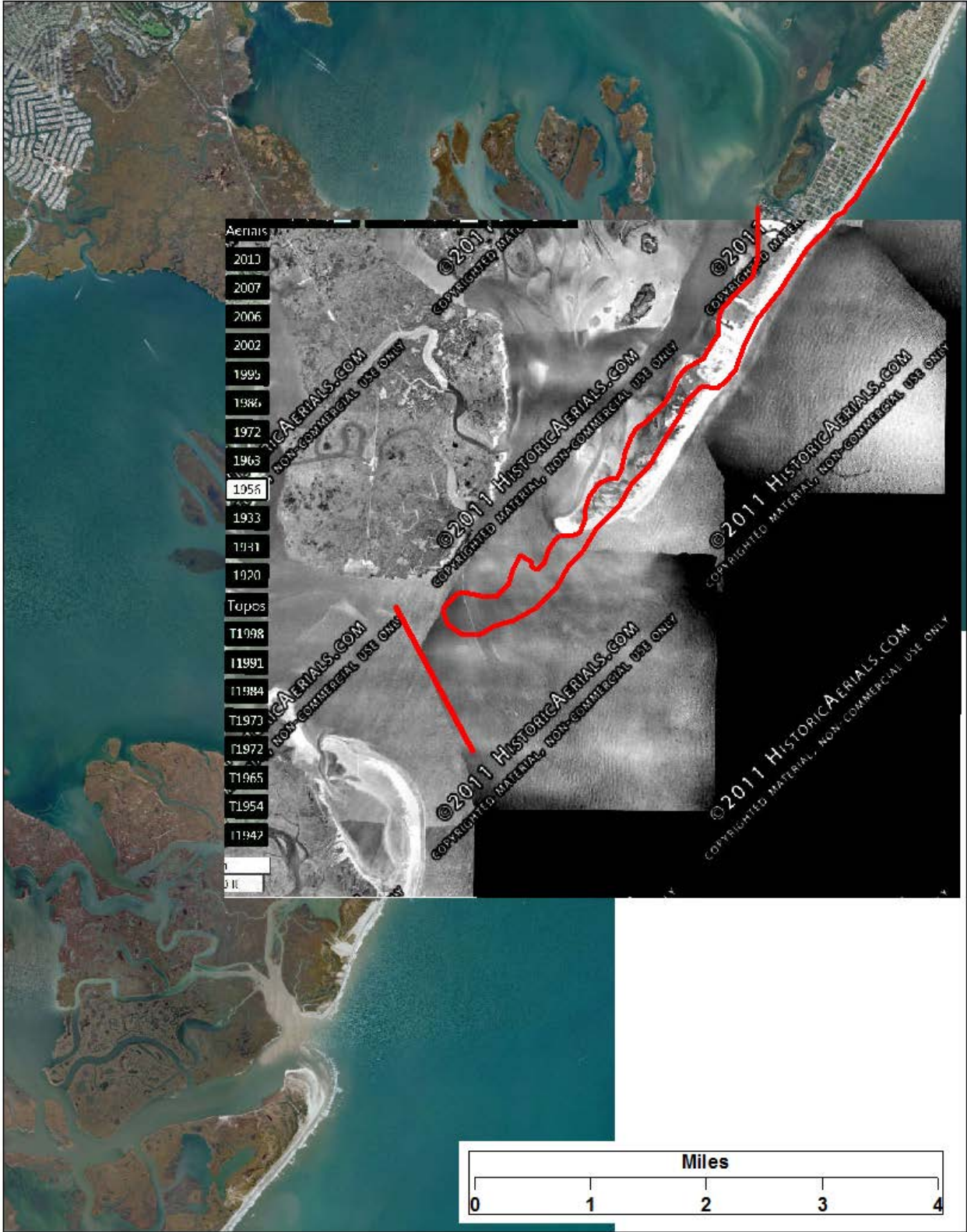


Figure 6. 1956 Aerial Photo (B&W inset)

Little Beach Island Historical Evolution

Introduction

Little Beach Island is located between Little Egg Inlet to the north and Brigantine Inlet to the south, and is one of the few remaining undeveloped barrier islands on the Atlantic coast of New Jersey. Little Beach Island presently has about 4 miles of sandy shoreline facing the Atlantic Ocean and Little Egg Inlet. Landward (west) of Little Beach Island there are extensive saltmarshes. These lands are part of the Edwin B. Forsythe National Wildlife Refuge. Like the Holgate spit located north of Little Egg Inlet, historical changes of Little Beach Island are well-documented by maps, nautical charts, and aerial photography that extend back at least to 1874. The historic changes in location and configuration of Little Beach Island between 1874 and 2015 are illustrated below.

Map, Survey and Photo Historic Sequence

All images (maps, charts, and aerial photos) were assembled in ArcMap and registered to a common horizontal reference. The first Figure is the most recent (May 2015) configuration of Little Beach Island. Images from 1874 through 2015 are presented in sequence. The red outline in each image shows the configuration of Little Beach Island in 2015, so that each of the historic images can be compared to most current conditions at Little Beach.

1874 US Coast Survey. The 1874 chart shows “Brigantine Beach”, approximately 8,000 feet southeast of Little Beach’s current location. More than half of Little Beach’s sandy beach facing the inlet was not present at this time.

1894 USGS Quad Sheet. Twenty years later, Little Beach Island is referred to as “Island Beach”. The northeast end of the island migrated northward about 4,000 feet between 1874 and 1894, but is situated more landward and approximately half the length of the present day inlet beach.

1920 Aerial Photograph. The 1920 aerial photo shows significant retreat and erosion of the northeast end of Little Beach Island with several breaches, likely due to a major coastal storm in February 1920. The southern portion of Little Beach Island is located landward of its 1894 location, and also displays several breaches and overwashed areas.

1931 Aerial Photograph. The photo shows significant accretion seaward of the southern portion of the island compared to 1920 conditions. The northeast portion of the barrier beach is still more landward than its present location but it has accumulated sand since the 1920 photograph. Previous breaches and overwash areas have filled in but are still evident.

1940 USCGS Nautical Chart. This chart indicates a similar configuration of Little Beach Island compared to the 1931 aerial photograph.

1957 Aerial Photograph. This aerial photo indicates northward growth of Little Beach Island as a spit that recurves westward into Little Egg Inlet, while the southern portion of the island retreated to its approximate alignment in 1920. Large ocean-facing sand deposits that were evident in 1931 and 1940 are no longer present.

1963 Aerial Photograph. The 1963 aerial photograph (one year after the March 1962 “Five High’ nor’easter) indicates additional growth of the northern spit of Little Beach into Little Egg Inlet, and also southward spit growth along the south end of the island. The 1963 shoreline along the southern half of Little Beach Island is about 2,000 feet farther seaward than the 2015 shoreline.

1972 Aerial Photograph. Between 1963 and 1972, the seaward-facing beach retreated landward, while the spits at the north and south ends of the island continued their growth toward Little Egg and Brigantine Inlets, respectively.

1995 Aerial Photograph. The 1995 photograph indicates a breach in Little Beach Island, about midway along the length of the island. However, by 1995 the overall configuration of the island has evolved to resemble its present (2015) configuration. The principal exception is the southern half of the island, which retreated landward between 600 and 1,000 feet from 1995 to 2006.

2006 - 2015 Aerial Photographs. The sequence of aerial photos from 2006 through 2015 indicate gradual but progressive retreat of the southern portion of Little Beach Island, and minor adjustments of shore alignment along the northern half of the island extending into Little Egg Inlet.

Summary. This abbreviated history of the evolution of Little Beach Island supports the following principal conclusion:

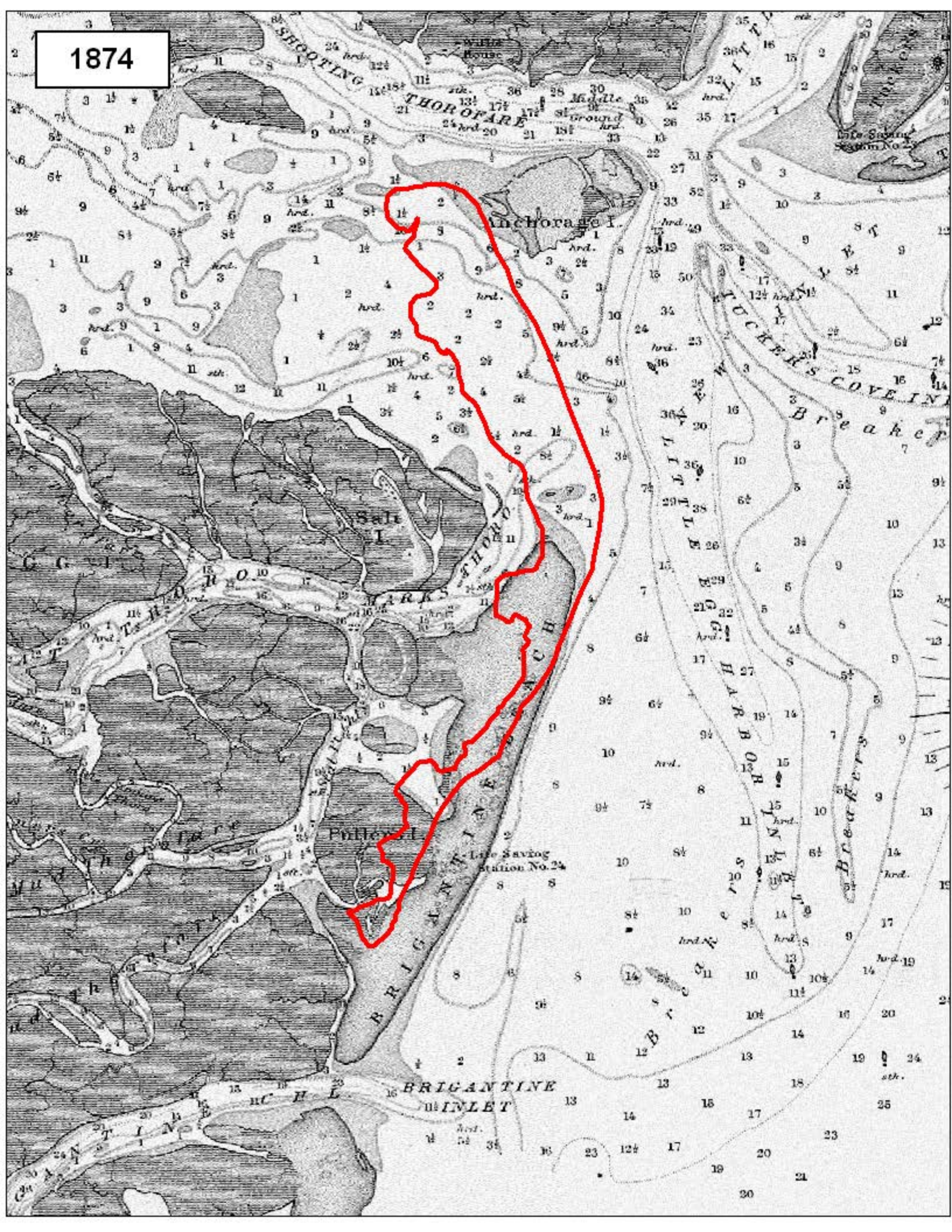
The *dominant* longshore transport direction along this portion of the NJ coast is to the southwest. Little Beach Island was historically positioned more southwest when the inlet was much wider. Little Beach has migrated northeast over the observed 141 year period. The text and figures of this presentation document the dynamic nature of the system comprised of Long Beach Island, the Holgate spit, Little Egg Inlet and Little Beach. The “system” is controlled by the more-or-less continuous input of littoral sediment toward the SW, from LBI and Holgate onto the Holgate spit as well as by erosional processes within the vicinity of the inlet entrance shifting sands along the southwest (ocean) side.

This dynamic system is indicative of the large quantities of sand that are transported alongshore, and indicates that a configuration that exists at any given time is subject to the type of transformations documented herein, and is subject to large potential changes over periods of years to decades or in the case of severe storms: days. Sand has shifted continuously and Little Beach has alternatively built up and eroded and repositioned. These represent typical morphological changes of an inlet/ocean interface where weather and currents play dominant roles in shaping the coastline.

2015 (May)



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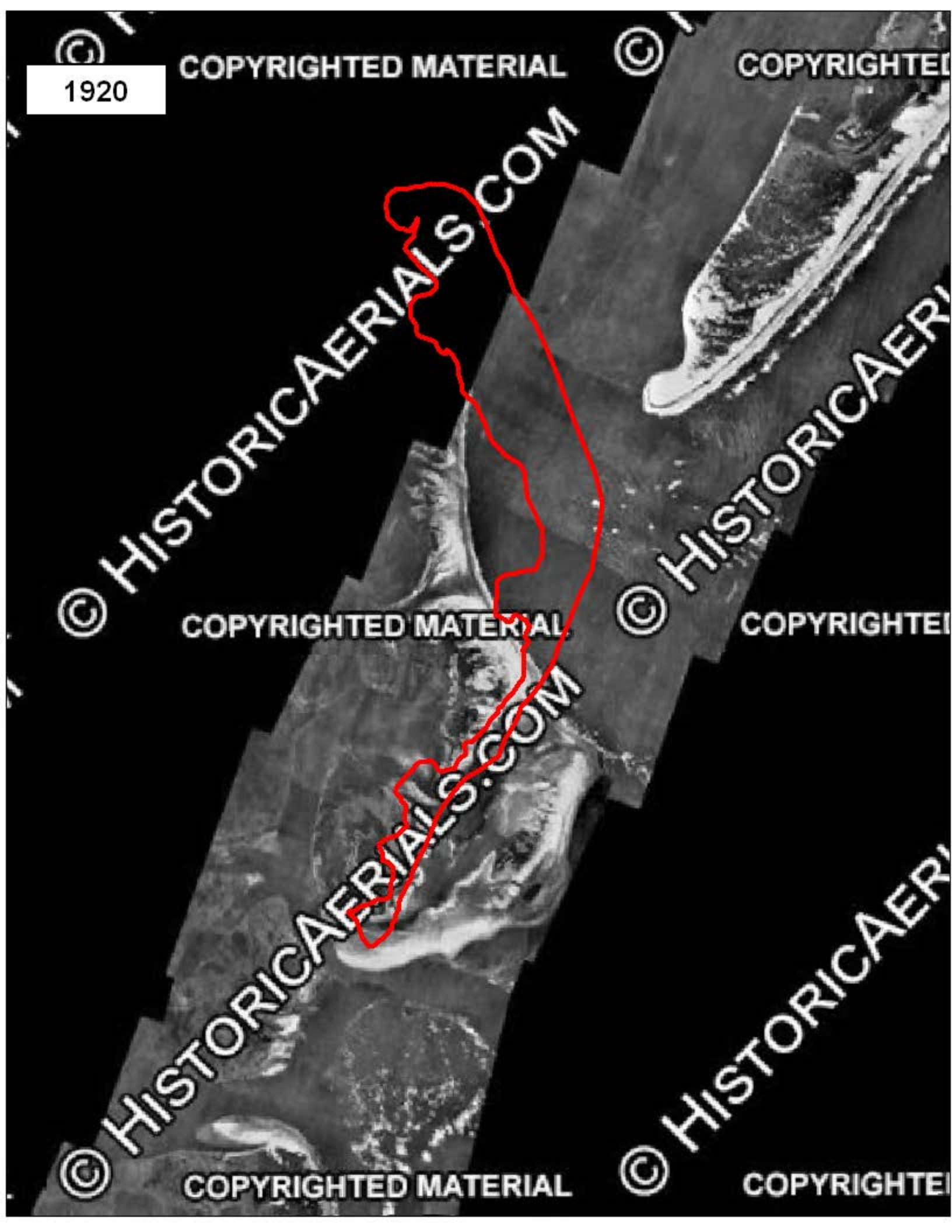
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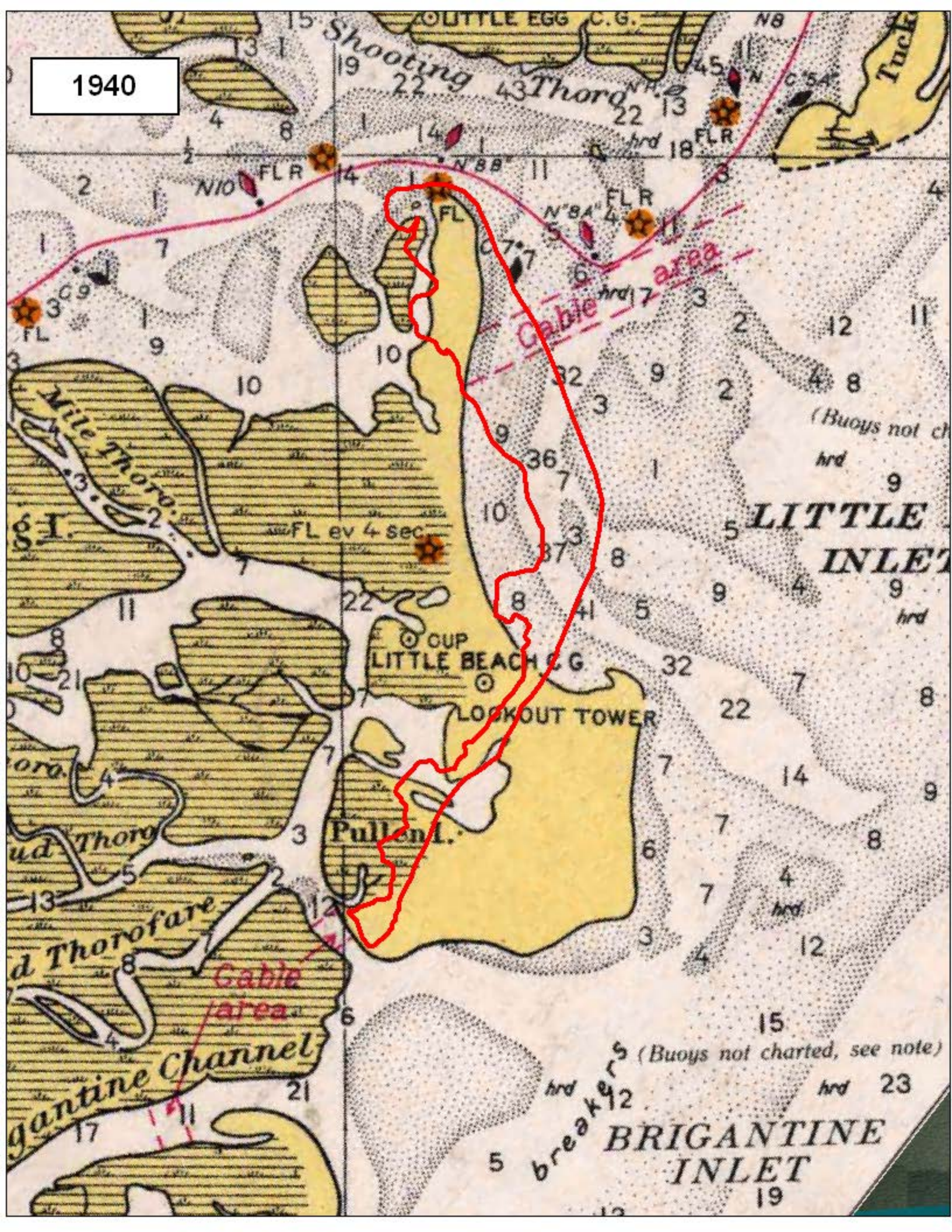
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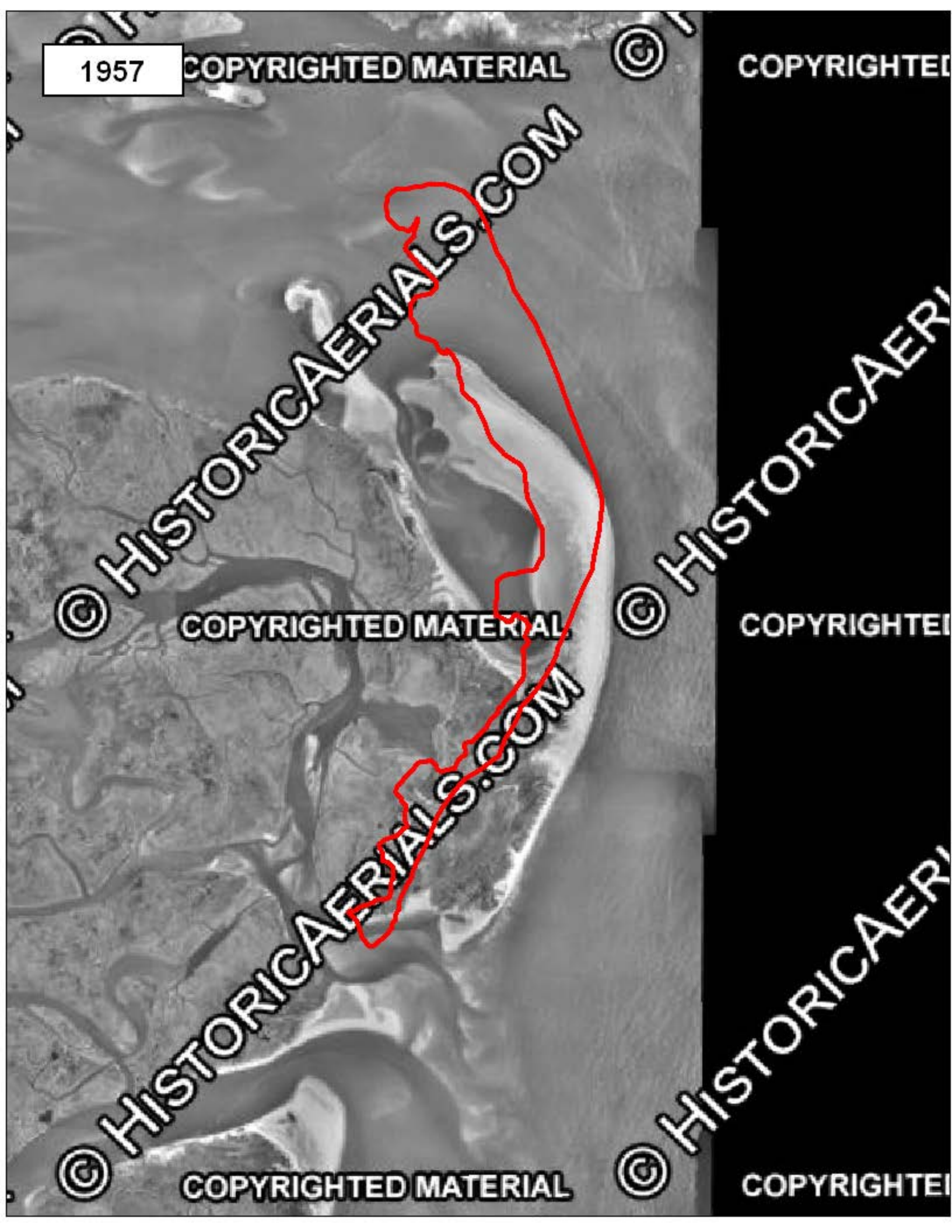
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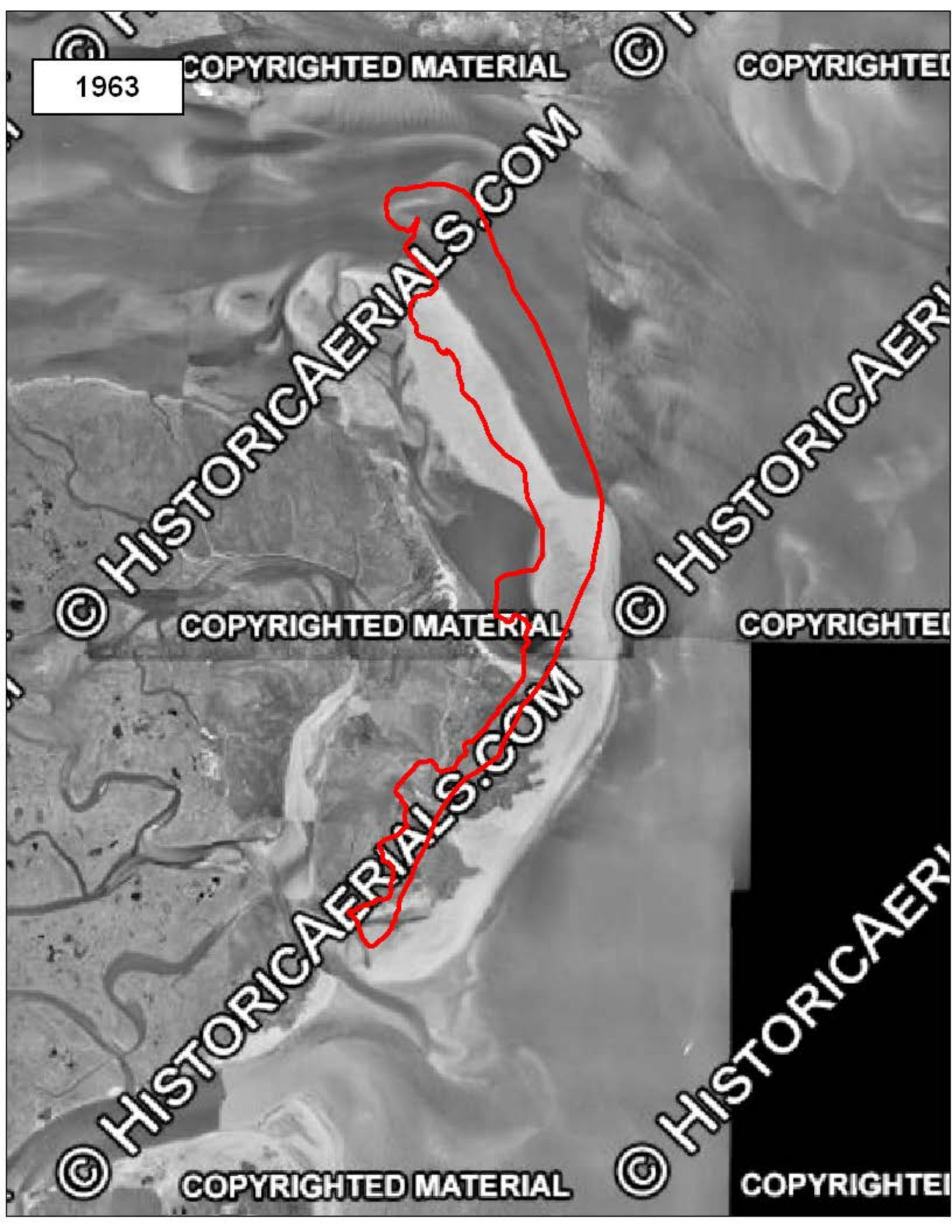
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