SEDIMENTS AND PROCESSES AT BIG SARASOTA PASS,

SARASOTA COUNTY

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EXECUTIVE SUMMARY

Big Sarasota Pass is an asymmetrical, mixed-energy tidal inlet that carries a tidal prism of about $2.2 \times 10^7 m^3$. The throat of the inlet has a cross section of about $1{,}000 m^2$ with maximum depth of more than 8m. The inlet channel migrated slowly to the south until stabilization of the north end of Siesta Key beginning in the 1940s.

The large ebb tidal delta bypasses considerable sediment across the inlet to Siesta Key. The nourishment of Lido Key has increased the volume of bypassing and has added sediment to the ebb delta. This bypassing has provided sand for the beaches of northern Siesta Key but now the ebb delta is so large that this sand is moving on to the barrier several hundred meters south of the end of the island. Erosion is extensive and severe on the north end of Siesta Key at the present time.

Tidal currents in the main channel of Big Sarasota Pass exceed a meter per second. As a consequence, it is expected to stay open and to maintain a channel similar to the present one. The mouth of the channel as it exits toward the south into the Gulf of Mexico is shoaling and provides navigational problems. Under the present circumstances this condition is expected to persist and perhaps become worse.

Sediments that comprise the ebb tidal delta at Big Sarasota Pass are dominated by fine quartz sand with varying amounts of carbonate sand and gravel. Gravel lenses of shells are scattered and comprise a minor constituent of the shoal. The thickness of the sand ranges from <3m to more than 5m. The volume of this type of quartz sand dominated sediment in the ebb delta is at least $10{,}000{,}000 m^3$. At least this amount of nourishment quality sediment is available in this sediment body.

Utilization of a portion of the ebb tidal delta as a borrow site for nourishment will not cause problems for the inlet or for the northern portion of Siesta Key beaches. In fact, it will enhance beach development in this part of the barrier. Removal of the distal portion of the ebb delta will permit sand that is bypassed around the ebb delta to provide sediment to this northern eroding end of Siesta Key in a fashion similar to that which is now taking place several hundred meters south of this area.

INTRODUCTION

Tidal inlets are among the most dynamic of all coastal environments. All have common elements but each inlet is different, much like fingerprints. This report presents both historical and recently collected data at Big Sarasota Pass such as bathymetry, tidal currents, and sediment characteristics. Included will be responses to the questions posed by the County dealing with the stability of the inlet, the volume of sediment in the ebb tidal delta and the quality of that sediment that might be used for beach nourishment purposes without negative impact on Siesta Key. Prior to presenting data and our analysis, it is helpful to provide a basic introduction to the morphodynamics of barrier-inlet systems with examples from the west-central Florida coast.

General Nature of Tidal Inlets

Tidal inlets separate barrier islands and provide an avenue for tidal flux between the open ocean environment and coastal bays. They may be large or small, and stable or unstable. The west-central coast of Florida has examples of all of these types. The nature of the inlet is controlled primarily by the interactions between tidal currents and waves, and wave-generated currents. Inlets are also the site of significant sediment accumulation in various forms and quantities.

We typically classify tidal inlets (figure 1) as being tide-dominated, wave-dominated or mixed energy (Davis and Gibeaut, 1990) based on the dominant process(s) that control the morphology of the inlet. Tide-dominated inlets tend to be stable with a large and nearly coast-perpendicular accumulation of sand (ebb-tidal delta) on the ocean side. The large tidal prism, that is the amount of water that flows through during a tidal cycle, produces a relatively deep and stable channel. Examples include Bunces Pass in Pinellas County and Longboat Pass. Waves have little influence on the inlet and longshore transport does not interfere with inlet functions. Wave-dominated inlets tend to be small and unstable. Waves and the longshore currents they produce cause large volumes of sediment (sand) to be transported along the coast. This longshore movement of sediment causes the generally small inlet to migrate in the direction of the longshore transport or in extreme conditions, causes closure of the inlet, e.g. at Dundein Pass in Pinellas County in 1988 and Midnight Pass in Sarasota County in 1983 (Davis et al, 1987),

Mixed energy inlets are those that develop where both wave and tidal processes interact to control the morphology of the inlet and its ebb delta. These inlets take on two distinctly different geometries. In one type the shoreline of the adjacent barriers is essentially in line (figure 1) whereas in the other there is a distinctly offset position of the shoreline. Big Sarasota Pass is an example of a mixed-energy, offset inlet. The shoreline at Lido Key is offset from that at Siesta Key by about 500 m (figure 2). In this type of inlet the ebb delta (the main sand body) at the mouth of the inlet tends to be “one sided” in that it is nearly all on one side of the channel. In the other type of mixed-energy inlets, the ebb delta is divided essentially in half by the main channel (figure 1) similar to Stump Pass.

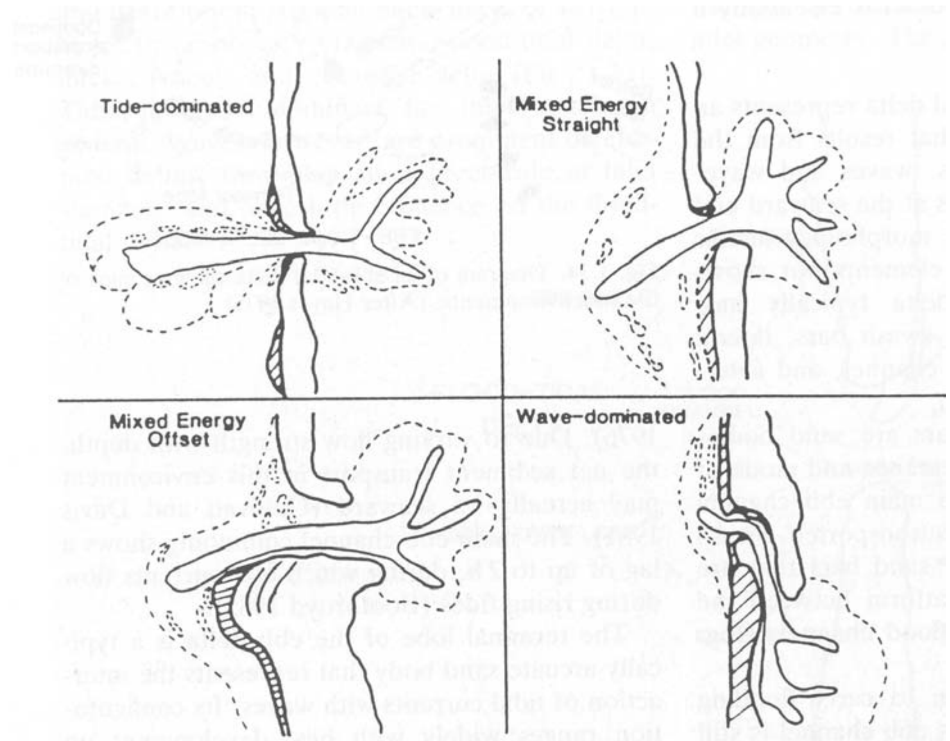


Figure 1 – Inlet classification based on coastal processes and inlet stability. (after Davis and Gibeaut, 1990)

Figure 2 - Oblique photo of Big Sarasota Press showing the offset between Lido Key on the left and Siesta Key on the right.

General Nature of Barrier Islands

Barrier islands are elongate accumulations of sand that are separated from the mainland by open water, and that are essentially parallel to the general trend of the coast. They owe their origin primarily to wave-generated processes. There are two primary shapes of barrier islands as a response to the wave- and tide-generated coastal processes. Wave-dominated barriers are generally long and straight (figure 3), e.g. Casey Key and Sand Key. There are no barriers along tide-dominated coasts because tidal flux does not permit shore-parallel accumulations of sand.

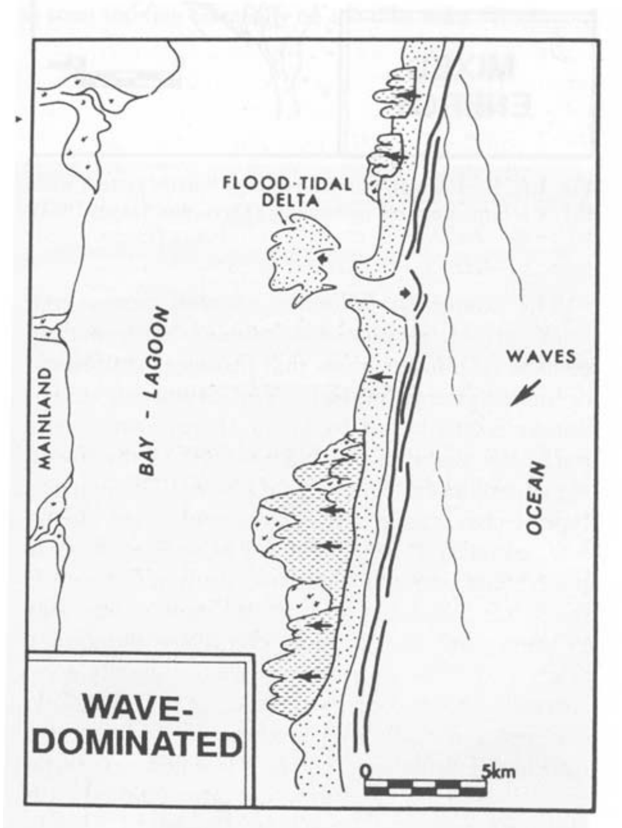


Figure 3 – Schematic diagram showing the general nature of a wave-dominated barrier island which is characterized by long, low barriers with abundant washover fans and small, generally unstable tidal inlets. (from Davis and Hayes, 1984)

The second primary barrier shape is that of one wide end and one narrow end. This is generally called a "drumstick" barrier (figure 4) because its shape resembles that piece of a chicken. The development of the wide portion of the barrier is the result of the interaction of the inlet with the barrier. The large and rounded ebb-tidal delta on mixed energy inlets causes waves to refract (bend) around it as they approach from the north, the dominant direction. This refraction coupled with the dominant longshore transport causes much sediment to bypass the inlet around the ebb delta and eventually to accumulate on the downdrift side of the inlet (figure 4). This sediment that is bypassed accumulates in the form of swash bars that eventually migrate on to the barrier and develop beach/dune ridges. The formation of many of these ridges produces the wide end of the drumstick barrier. An excellent example of this type of island that is still in a natural state is Caladesi Island in Pinellas County (figure 5). Siesta Key is also a good example of a drumstick barrier (figure 6).

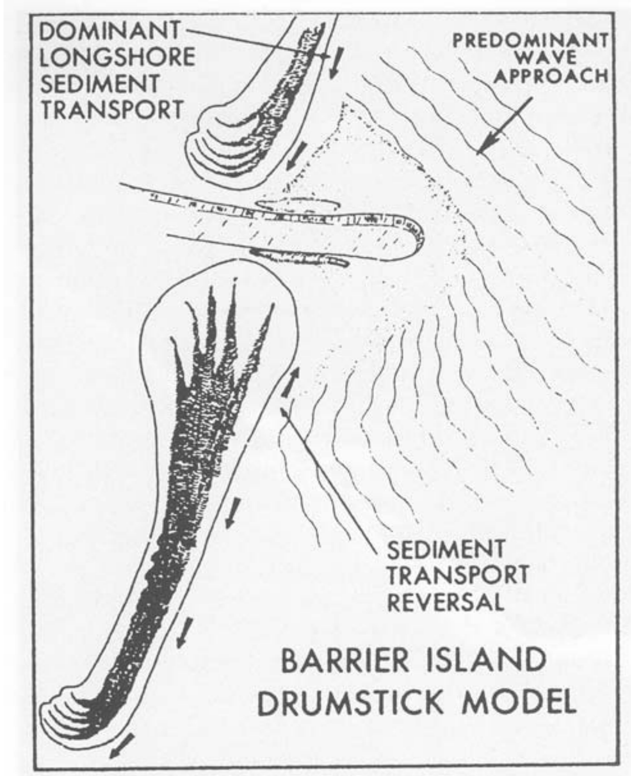


Figure 4 – Diagram of a drumstick barrier island that is typical of mixed energy coasts such as at Siesta Key. (from Hayes et al, 1974).

Figure 5 – Vertical view of Caladesi Island, a good example of a mixed-energy drumstick barrier island. The south end has built Gulfward and the north end is starved of sediment.

Figure 6 – Siesta Key looking south in 1946 before most of the present development took place. The seaward bulge on the narrow end of the island is Point of Rocks. Not in the lower right of the photo that a sand bar is moving landward.

HISTORY AND MORPHOLOGY OF BIG SARASOTA PASS

Although Big Sarasota Pass has been present since the earliest maps of the area were made, Lido Key has experienced considerable change during the past century. The chart of 1883 shows disconnected mangrove islands at the site of the present Lido Key (figure 7). Over time, both natural processes and human activities have added considerable sand to this location resulting in the barrier island that has been in its present general size and shape since the 1920s. Much of this change was the result of a large dredging project of John Ringling in 1920. As a result, a group of islets and mangrove stands became a defined barrier island now known as Lido Key. The formation of this barrier forced considerable tidal flux to be directed through the now more confined Big Sarasota Pass.

The offset between the ancestral Lido Key and Siesta Key was also essentially as it is today. Actually, it was slightly more than at present (figure 2) because Lido has been nourished and the northern portion of Siesta Key has been eroding for the past few decades.

Historical data show that the channel at Big Sarasota Pass has migrated to the south throughout its known history (figure 8). As a consequence, various types of stabilization were constructed on the south side of the inlet beginning in the 1950s. These structures have been successful in maintaining the channel position.

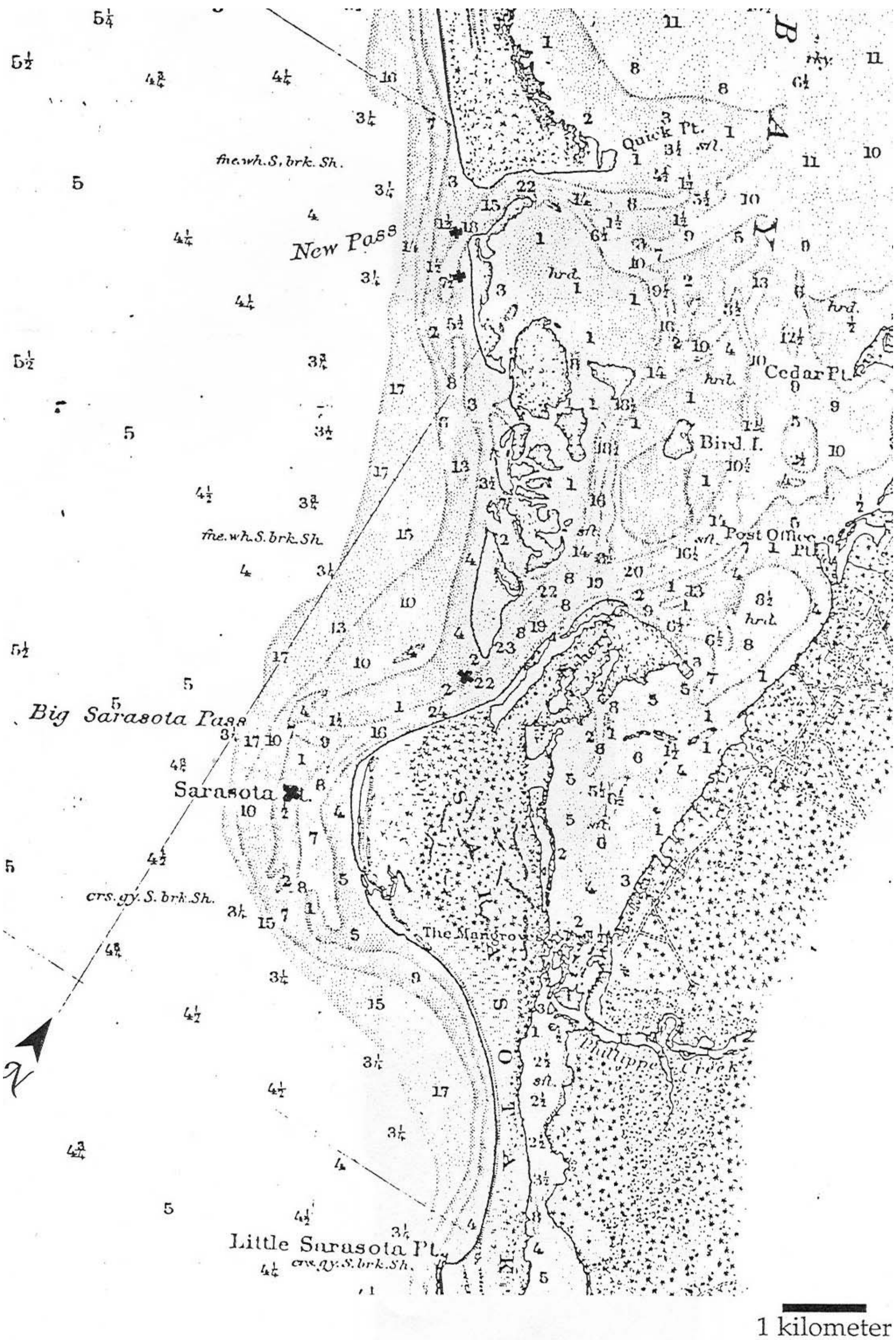


Figure 7 - The Big Sarasota Pass area as it appears on the map of 1883, the earliest accurate map of this coast.

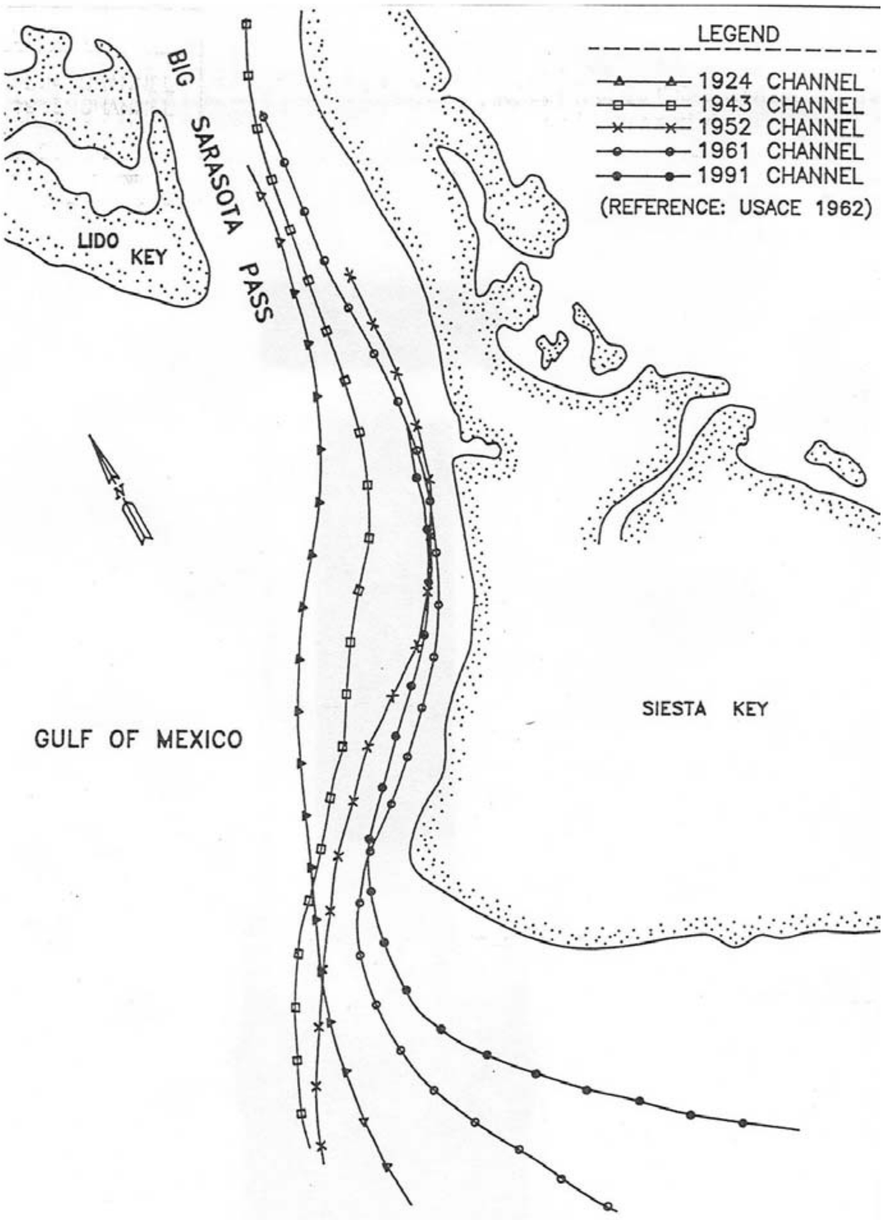


Figure 8 - Map showing the migration of the main channel of Big Sarasota Pass since 1924.

Ebb-tidal Delta

The ebb-tidal delta or ebb shoal of a tidal inlet is a huge accumulation of sand and shell that owes its presence, its size and its shape to the combined wave and tidal processes that interact in the Big Sarasota Pass and adjacent area. The large offset between Lido Key and Siesta Key has caused the ebb delta to be asymmetrical and take on a spit-like form (figure 9). The north to south transport of sediment across the mouth of the inlet has produced the many beach ridges on the north end of Siesta Key resulting in a barrier island that is more than 2 km wide. This huge ebb tidal sand body acts like a conveyor for sediment from north to south.

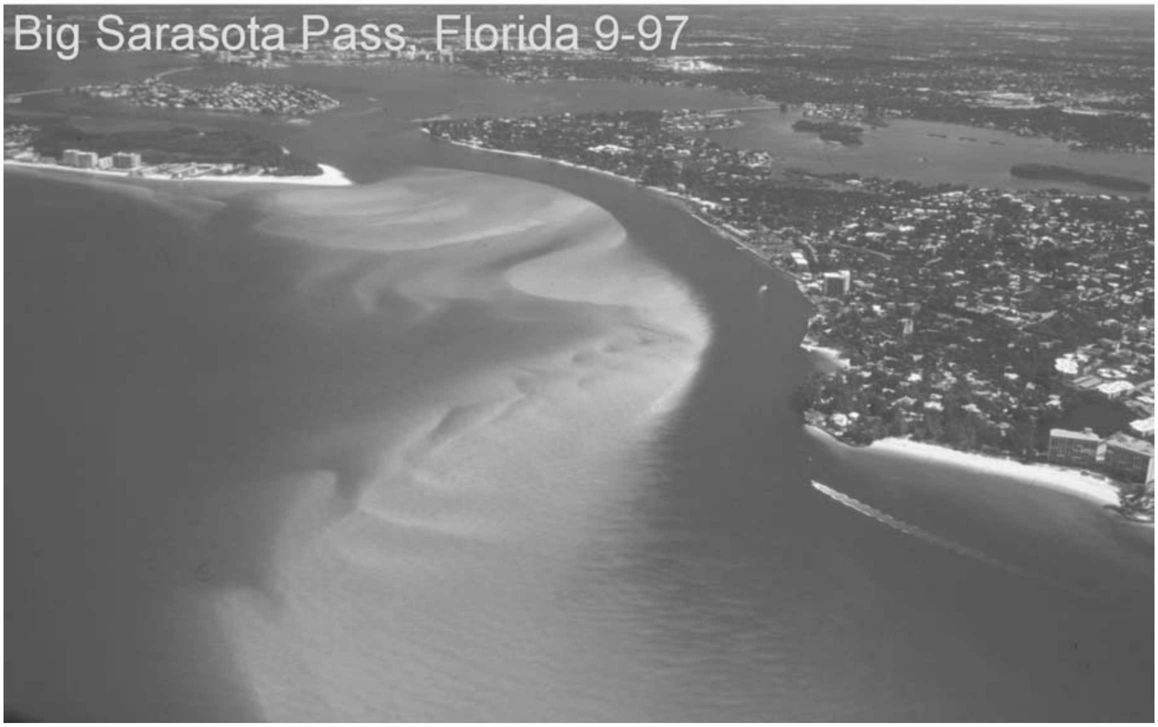


Figure 9 - Oblique photography from 1997 showing the elongate and spit-like nature of the ebb tidal delta of Big Sarasota Pass.

The southern extension of the ebb delta across the inlet channel causes problems of channel stability at the mouth of the channel. The combination of the extreme southern displacement of the channel as it enters the Gulf of Mexico and the tendency for the sand at the southern tip of the ebb delta sand body to migrate landward has presented problems for navigation. The channel in this area is only 2-3 m deep and is commonly partially filled by sand that comes southward along the large ebb tidal delta.

The stabilization of the inlet channel coupled with the continued growth and southerly extension of the ebb tidal delta has bypassed the northern end of Siesta Key. This end has experienced erosion because of the absence of “nourishment” from the bypassing across the inlet mouth. The current condition has this natural nourishment of sand being added to the beach a few hundred meters south of the north end of Siesta Key.

Analysis of sequential vertical aerial photographs of Big Sarasota Pass permits an understanding of the evolution of the ebb delta over the past 50 years. This covers the period of time from before the stabilization of the south shoreline of the inlet to the present. The first of the vertical photos (1948) shows the inlet prior to any significant development on Siesta Key including stabilization of the south shoreline of the inlet channel. At this time the ebb tidal delta was well developed but did not extend significantly south of the northern tip of Siesta Key (figure10). The main channel extends directly gulfward, straight out from the channel at the north end of the barrier.

Only a small sediment shoal is present south of the inlet channel gulfward of Siesta Key. The main ebb delta does not extend much gulfward of Siesta Key. The general appearance of this inlet area is as would be expected for a mixed energy inlet with a downdrift offset (figure 1). There is apparent bypassing of sediment to the accreting north end of Siesta Key (figure 10).

Figure 10 - Vertical aerial photograph from 1948 showing Big Sarasota Pass and the adjacent barriers. Note the accretion on the north end of Siesta Key as the result of sediment bypassing across the inlet from north to south.

By 1957 development of northern Siesta Key had begun in earnest as evidenced by the numerous roads. The general morphology of the inlet channel had changed with the gulfward portion bending markedly to the south (figure 11). The outer portion of the ebb delta shoal now extends well past the accreted northern tip of Siesta Key. Under these circumstances sediment from the north is now being bypassed to several hundred meters down the island. This is the result of the stabilization of the inlet channel and an apparent increase in longshore sediment transport from Lido Key across the inlet.

More changes in the system are apparent by the time of the 1972 aerial photo. The obvious one is the nearly total development of Siesta Key (figure 12). The change that is most important for the inlet itself, is the loss of beach sediment on the gulfward side of the north end of Siesta Key. This is the result of sediment being bypassed to a position further south on the barrier.

Figure 11 - Vertical aerial photo of Big Sarasota Pass showing a south curving channel and an extended outer ebb delta shoal.

Figure 12 – Aerial photo of Big Sarasota Pass in 1972 showing multiple channels cutting the ebb delta

Figure 13 – Aerial photo of Big Sarasota Pass in 1977 showing similar features to those of 1972,

Figure 14 - Vertical aerial photograph of the Big Sarasota Pass area taken in 1993. Although not distinct, it is apparent that the small channels cutting the ebb tidal delta are present.

Figure 15 - Vertical aerial photograph of Big Sarasota Pass area taken in 2003. Note that the small channels that were present on most previous photos have been filled and the sand body just offshore of Siesta Key has increased in size.

INLET SYSTEM BATHYMETRY

The general bathymetry of Big Sarasota Pass has remained fairly constant for more than a century. The channel depth and configuration has migrated to the south (figure 8). The most obvious change in the inlet area is the increase in the size of the ebb tidal delta (figure 16). The first detailed bathymetric survey presented here is the boat sheet for the 1953 survey by the National Ocean Survey is presented (figure 17). This represents the raw survey data in feet. The inlet and ebb delta at this time are similar to the 1948 aerial photo (figure 10). This boat sheet shows a distinct channel across the ebb delta with depths of up to 10 ft (3 m). It also shows that the main channel is up to 26 ft (8 m) deep. The gulfward end of the main channel is directed toward the SSW with depths of 10-11 ft (3.0-3.3 m) consistently.

A detailed bathymetric map of the inlet area was surveyed in May, 1991 by Coastal Planning and Engineering (1993). It shows less detail than the 1953 survey but does permit a comparison with it (figure 18). It shows no channel across the ebb delta and depths in the main channel about the same as the 1953 survey. The distal end of the main channel is shoaled to less than 8 ft (2.4 m). There is no indication of the orientation of the most distal portion of the channel.

As part of the present study another bathymetric survey was conducted of the inlet and vicinity (figure 19. It shows maximum depth of the main channel to be in excess of 8 m and only very shallow (~0.5 m) channels across the ebb delta away from the area of the previous deep channel. The distal end of the channel has shoaled to only about 2 m and

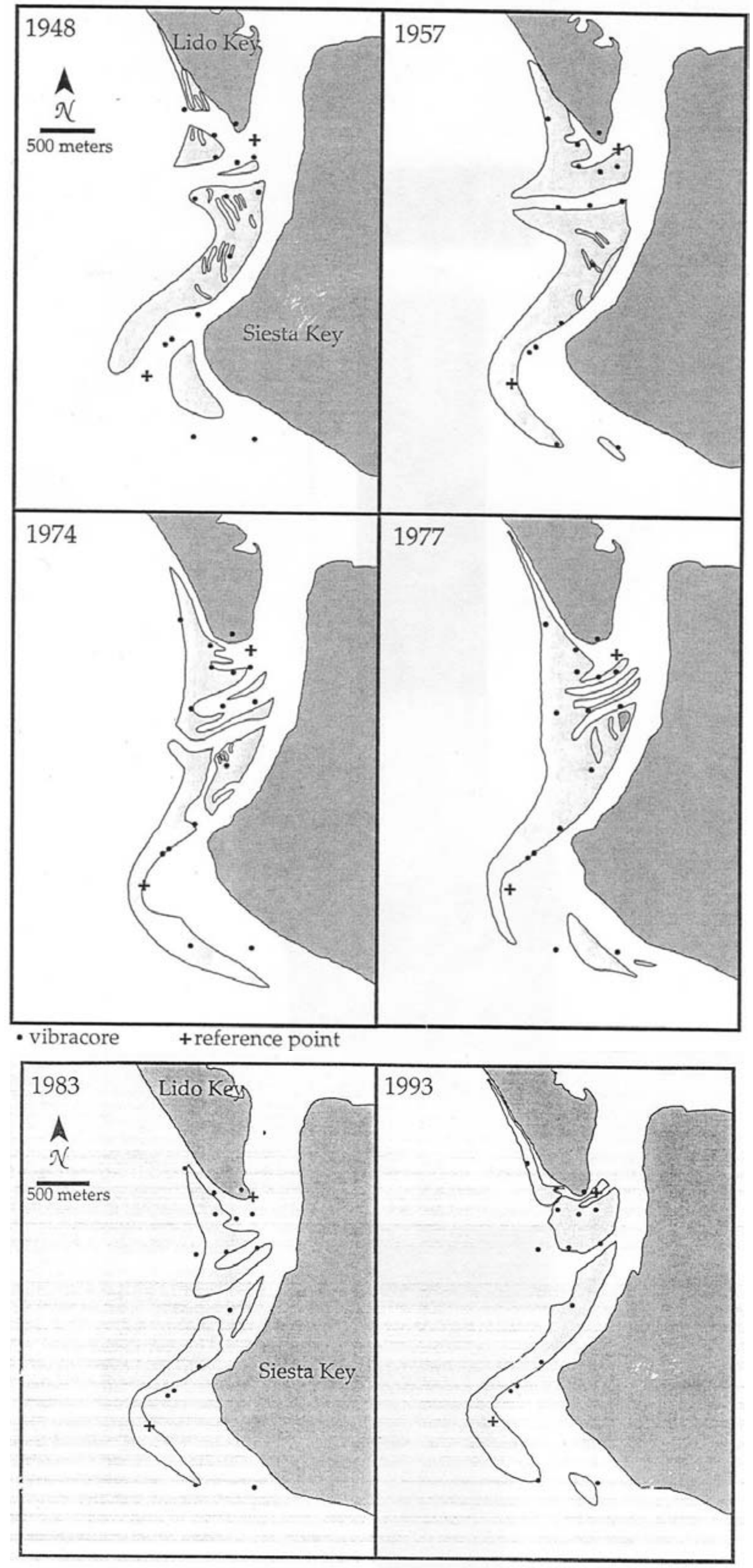


Figure 16- Sequence of outline maps based on previous photos and showing the temporal changes in Big Sarasota Pass and vicinity over the past 50 years. (from Kowalski, 1995).

Figure 18 – Boat sheet from the 1953 survey of the Big Sarasota Pass area. Note the presence of a distinct channel across the ebb delta and the position of the main channel.

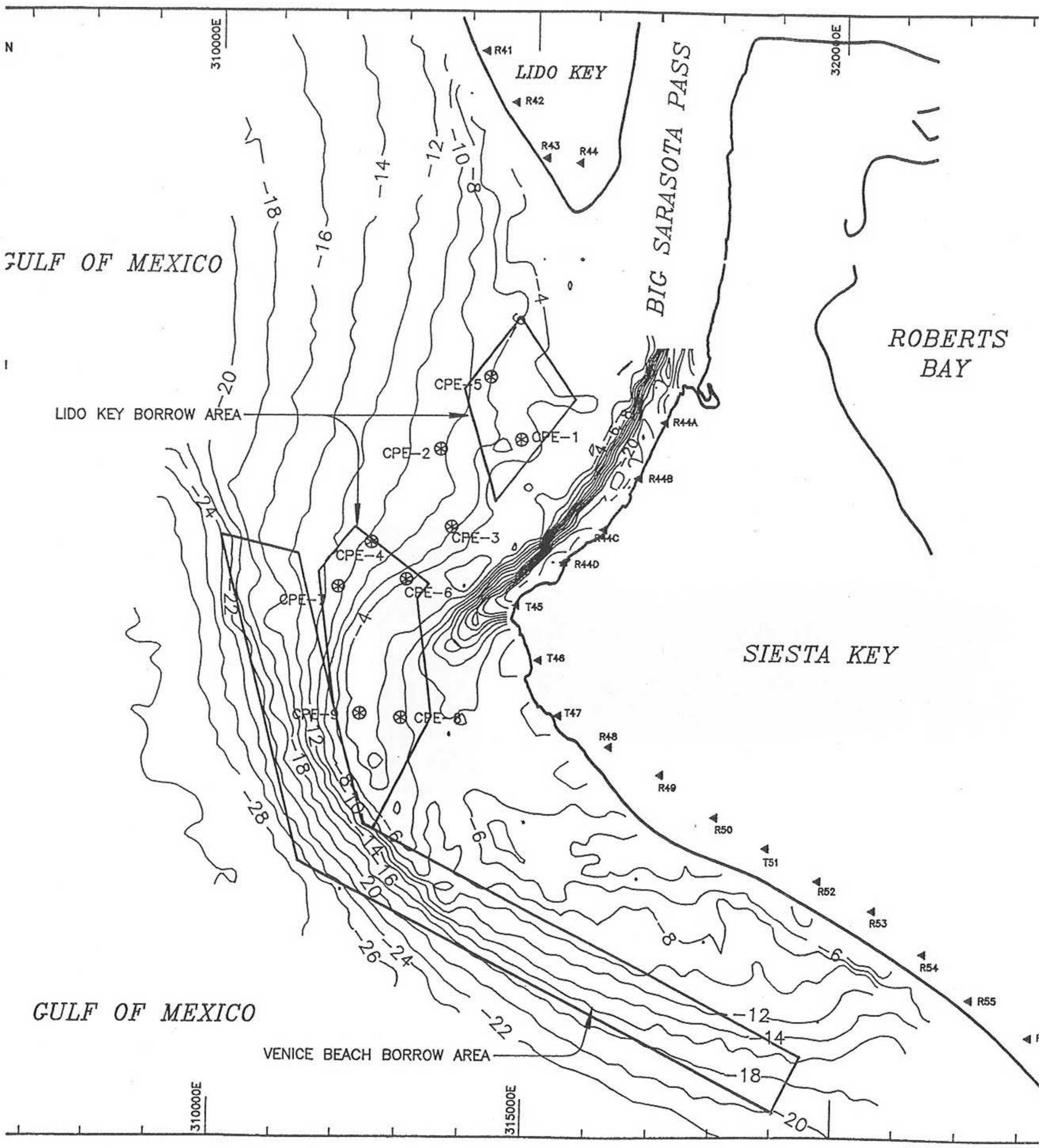


Figure 19 – Bathymetric map along with core locations from 1991 survey of the Big Sarasota Pass area. Not the absence of the distinct channel across the ebb delta and the southward trend of the distal end of the main channel. Compare with figure 18 (from CPE, 1993)

is oriented directly to the south. As the channel continues it becomes directed to the southeast before reaching the open Gulf of Mexico (figure 19). This map also shows that the ebb delta sand body has extended further to the south than on previous surveys.

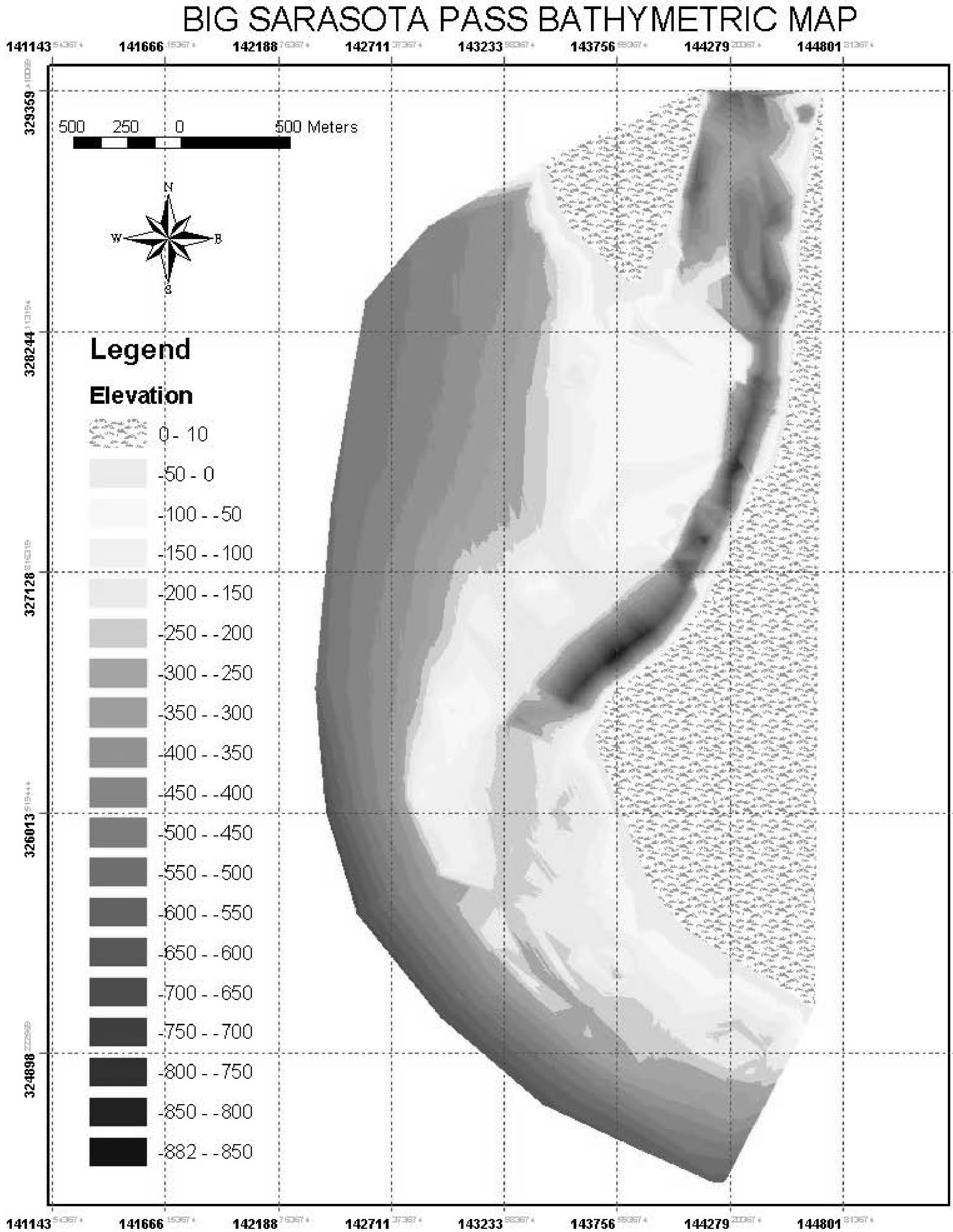


Figure 19 – Bathymetric map of Big Sarasota Pass and vicinity surveyed in February, 2004.

INLET TIDAL CURRENTS

Tidal currents are an important element of all tidal inlets in that these currents are a major factor in determining the size, location and stability of the inlet. In the case of Big Sarasota Pass, the tidal currents keep the channel open but have historically not been able to maintain a stable position for the inlet. As a consequence the north to south transport of sediment in the longshore current system has moved the channel throat to the south as shown in figure 8. The stabilization of the channel position has prevented further migration. It has not, however, prevented the large sediment body at the mouth of the inlet from building to the south across the mouth of the inlet. This is a response to the inability of the tidal currents to maintain a channel cross-section area and to maintain its position.

The earliest good information on tidal currents in Big Sarasota Pass were provided in the NOAA Tide Tables of 1983. Maximum flood velocity was reported as about 0.77 m/sec (1.5 knots) with a maximum ebb velocity of 0.51 m/sec (1.0 knots). More recent data from 1883 have both ebb and flood at 0.93 m/sec (Davis and Gibeaut, 1990). The latter is difficult to understand because it is typical that maximum ebb velocity exceeds maximum flood velocity.

Tidal currents were measured at two locations over a diurnal cycle in a previous study (Kowalski, 1995) at two locations, one in the channel throat about halfway in the length of the inlet and the other near the mouth of the channel. Tidal currents were also measured as part of the present study near the mouth of the inlet over several weeks. The synoptic current data from Kowalski shows distinct differences in the tidal currents at the two locations. The proximal location near the middle of the inlet length shows maximum floods tide velocities of 0.9 m/sec and ebb velocities near the same at 0.8 m/sec (figure 20); a nearly symmetrical pattern of velocities. By contrast, the velocities near the mouth of the inlet show considerable difference between the flood and ebb current values. Maximum flood velocity is only 0.25 m/sec whereas the maximum ebb velocity is 1.2 m/sec (figure 21); a difference of nearly a meter per second.

The primary reason for this difference in velocity patterns is the large amount of tidal flux that enters the inlet over the shallow sediment that extends from Lido Key. Here flood currents cross into the inlet area meaning that much of the tidal flux that enters the inlet does now pass through the channel where the proximal current meter was located near the middle of the channel length. The current meter near the mouth of the inlet experiences little flood tidal flux because so much is passing over the sand body. The ebb currents are channelized however, and show high velocities.

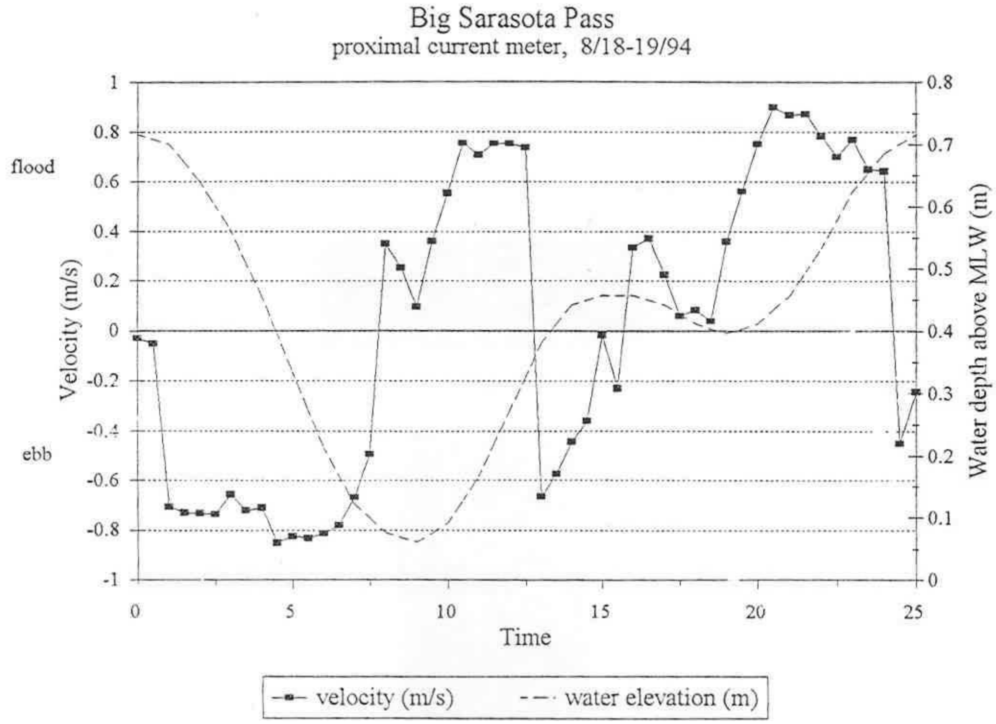


Figure 20 - Tidal current velocity (solid line) and tidal level (dashed line) in the throat of Big Sarasota Pass in August, 1994 (from Kowalski, 1995).

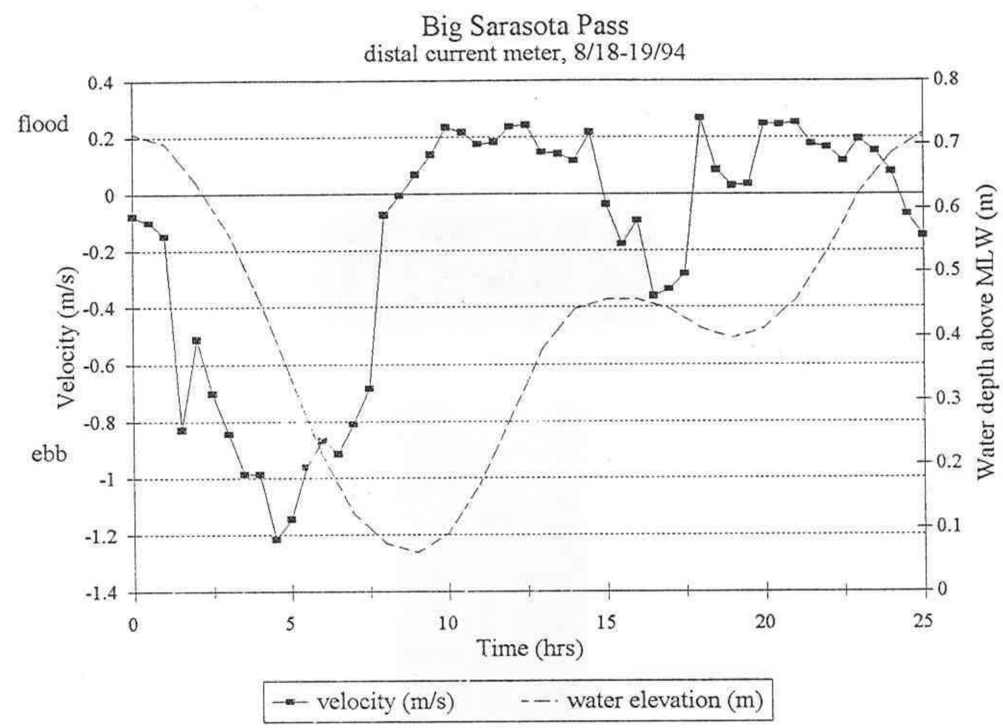


Figure 21 - Tidal current (solid line) and tidal level (dashed line) near the mouth of Big Sarasota Pass in August, 1994. These measurements are from the same time as those of figure 20. (from Kowlaski, 1995)

SURFACE SEDIMENTS

Surface sediments were collected as part of a study by Kowalski (1995) and in the present study. Kowalski collected and analyzed 78 samples from the inlet area and the present study includes an additional 35 (27 subaqueous and 8 from adjacent beaches). All were analyzed for texture and composition. Mean grain size and sorting values were obtained for each. The total carbonate content was also determined from both the sand and gravel fractions. All of the gravel is shells and shell debris whereas in some samples a significant amount of fine carbonate shell debris is also present (Appendix A).

The general distribution of sediment texture is dominated by fine sand (figures 22 and 23). Coarser sediments are the result of shell debris which can range from fine sand to gravel. The fine sand is from 0.15 to 0.20 mm in mean grain size. This sediment is nearly all quartz. This is the type of sediment that is characteristic throughout the west-central coast of the Florida Peninsula. The coarser sediment with significant shell content is concentrated on the floor of the inlet channel (figures 22 and 23) with minor concentrations on the shallow surface of the ebb delta just south of Lido Key.

The mean grain size of the surface sediments ranges from about 2.5 phi (0.18 mm) to 2.8 phi (0.14 mm) although some samples are both coarser and finer (figure 22) These general characteristics are also present in the surface samples that were collected as part of the current study. This type of sediment extends throughout the ebb delta sediment body. A few samples from the landward side of the northern part of the shoal are coarser. Sediment on the channel floor is also coarser. The coarse sediments are strictly a result of shell debris in the sediment. The more shell material, generally the coarser the sediment.

The mixture of fine quartz sand with small to moderate amounts of shell debris has been used successfully for beach nourishment throughout the Gulf peninsula coast of Florida. The sediment that comprises the vast majority of the ebb delta at Big Sarasota Pass is this type and would make good nourishment material.

Because carbonate content varies greatly in the sediment of this entire region, it was important to analyze each surface sample for carbonate percent by weight. All gravel is carbonate in nature; shells and shell debris. In most samples gravel is absent or is less than 5% (figures 24 and 25). This gravel is most abundant on the channel floor and scattered over the surface of the northern portion of the ebb delta. There is no indication from surface sediments that gravel would be a problem in nourishment material.

Total carbonate content combines the gravel fraction with the carbonate portion of the sand sizes sediment. The latter ranges from essentially zero up to 20%. In most samples the carbonate (shell) portion of the sand fraction is less than 5% (figures 26 and 27). High concentrations of calcium carbonate are associated with high gravel concentrations (compare figures 24 and 25 with 26 and 27).

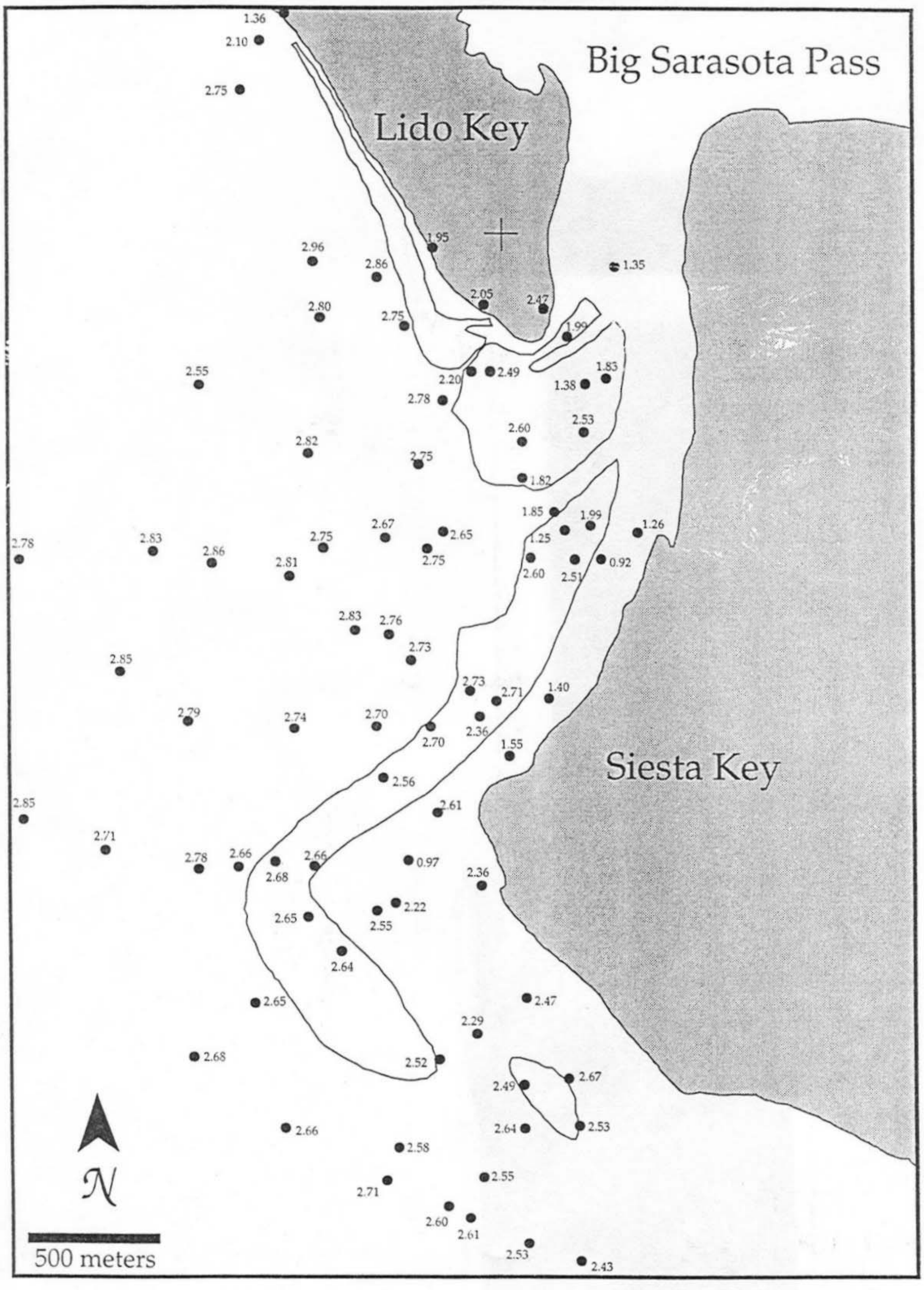


Figure 22 – Map showing the distribution of the mean grain size (phi units) of surface sediments (from Kowalski, 1995)

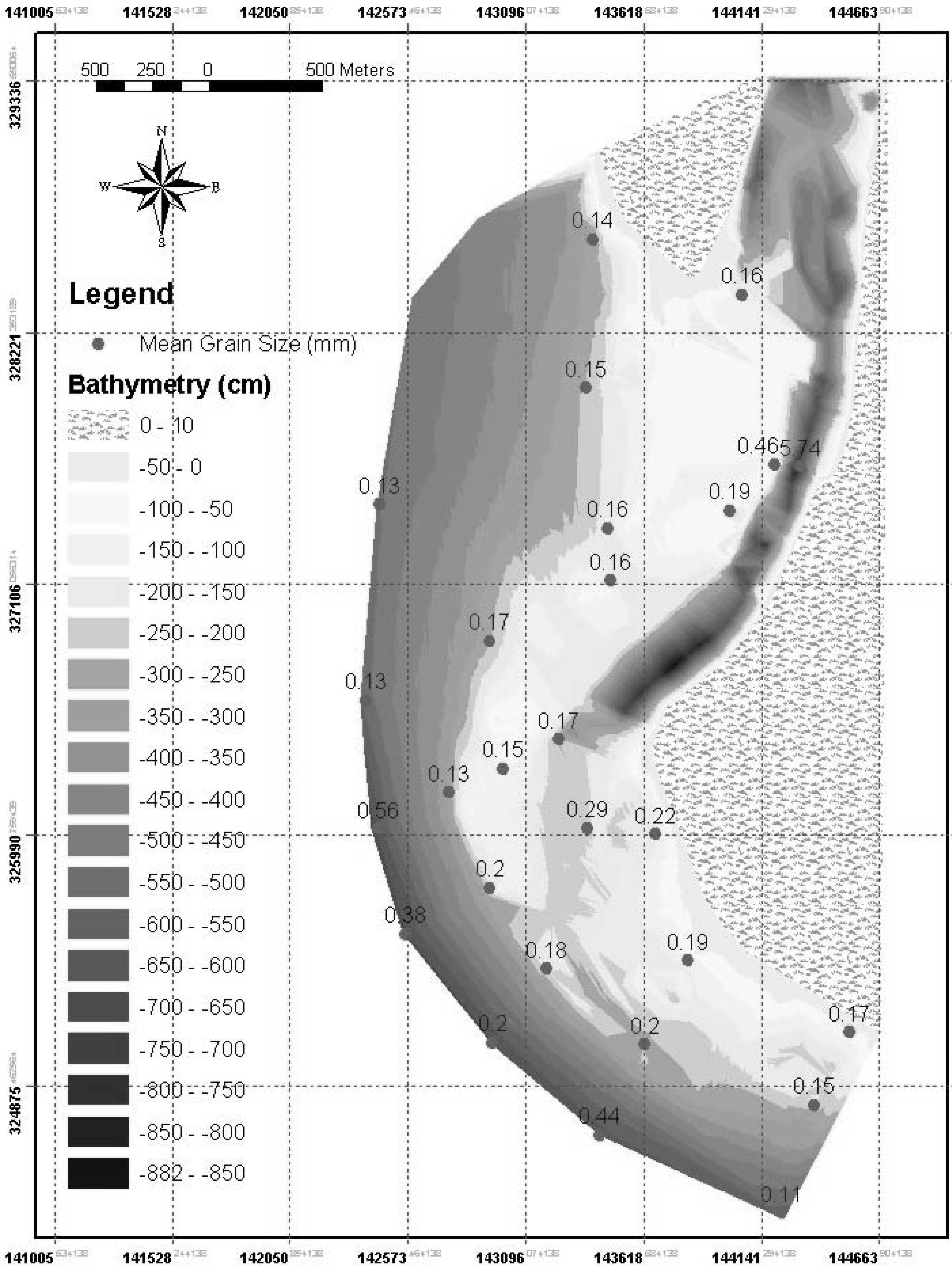


Figure 23 – Mean grain size in millimeters for surface sediment samples collected and analyzed in 2004.

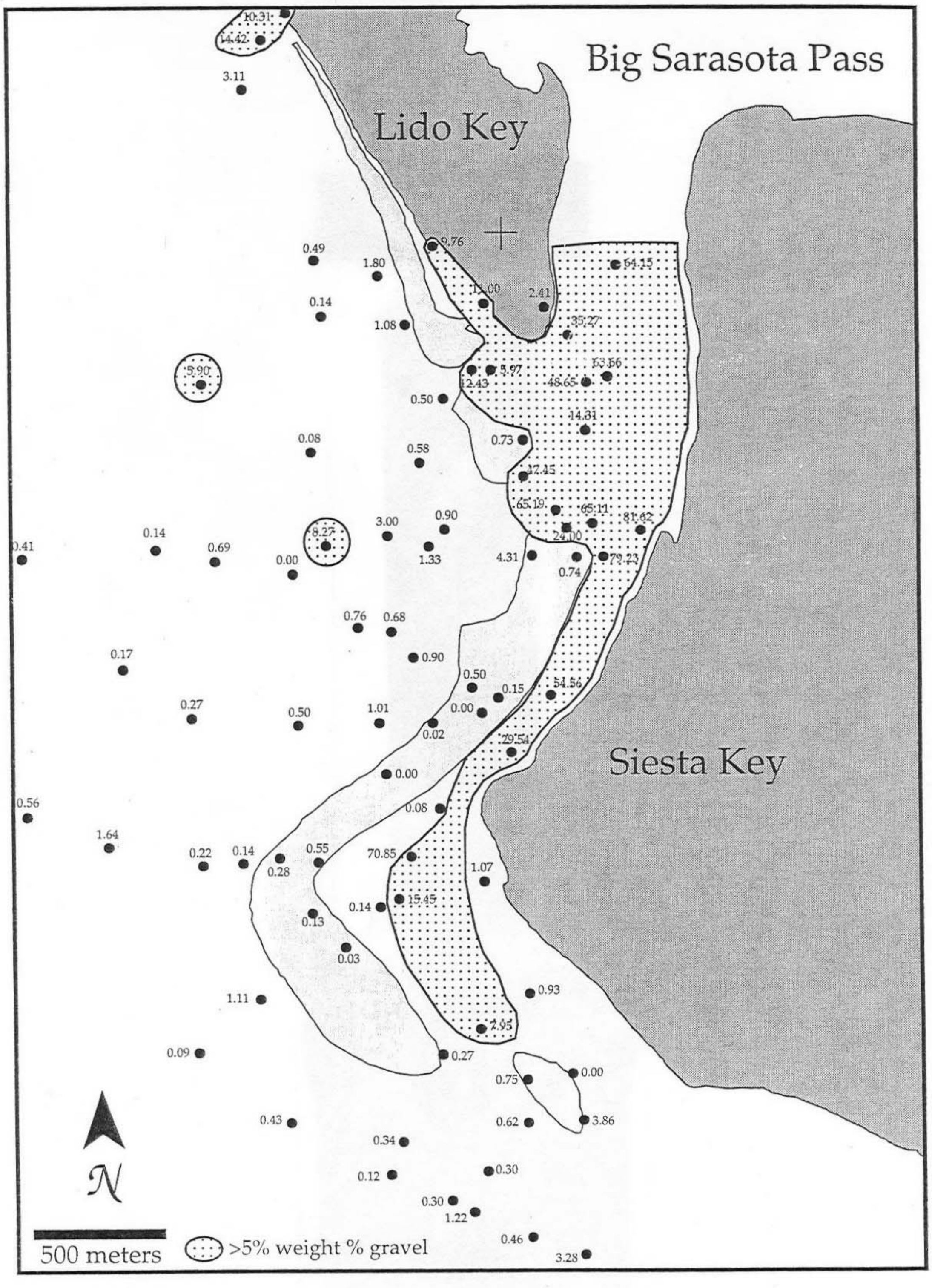


Figure 24 – Map showing the distribution of the gravel content in surface sediments. (from Kowalski, 1995)

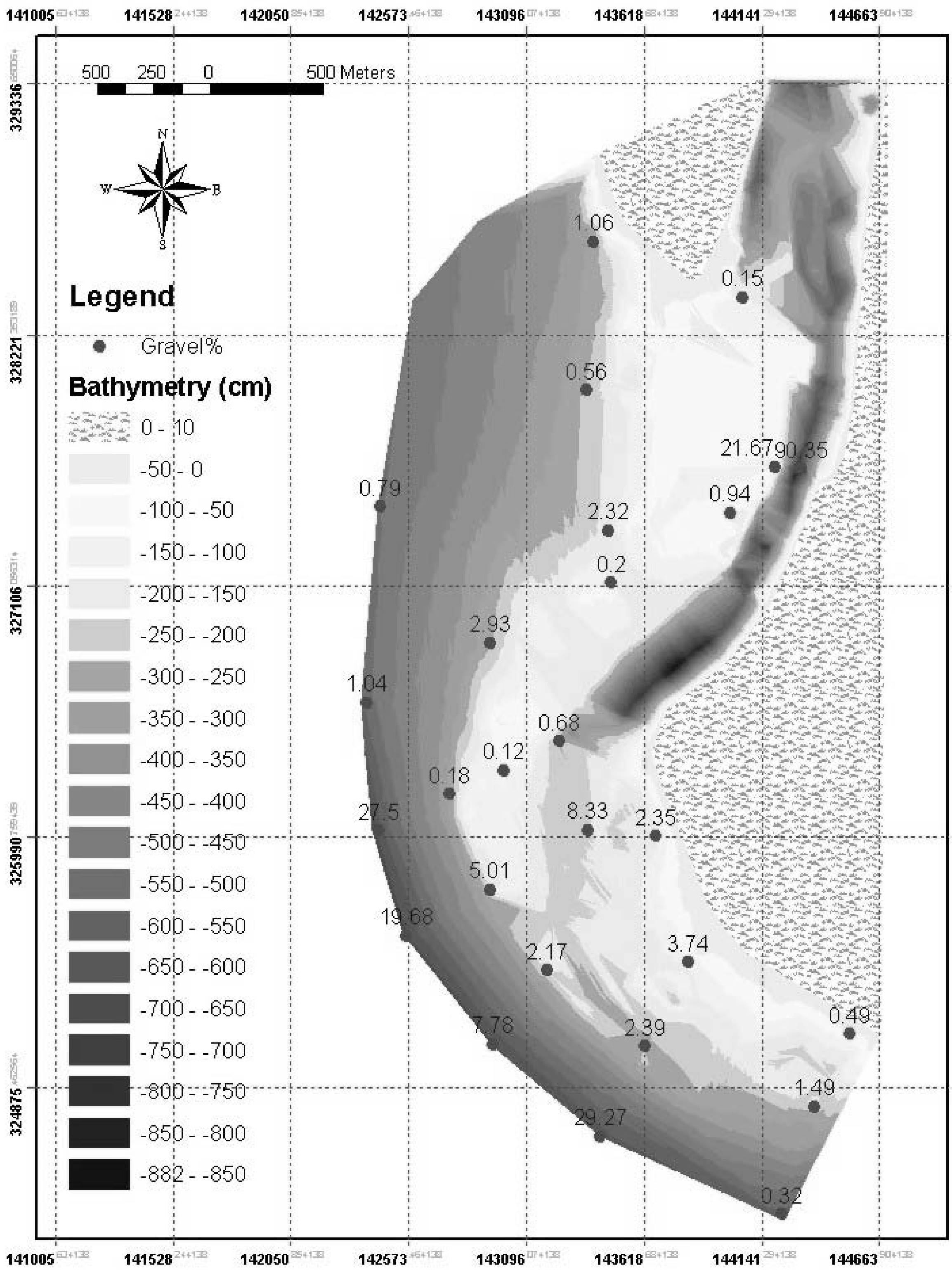
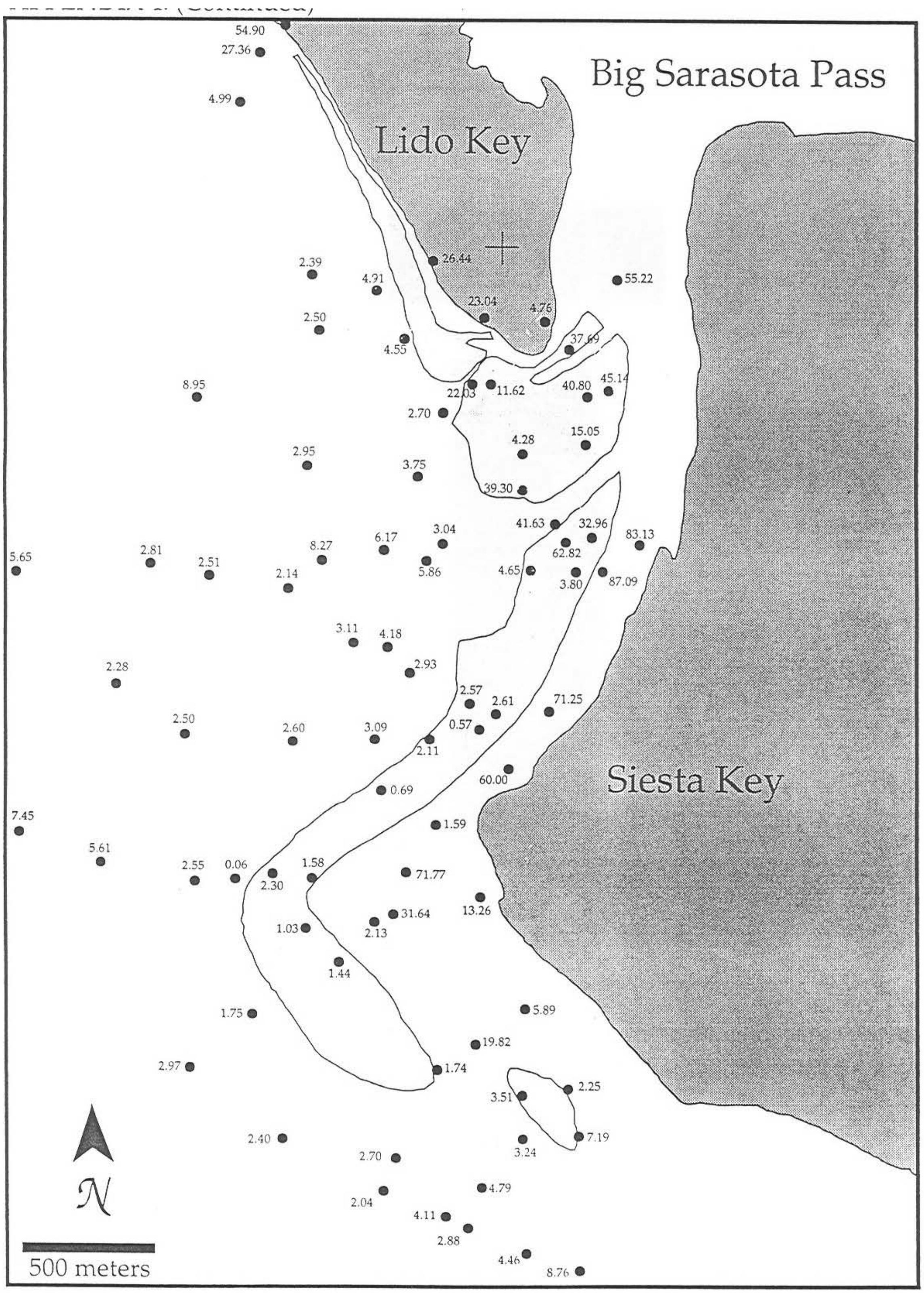


Figure 25 – Gravel content in percent of surface sediment samples collected in 2004.


Big Sarasota Pass
Lido Key
Siesta Key
54.90
27.36
4.99
2.39
4.91
26.44
55.22
2.50
23.04
4.76
4.55
37.69
8.95
22.03
11.62
40.80
45.14
2.70
4.28
15.05
2.95
3.75
39.30
41.63
32.96
83.13
6.17
3.04
62.82
5.65
2.81
2.51
8.27
2.14
5.86
4.65
3.80
87.09
3.11
4.18
2.28
2.93
2.57
2.61
71.25
2.50
2.60
3.09
0.57
2.11
60.00
0.69
7.45
1.59
5.61
2.55
0.06
2.30
1.58
71.77
13.26
31.64
1.03
2.13
1.44
5.89
1.75
19.82
2.97
1.74
3.51
2.25
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7.19
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4.79
2.04
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4.46
8.76
N
500 meters

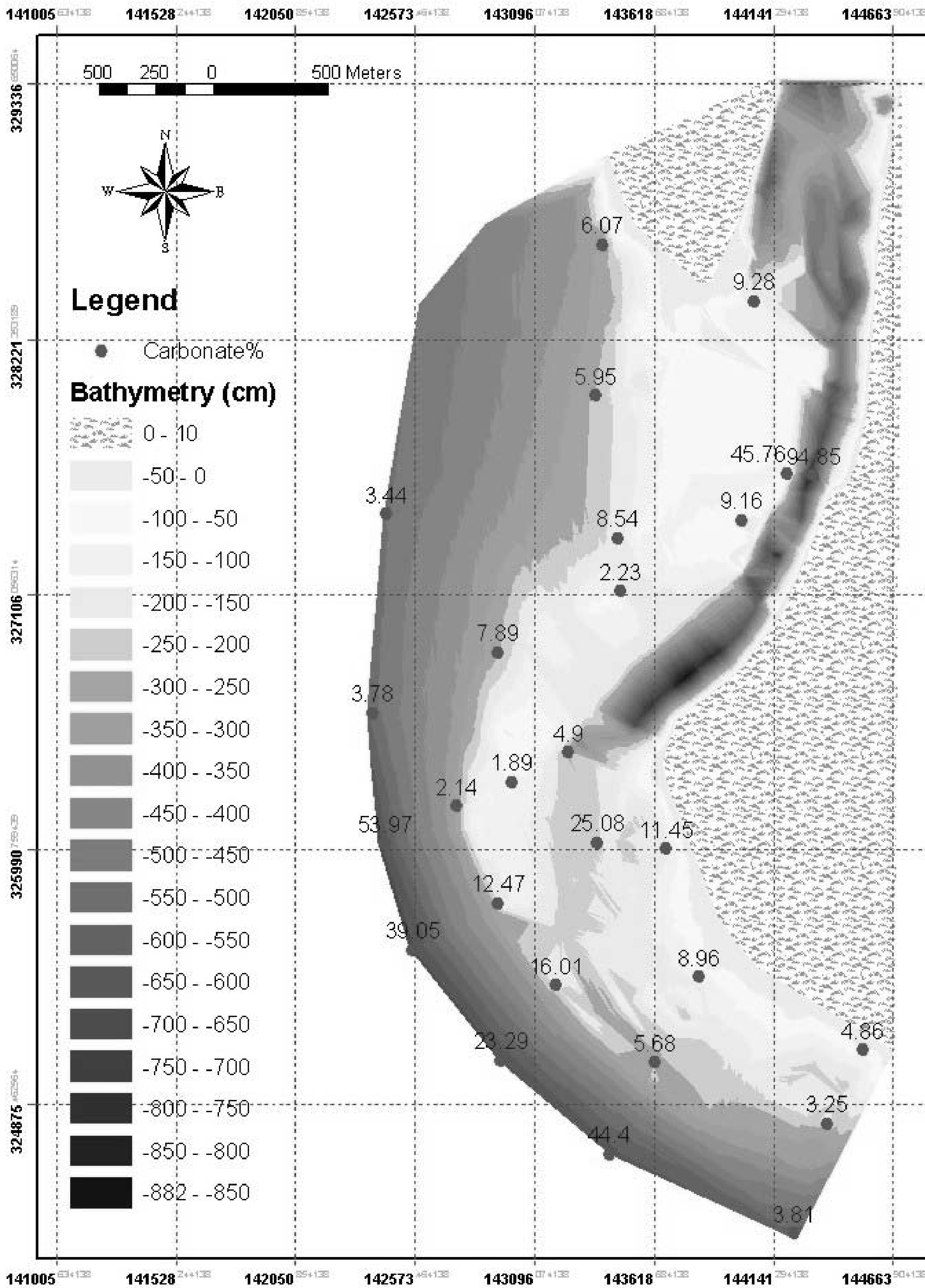

Figure 27 – Percent carbonate of all surface sediments collected in 2004.

STRATIGRAPHY OF THE EBB DELTA SAND BODY.

Three sets of vibracores have been taken from Big Sarasota Pass and vicinity; the Corps of Engineers in the 1960s and 1980s and Kowalski (1995). Coastal Planning and Engineering also took cores in 1991 as part of the inlet management study (1993). A total of 61 cores was collected ranging from one a meter to more than 20 m in length. These cores are primarily in the ebb delta but also include the adjacent areas. Sediments in the cores reflect well the sediment on the present surface of the ebb delta. Fine sand dominates with shell debris is a range of sizes. The shell is scattered in most cores but may be concentrated in thin layers of in some cores, in this shell beds.

The core data were assembled in a GIS database to determine the volume of sediment in the ebb tidal delta at Big Pass. The volume of sediment there has been reported at various amounts ranging from 8 million to 30 million cubic meters . In order to determine the amount of this volume that is of beach nourishment quality only the dominantly quartz sand portion of the sediment body was used. The first thick shell gravel layer was used as the bottom of the potentially usable sand body. The thickness of this sand and slightly shelly sand for each of the cores was plotted and contoured to produce an isopach (thickness) map of this unit. Because boundary problems cause contouring to become distorted and sometimes misleading, the boundary for this map was drawn by connecting the outer core locations over the area. As a result the map looks a bit unusual (figure 28) but it gives the most conservative volume of sediment for the ebb delts. This approach provides a volume of 14.6 million cubic meters as the most conservative amount of beach quality sediment that is within the ebb delta. The actual amount is probably 30 percent more or about 19 million cubic meters.

DISCUSSION

The present conditions at Big Sarasota Pass are the result of a combination of natural processes and human intervention. This inlet plays a major role in the character of the northern portion of Siesta Key, it has little influence on the character of Lido Key because of the dominant north to south longshore transport of sediment. This inlet is a good example of a mixed-energy tidal inlet with a downdrift offset. The behavior of such inlets is quite predictable. Sediment is bypassed across the ebb tidal delta and deposited on the downdrift island in the form of beach/dune ridges. It is this phenomenon that causes islands downdrift of such inlets to prograde seaward and become quite wide.

In the case of Big Sarasota Pass this phenomenon has been modified by human activity that includes control of the position of the main inlet channel and beach nourishment on the updrift barrier island. Because of the natural tendency for inlets like this to migrate slowly in the direction of dominant longshore sediment transport, and the desire to protect development along the inlet channel on the north end of Siesta Key, the channel was stabilized by a wide range of structures, in a generally disorganized fashion. The net result was the successful halting of further migration of the inlet channel.

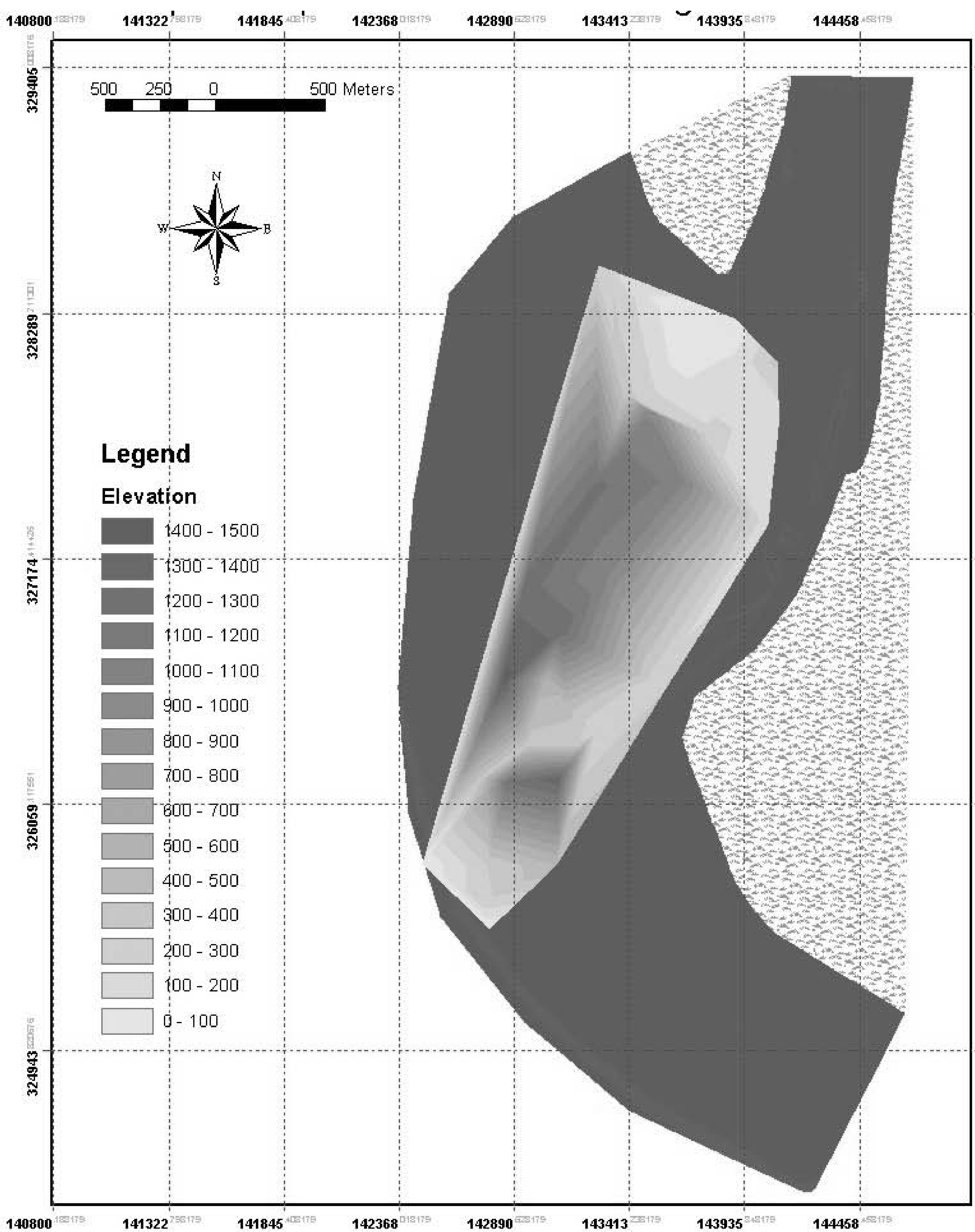

Figure 28 – Isopach map of cores taken from the ebb delta at Big Sarasota Pass. The boundaries are limited by the position of the cores themselves.

The consequences of the stabilization of the inlet channel was that only that part of the inlet system was stabilized and the remainder continued to operate in the natural fashion. The ebb tidal delta functioned well as a sediment bypassing feature and Siesta Key was continually provided with sediment from the north. As Lido Key extended to the south due to the combination of beach erosion on the barrier and the dominant longshore sediment transport, the ebb delta became increasingly asymmetrical and grew toward the south across the north end of Siesta Key. This resulted in the sediment that was being bypassed to Siesta Key moving several hundred meters to the south of the north end of the island. As a consequence, the north end of the island was eroded due to lack of sediment supply and the area immediately to the south has experienced considerable additional beach as a result.

The recent nourishment of the beach at Lido Key has also had an influence on both Big Sarasota Pass and the north end of Siesta Key. This nourishment placed hundreds of thousands of cubic meters of sand on the beach updrift of Big Sarasota Pass. The erosion of a significant portion of this nourishment project has provided considerable additional sediment to the ebb delta at Big Sarasota Pass. Evidence of this is in the absence of the previously persistent shallow channels across the ebb delta from the open Gulf to the inlet channel. These have been filled with sediment from the erosion of the Lido Beach. An additional consequence of the increased supply of sediment provided by the erosion of this nourishment project has been to lengthen the ebb delta toward the south and to fill in part of the main inlet channel. Increased sediment volumes are being provided to Siesta Key as a result.

SUMMARY

The objective of this investigation was to answer five questions posed by the County. The data assembled have provided the answers to these questions. They are:

1) “What is the likelihood of Big Pass closing?” Under the present circumstances there is little likelihood that Big Pass will close in the sense that there will no longer be tidal flux through the inlet. It is likely that the mouth of the main channel will continue to shoal as has been the case over the past several years.

2) “Does the Big Pass shoal benefit directly from updrift restoration projects?” Yes, there is additional sediment being moved to and along the Big Pass shoal as the result of the nourishment on Lido Key.

3) “Is the sand in the Big Pass shoal (or the historical channel) suitable for beach nourishment purposes?” Yes, there are several million cubic meters of beach quality sand in this shoal.

4) “Are there any portions of the shoal (or the historical channel) that can be removed without having a detrimental impact to the adjacent shorelines?” Yes, there is a considerable portion of the ebb delta that can be removed without causing problems on the Siesta Key shoreline, especially the distal southern end.

In fact, the removal of this portion of the sand body would benefit the northern end of Siesta Key by enabling bypassed sediment to reach this critically eroding area whereas now it is carried several hundred meters to the south.

5) “Would dredging in or around the inlet affect (improve or decrease) the stability of the channel, especially in the more seaward areas?” It is not recommended to dredge the main channel of Big Pass which is stabilized and maintains a depth of 5-8 m. Dredging of the distal portion of the inlet channel in combination with removal of sediment for nourishment purposes would enhance tidal flux in this area and would provide for a deeper distal portion of the main channel. It is unlikely that the channel would remain in this state for very long but would continue to shoal and migrate to the south in response to the longshore sediment transport from the north. A possible solution would be the regular dredging and use of this sediment for nourishment purposes.

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APPENDIX: Sediment characteristics