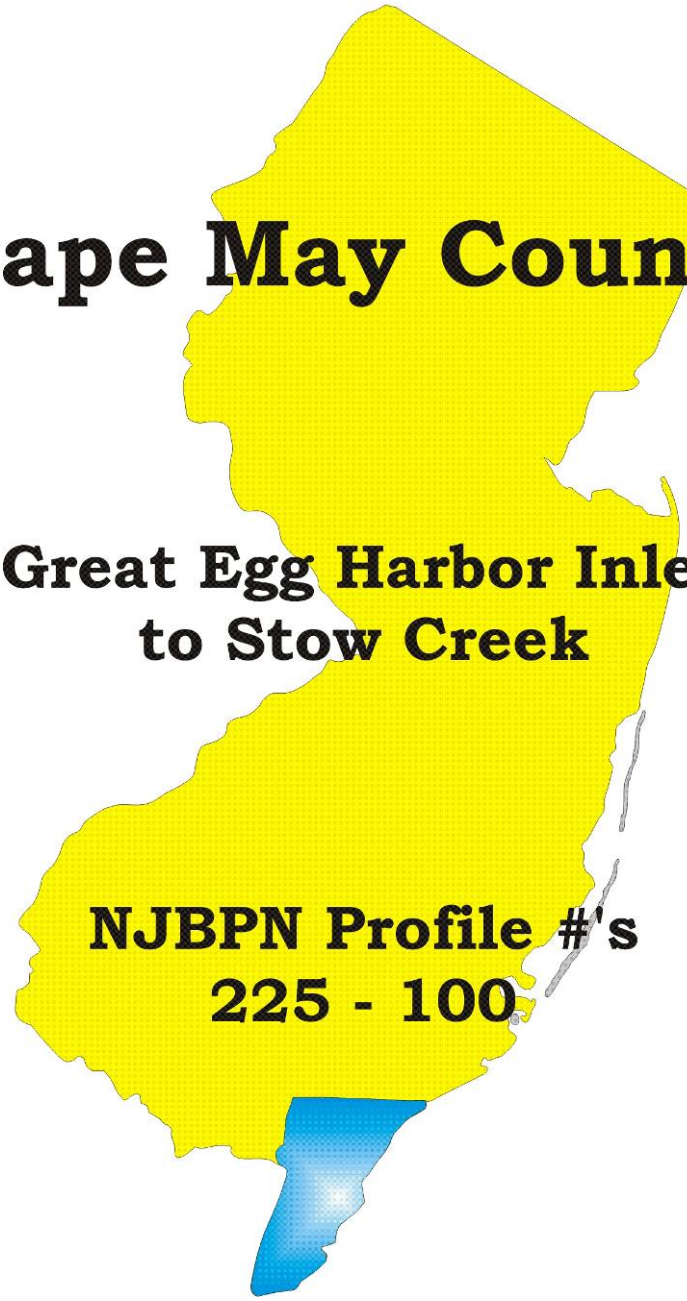
New Jersey Beach Profile Network

Cape May County

Great Egg Harbor Inlet to Stow Creek

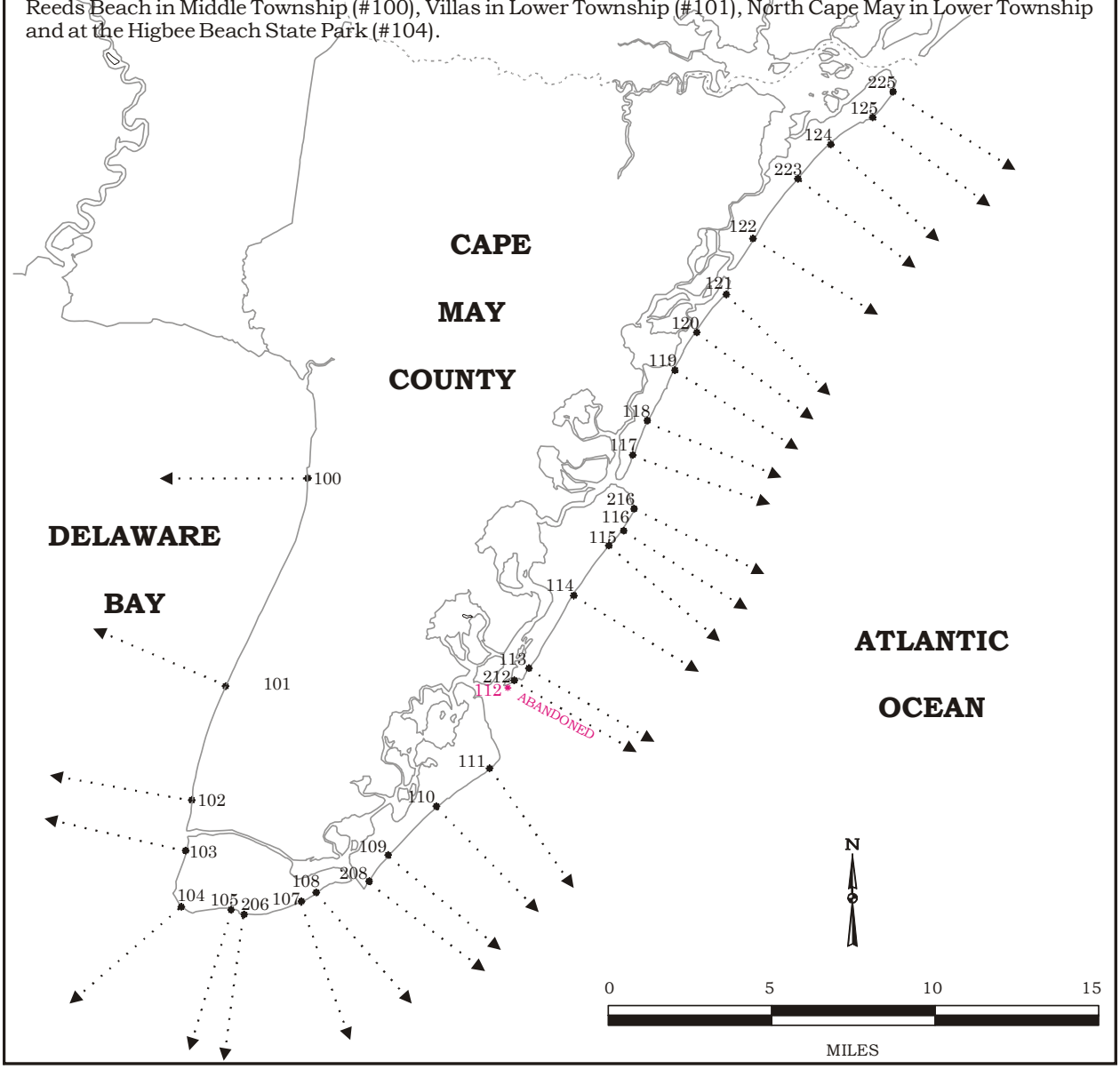


NJBPN Profile #'s 225 - 100

New Jersey Beach Profile Network
Cape May County Profile Site Locations

Figure 147

There are twenty-nine NJBPN survey sites along the beaches of Cape May County, consisting of a combination of barrier islands, coastal headlands and bayshore. Twenty-five sites are Atlantic Ocean profiles and the remaining four are set along the Delaware Bay shoreline of western Cape May County. The ocean profile sites are located in the following municipalities: the City of Ocean City, Strathmere in Upper Township, the City of Sea Isle City, the Borough of Avalon, the Borough of Stone Harbor, the City of North Wildwood, the City of Wildwood, Lower Township, the City of Cape May, and the Borough of Cape May Point. Profile #112 on South Pointe in Stone Harbor was lost due to continuous erosion and was replaced by profile #212, which is located south of 121st Street in Stone Harbor. The four Delaware Bay profiles are located in the communities of Reeds Beach in Middle Township (#100), Villas in Lower Township (#101), North Cape May in Lower Township and at the Higbee Beach State Park (#104).



How to Interpret the Data:

A 20-year analysis of each site location in Monmouth County is presented in the following pages. The analysis for each site includes: a 20-year shoreline trend graph designed to show yearly changes (fall) in the position of the shoreline with respect to the survey monument for each site plus a cumulative summation of the change over time to 2006 with a power function trend line generated by the data. Next there is a cross-section plot for each site comparing 1986 and 2006 data, with two comparison photographs with text.

Shoreline Trend Graph
The shoreline trend graph includes several useful pieces of information. The red and green bars on each graph show the annual shoreline change for each year. The red bars indicate a shoreline retreat and the green bars indicate a shoreline advance. The blue line towards the top of each graph shows the summation of all shoreline positions throughout the 20-year study period. The black line shows the median trend for the profile's annual shoreline position changes. The reference position for each profile is variable resulting in a variety of scaling options used to represent the changes in feet from reference position for each graph. This may result in the graph bars appearing smaller or larger depending on the required scale for each location. This does not affect the value for the shoreline change calculated for each site since this is simply the difference between the distances from the reference position to the shoreline point for each survey.

Comparison Photographs
At least two photographs were selected for each profile location. An early photograph (usually taken between 1986 and 1991) and a more recent photograph taken in 2006 is included for each profile. The photographs are then followed by text explaining what is seen in each photograph along with the year in which it was taken.

Cross-section Plot
The cross-section plots compare data collected in 1986 to 2006 data. They provide a visual comparison of changes that occurred over the study period both above and below the shoreline position (zero datum, NGVD 29). Profiles that were added to the project at a later date only compare 1995 data to 2006 data. The solid black line shows the data that was collected during the fall 2006 survey. The red-dotted line, except in cases where the profile was added at a later date, shows the data that was collected during the fall 1986 survey.

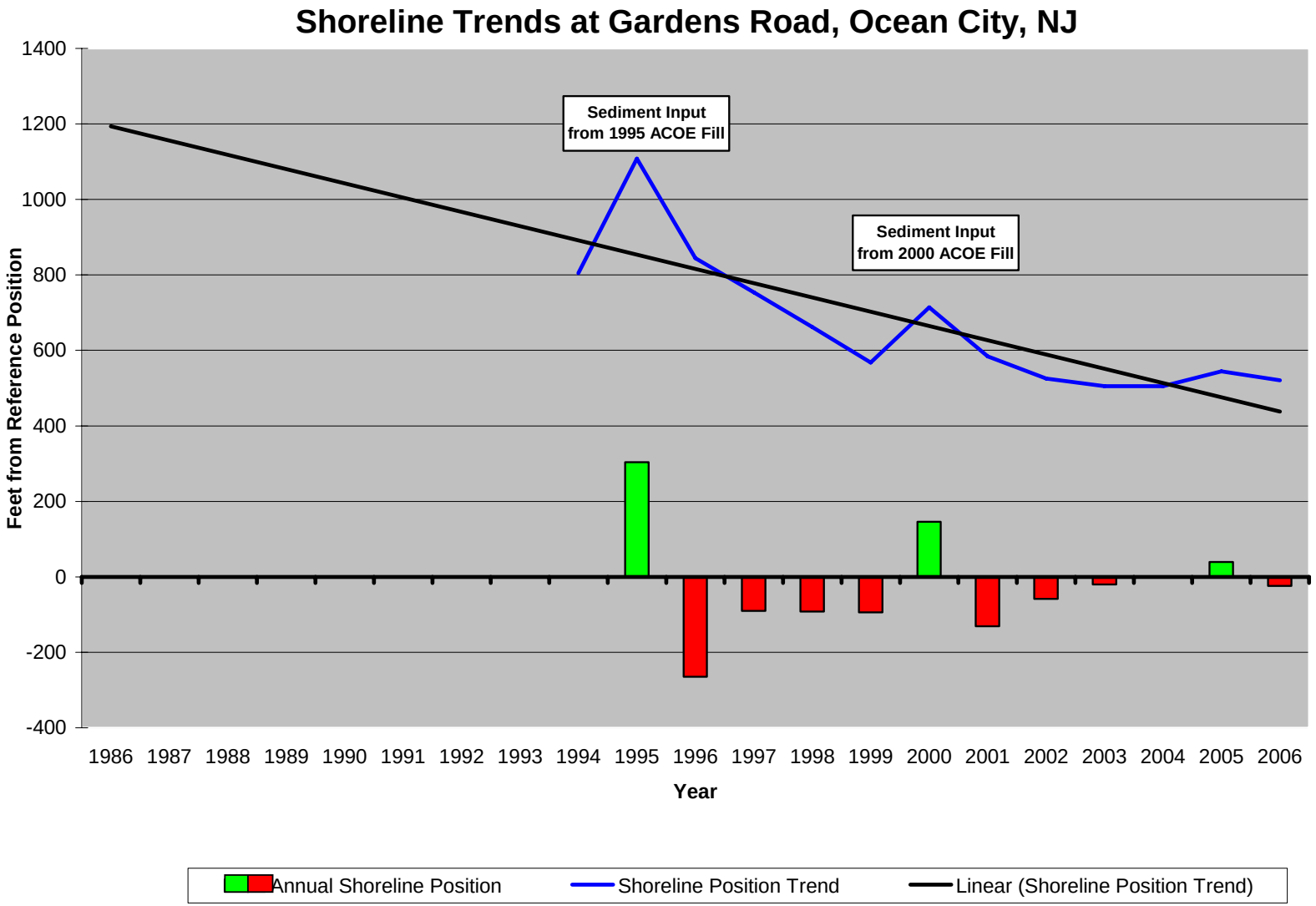


Figure 148 – Site 225. This site was established in 1994 to provide information near Great Egg Inlet. This profile line is strongly influenced by sand placement events on the oceanfront beach. During the years following the sand placement, the beach expanded as

material moved into the inlet from the ocean beach. Later, the established inlet beach retreated as sand re-entered into the inlet shoal system. The trend line is strongly negative at Gardens Road as 588 feet of shoreline retreat occurred in spite of two oceanfront beach nourishment cycles.

A.

B.

C.

20-Year Comparison Photographs – Site 225, Gardens Road, Ocean City

The photograph taken in 1995 (top, A) shows the much larger beach and dune system that was present at that time. By 2006 (bottom, B and C), the shoreline retreated over 300 feet and significant erosion of the primary dune occurred.

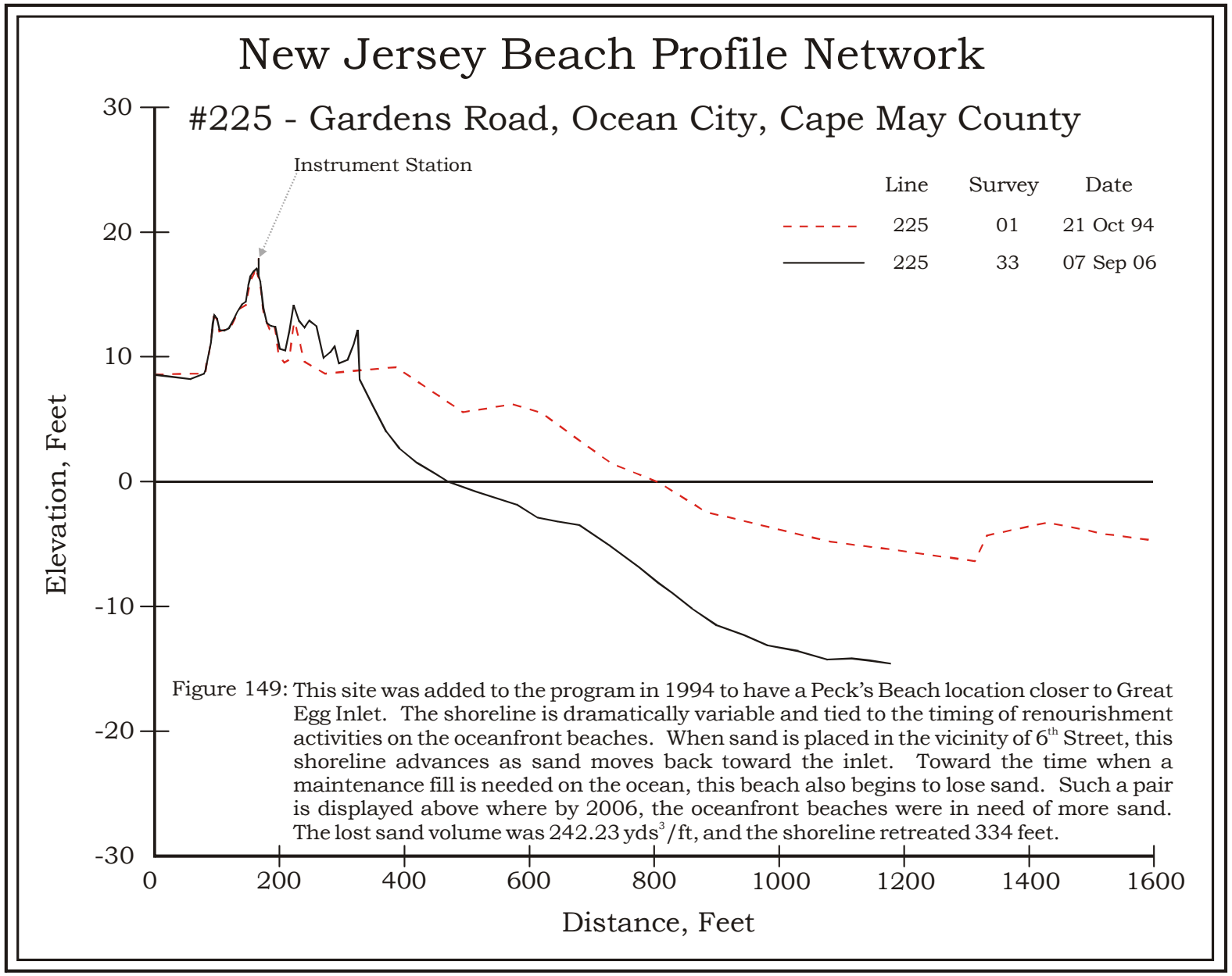


Figure 149: This site was added to the program in 1994 to have a Peck's Beach location closer to Great Egg Inlet. The shoreline is dramatically variable and tied to the timing of renourishment activities on the oceanfront beaches. When sand is placed in the vicinity of 6th Street, this shoreline advances as sand moves back toward the inlet. Toward the time when a maintenance fill is needed on the ocean, this beach also begins to lose sand. Such a pair is displayed above where by 2006, the oceanfront beaches were in need of more sand. The lost sand volume was 242.23 yds^3/ft, and the shoreline retreated 334 feet.

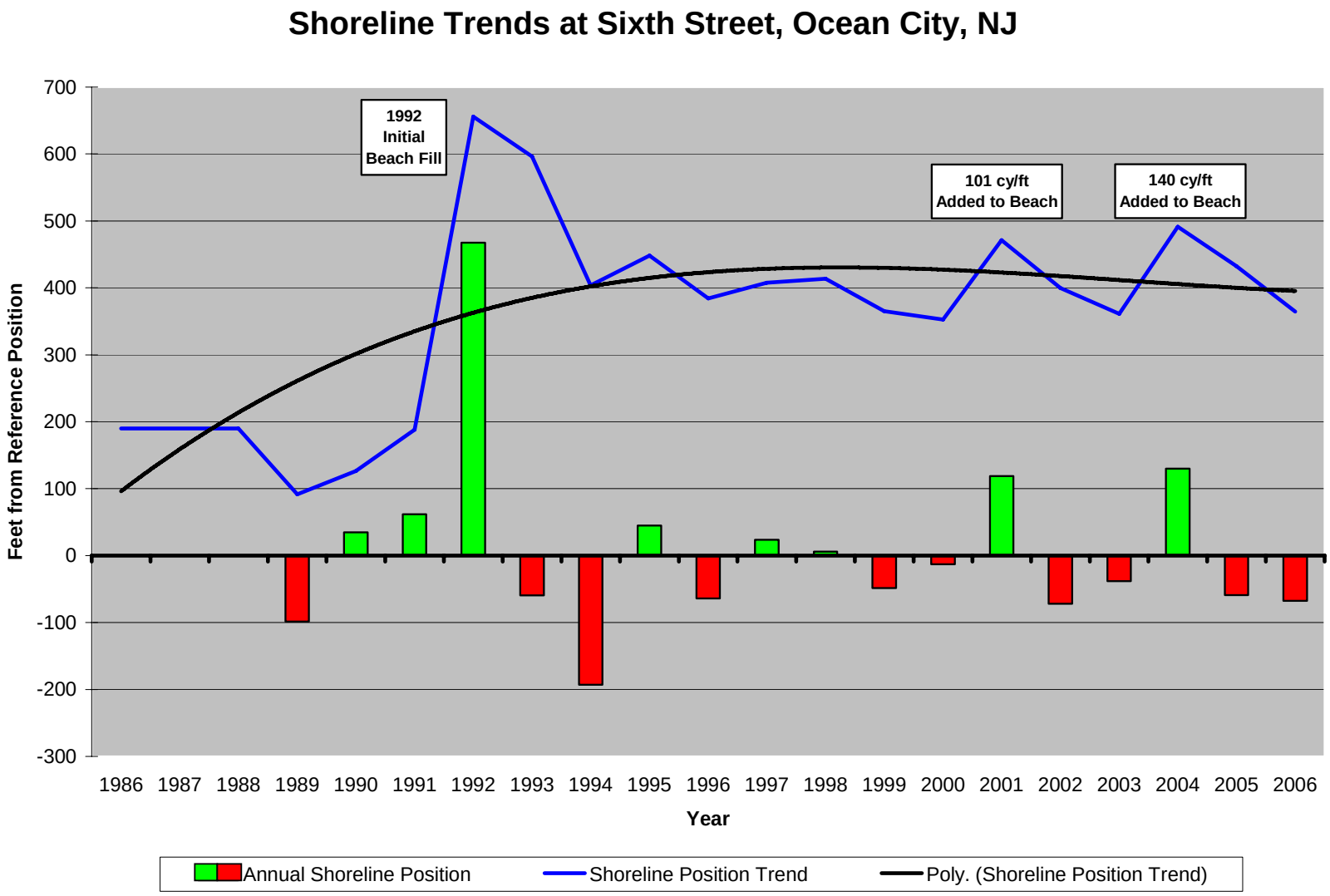


Figure 150. Site 125. This site in Ocean City has suffered from chronic losses since beach nourishment under either State or Federal projects commenced in 1983. Ocean City's beach restoration using sand from the bays goes back to 1952 when the ACOE undertook

a 2.55 million cubic yard project. The only years with significant shoreline accretion appear to be when the dredge was pumping sand onto the beach in 1992, 1995 (post-1992 storm restoration), 2001 and 2004.

A. 

B. 

C. 

20-Year Comparison Photographs – Site 125, 6th Street, Ocean City

The photograph taken in 1991 (A) shows how the waves reached the boardwalk at that time. The erosion by 2006 had produced retreat to the point where waves had the potential to reach this structure once again (Photos B and C). The movement of sand to the north had slowed to the point where the Gardens Road site was also retreating badly. It now appears as if funding will allow the ACOE to return to Ocean City and continue the process of pumping sand back to this hot spot along the NJ coastline.

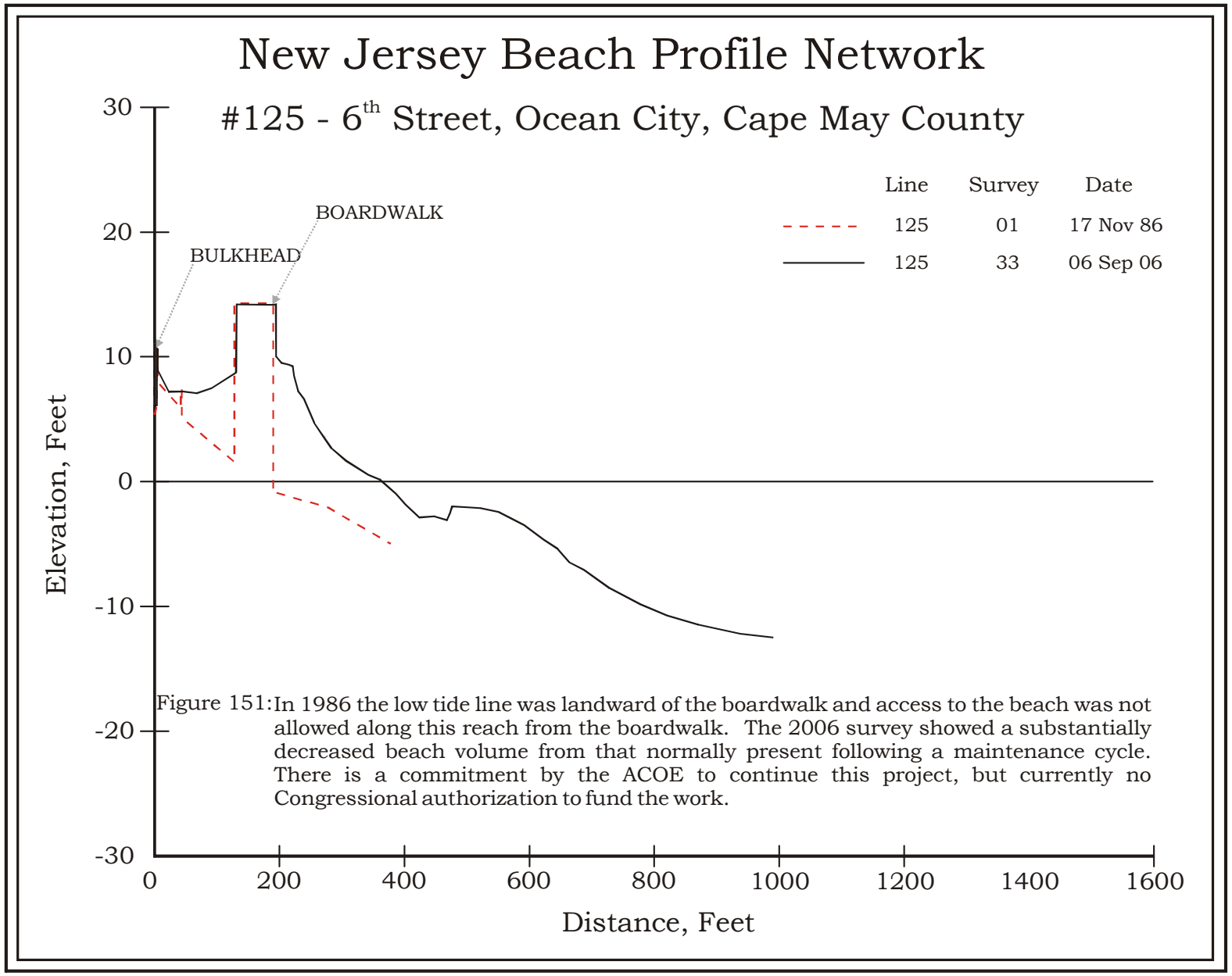


Figure 151: In 1986 the low tide line was landward of the boardwalk and access to the beach was not allowed along this reach from the boardwalk. The 2006 survey showed a substantially decreased beach volume from that normally present following a maintenance cycle. There is a commitment by the ACOE to continue this project, but currently no Congressional authorization to fund the work.

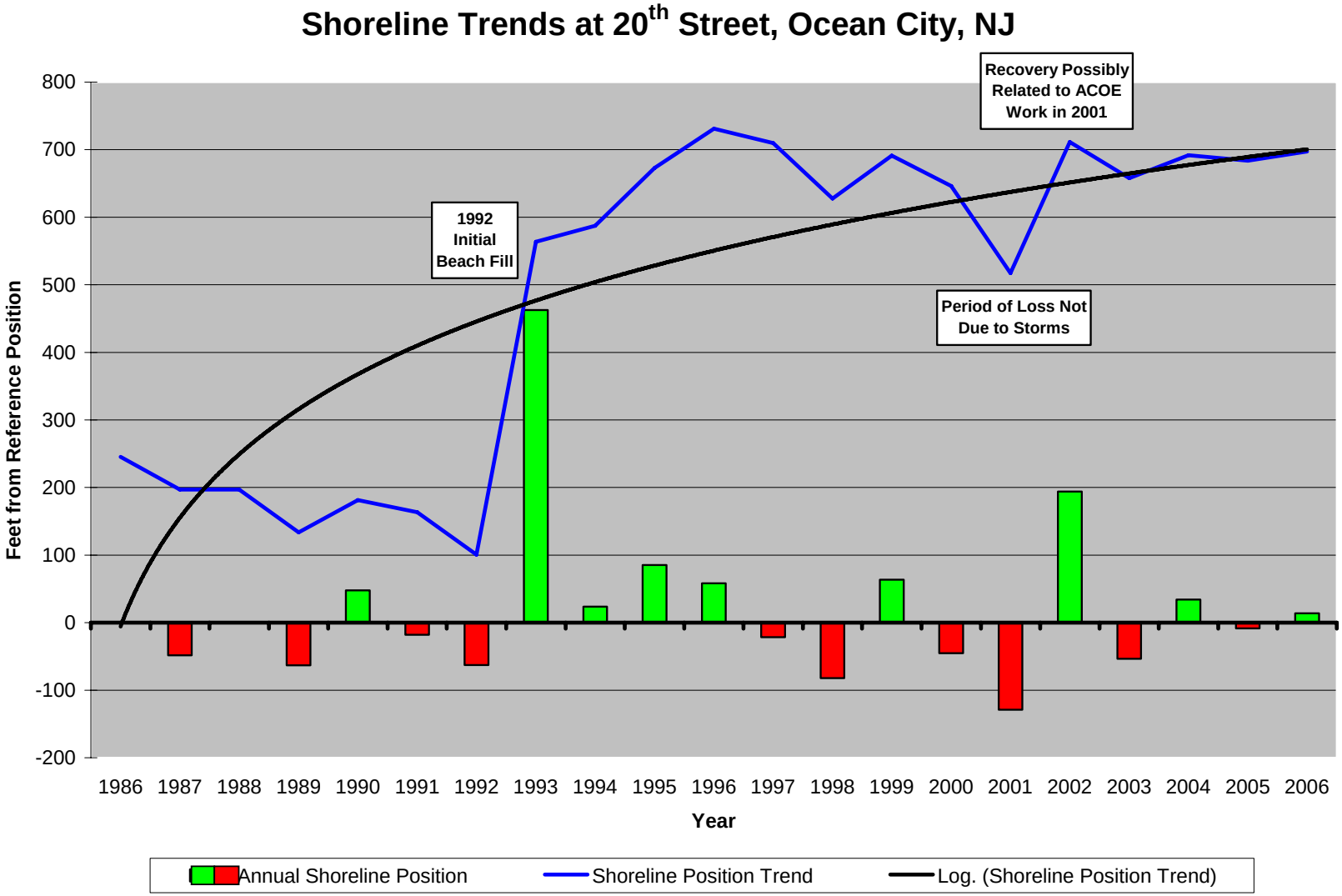


Figure 152. Site 124. Further south along the Ocean City shoreline, the beach has responded dramatically different from that seen at 6th Street in Ocean City. The decline in beach width was evident between 1986 and 1992 when the initial fill commenced at this site.

Since then no sand has been directly placed along this beach. The reversal in trends seen between 2001 and 2002 is related to long-shore movement of sand following the 2001 maintenance effort. Since that time the trend has remained positive. The shoreline has advanced from under the boardwalk to a point some 700 feet from the initial survey reference monument.

A.  **B.** 

20-Year Comparison Photographs – Site 124, 20th Street, Ocean City

Photograph A, was taken Aug. 11, 1995 following the restoration of the erosion to the Ocean City beach restoration project produced by the December 1992 northeast storm. The dune was developed at the boardwalk on the reconstructed beach. Sand continued to accumulate along this mid-island shoreline until the dune field was 300 feet wider east of the boardwalk and then the beach remained about as wide as it was in 1995. Keep in mind that low tide came up under the boardwalk in 1986 as can be seen in the cross section below and the zero elevation shoreline has advanced over 450 feet seaward since then.

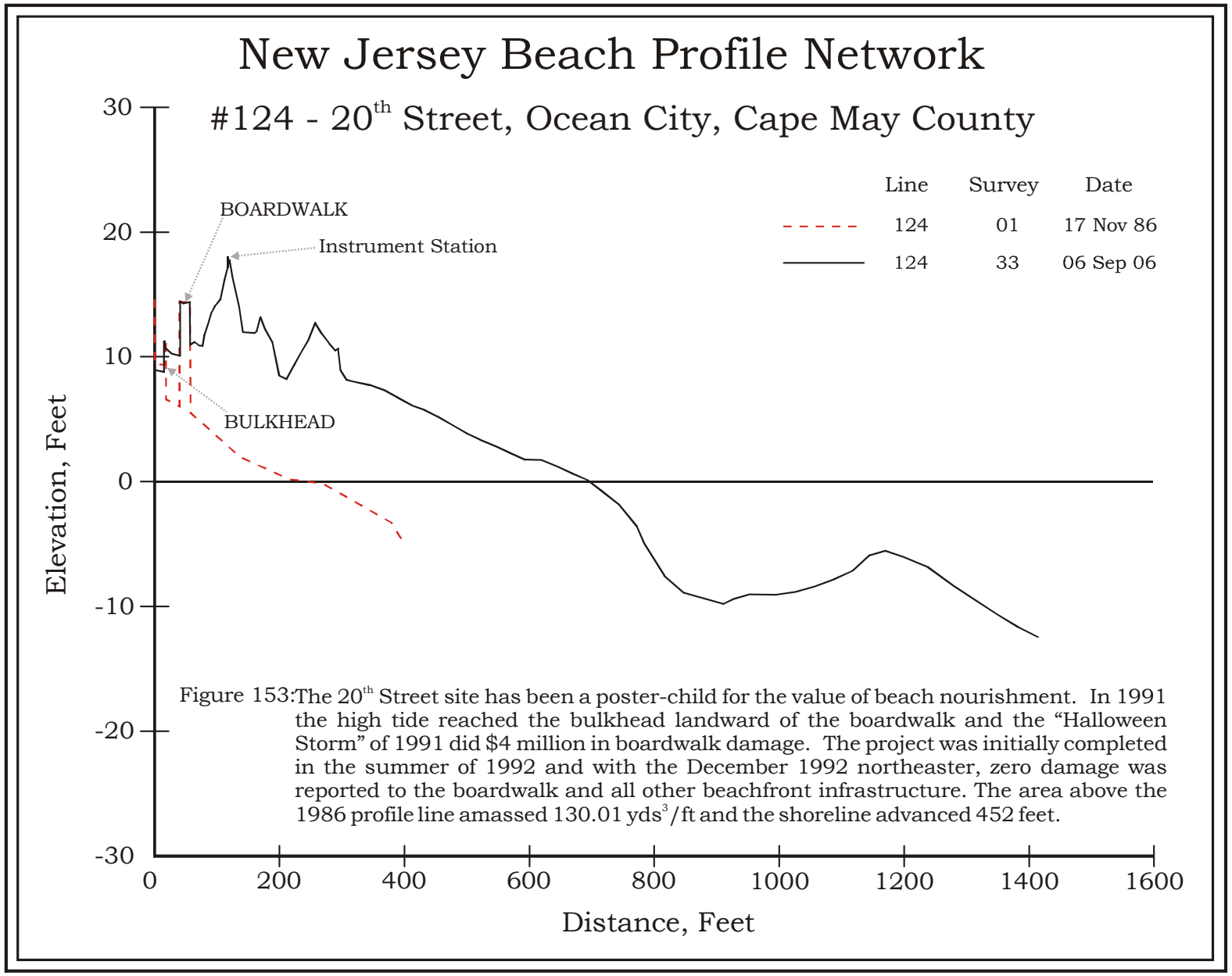


Figure 153: The 20th Street site has been a poster-child for the value of beach nourishment. In 1991 the high tide reached the bulkhead landward of the boardwalk and the "Halloween Storm" of 1991 did $4 million in boardwalk damage. The project was initially completed in the summer of 1992 and with the December 1992 northeaster, zero damage was reported to the boardwalk and all other beachfront infrastructure. The area above the 1986 profile line amassed 130.01 yds^3/ft and the shoreline advanced 452 feet.

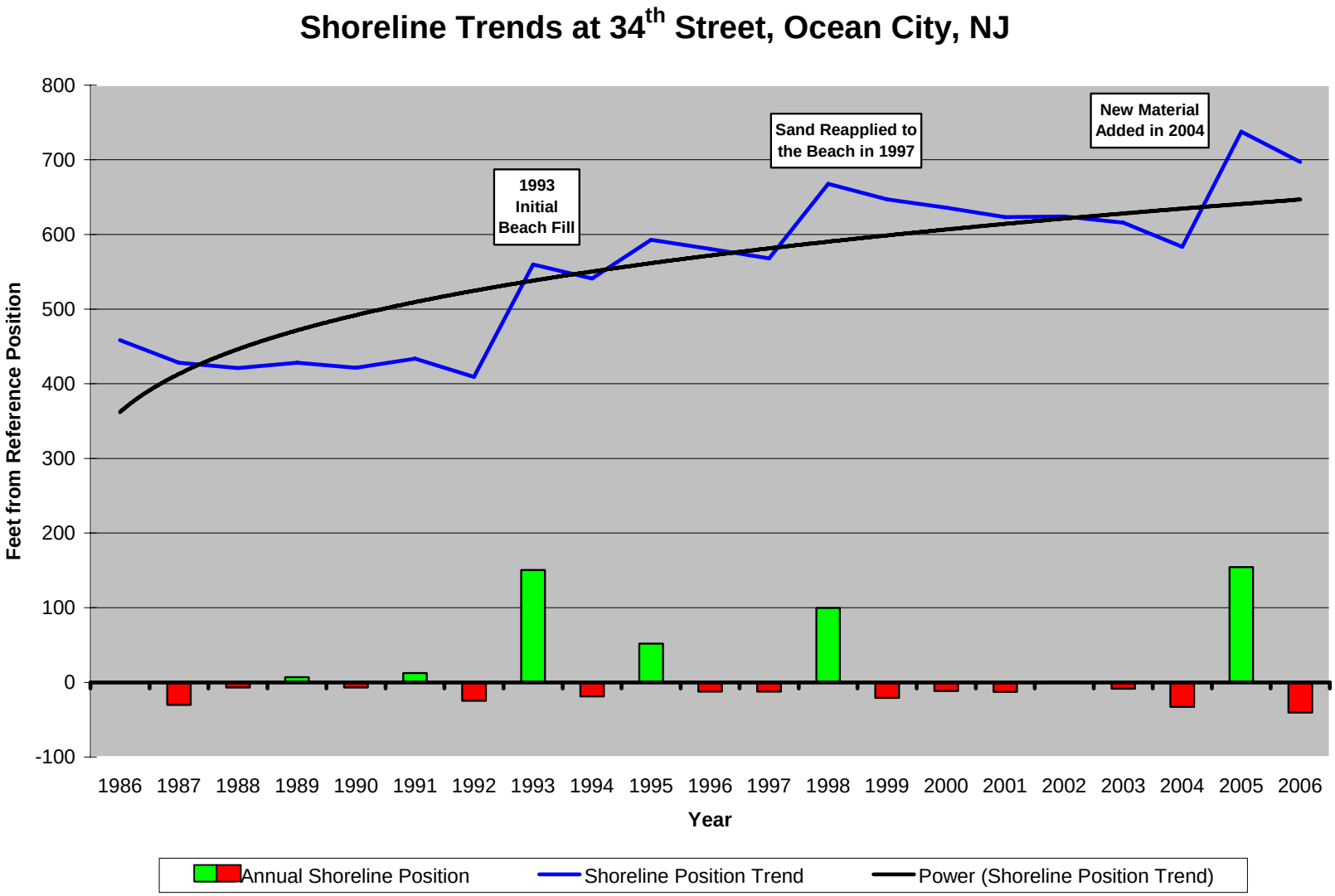


Figure 154. Site 223. Prior to the commencement of beach nourishment, 34th Street showed minor declines in shoreline position. Response to each beachfill activity produced a step seaward in the position of the shoreline moving the zero elevation location 300

feet further from the reference located on the street end. Recently the profile line was moved south by 40 feet to produce a cross section that included the dune rather than the beach access pathway formerly surveyed. There was no dune across the entire width of the 34th Street end because of the presence of the lifeguard headquarters and a heavy traffic of beachgoers at this entrance. Following the beach nourishment a dune has developed across most of the entrance at 34th Street.

A.  **B.** 

20-Year Comparison Photographs – Site 223, 34th Street, Ocean City

The 34th Street site has a major entrance from the street end for lifesaving vehicles and other beach maintenance activities. The 1995 photograph (A.) shows the wide gap in the dunes. As the dunes grew on either side it was decided to move the profile 40 feet south to cover these features. The 2006 photograph (B) shows the enhanced dune and the access gap still present at the street end.

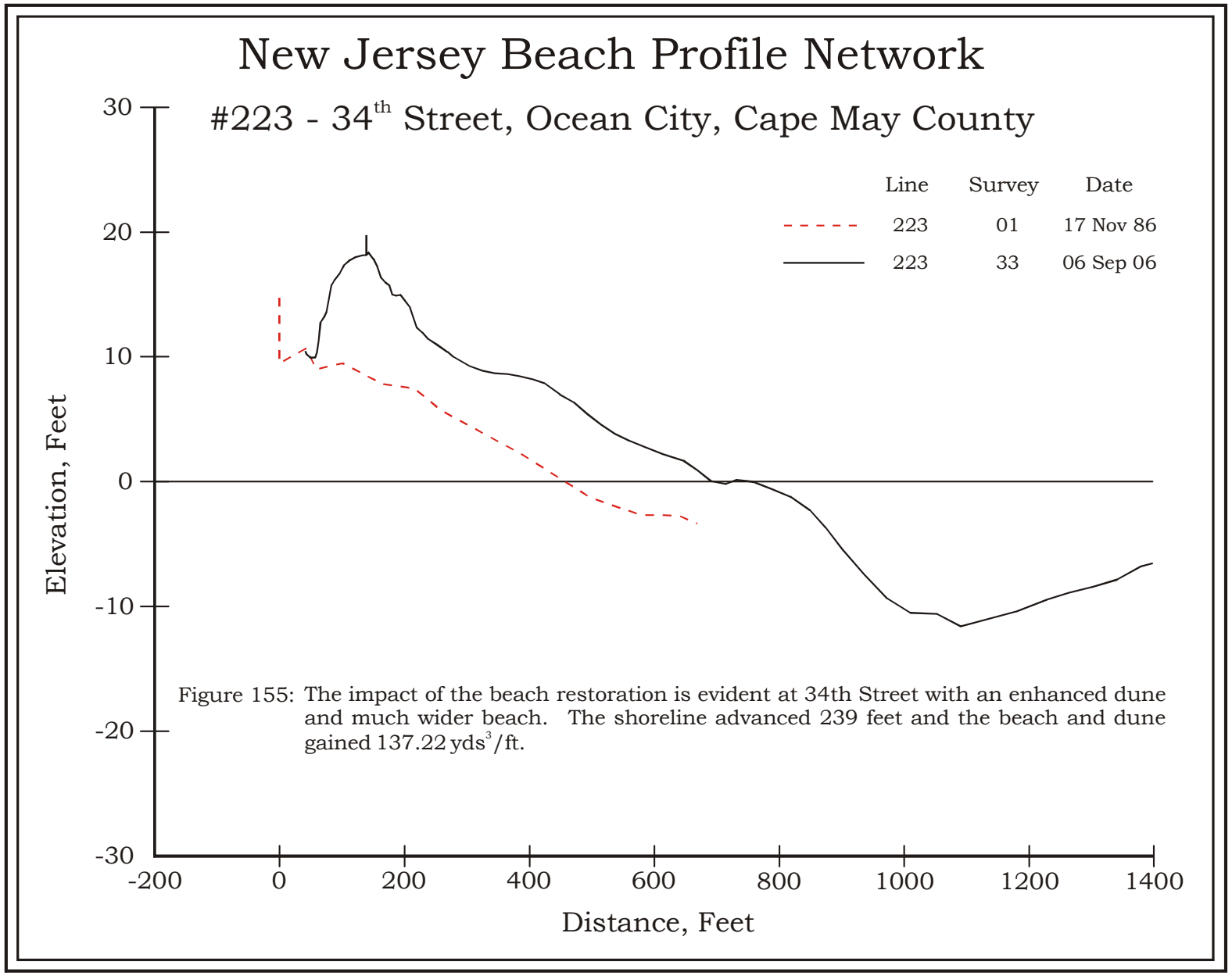


Figure 155: The impact of the beach restoration is evident at 34th Street with an enhanced dune and much wider beach. The shoreline advanced 239 feet and the beach and dune gained 137.22 yds^3/ft.

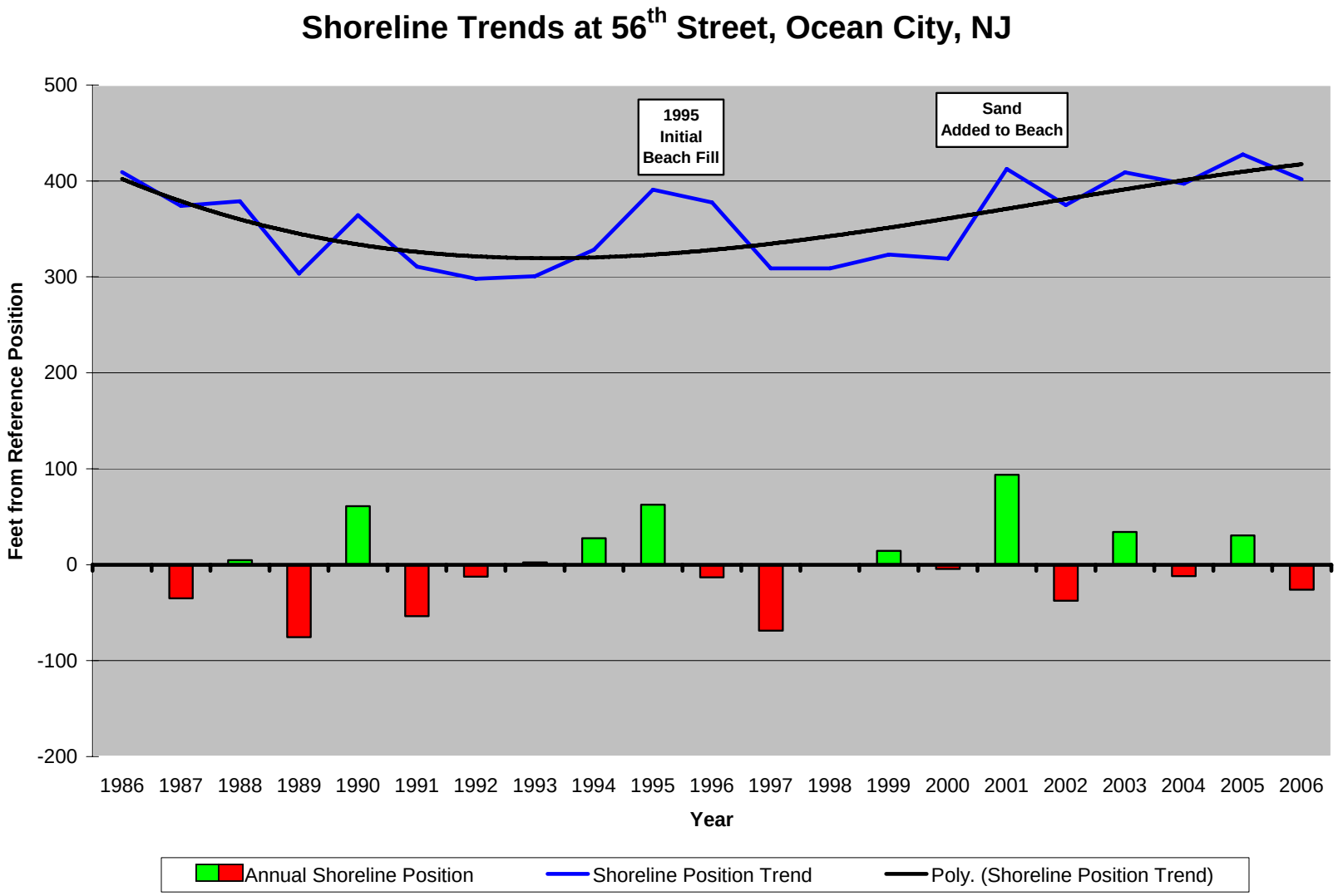


Figure 156. Site 122. At the south end of Pecks Beach the State of NJ assumed the role of cooperative partner in beach restoration. The fill first arrived in 1995 adding substantially to the width of the beach. Since then there has been slow accretion combined with shoreline advance to 2005. The trend line shows the turn-around in shoreline position.

A.  **B.** 

20-Year Comparison Photographs – Site 122, 56th Street, Ocean City

The southern end of the island was supplemented by a NJ State cooperative beach restoration effort in 1995. The left photo (A) shows the relative vulnerability to storm damage at the private home development along this reach. By 2006 dune growth has placed a substantial barrier between the homes and the shoreline leaving a beach of similar width seaward of the dunes. If you look at the groin and pilings in the far distance in both photographs the seaward advance in the low tide elevation is not great, but the dunes appear stable on the beach that has emerged a decade after the fill.

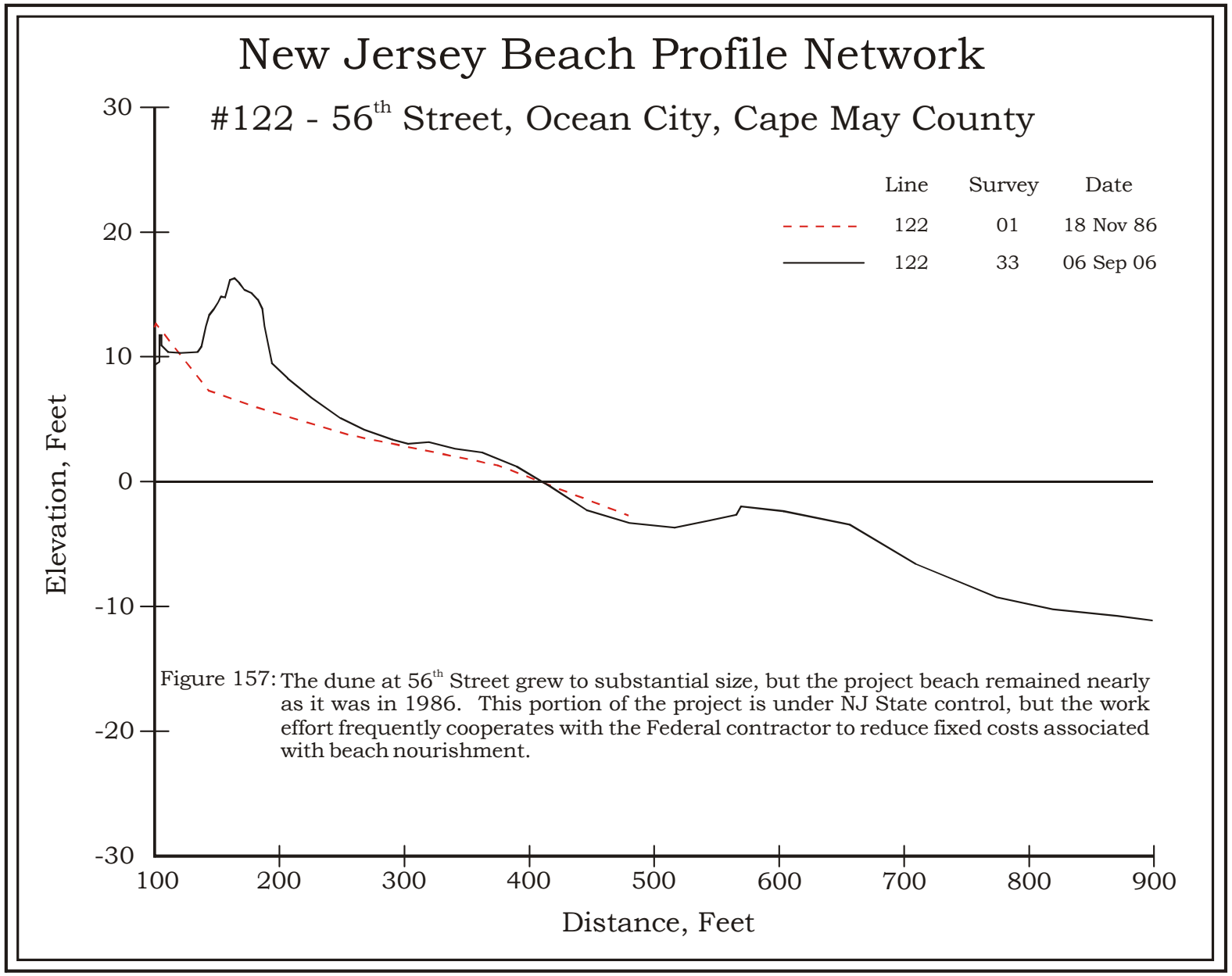


Figure 157: The dune at 56th Street grew to substantial size, but the project beach remained nearly as it was in 1986. This portion of the project is under NJ State control, but the work effort frequently cooperates with the Federal contractor to reduce fixed costs associated with beach nourishment.

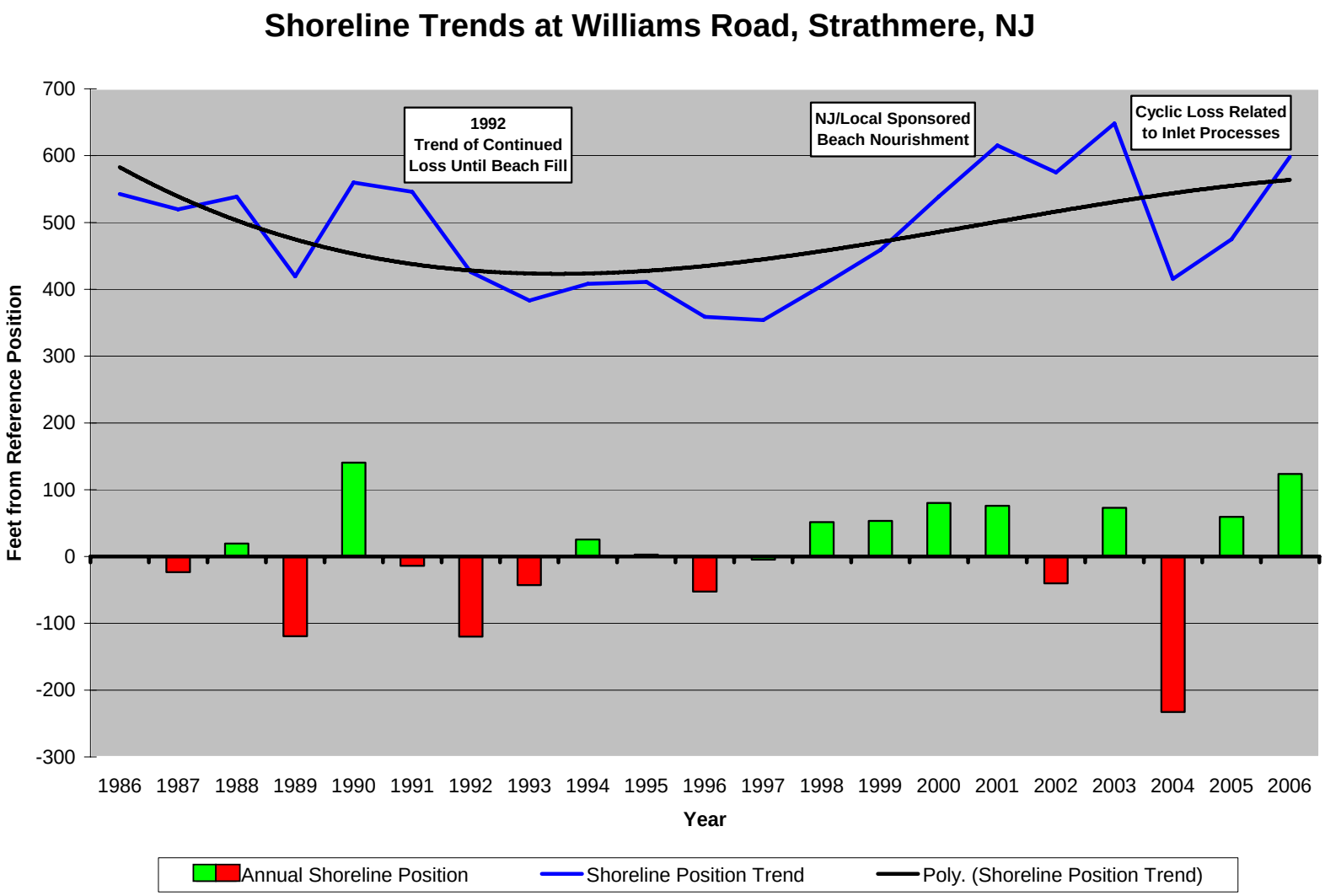


Figure 158. Site 121. Positioned near Corson's Inlet, this site shows the influence that both beach nourishment and inlet dynamics can have on an area. Sand naturally cycles between the inlet channel, the ebb-tidal shoals and the beach creating episodes of extensive

erosion or accretion on the beach depending on the phase of the cycle. Sand was pumped onto the beach in 2001 following an erosion cycle at the inlet. The present situation is moving into another erosion cycle so the municipal government is hauling in quarry sand to the north end beaches.

A.  **B.** 

20-Year Comparison Photographs – Site 121, William Road, Strathmere

Positioned fairly near Corson's Inlet, site 121 often receives large volumes of sand as the inlet channel shifts around in its delta region. The influence of sand supplies added to Ocean City to the north has also impacted this site. Beach nourishment was completed here in 1984 and in 2001 by the State of NJ along with funding from the Township of Upper. In 1988 the beach was in a wide format following the fill and inlet configuration allowing large bars to migrate onto the shoreline as shown in photo A. The 2006 photo (B) shows a larger dune system and a similar beach, but there was additional sand pumped onto this beach in 2001.

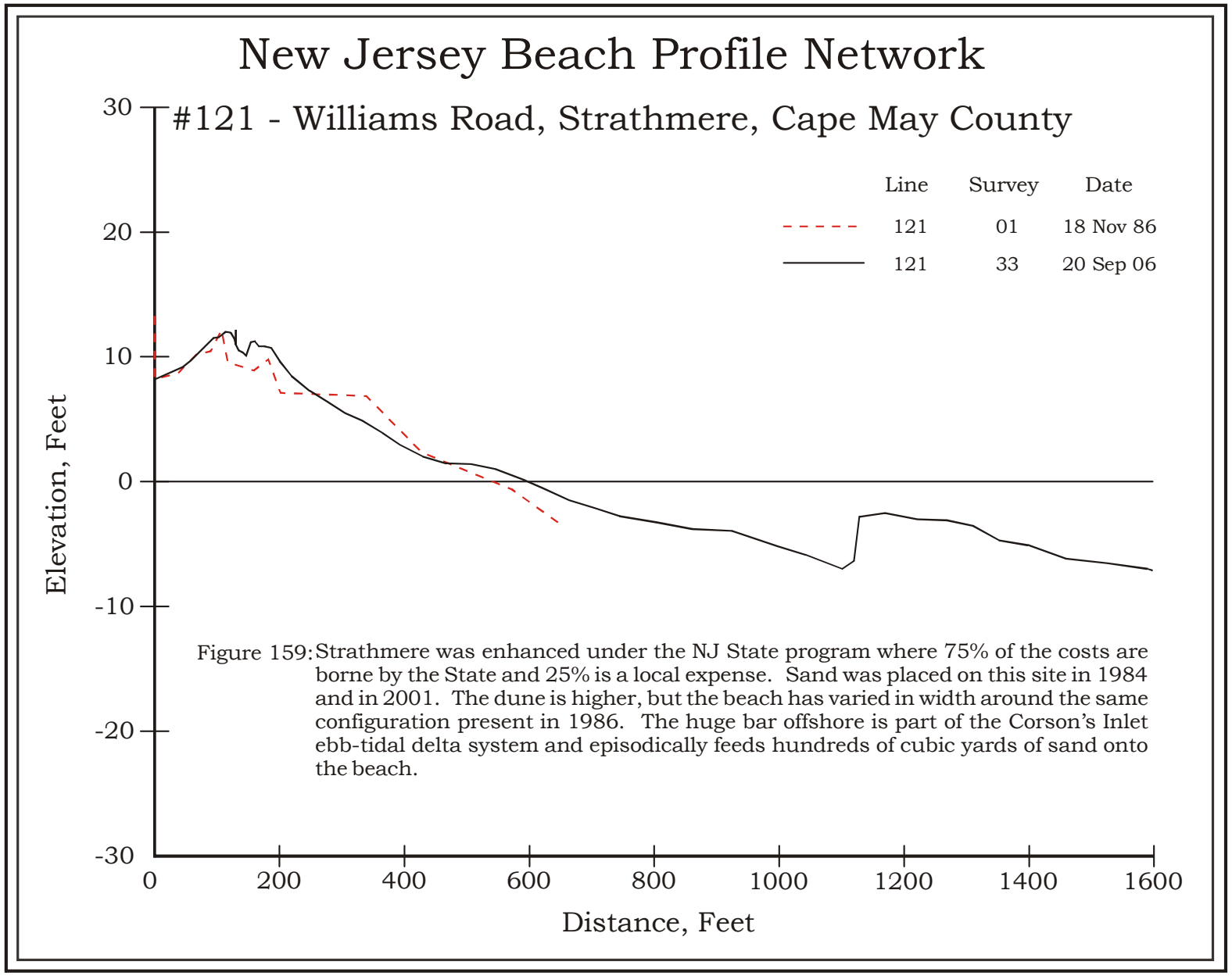


Figure 159: Strathmere was enhanced under the NJ State program where 75% of the costs are borne by the State and 25% is a local expense. Sand was placed on this site in 1984 and in 2001. The dune is higher, but the beach has varied in width around the same configuration present in 1986. The huge bar offshore is part of the Corson's Inlet ebb-tidal delta system and episodically feeds hundreds of cubic yards of sand onto the beach.

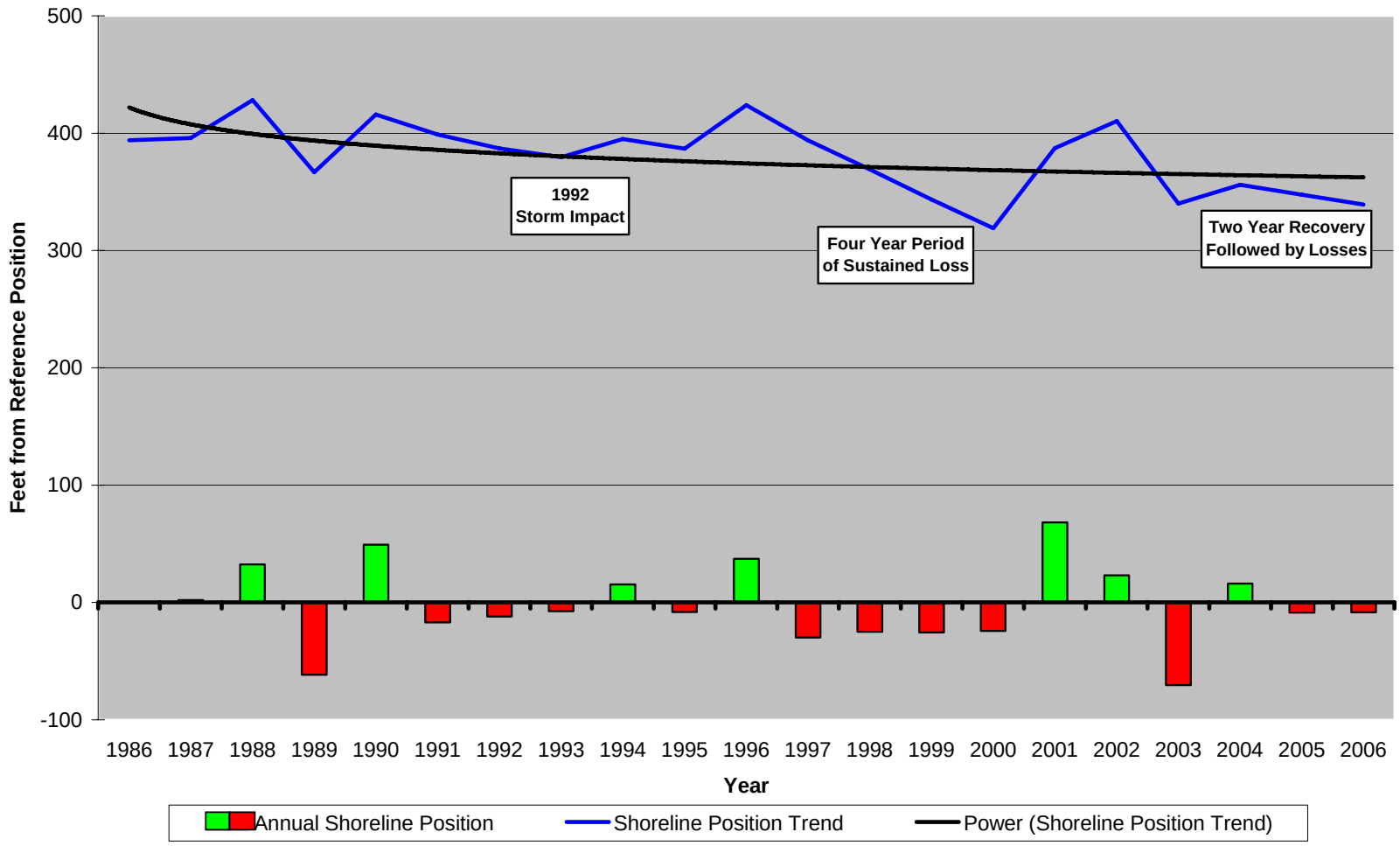


Figure 160. Site 120. No sand has been added to this shoreline reach except for dune reconstruction following several northeasters. After these storm episodes, quarry sand was used to cover the core of the dune. The beach is low and narrow making it subject to frequent storm overwash episodes. The trend is one of retreat over the past 20 years.

A. 

B. 

20-Year Comparison Photographs – Site 120, 1st Street, Sea Isle City
In spite of two significant nourishment efforts north of this site, very little new sand has arrived to widen this beach or improve the dunes. In 1991 the dune was all natural (A), but narrow and fairly low with a narrow low elevation beach seaward. Multiple storms breached this stretch and washed directly into the bay. In 1996 a 10-foot diameter geo-textile tube was installed along 2,000 feet of the northern Sea Isle City shoreline, filled with beach sand and covered with quarry sand hauled to the site. This feature has withstood storm events of low intensity since, but the beach is still narrow and of low elevation (B).

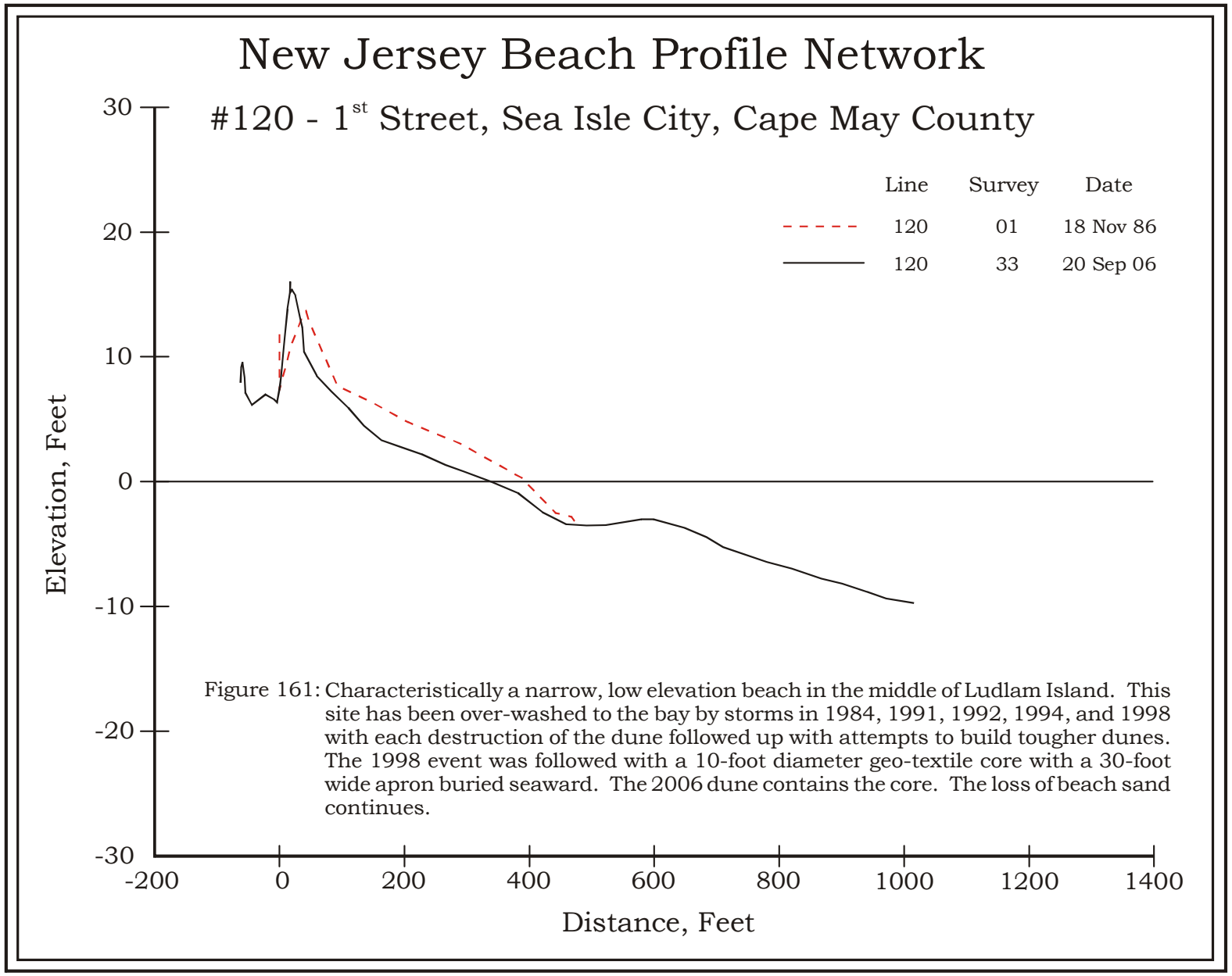


Figure 161: Characteristically a narrow, low elevation beach in the middle of Ludlam Island. This site has been over-washed to the bay by storms in 1984, 1991, 1992, 1994, and 1998 with each destruction of the dune followed up with attempts to build tougher dunes. The 1998 event was followed with a 10-foot diameter geo-textile core with a 30-foot wide apron buried seaward. The 2006 dune contains the core. The loss of beach sand continues.

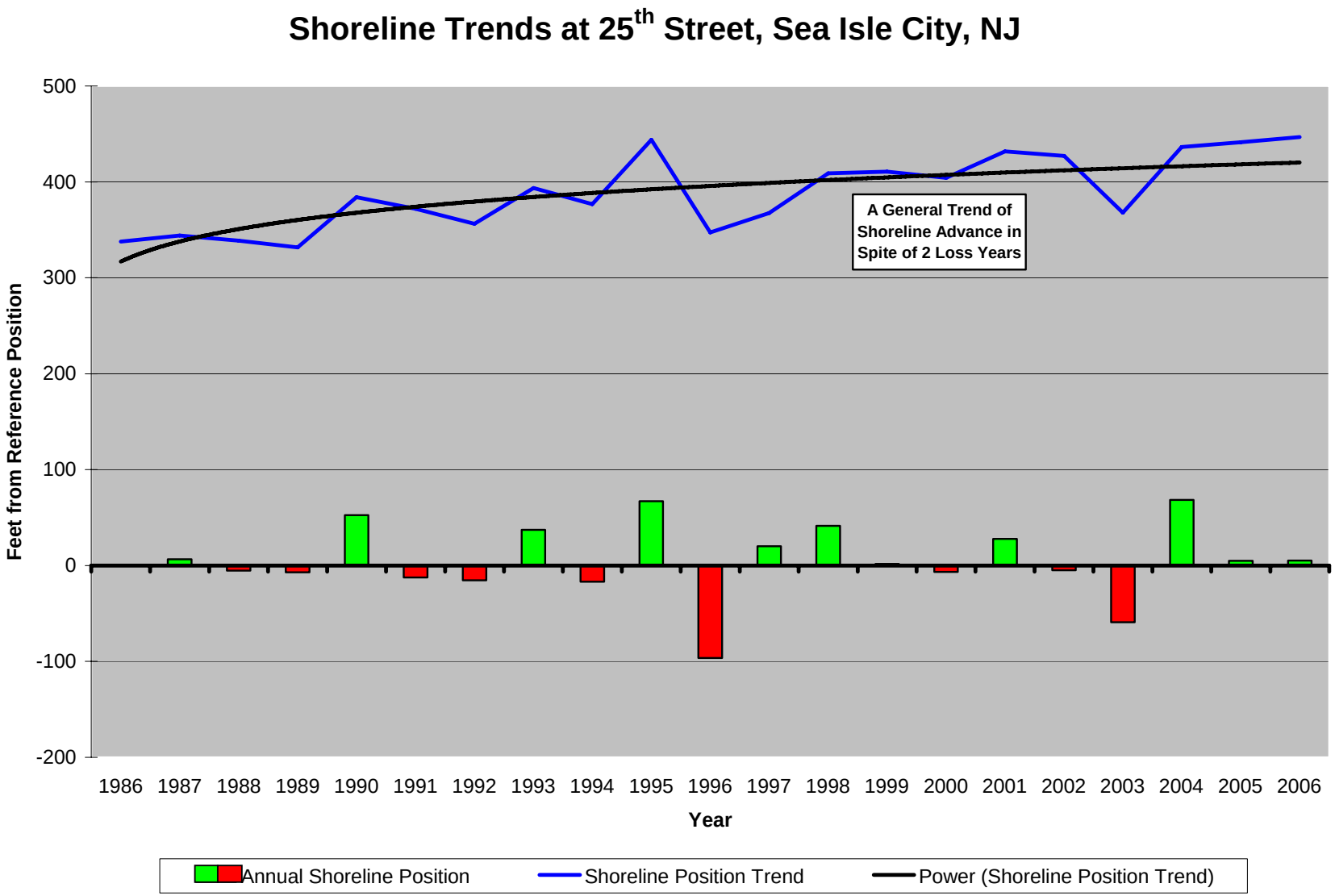


Figure 162. Site 119. Toward the middle of Ludlam Island a gradual trend of shoreline advance has occurred in spite of two years of considerable retreat. The shoreline position has moved seaward by 100 feet in 20 years.

A. 

B. 

20-Year Comparison Photographs – Site 119, 25th Street, Sea Isle City
The 25th Street beach is south of the installed geo-textile dune core. In 1991 the view to the north shows the dune and beach (A). The addition of sand to the dune is substantial over the years and the beach widened at the same rate as the dune advanced seaward. Sand fencing shown in B. will continue the accretion to the seaward dune toe in the absence of storm activity.

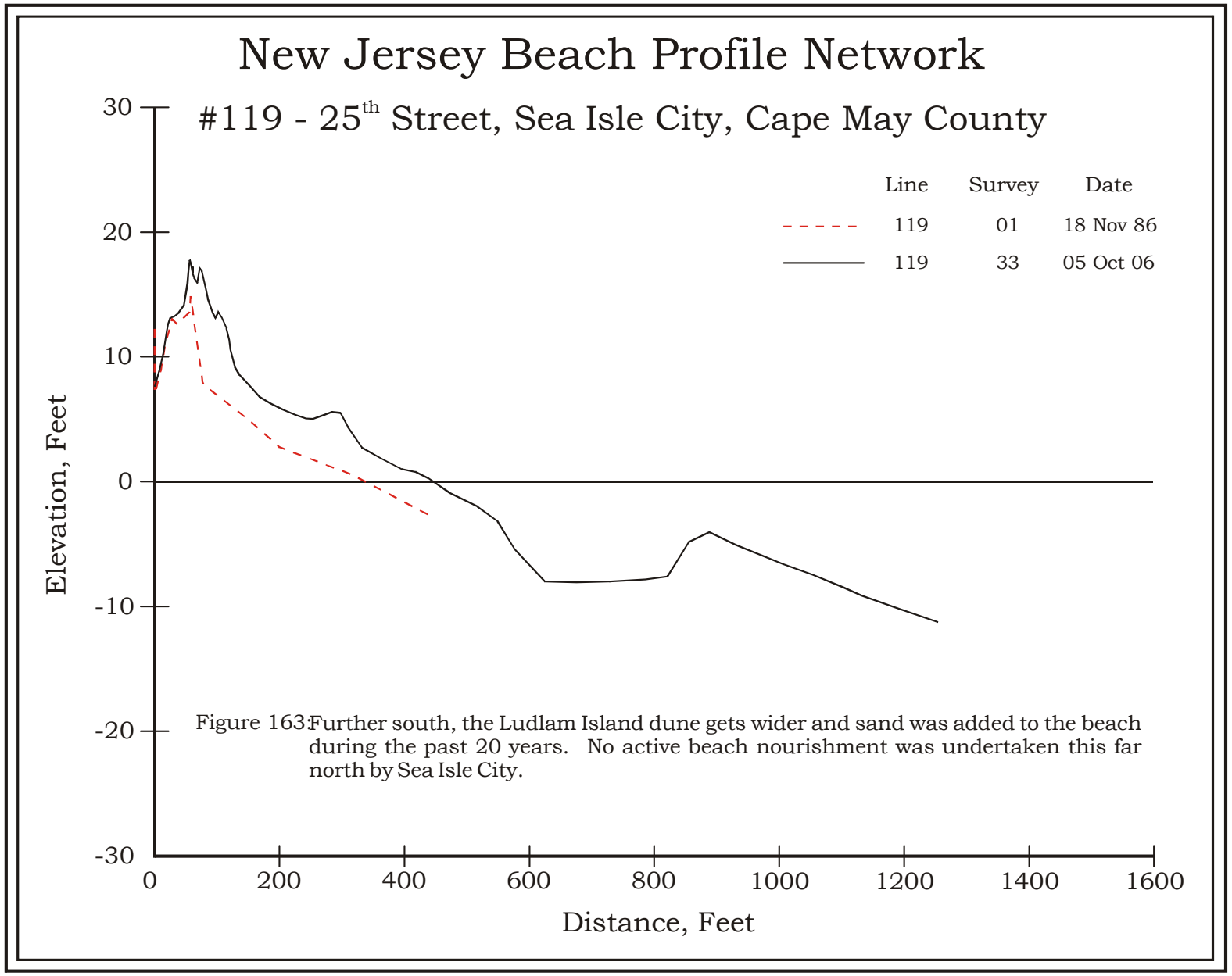


Figure 163: Further south, the Ludlam Island dune gets wider and sand was added to the beach during the past 20 years. No active beach nourishment was undertaken this far north by Sea Isle City.

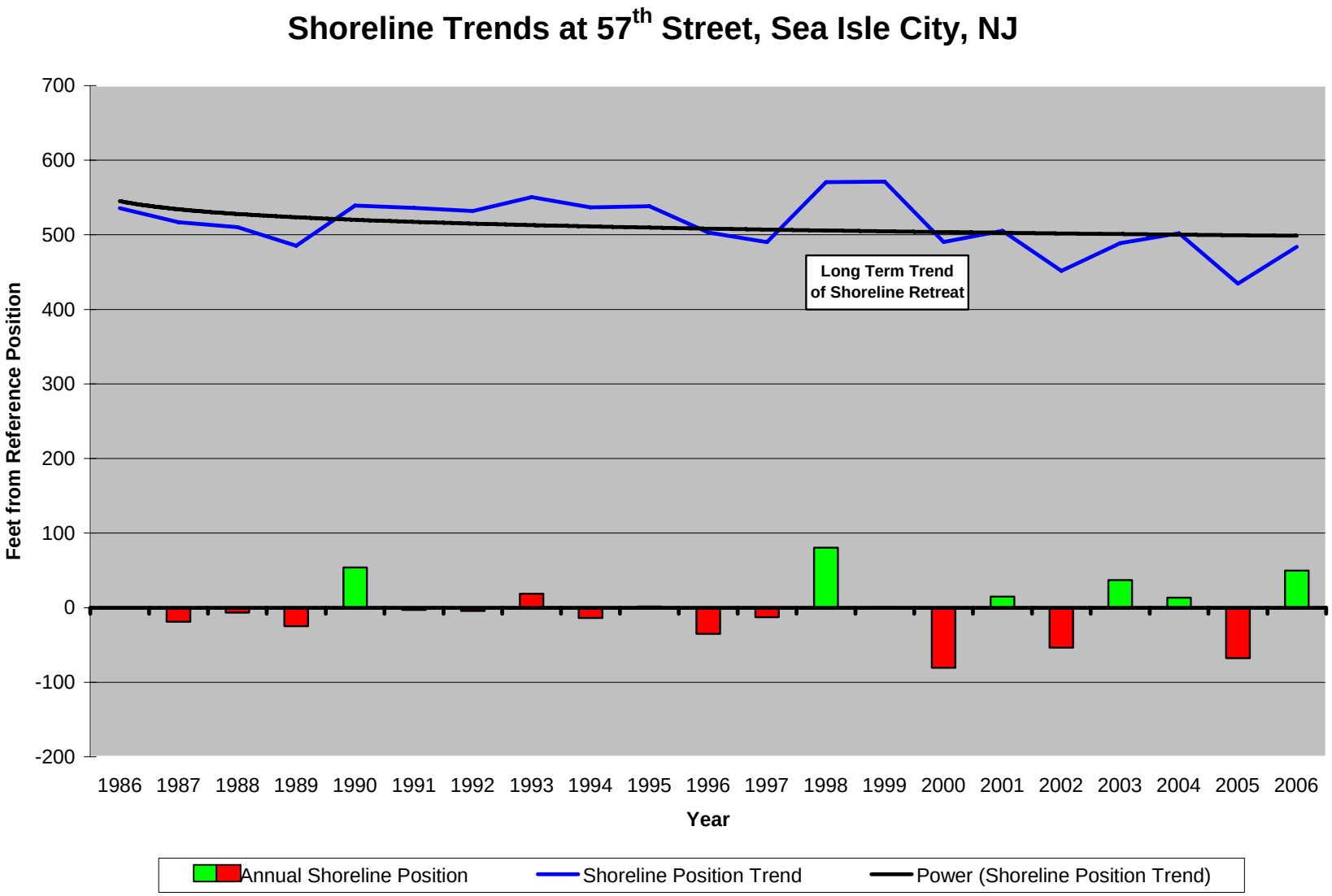


Figure 164. Site 118. The shoreline position trend saw a minor retreat at 57th Street in Sea Isle City. The beach has not had nourishment sand applied since 1978, which was prior to NJ Beach Profile surveying.

A. 

B. 

20-Year Comparison Photographs – Site 118, 57th Street, Sea Isle City
This beach is located in the heart of the Sea Isle City recreational district. There is an asphalt promenade landward of the dunes that forms a demarcation line for the dune system. The 1995 photo (A) shows a relatively wide beach with a dune scarp beginning to heal as sand accumulated at the dune fencing. By 2006 (B) the dune had grown higher, but not much wider as it is confined by the fencing in front and the promenade to the rear.

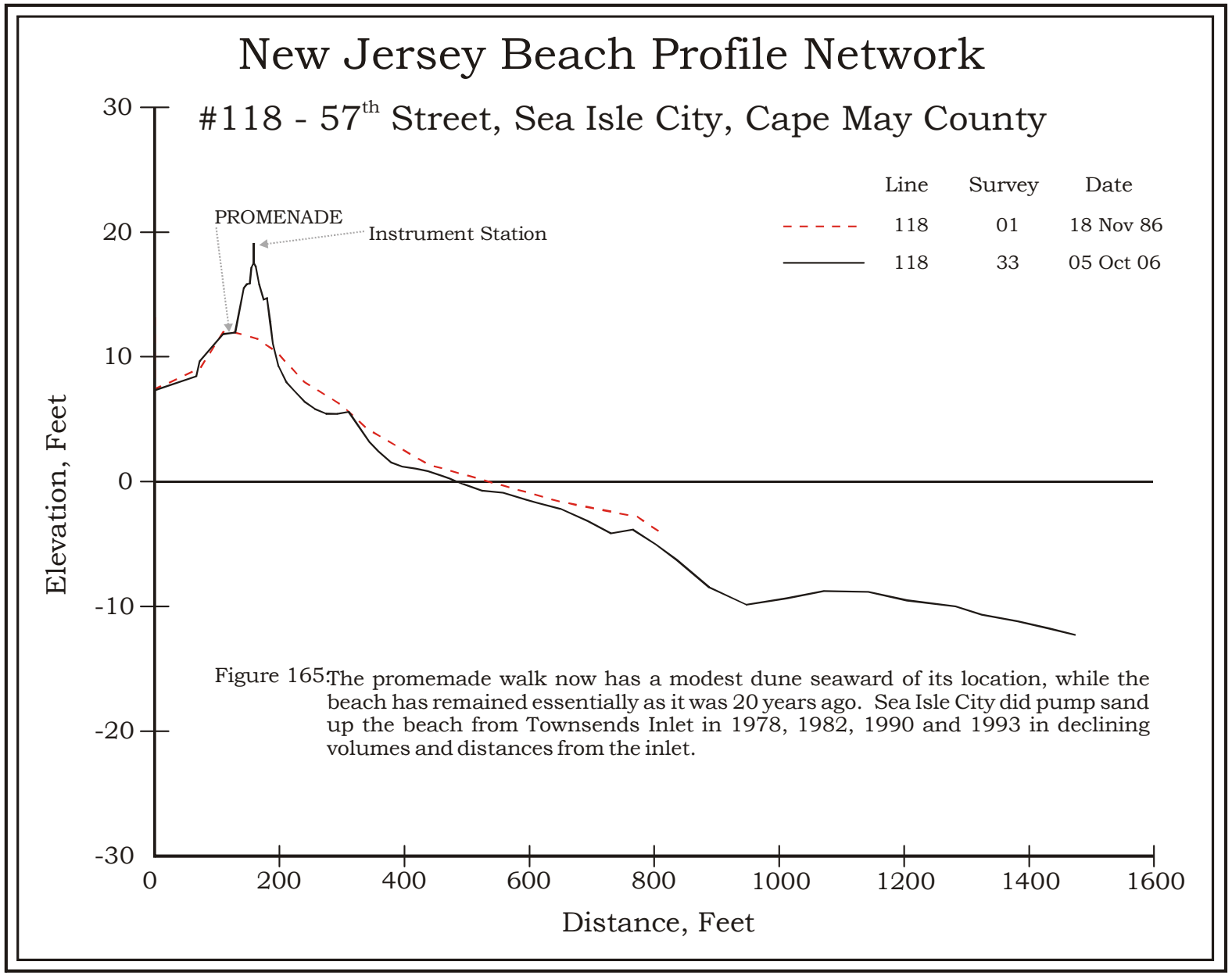


Figure 165: The promemade walk now has a modest dune seaward of its location, while the beach has remained essentially as it was 20 years ago. Sea Isle City did pump sand up the beach from Townsends Inlet in 1978, 1982, 1990 and 1993 in declining volumes and distances from the inlet.

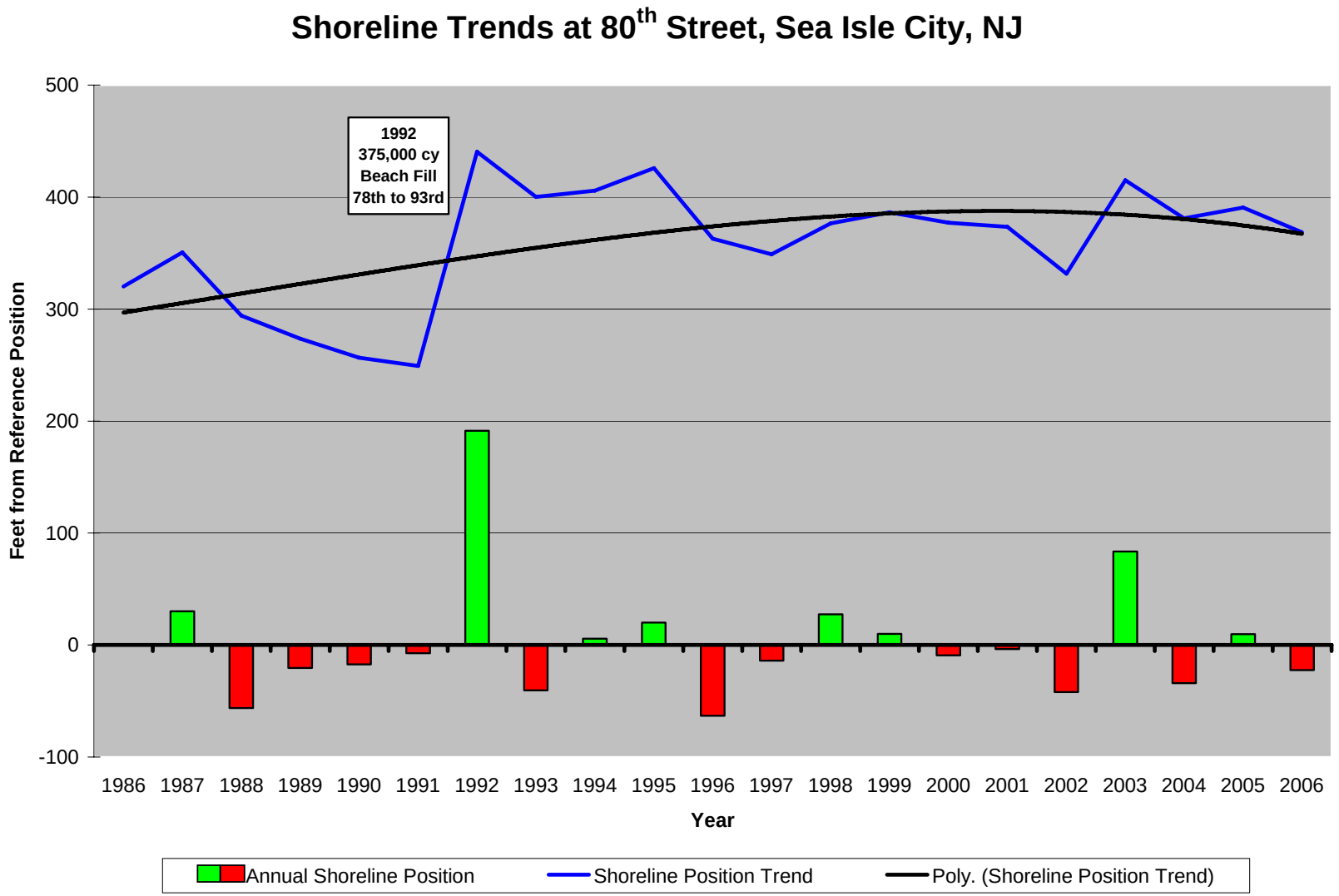


Figure 166. Site 117. In 1992 Sea Isle City conducted a beach nourishment project between 78th Street and Townsends Inlet. The impact on the shoreline position is clear as the shoreline position moved 211 feet seaward. Modest retreat followed in a non-linear fashion over the next 14 years.

A.  **B.** 

20-Year Comparison Photographs – Site 117, 80th Street, Sea Isle City
The left photo (A) was taken in 1994 following the 1992 beach nourishment that enhanced both the dune and beach width. Since then the dune has remained stable and the beach declined only modestly by 2006 (B).

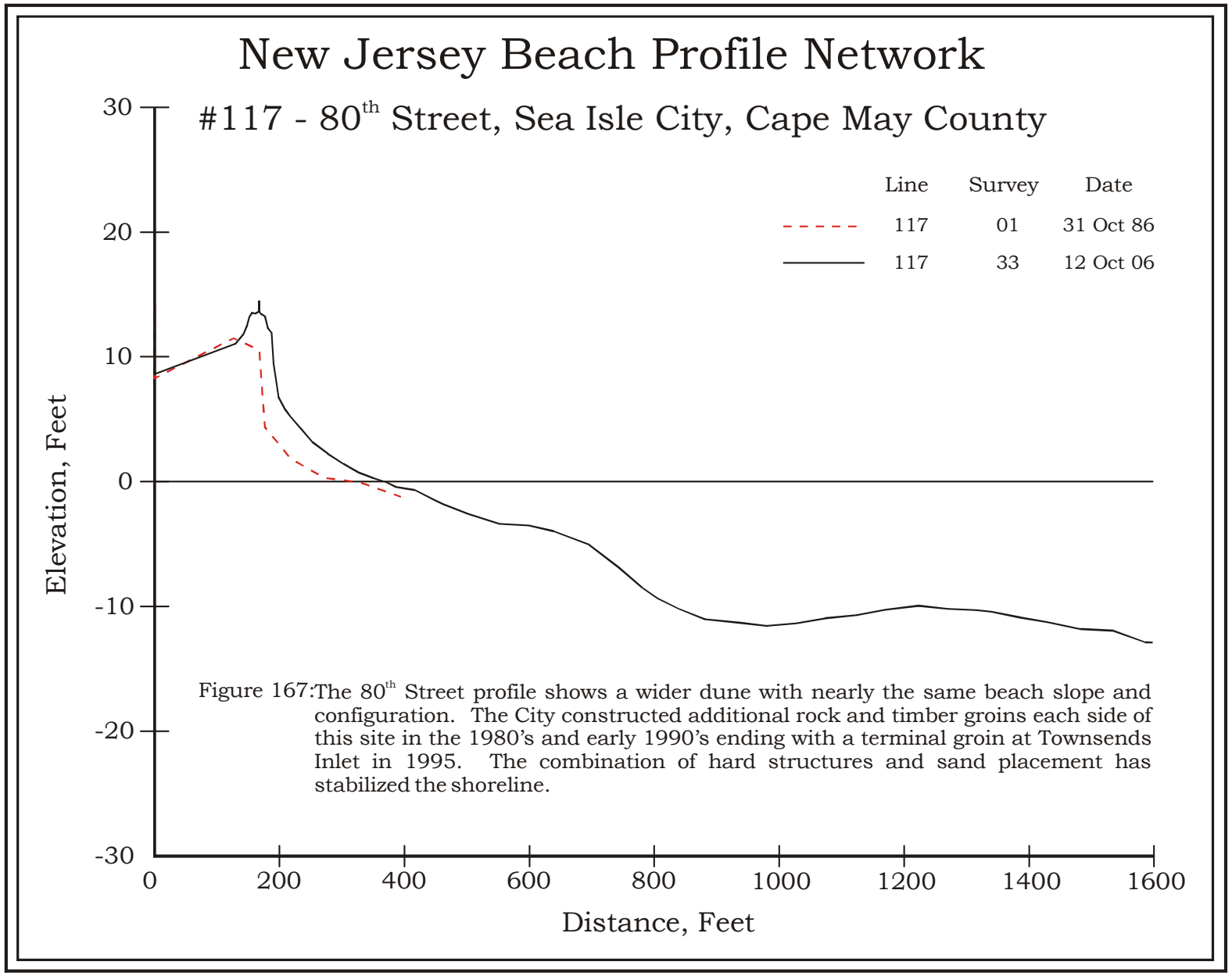


Figure 167: The 80th Street profile shows a wider dune with nearly the same beach slope and configuration. The City constructed additional rock and timber groins each side of this site in the 1980's and early 1990's ending with a terminal groin at Townsends Inlet in 1995. The combination of hard structures and sand placement has stabilized the shoreline.

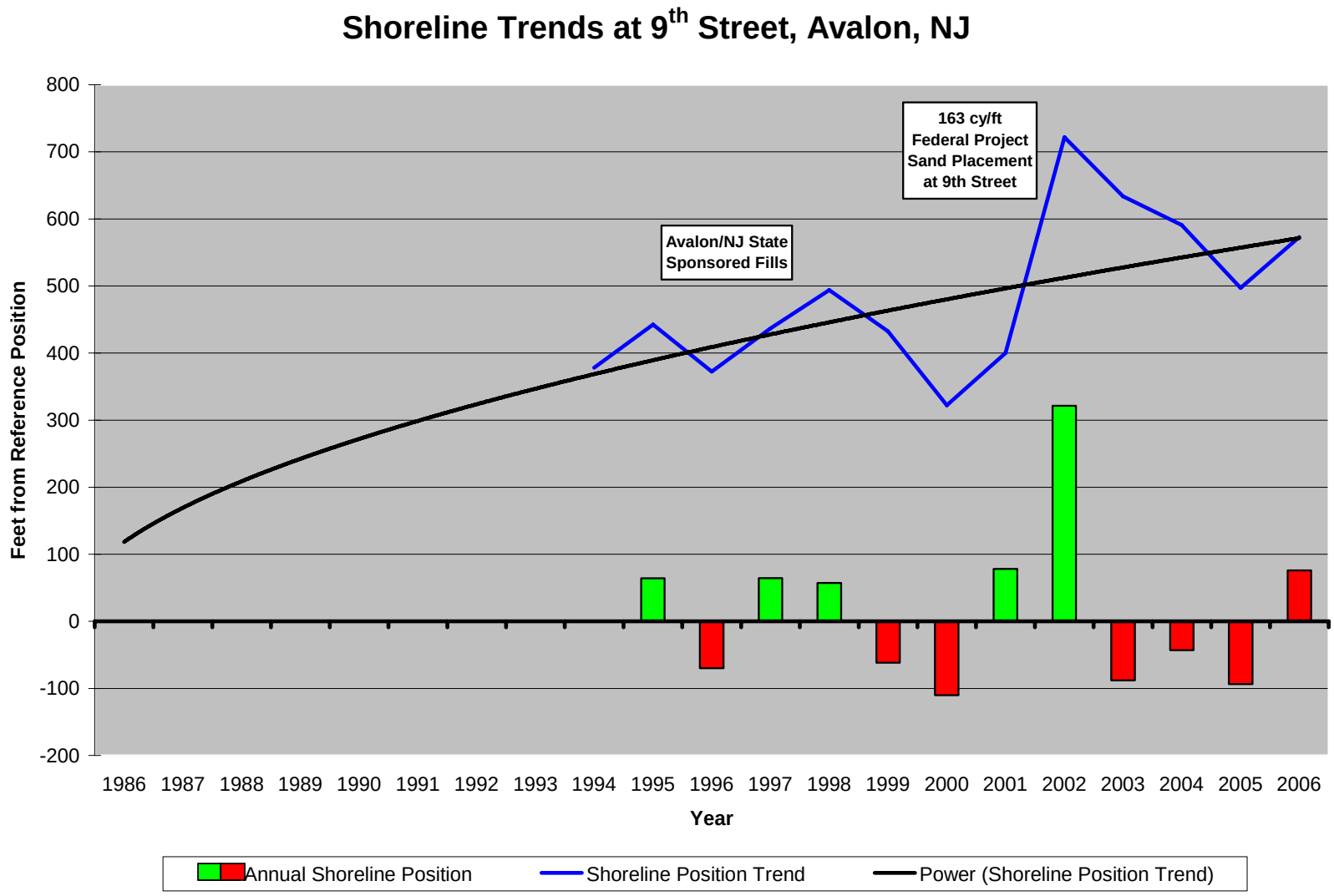


Figure 168. Site 216. Established in 1994 to study the inlet-associated shoreline south of Townsends Inlet, 9th Street has responded to beach nourishment multiple times. The largest spike in shoreline advance seaward came in 2002 when the Federal project was complete.

A.  **B.** 

20-Year Comparison Photographs – Site 216, 9th Street, Avalon

Site 216 was added in 1994 to help define changes near Townsend's Inlet in Avalon. In 1996 (A) the beach was retained by the inlet jetty which was extended during 2001. This plus multiple nourishment events widened the beach as sand remained sheltered from northeast storm waves by the longer jetty (B). The dune grew both higher and wider as well.

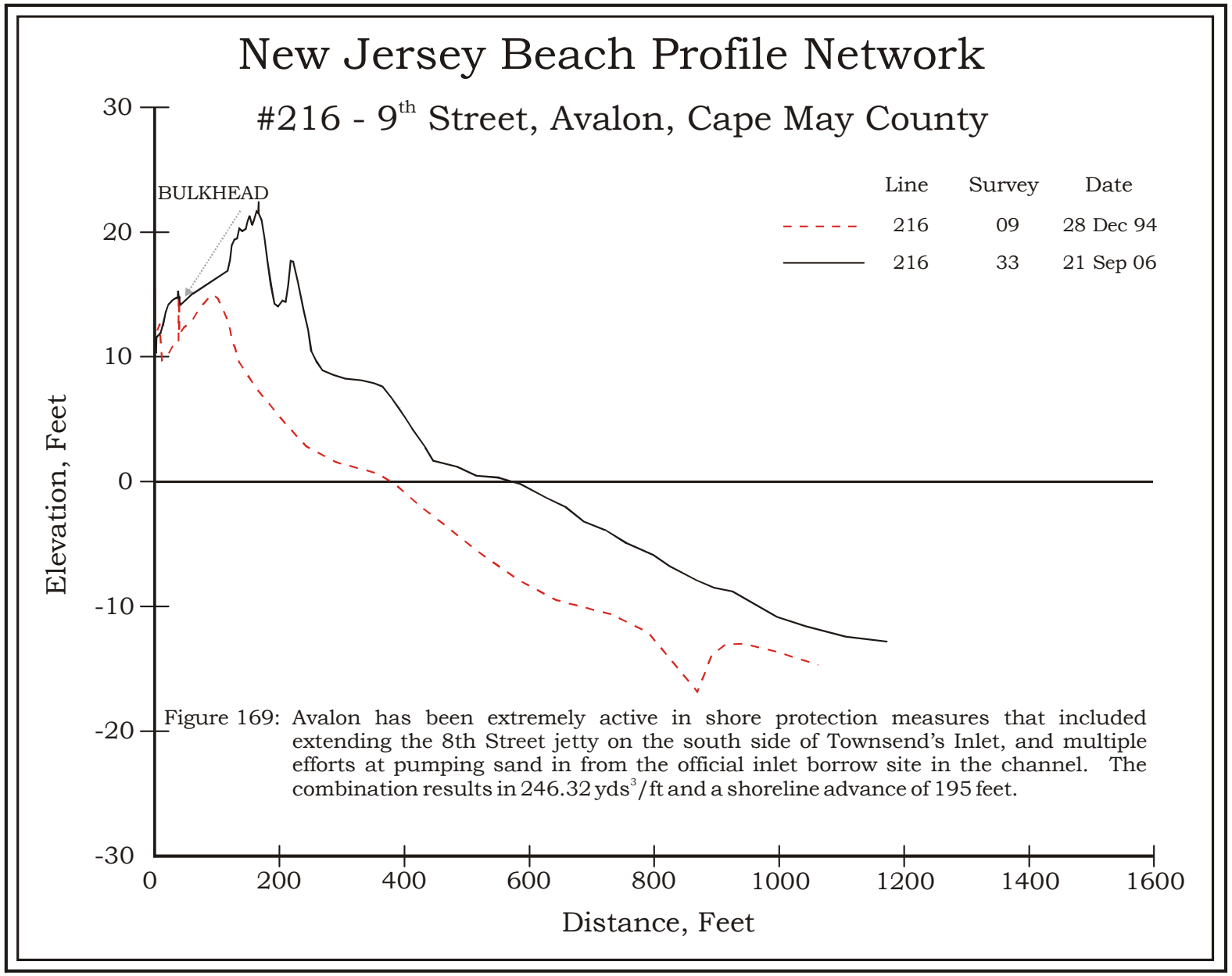


Figure 169: Avalon has been extremely active in shore protection measures that included extending the 8th Street jetty on the south side of Townsend's Inlet, and multiple efforts at pumping sand in from the official inlet borrow site in the channel. The combination results in 246.32 yds^3/ft and a shoreline advance of 195 feet.

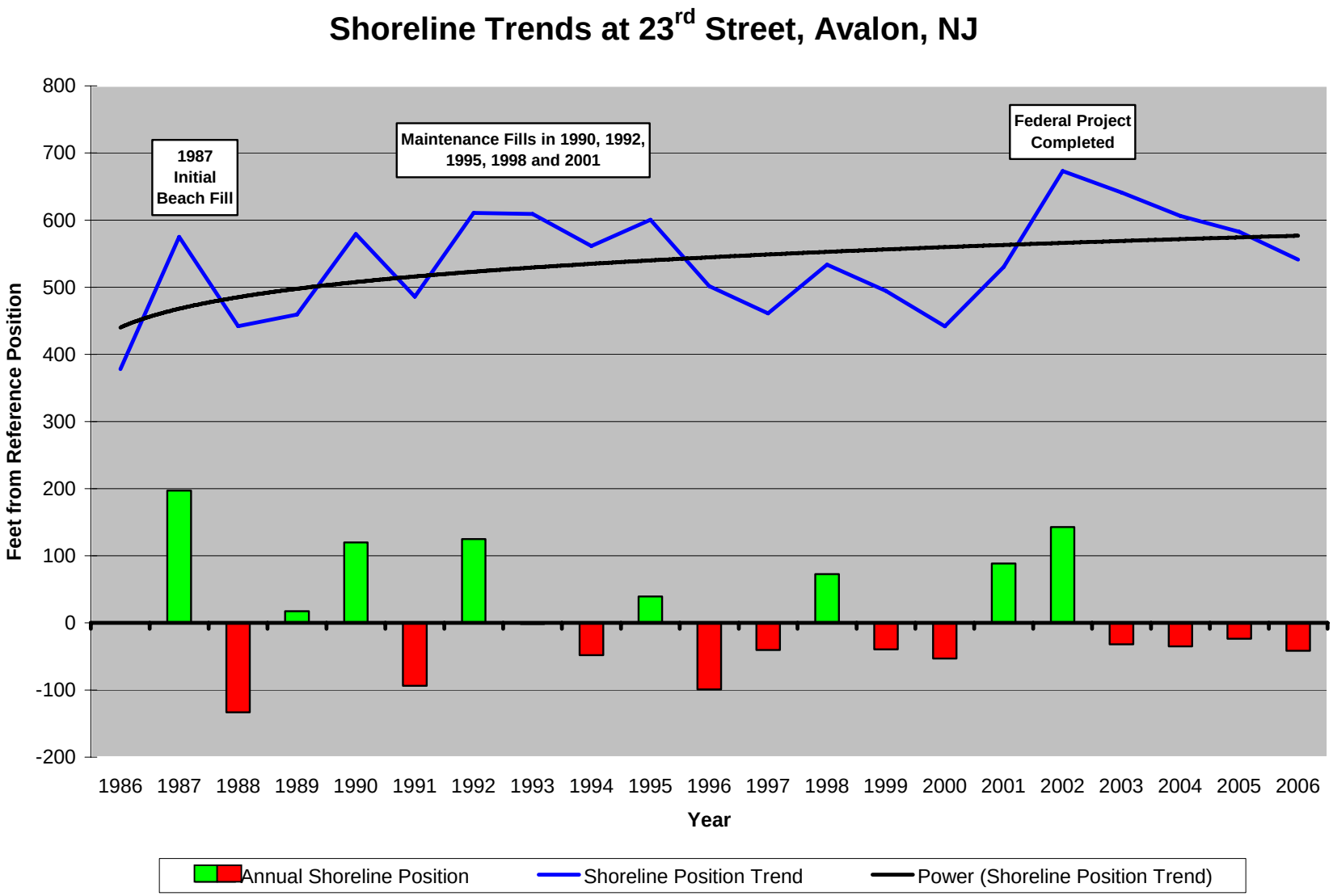


Figure 170. Site 116. This site received multiple State and local projects plus a Federal nourishment project between 1987 and 2002. Avalon reacted by pushing forward the NJ State and local sharing work on their northern beaches following serious loss between 1981

and 1986. The spikes in shoreline advance are all related to beach nourishment, with the loss rate trend remaining relatively low and constant.

A. 

B. 

20-Year Comparison Photographs – Site 116, 23rd Street, Avalon
Beach nourishment commenced (A) in 1987 with over a million cubic yards of sand added between the jetty at 8th Street and the fishing pier at 31st Street. Prior to the initial project the high tide reached landward of the boardwalk into private property. By 1991 the beach and dune had received a renourishment in 1990. Multiple NJ State – locally funded projects continued until the Federal project started in 2002. By 2006 (B) the beach/dune system was wider and afforded considerable increase in protection when compared to the 1986 situation. The profile cross section below shows 1986, but that situation deteriorated further during the 1986 – 1987 winter season leading to the need for the initial nourishment project.

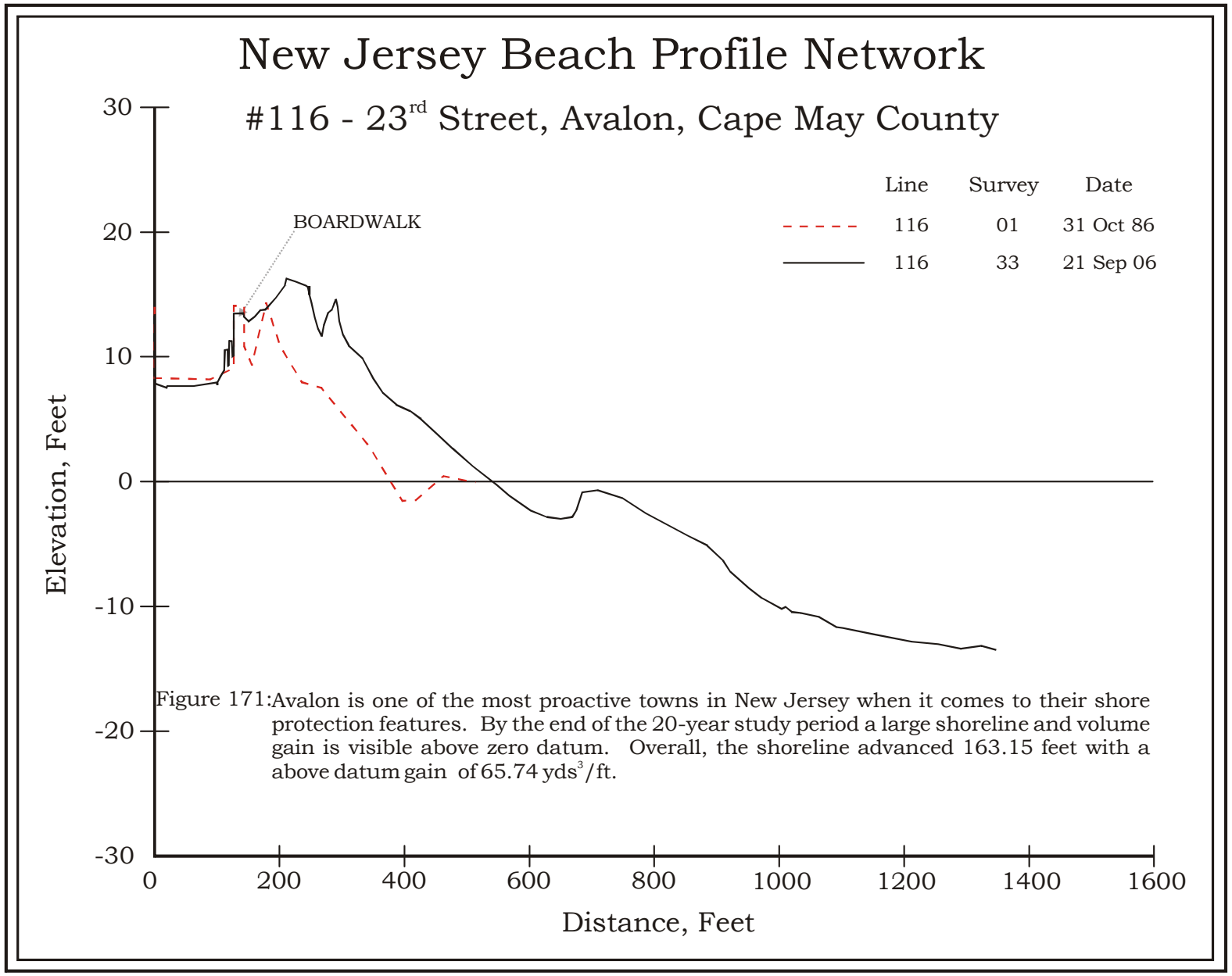


Figure 171: Avalon is one of the most proactive towns in New Jersey when it comes to their shore protection features. By the end of the 20-year study period a large shoreline and volume gain is visible above zero datum. Overall, the shoreline advanced 163.15 feet with a above datum gain of 65.74 yds^3/ft.

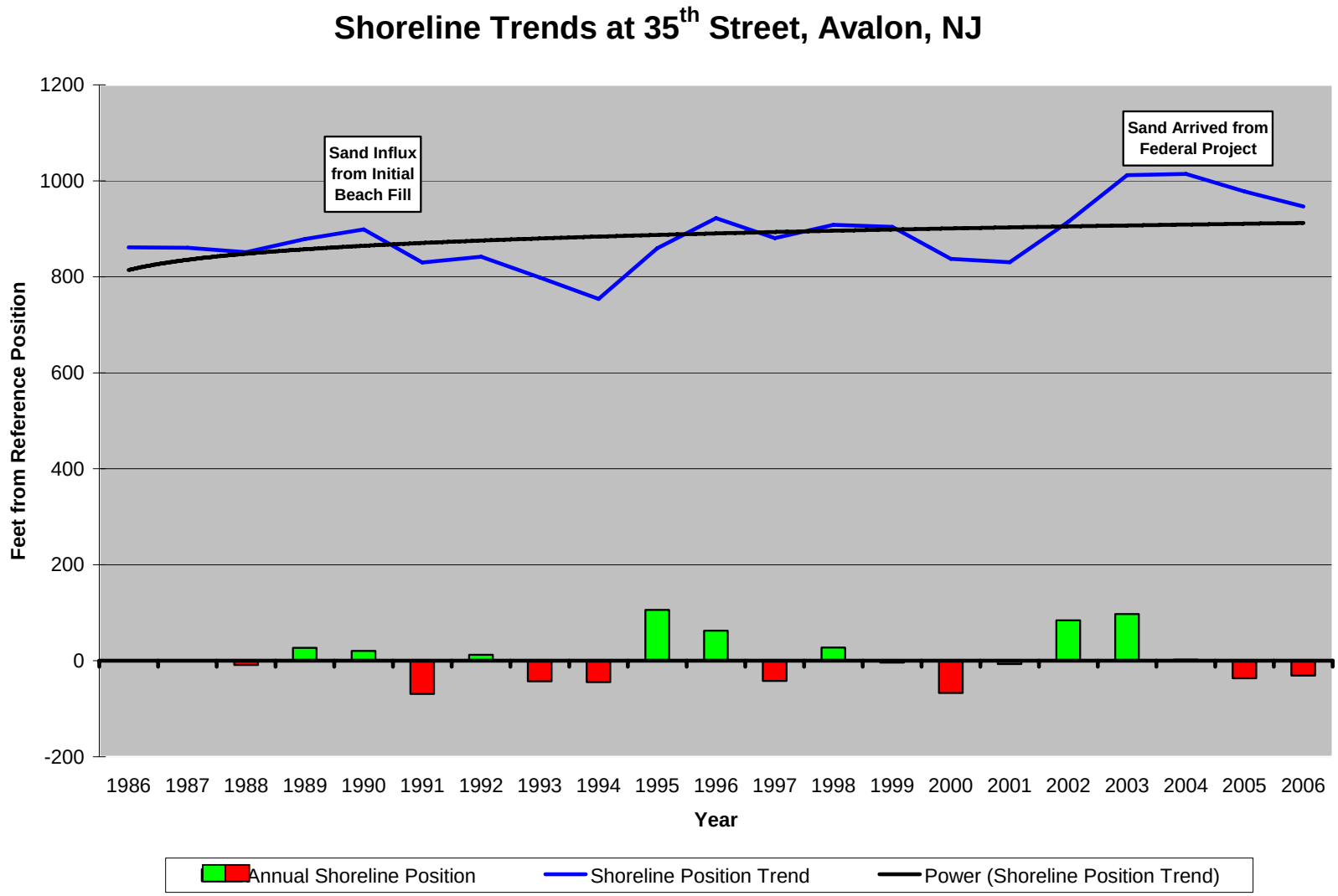


Figure 172. Site 115. Beginning at 35th Street, the Avalon shoreline has been steadily accumulating sand producing a steady advance in the shoreline position. There have been no direct placements of sand along this beach, but littoral transport has moved material into position here over the past two decades.

A. 

B. 

20-Year Comparison Photographs – Site 115, 35th Street, Avalon

35th Street has a wide dune "forest" between the development and the ocean beach. Termed the "High Dune Area" by the Borough of Avalon, this area is unique to the New Jersey developed coastline. Dunes rise to over 50-foot elevations 900 feet west of the seaward toe of dune development. This toe position has advanced seaward steadily as the management efforts added sand to the northern shoreline. 1991 Photo shows the instrument position that was moved seaward once since it was established in 1982 (A). The 2006 photograph shows the new dune toe location with the instrument position at the ridge located to the far left of photograph B. The cross sections below show the extent of dune growth.

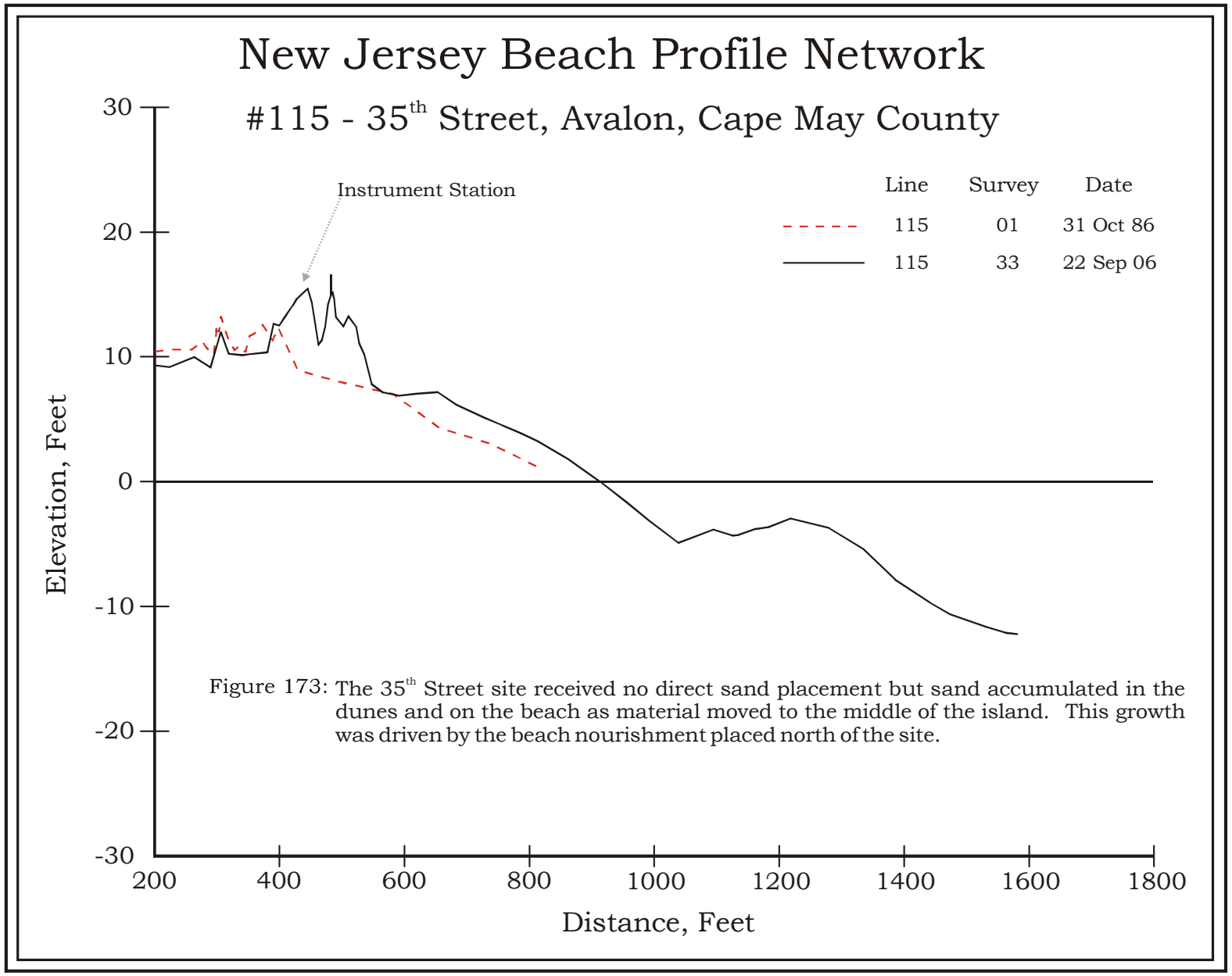


Figure 173: The 35th Street site received no direct sand placement but sand accumulated in the dunes and on the beach as material moved to the middle of the island. This growth was driven by the beach nourishment placed north of the site.

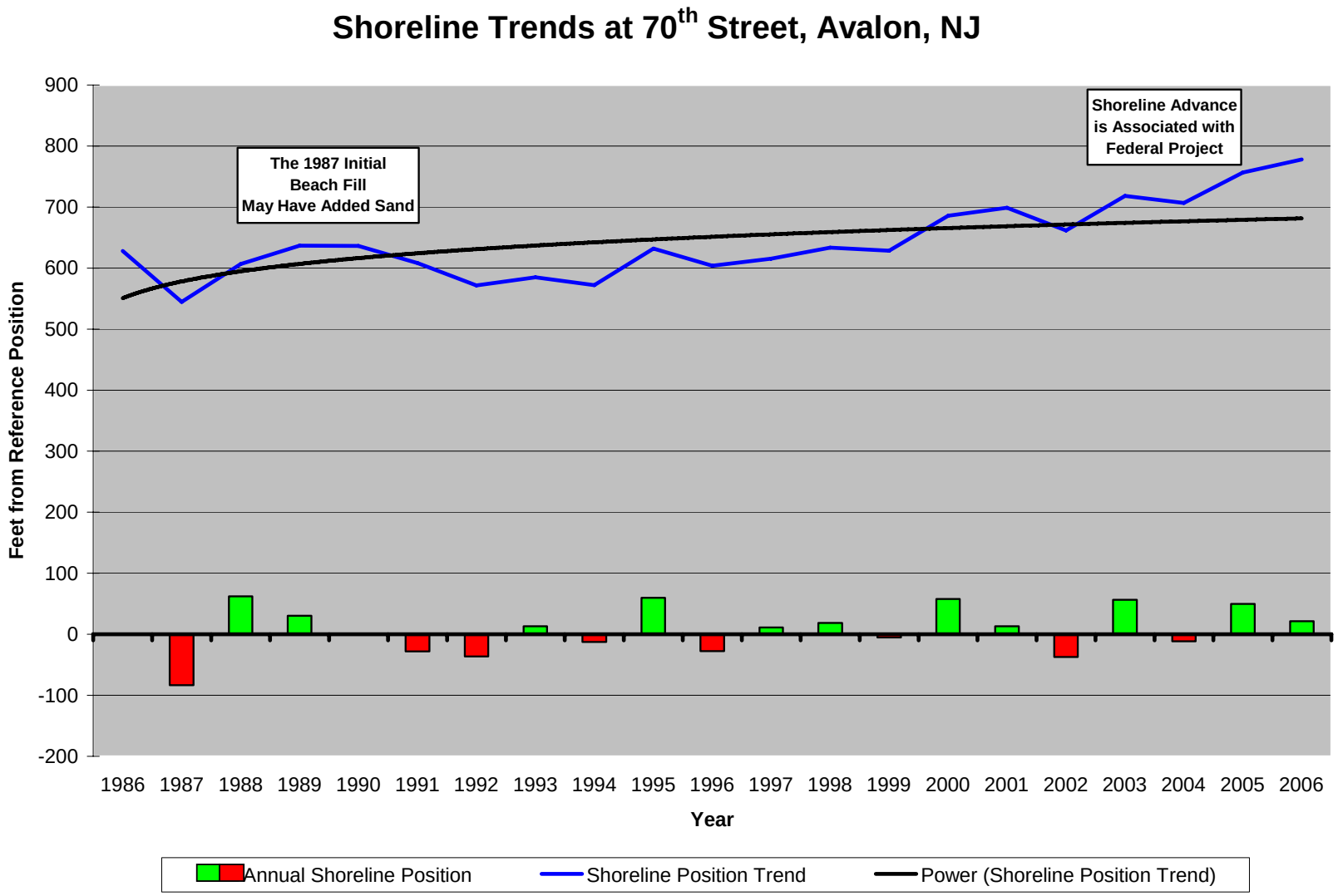


Figure 174. Site 114. The trend of shoreline advance continued south from 35th Street to include the beach at 70th Street in Avalon. No direct placement of sand occurred anywhere between 35th and 70th Streets, yet the shoreline continued to advance and sand accumulated.

A. 

B. 

20-Year Comparison Photographs – Site 114, 70th Street, Avalon

70th Street represents the southern end of the wide expanse of dunes because development pushed seaward from Dune Drive toward the beach south of 56th Street. However, the municipality reserved a wide area for dunes and this foresight has paid off handsomely in the width of shore protection available even in 1994 (A). By 2006 (B) the dunes had widened by double their 1986 width with a corresponding widening at the beach creating a stable, formidable shore protection barrier along this segment of the Borough of Avalon.

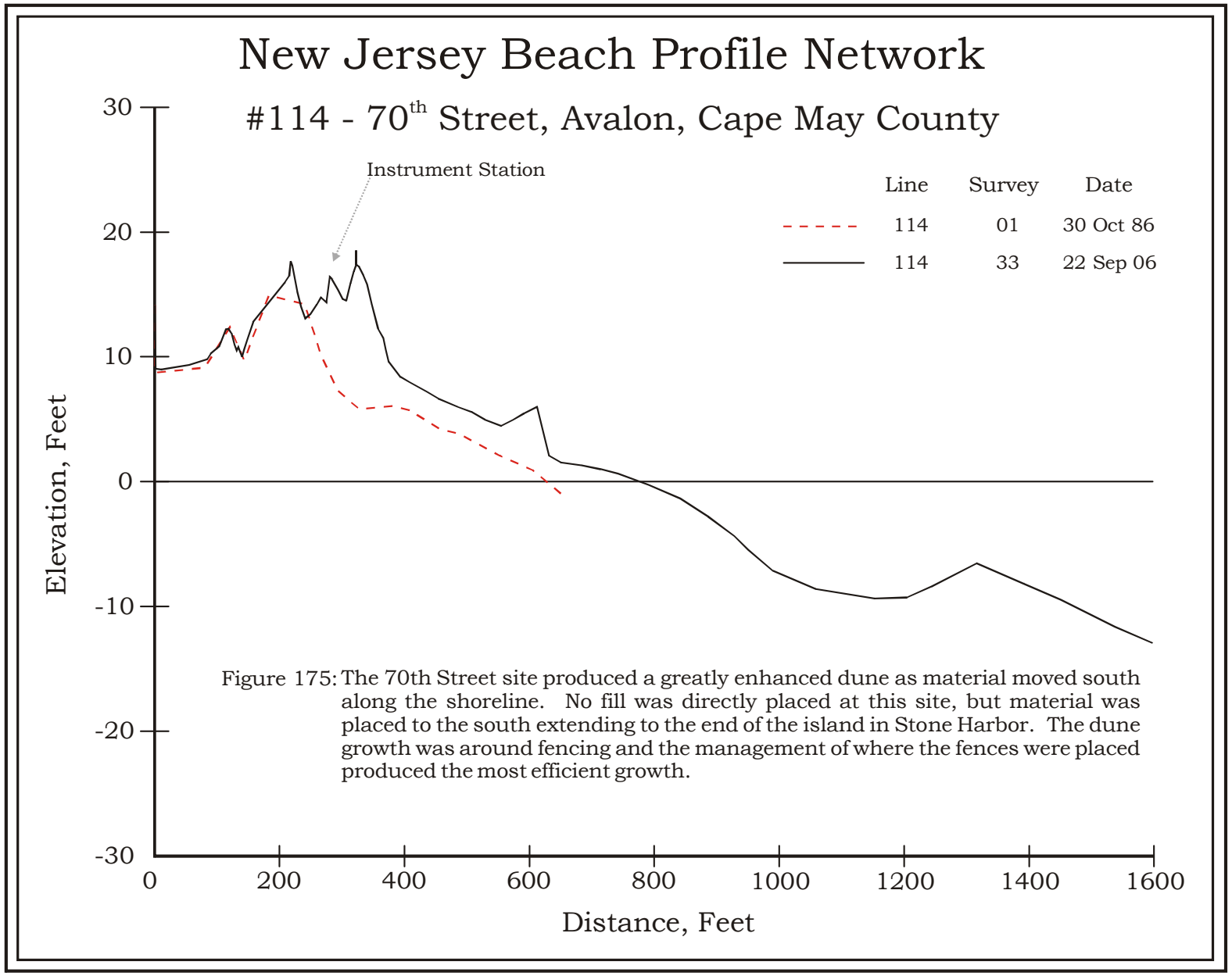


Figure 175: The 70th Street site produced a greatly enhanced dune as material moved south along the shoreline. No fill was directly placed at this site, but material was placed to the south extending to the end of the island in Stone Harbor. The dune growth was around fencing and the management of where the fences were placed produced the most efficient growth.

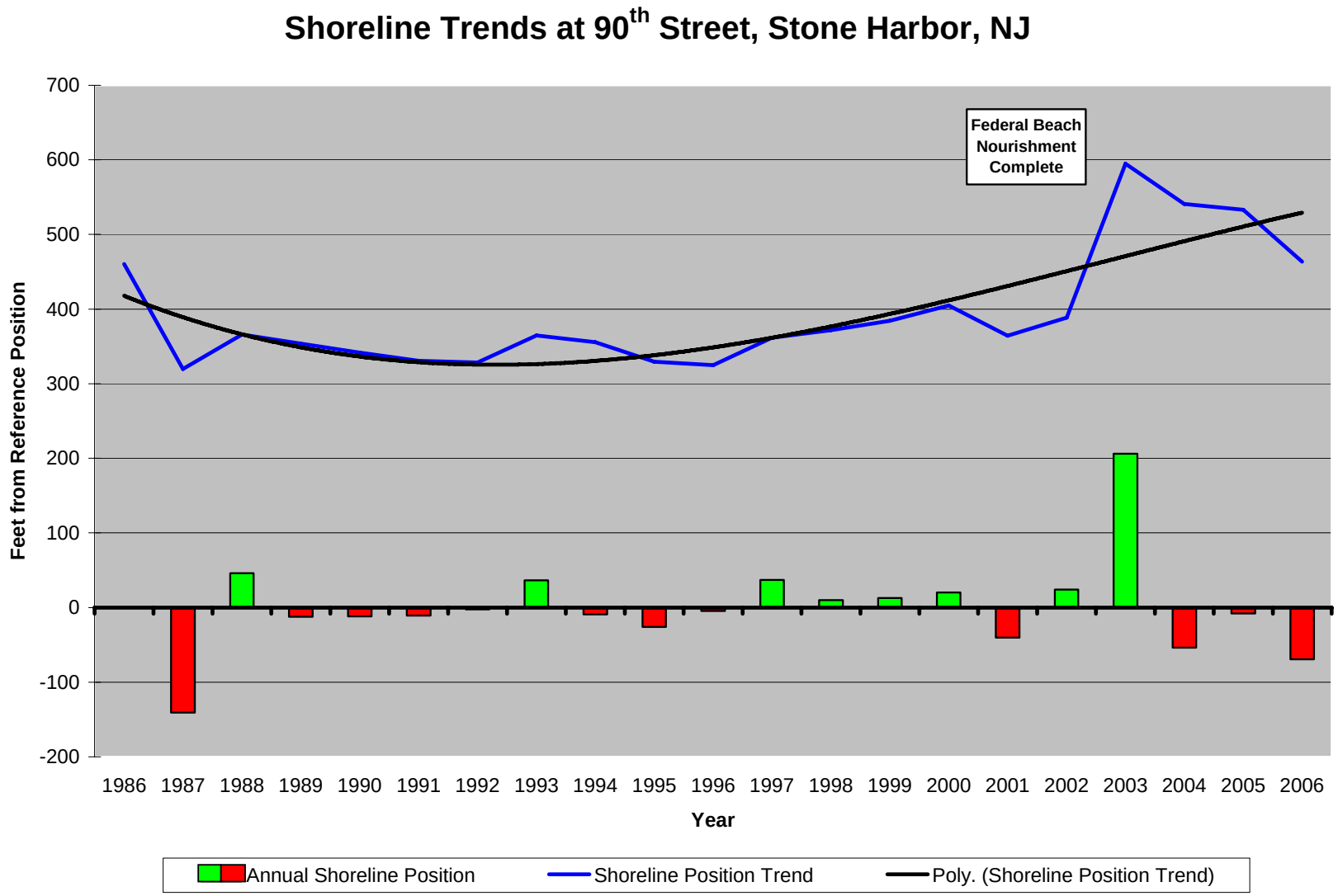


Figure 176. Site 113. The Borough of Stone Harbor conducted its own beach nourishment project in 1997 to counter a long trend of erosion that had pushed the dune back landward of the bulkhead along the central segment of the municipal beach. In 2003, the

Federal project was complete that added the much-needed sand volume to the shoreline. Erosion since, has cut back the quantity by just over half.

A. 

B. 

20-Year Comparison Photographs – Site 113, 90th Street, Stone Harbor

The view to the left was taken about a month following the October 1991 "Halloween Storm" that produced an extensive scarp taking about half the width of the dune system. The Borough of Stone Harbor conducted a cooperative fill in 1997 with the State of New Jersey, then participated in the 2003 Federal project that added a large volume of sand to the municipal shoreline. The 2006 photograph (B) shows the beach, new dune fencing and the wider dune field between the development and the sea.

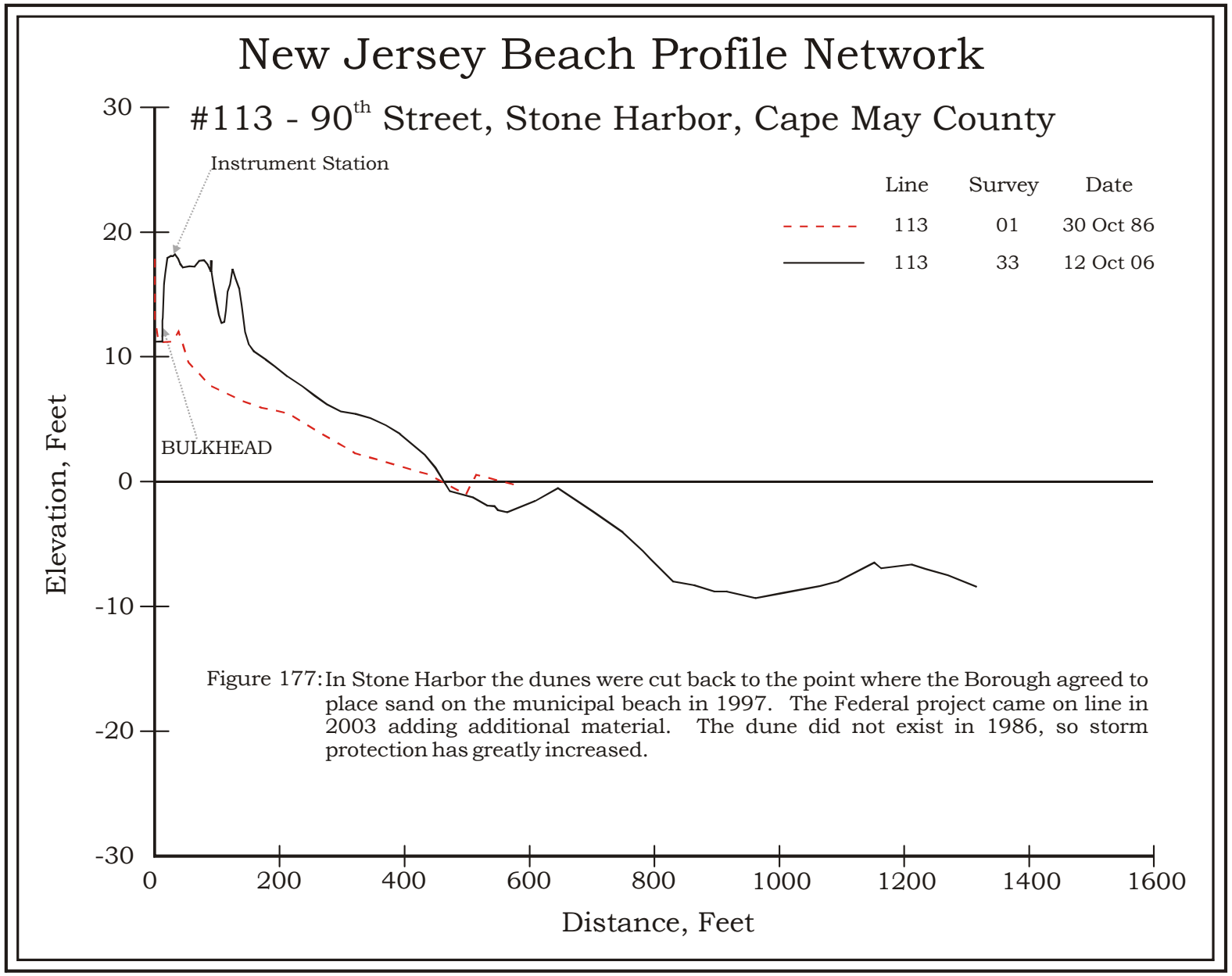


Figure 177: In Stone Harbor the dunes were cut back to the point where the Borough agreed to place sand on the municipal beach in 1997. The Federal project came on line in 2003 adding additional material. The dune did not exist in 1986, so storm protection has greatly increased.

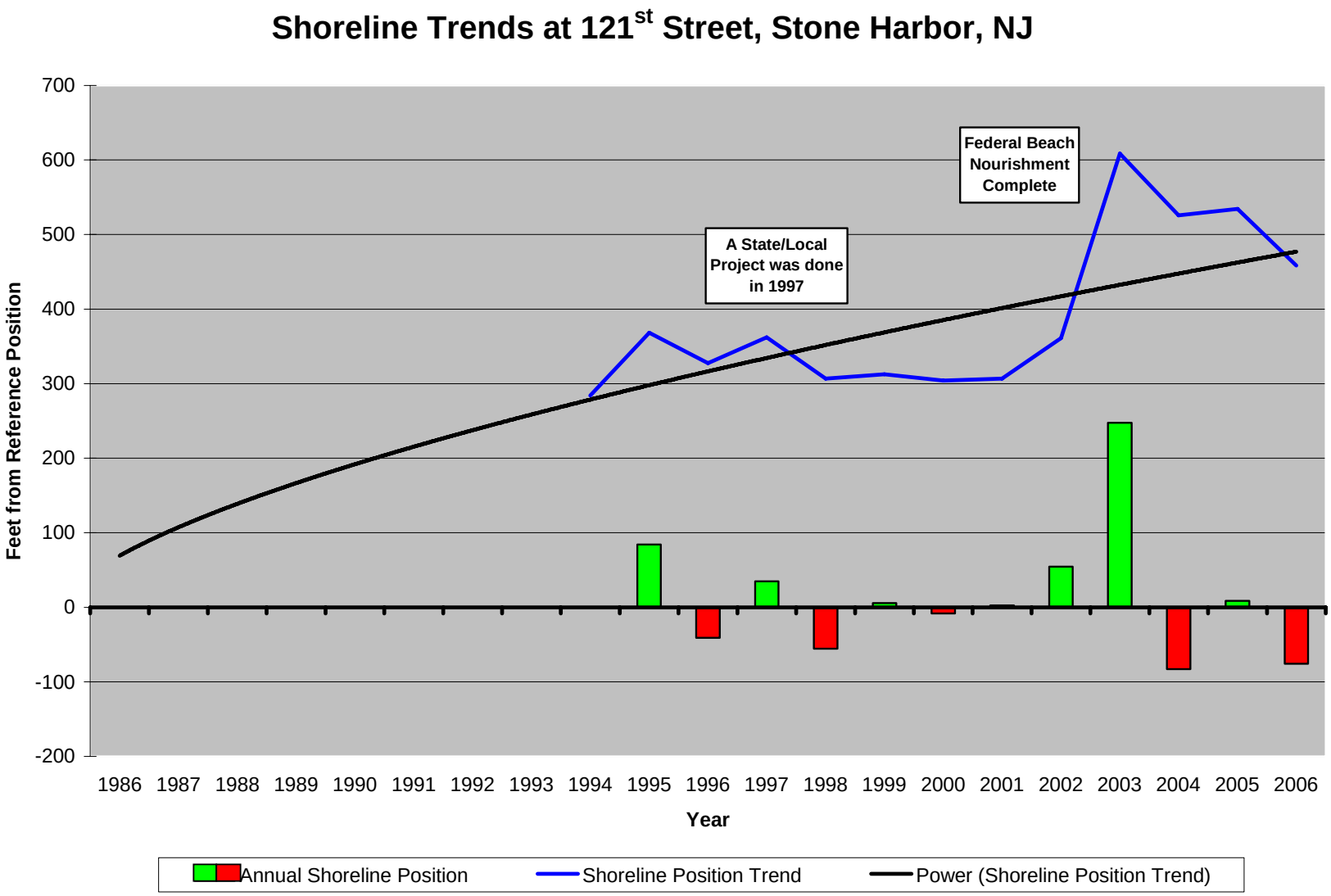


Figure 178. Site 212. Inserted into the rotation of survey sites in 1994 to get data close to Hereford Inlet, this site also shows the impact of the Federal project completed in 2003. Similar losses at this location have cut back the total volume as the shoreline

retreated. This site replaced one located on the undeveloped segment of South Point that vanished in 1990 (Site 112 surveyed in 1986, 87 and 88).

20-Year Comparison Photographs – Site 212, South End, Stone Harbor
This site was added in 1994 to have a replacement site for 112 that eroded out of existence in 1990. Hereford Inlet processes influenced that disappearance. This site is defended by the bulkhead and rock revetment and a terminal groin at its southern end. The 1994 photograph (A) was taken prior to beach nourishment and shows the initial configuration of the shoreline. By 2006 the Federal project was completed burying the revetment in the dune and widening the beach nearly to the seaward end of the terminal groin (B).

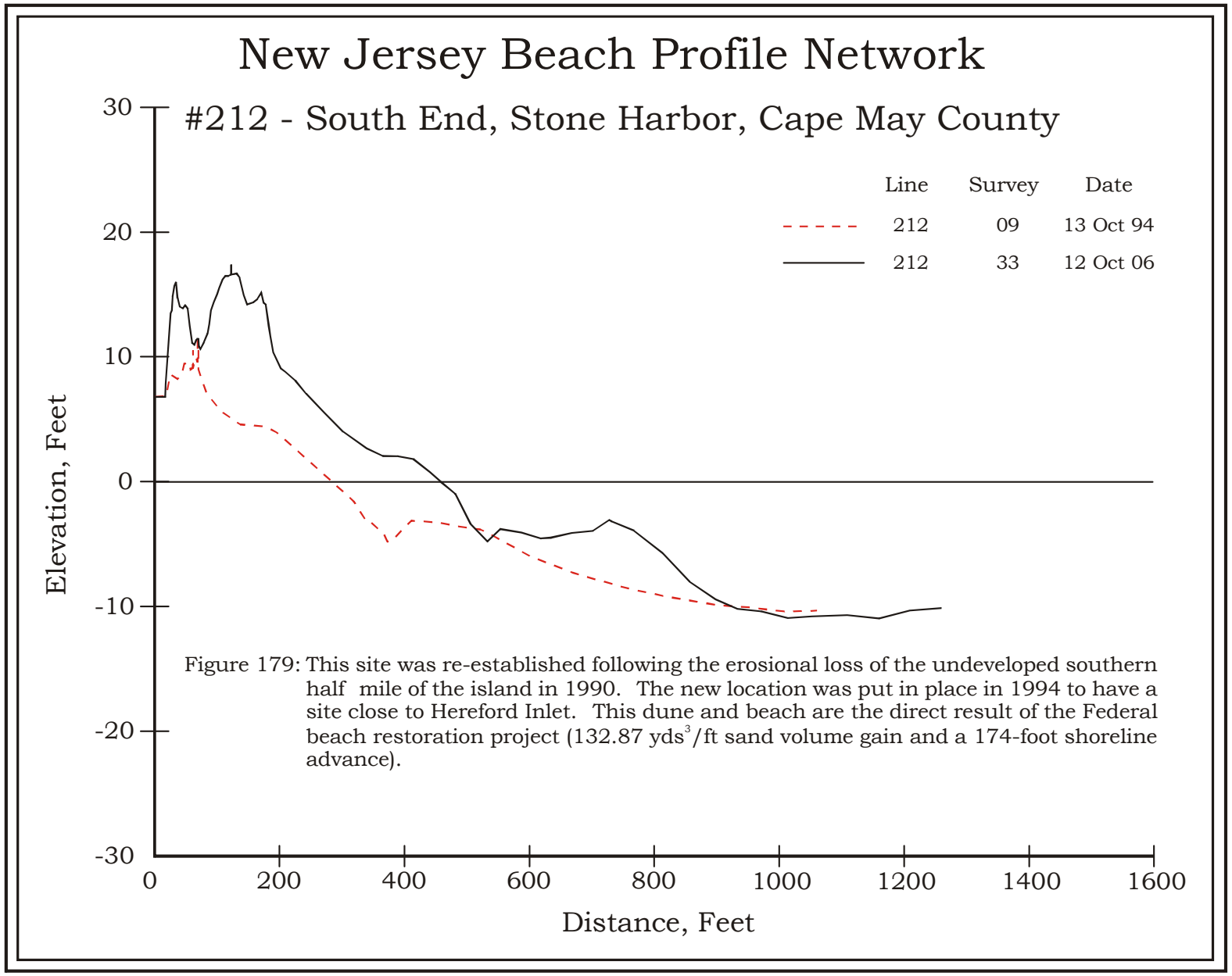


Figure 179: This site was re-established following the erosional loss of the undeveloped southern half mile of the island in 1990. The new location was put in place in 1994 to have a site close to Hereford Inlet. This dune and beach are the direct result of the Federal beach restoration project (132.87 yds^3/ft sand volume gain and a 174-foot shoreline advance).

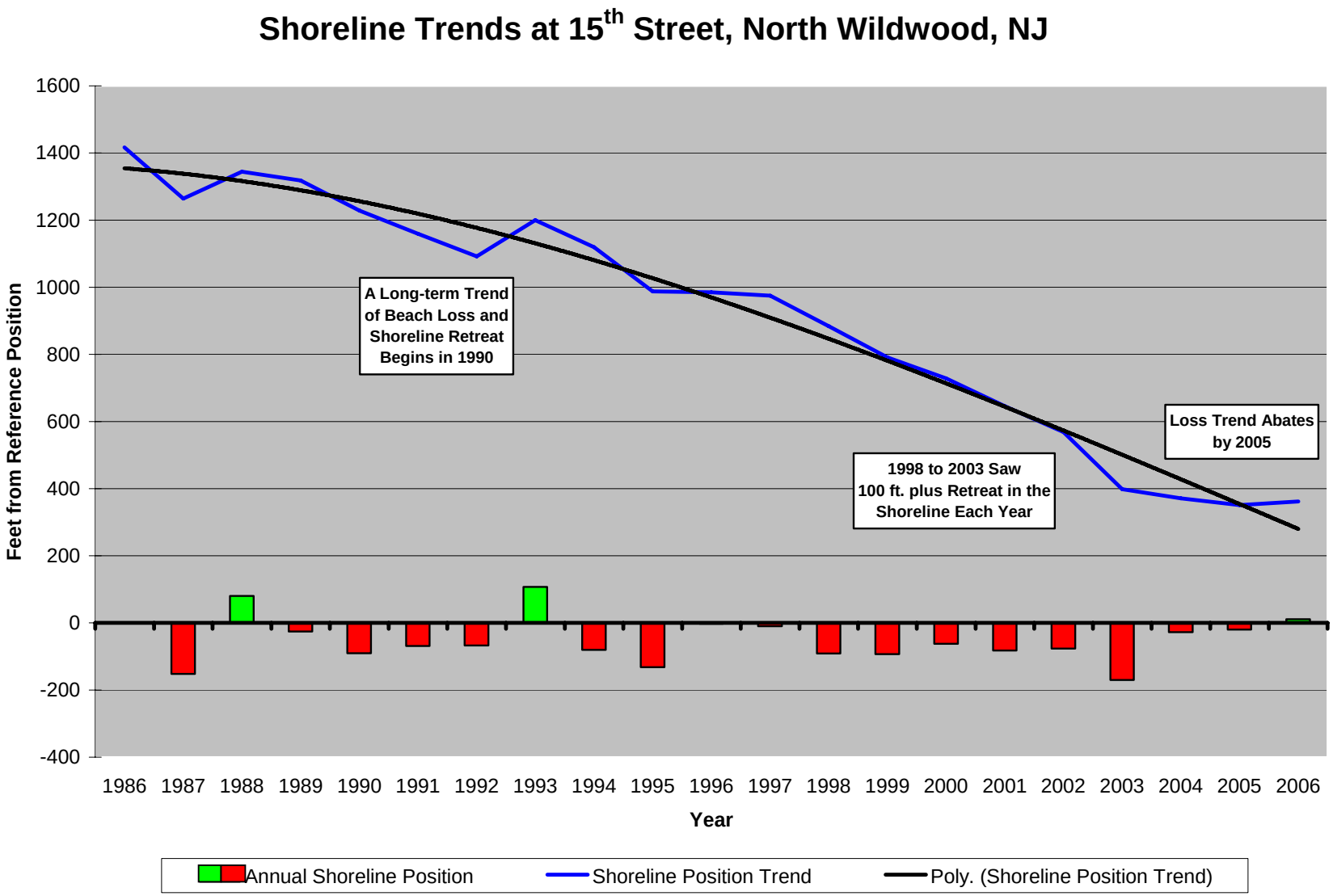


Figure 180. Site 111. North Wildwood takes the prize as the most erosional location in New Jersey, the opposite of site 245 in Barnegat Light Borough where the Barnegat Inlet jetty causes the greatest shoreline advance. The initial shoreline position was

located just over 1,400 feet from the reference position. A long-term trend of erosion began immediately that accelerated rapidly starting in 1998. It barely reversed in 2006 producing a total retreat of 1,055 feet. Had this occurred on any other NJ beach than in the Wildwoods, there would have been serious destruction to the coastal development. Beach replenishment is being pursued for this segment by the municipality and the State of NJ.

A. 

B. 

20-Year Comparison Photographs – Site 111, 15th Avenue, North Wildwood

This site lost more width to the beach than any other of the 100 sites in NJ. In 1991 (A) there were multiple "island" dunes located on the dry beach behind the high tide line. The rate of loss commenced in 1988 and accelerated until 2005. The loss removed about 70% of the huge beach width there in 1986. The right photograph (B) shows the view to the south and the presence of the amusement pier at the water's edge in 2006.

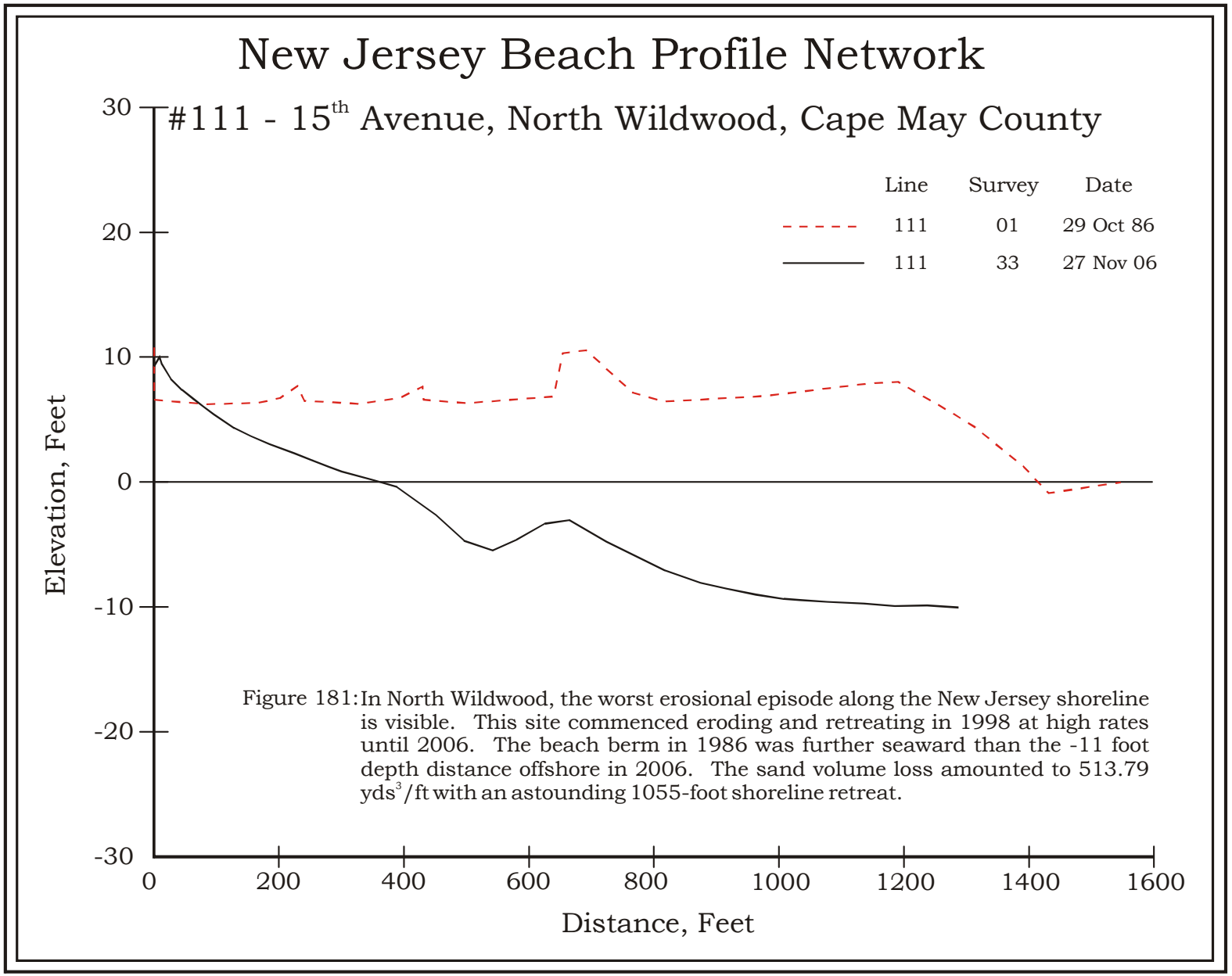


Figure 181: In North Wildwood, the worst erosional episode along the New Jersey shoreline is visible. This site commenced eroding and retreating in 1998 at high rates until 2006. The beach berm in 1986 was further seaward than the -11 foot depth distance offshore in 2006. The sand volume loss amounted to 513.79 yds^3/ft with an astounding 1055-foot shoreline retreat.

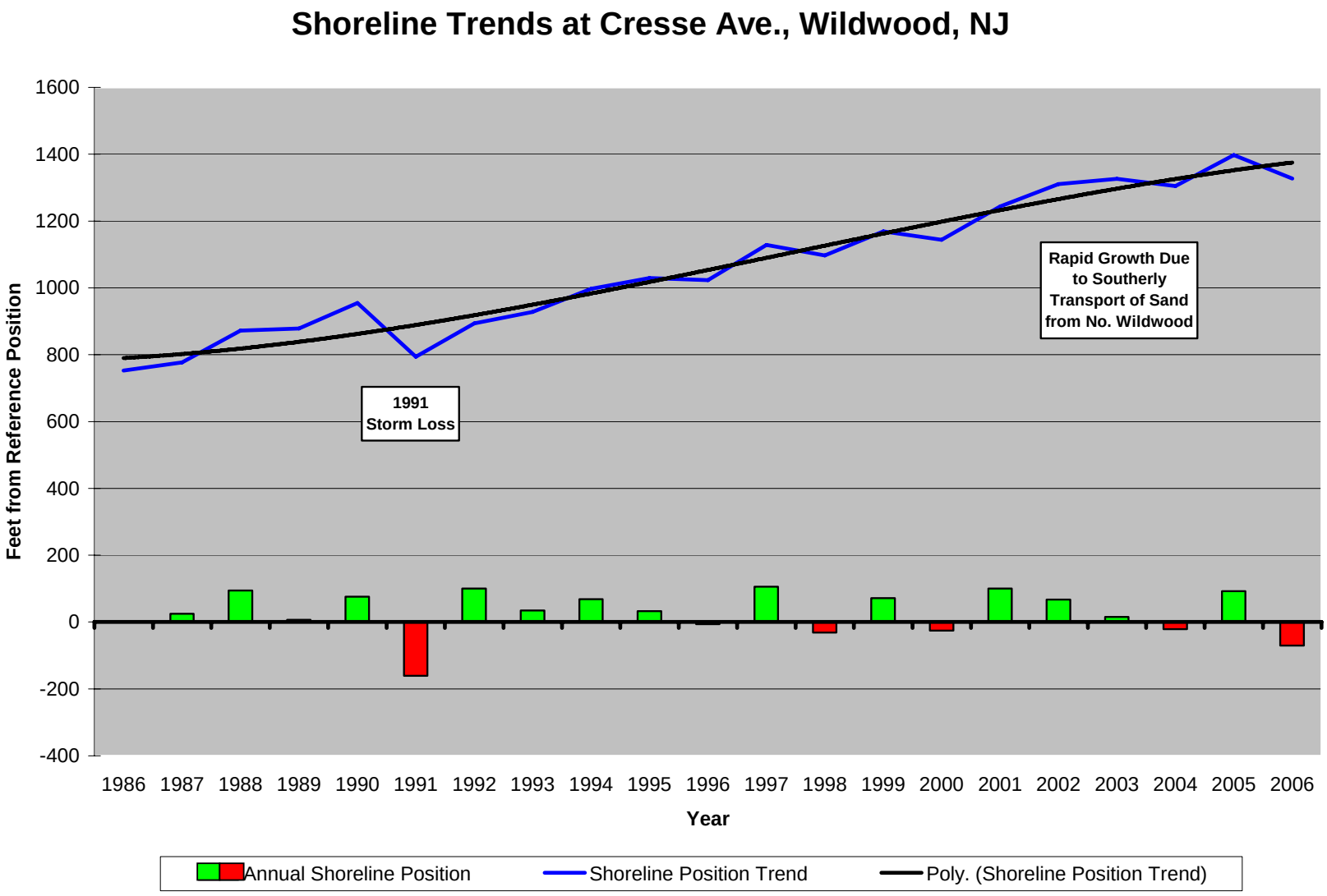

Shoreline Trends at Cresse Ave., Wildwood, NJ
Feet from Reference Position
1600
1400
1200
1000
800
600
400
200
0
-200
-400
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
Year
1991
Storm Loss
Rapid Growth Due
to Southerly
Transport of Sand
from No. Wildwood
Annual Shoreline Position
Shoreline Position Trend
Poly. (Shoreline Position Trend)

Figure 182. Site 110. The trend of retreat dramatically reversed at Cresse Avenue in Wildwood as sand migrated south along the shoreline adding to this beach. The advance amounted to a move from 752 to 1,327 feet seaward of the reference (575 feet). This amounts to about half the sand volume loss at 15th Street in N. Wildwood.

A. 

B. 

20-Year Comparison Photographs – Site 110, Cresse Avenue, Wildwood

The Wildwood site gained dramatically as the North Wildwood site eroded. About half the sand moved south, the remainder was transported by flood-tidal currents into Hereford Inlet as a spit deposited along the inlet shoreline. The 1991 photograph (A) shows a wide, flat beach with dunes at the end of the Wildwood boardwalk at Cresse Avenue. The right photograph (B) shows a wider beach, but little different in geometry except the 575-foot increase in width.

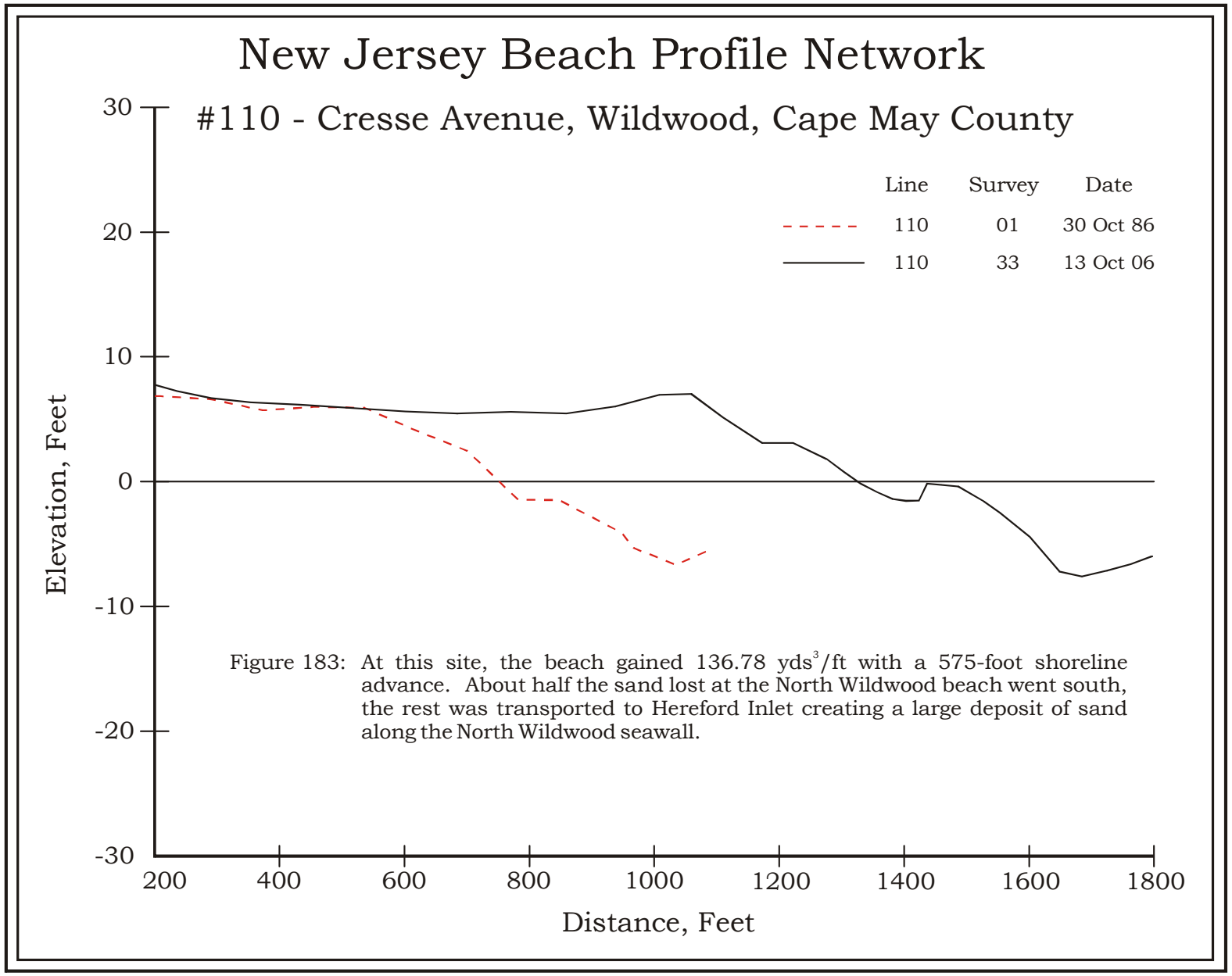


Figure 183: At this site, the beach gained 136.78 yds^3/ft with a 575-foot shoreline advance. About half the sand lost at the North Wildwood beach went south, the rest was transported to Hereford Inlet creating a large deposit of sand along the North Wildwood seawall.

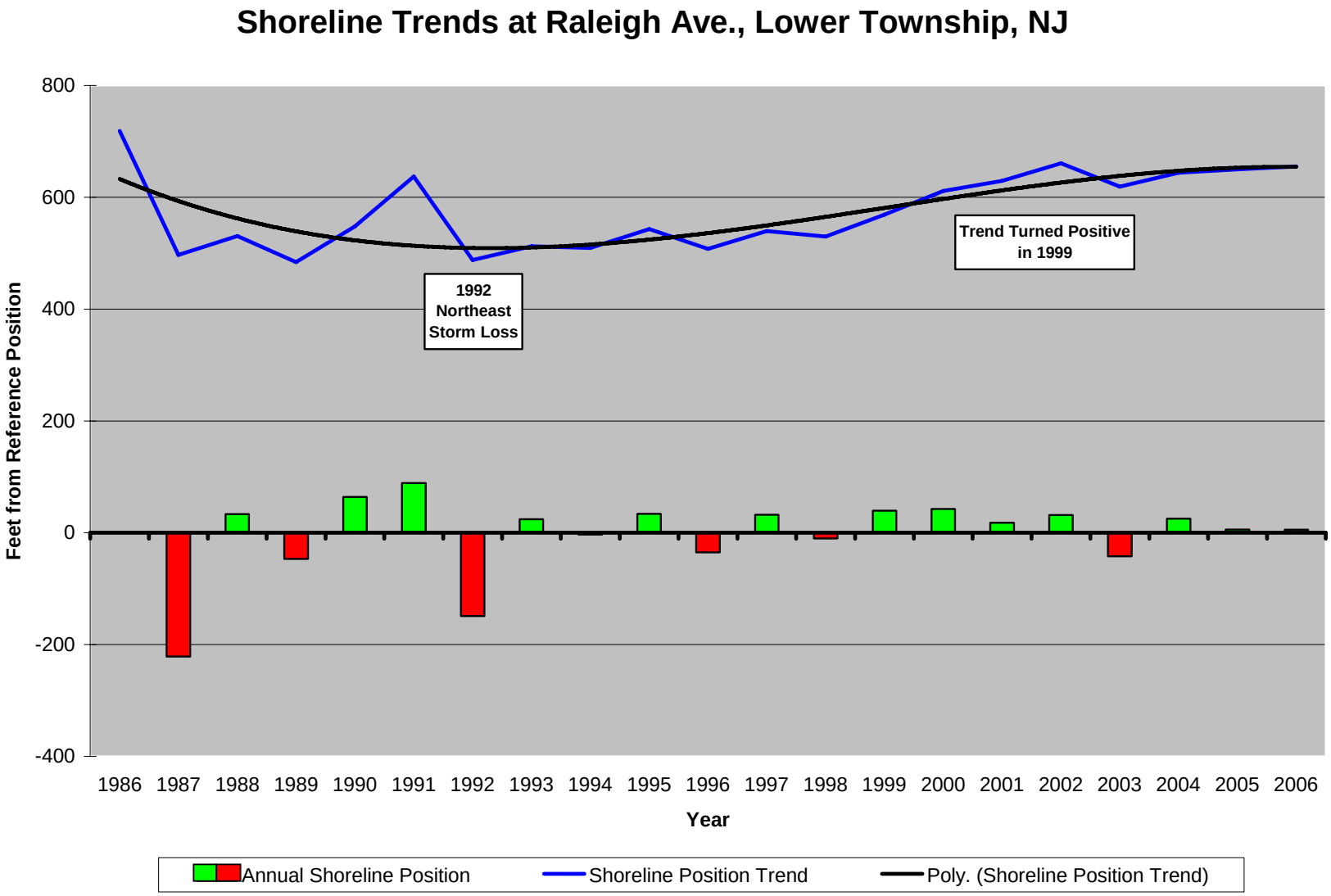


Figure 184. Site 109. A trend of storm-related loss pushed the shoreline about 200 feet landward by 1992. This was followed by a trend of advance that continued from 1993 to 2006. No beach material was pumped onto any of this shoreline.

A. 

B. 

20-Year Comparison Photographs – Site 109, Raleigh Avenue, Lower Township
Further south along the Wildwood's shoreline sand accumulation produced incremental shoreline advances after the 1992 northeast storm. The 1991 photograph (A) shows the beach and dune field at Raleigh Avenue. The 2006 photograph (B) shows a wider beach seaward of the dunes developed as sand moved south and was trapped by the Cold Springs Inlet jetty.

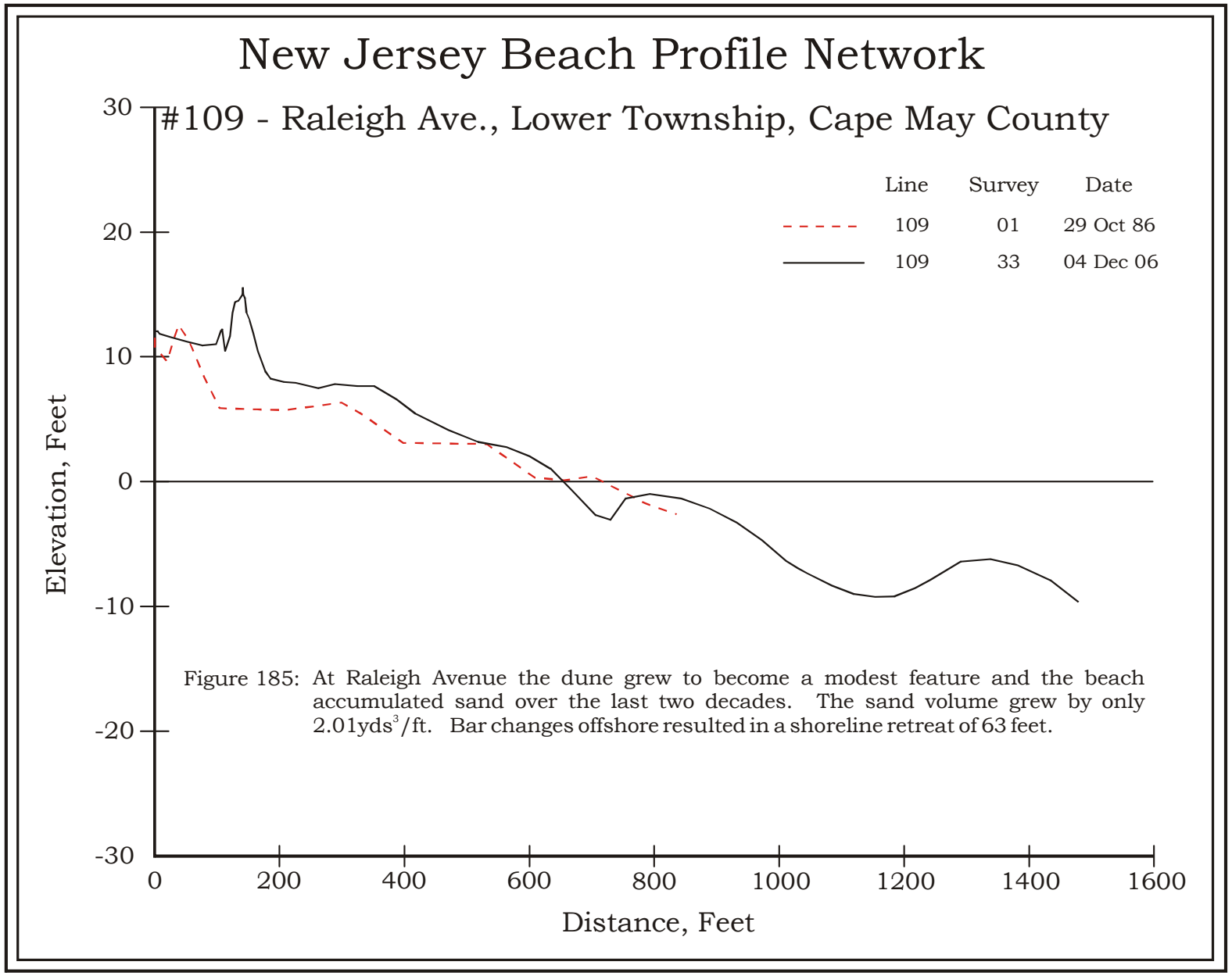


Figure 185: At Raleigh Avenue the dune grew to become a modest feature and the beach accumulated sand over the last two decades. The sand volume grew by only 2.01yds^3/ft. Bar changes offshore resulted in a shoreline retreat of 63 feet.

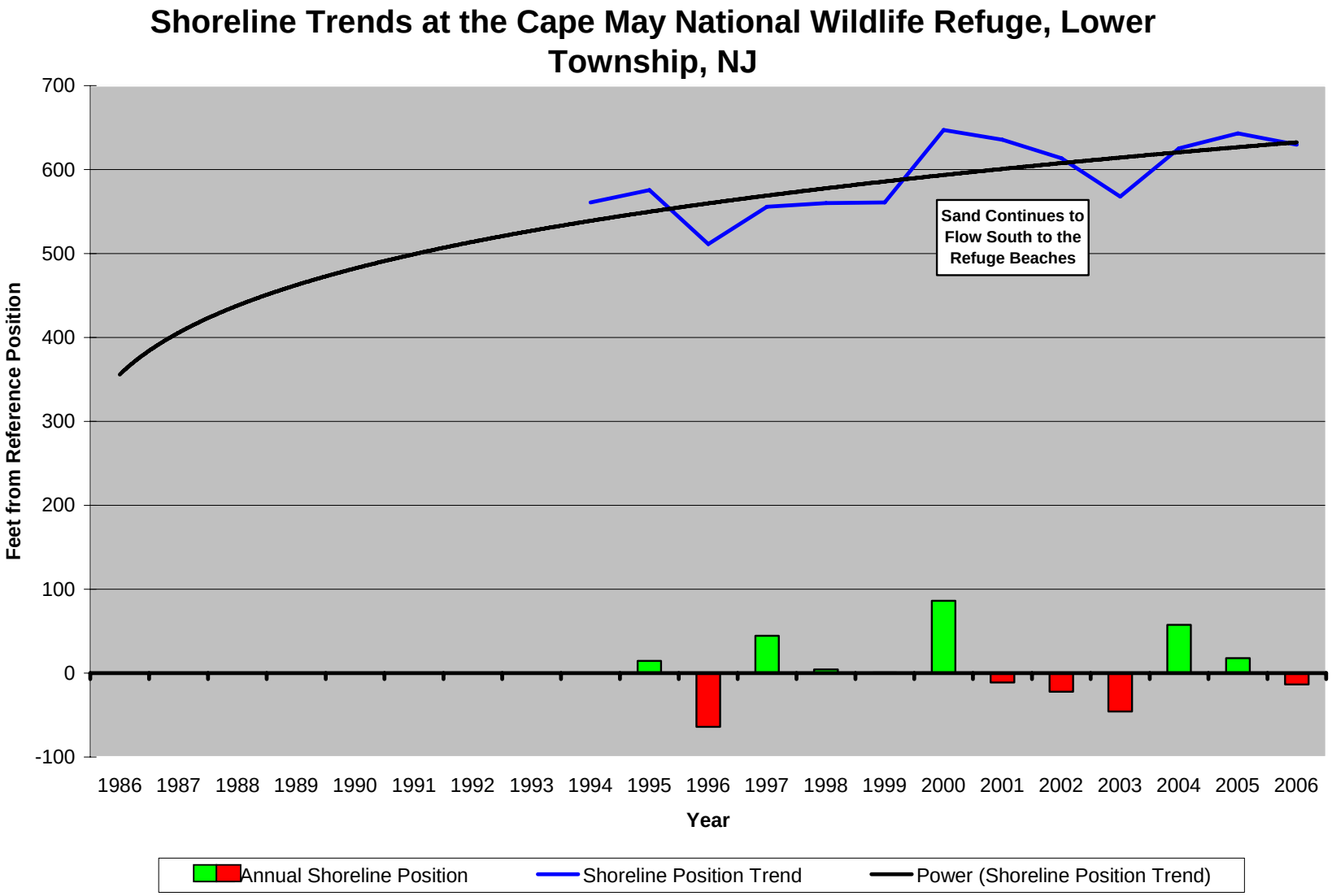


Figure 186. Site 208. Established within the natural area of the Cape May National Wildlife Refuge in 1994, this site shows the impact of the 1911-vintage Cold Springs Inlet jetties in trapping sand. The area has been constructional for decades.

A. 

B. 

C. 

20-Year Comparison Photographs – Site 208, Cape May National Wildlife Refuge, Lower Township
This site was added in the new wildlife refuge that was created from the military installation formerly using this southern segment of "2-Mile Island". The 1994 photographs (A and B) show the dune ridge and the beach from the ridge as profiling commenced. The continued addition of sand has produced an advance in the dune position seaward following the shoreline accretion. The stone jetties are the dominant feature trapping the sand moving south since completion in 1911.

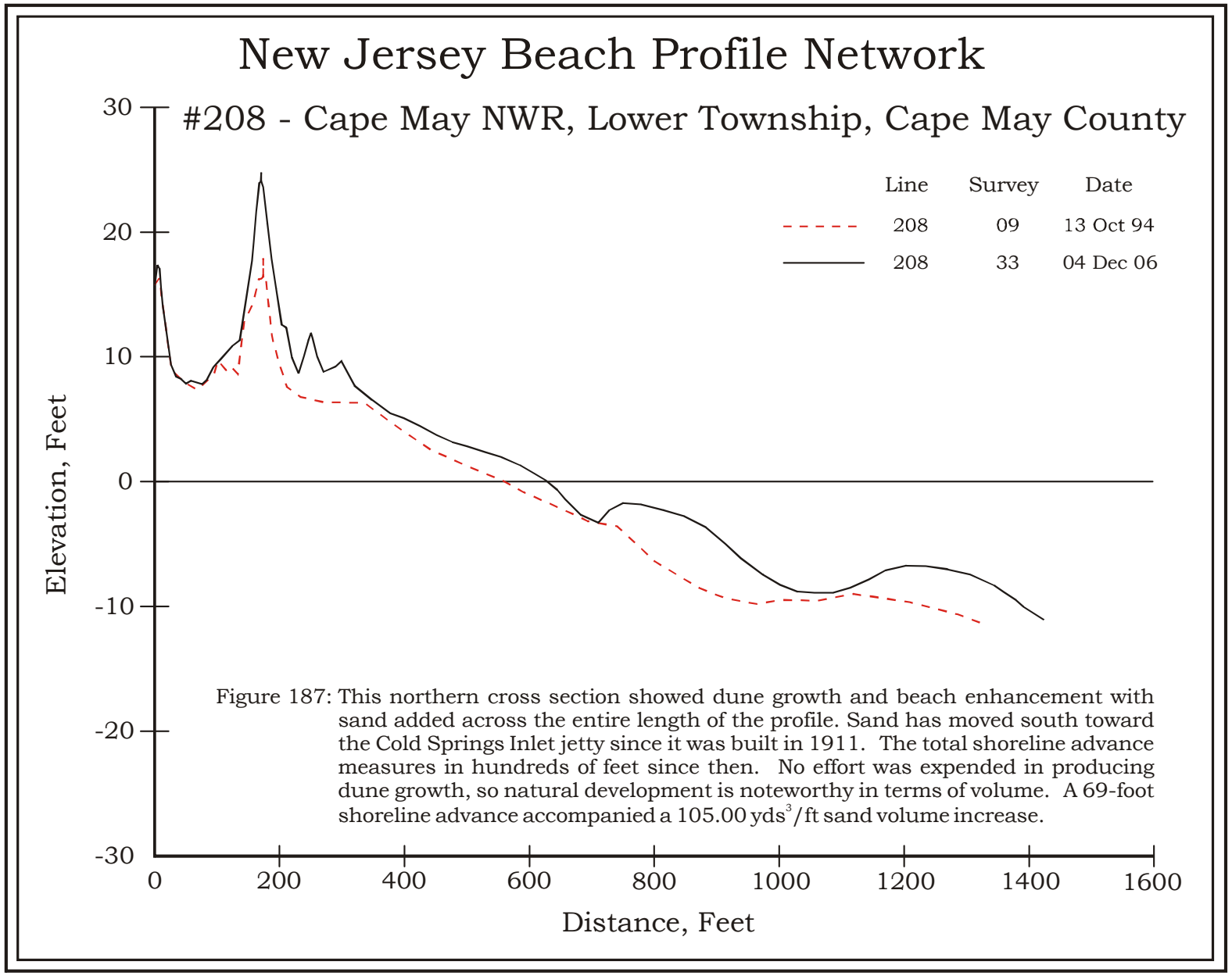


Figure 187: This northern cross section showed dune growth and beach enhancement with sand added across the entire length of the profile. Sand has moved south toward the Cold Springs Inlet jetty since it was built in 1911. The total shoreline advance measures in hundreds of feet since then. No effort was expended in producing dune growth, so natural development is noteworthy in terms of volume. A 69-foot shoreline advance accompanied a 105.00 yds^3/ft sand volume increase.

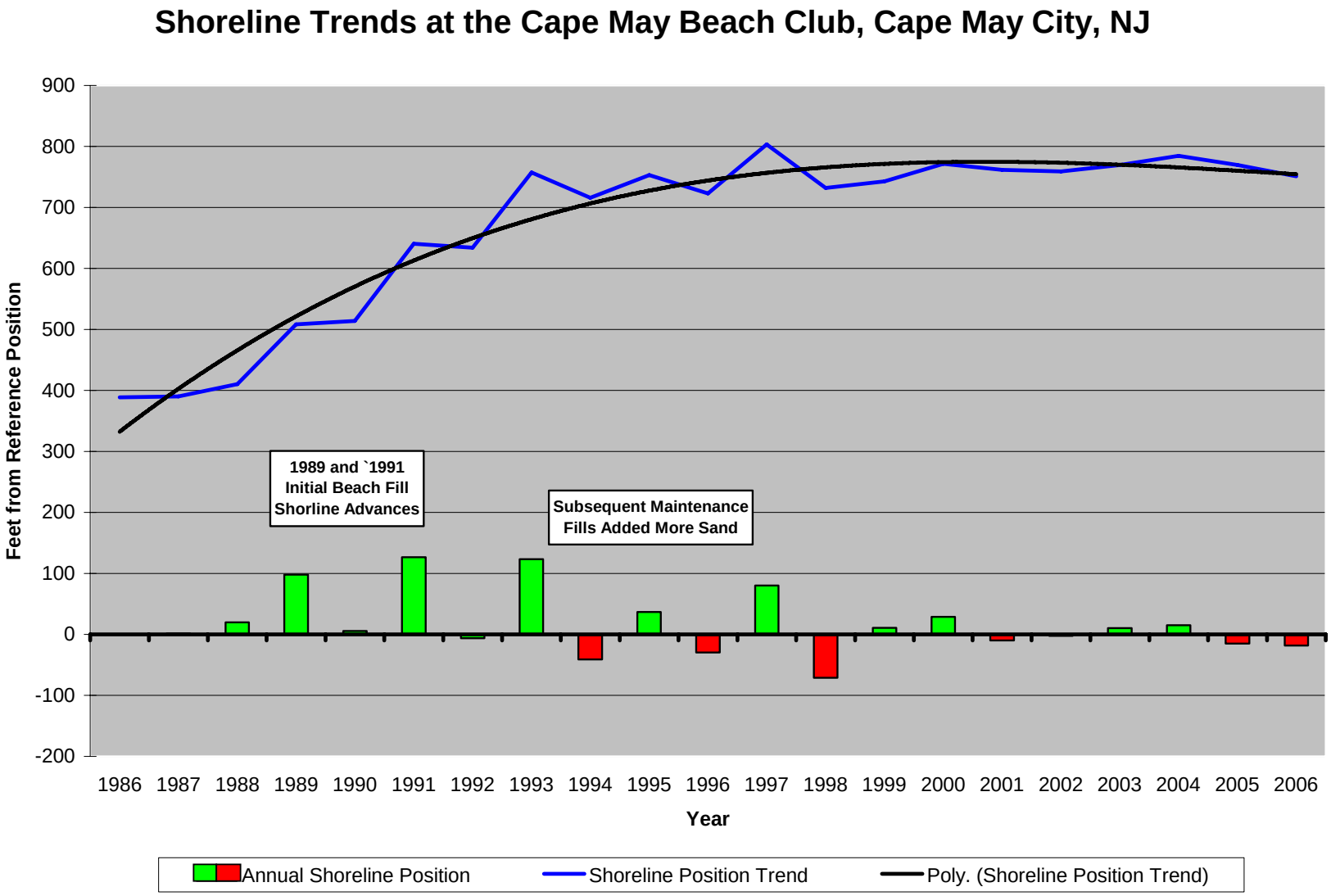


Figure 188. Site 108. The City of Cape May enjoyed the benefits of the initial Federal project constructed by the Philadelphia District on the NJ coastline. The trend line represents the addition of sand in 1989 through 1997 with direct placement at this site.

The later maintenance fills did not add to the side but material movement has maintained the 350-foot advance in the shoreline position.

A. 

B. 

20-Year Comparison Photographs – Site 108, Cape May Beach Club, Cape May

The 1991 photograph follows the 1989 addition of sand to the Cape May City shoreline as the initial New Jersey Federal beach restoration project got underway. The impact of the "Halloween Storm" in 1991 shows as overwash into the dune area with a large ridge developed seaward of the transit position. By 2006 the site (B) had grown seaward by an additional 250 feet from the 1991 situation. Several renourishment efforts have kept the beach in excellent condition.

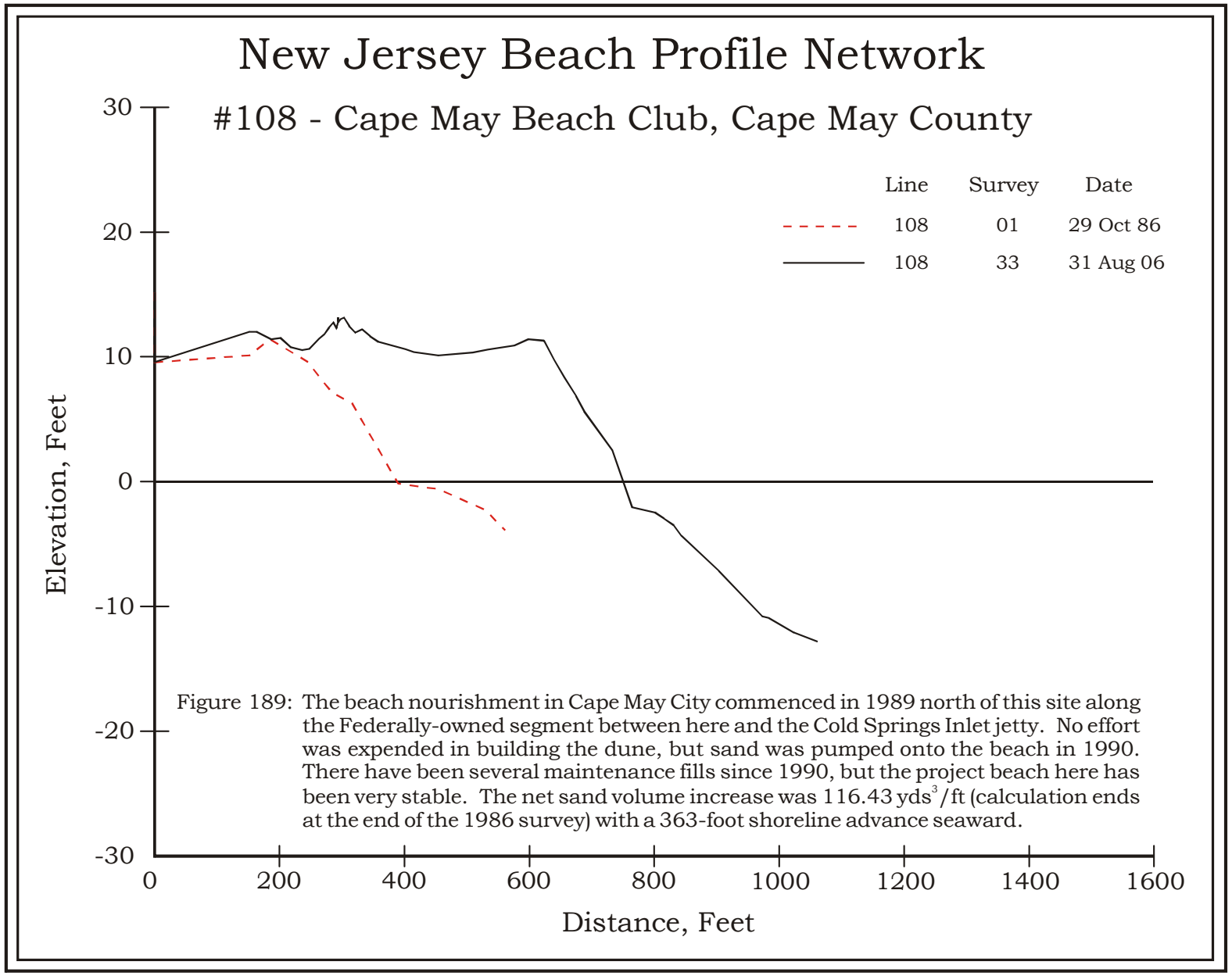


Figure 189: The beach nourishment in Cape May City commenced in 1989 north of this site along the Federally-owned segment between here and the Cold Springs Inlet jetty. No effort was expended in building the dune, but sand was pumped onto the beach in 1990. There have been several maintenance fills since 1990, but the project beach here has been very stable. The net sand volume increase was 116.43 yds^3/ft (calculation ends at the end of the 1986 survey) with a 363-foot shoreline advance seaward.

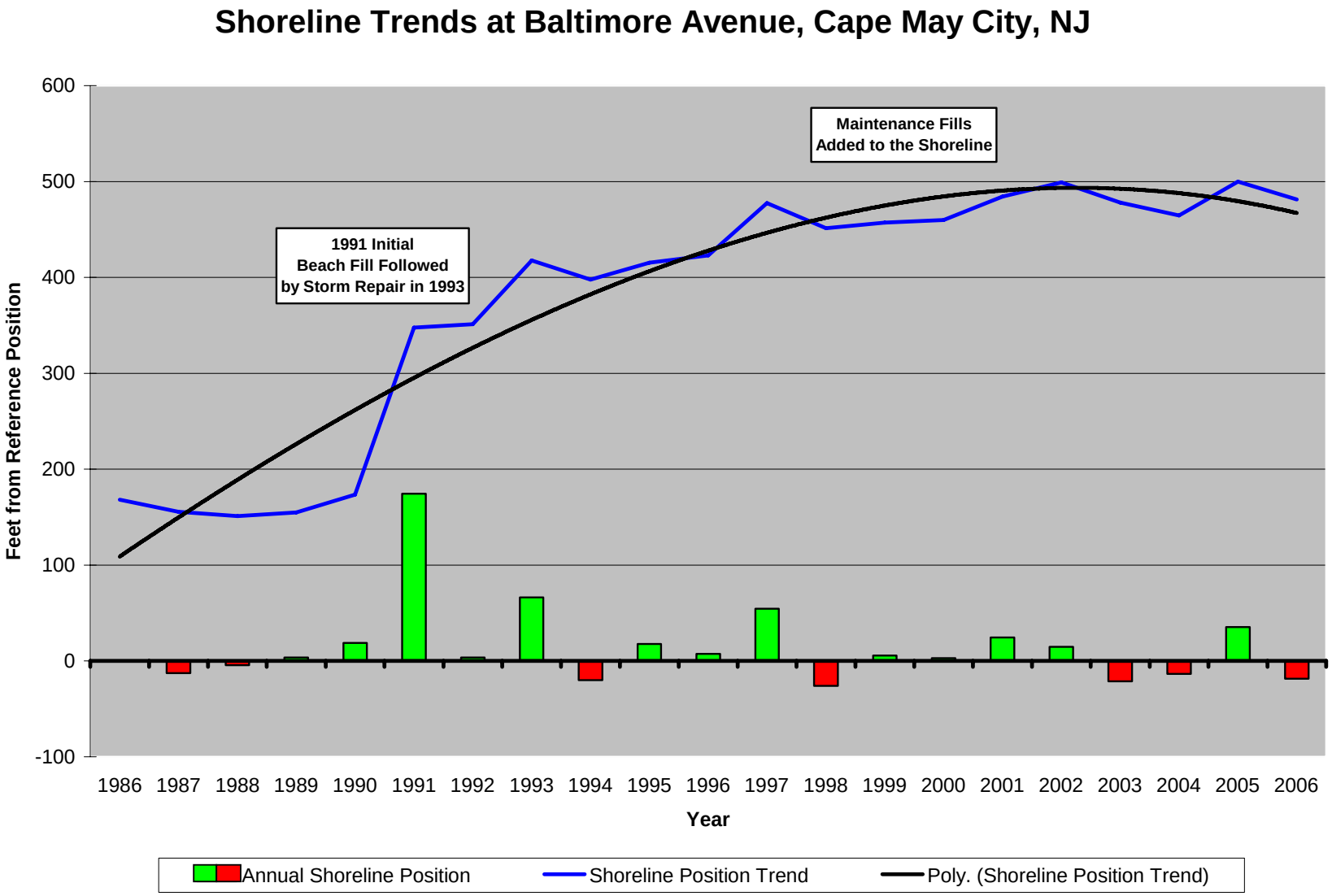


Figure 190. Site 107. Baltimore Avenue beach was wet sand at the base of the rock revetment along Beach Drive in 1986 to 1990 prior to the Federal project's commencement. Sand was added multiple times starting in 1993 principally as a result of damage done

by the 1991 and 1992 northeast storms. The site remained very stable between episodes of renourishment due to its central position within the region of the project.

A.  **B.** 

20-Year Comparison Photographs – Site 107, Baltimore Avenue, Cape May

There was no dry beach at Baltimore Avenue in 1990 (A), but the development was protected by a series of rock groins and a rock revetment in front of a timber bulkhead. A little dry sand would appear each summer and quickly be moved back offshore each winter. The fill arrived in 1991 with a repair fill in 1993 following the December 1992 northeaster. The dune width extends further seaward (B) than the position of the 1990 zero elevation position. The 313-foot shoreline advance has produced a fine recreational beach and a tremendous increase in shore protection.

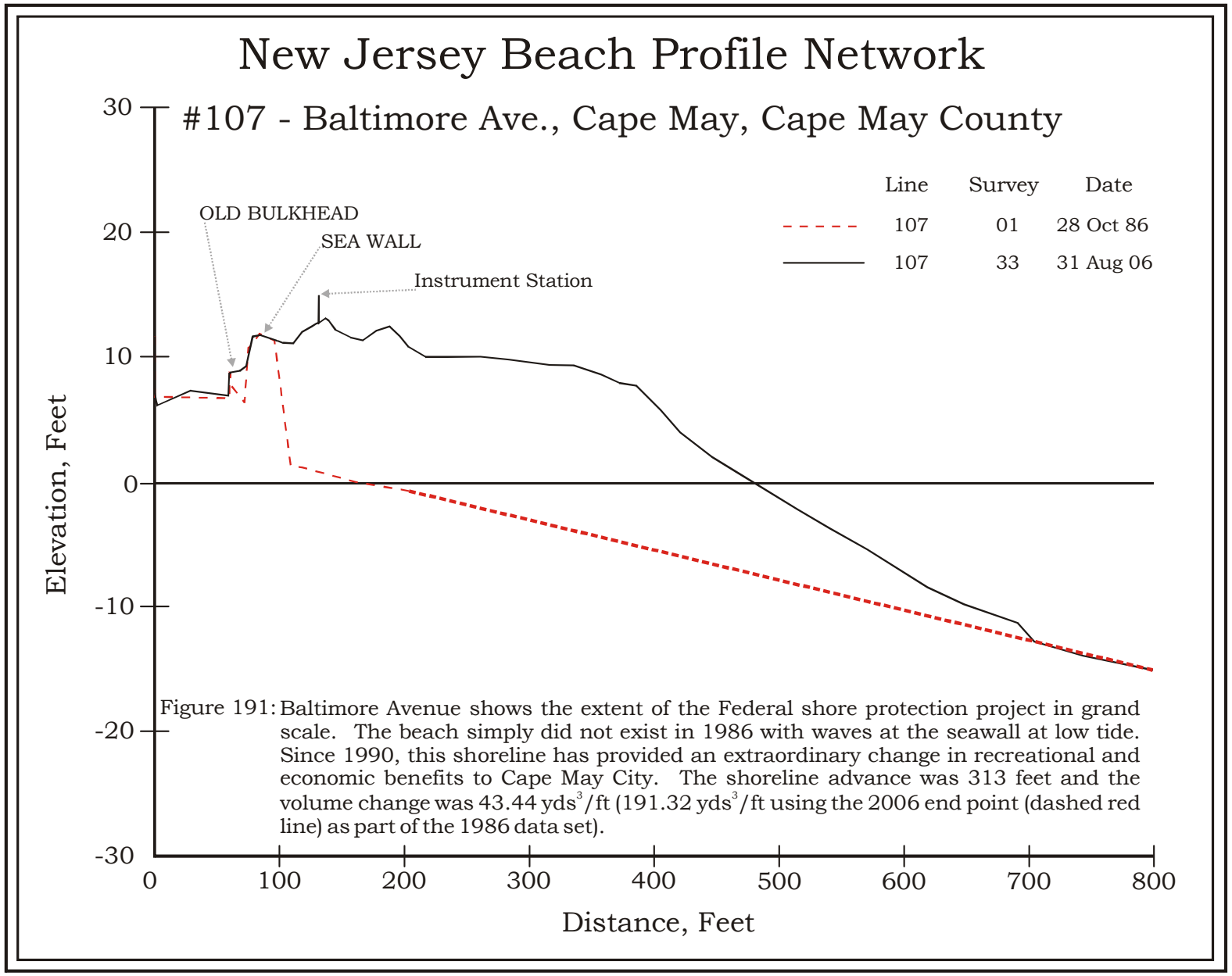


Figure 191: Baltimore Avenue shows the extent of the Federal shore protection project in grand scale. The beach simply did not exist in 1986 with waves at the seawall at low tide. Since 1990, this shoreline has provided an extraordinary change in recreational and economic benefits to Cape May City. The shoreline advance was 313 feet and the volume change was 43.44 yds^3/ft (191.32 yds^3/ft using the 2006 end point (dashed red line) as part of the 1986 data set).

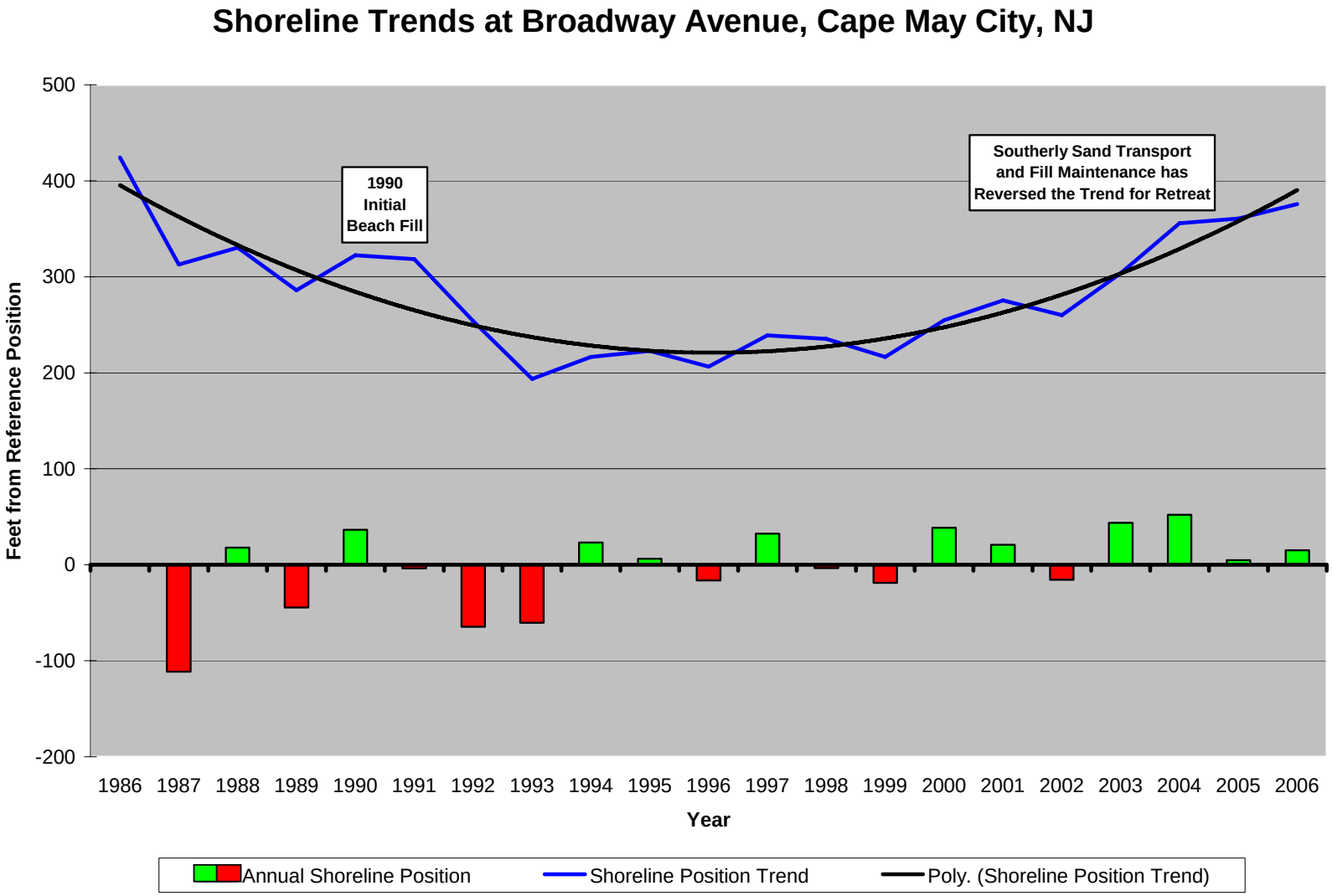


Figure 192. Site 206. Broadway Avenue lies just a short distance from the Cape May City boundary with an undeveloped segment of the shoreline known as Cape May Meadows. A rock groin was put in place to retain sand on the municipal beach years prior to

beach nourishment. The initial sand placement in 1990 advanced the shoreline nearly to the end of this groin. As a result loss rates were high. Sand was added multiple times with a trend developing reversing loss rates as the shoreline south of the groin dramatically advanced to nearly parallel the Cape May City shoreline. The last ten years of sediment accumulation have returned the position of the zero elevation shoreline to within 40 feet of its 1986 location.

A.  **B.** 

20-Year Comparison Photographs – Site 206, Broadway Avenue, Cape May
The southern extent of the Cape May City shoreline retained a beach in 1986 (A), but only because of a terminal groin at the southern edge of town. The promenade was the only "shore protection" afforded to an expensive array of hotel and restaurant development. The Federal project allowed enough space for a reasonable dune development seaward of the promenade as the added sand also widened the beach (B).

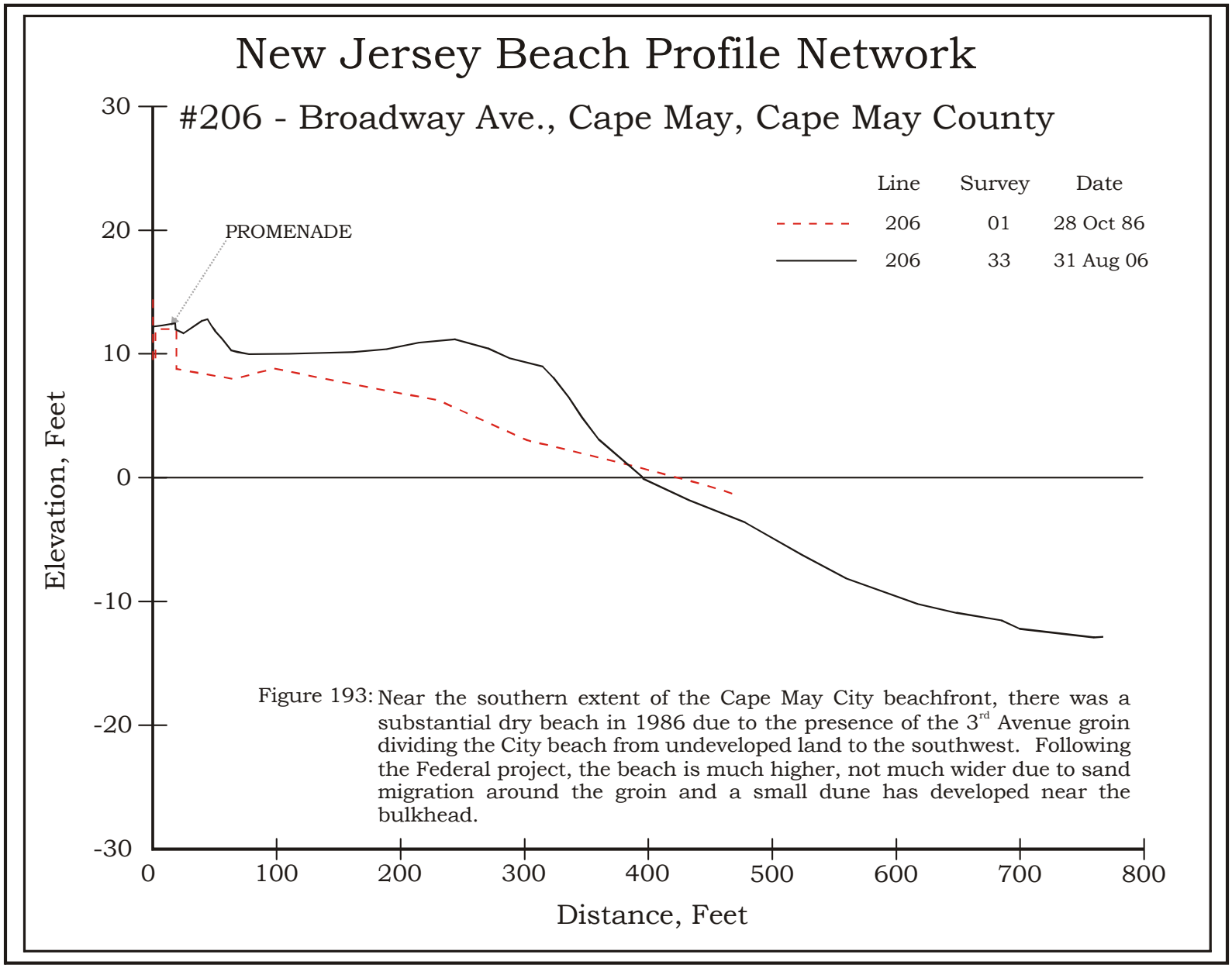


Figure 193: Near the southern extent of the Cape May City beachfront, there was a substantial dry beach in 1986 due to the presence of the 3rd Avenue groin dividing the City beach from undeveloped land to the southwest. Following the Federal project, the beach is much higher, not much wider due to sand migration around the groin and a small dune has developed near the bulkhead.

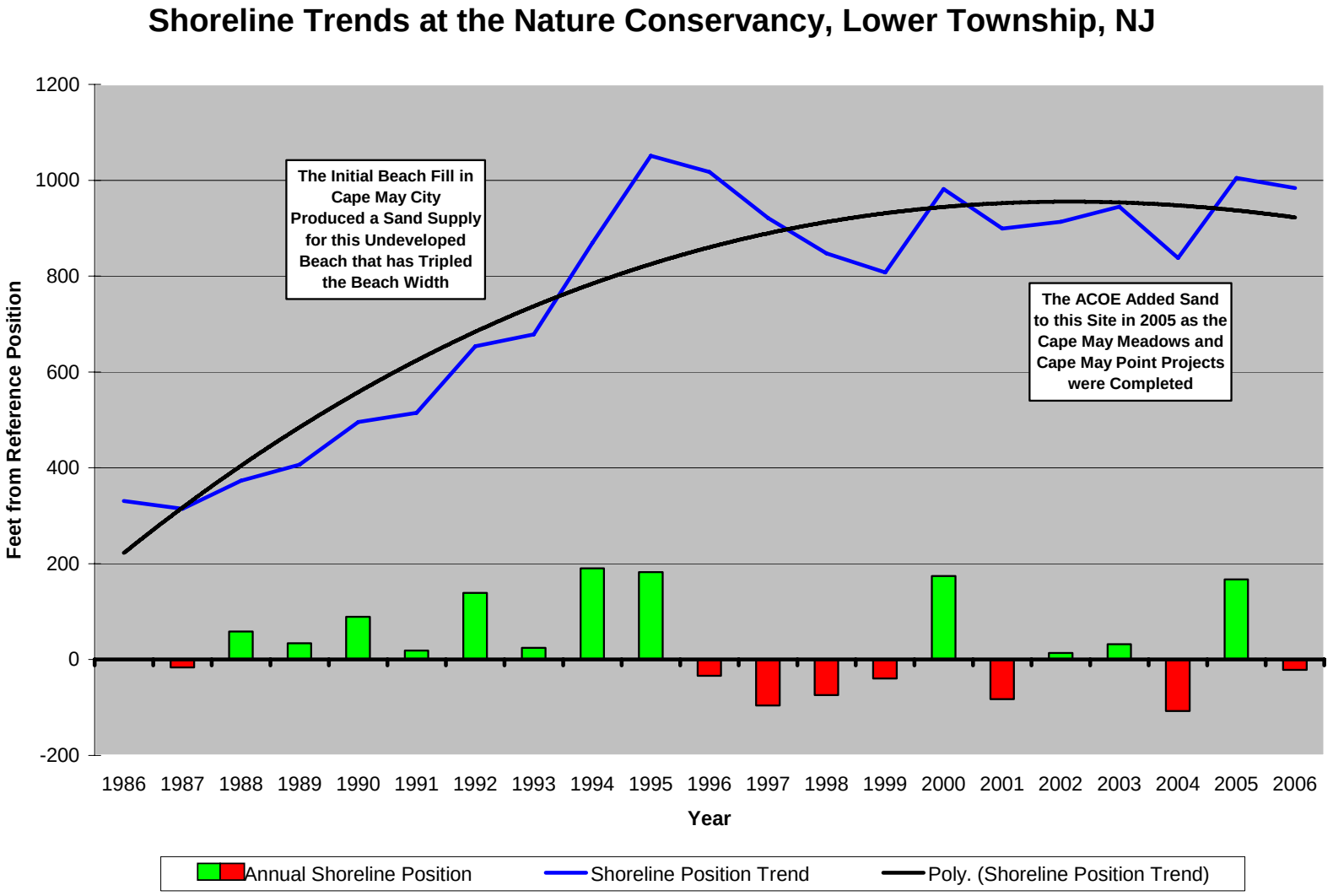


Figure 194. Site 105. Located on the opposite side of the Cape May City groin from the Broadway Avenue site, this location documents the large-scale sediment transport around this groin onto the undeveloped beaches of the Cape May Meadows. The State

had constructed a “dune” in 1986 composed of a gravel, sand and silt mix known as I-5 gravel to serve as a storm barrier to the continued loss of valuable ecological wetlands for migrating birds. The real solution to the erosion problem was the sand lost from the southern Cape May City beaches being deposited south of the final groin on the City beaches. Direct addition of sand was complete in 2004 into 2005 mostly to the south of this site into Cape May Point that shows as the final gain at this site. The shoreline advanced 670 feet since 1986.

A.  **B.** 

20-Year Comparison Photographs – Site 105, Nature Conservancy, Cape May

This site was chosen to portray the natural beach existing south of Cape May City. In 1986 the State of NJ had just completed an I-5 gravel core to the dune to reduce storm flooding of the marshes and other development landward of the marsh along this beach segment. Erosion was cutting into this core as the initial survey was conducted. The Cape May City Federal beach restoration project generated a sand supply escaping the City’s southern terminal groin that tripled the width of this beach. The original dune just shows to the extreme right in the B photograph as a darker green vegetated ridge extending to the distance. All the dunes and sand in the photograph have been built where waves moved ashore in 1986.

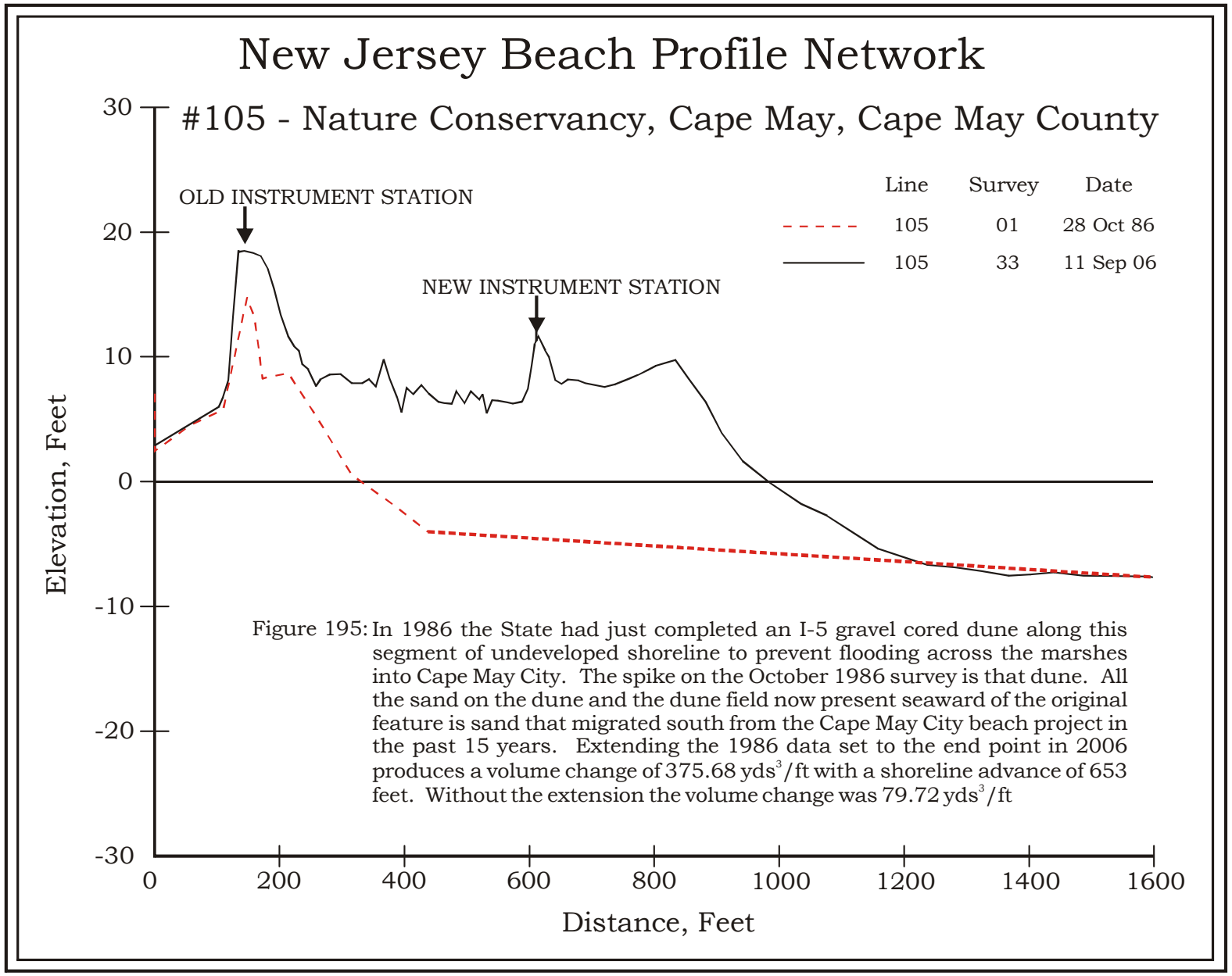


Figure 195: In 1986 the State had just completed an I-5 gravel cored dune along this segment of undeveloped shoreline to prevent flooding across the marshes into Cape May City. The spike on the October 1986 survey is that dune. All the sand on the dune and the dune field now present seaward of the original feature is sand that migrated south from the Cape May City beach project in the past 15 years. Extending the 1986 data set to the end point in 2006 produces a volume change of 375.68 yds^3/ft with a shoreline advance of 653 feet. Without the extension the volume change was 79.72 yds^3/ft

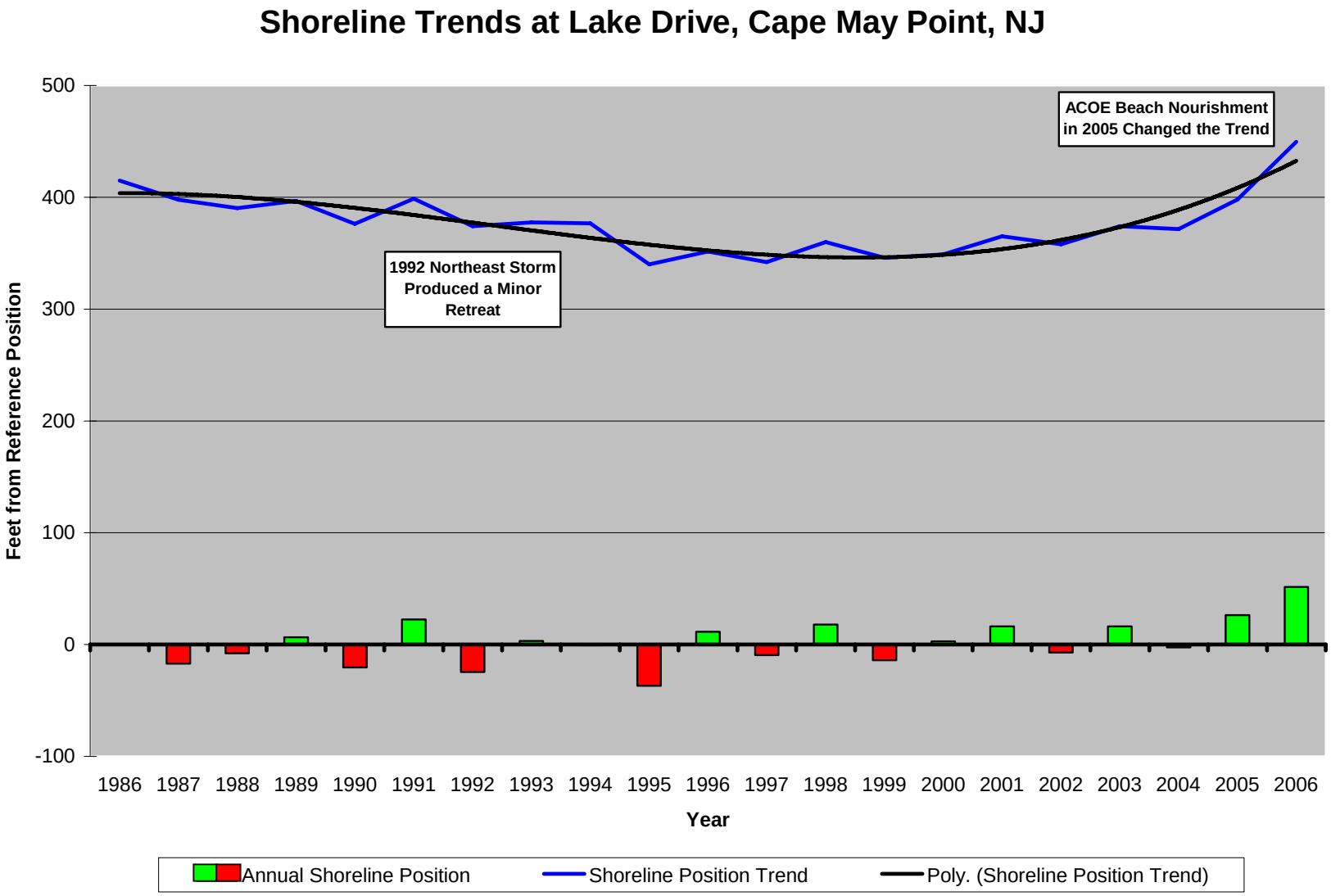


Figure 196. Site 104. Lake Drive in the Borough of Cape May lies at the entrance to Delaware Bay and faces directly south into the bay entrance. The site experiences lower storm wave activity, but enhanced tidal current impacts due to the action of the vast amount

of tidal water entering and leaving the bay produces a different type of shoreline response. The retreat in the shoreline position was slow and steady and independent of storm activity (1992). Sand was added in 2004 by the ACOE with beneficial impacts on the beach.

A. 

B. 

20-Year Comparison Photographs – Site 104, Lake Drive, Cape May Point

Cape May Point has been the site of experiments in beach retention using submerged offshore breakwater units that were placed between groins in 1993, 1995 and by the ACOE in 2002. Four of the eight groin cells contain these structures and in 2004 a Federal beach nourishment project added sand in the first 6 of the 8 cells. The 1991 photo (A) shows the Lake Drive beach prior to any work. No structures were placed in this cell, but sand was added as shown in photo B to the right. The breakwater-protected beach cells appear to be resisting sand loss better than the unprotected shoreline segments.

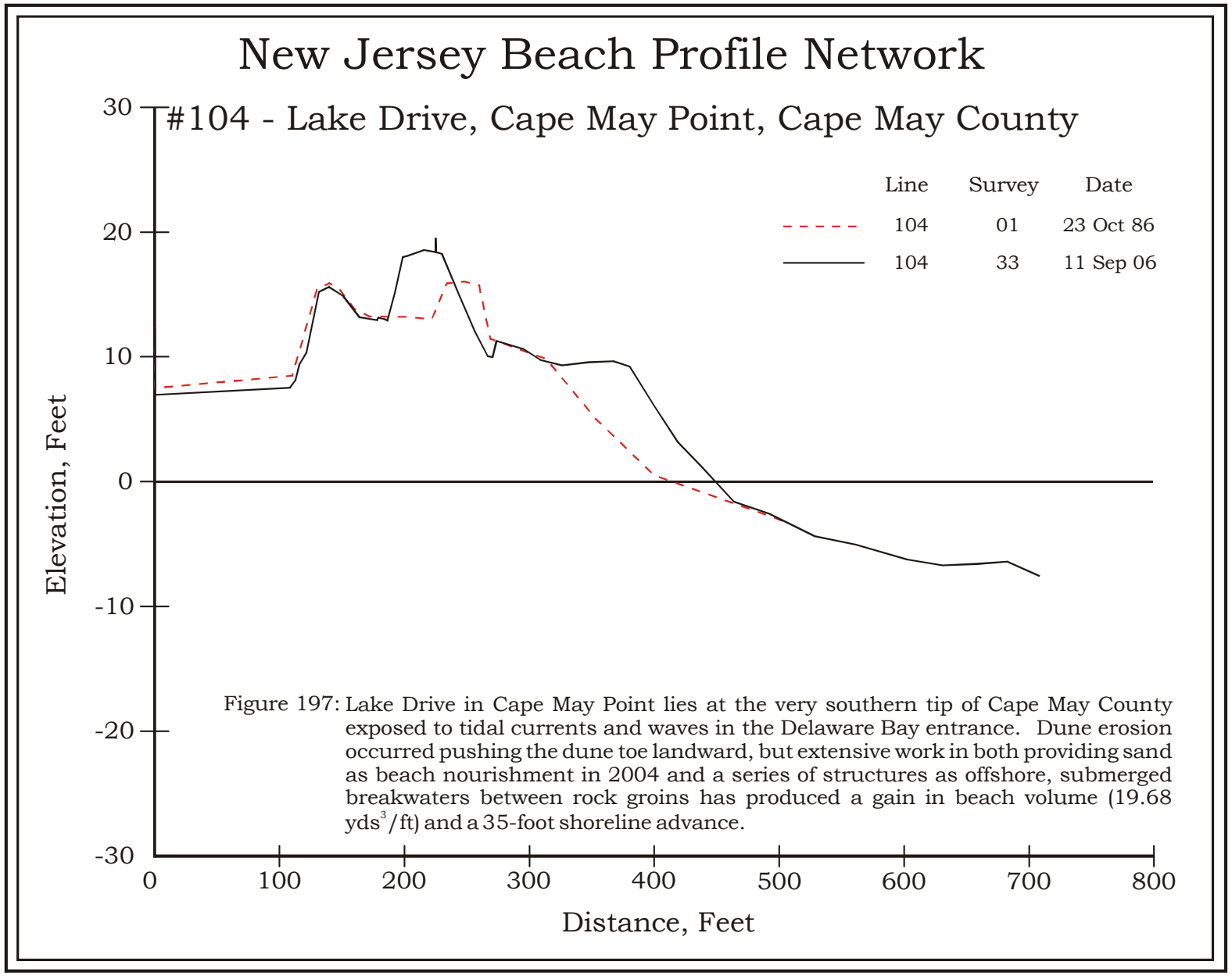


Figure 197: Lake Drive in Cape May Point lies at the very southern tip of Cape May County exposed to tidal currents and waves in the Delaware Bay entrance. Dune erosion occurred pushing the dune toe landward, but extensive work in both providing sand as beach nourishment in 2004 and a series of structures as offshore, submerged breakwaters between rock groins has produced a gain in beach volume (19.68 yds^3/ft) and a 35-foot shoreline advance.

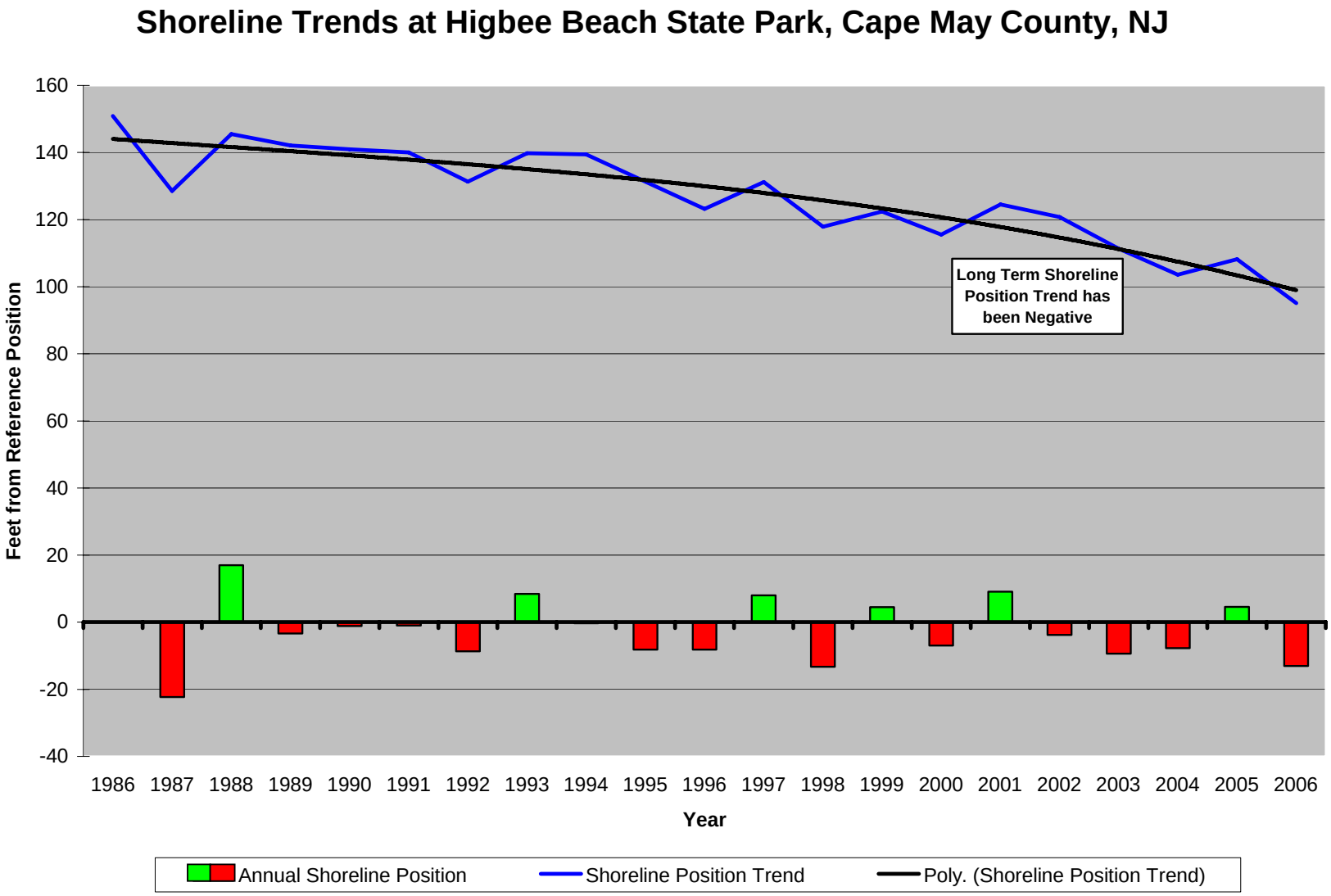


Figure 198. Site 103. The last four sites lie facing into Delaware Bay toward the southwest. The shoreline gradient is a very low slope with shallow water extending hundreds of feet beyond the zero datum elevation. The site at Higbee Beach State Park is a sand

bluff backing up a narrow beach. The bluff retreats during periods of high water levels combined with winds from the northwest that attack the base of the bluff. This has produced a long term retreat in the shoreline position of over 50 feet.

A.  **B.** 

20-Year Comparison Photographs – Site 103, Higbee Beach State Park

The western shoreline of Cape May County is exposed to strong westerly winds across Delaware Bay and a very limited sand supply that bleeds around Cape May Point and the nine groins. The 1990 photograph (A) shows the bluff and the beach curving north toward the Cape May Canal entrance. Slow bluff retreat related to strong winds during elevated water levels has produced about 50 feet of shoreline retreat since 1986 (B). Six of 20 surveys showed minor shoreline advance as sand taken from erosion of the bluff consolidated on the beach.

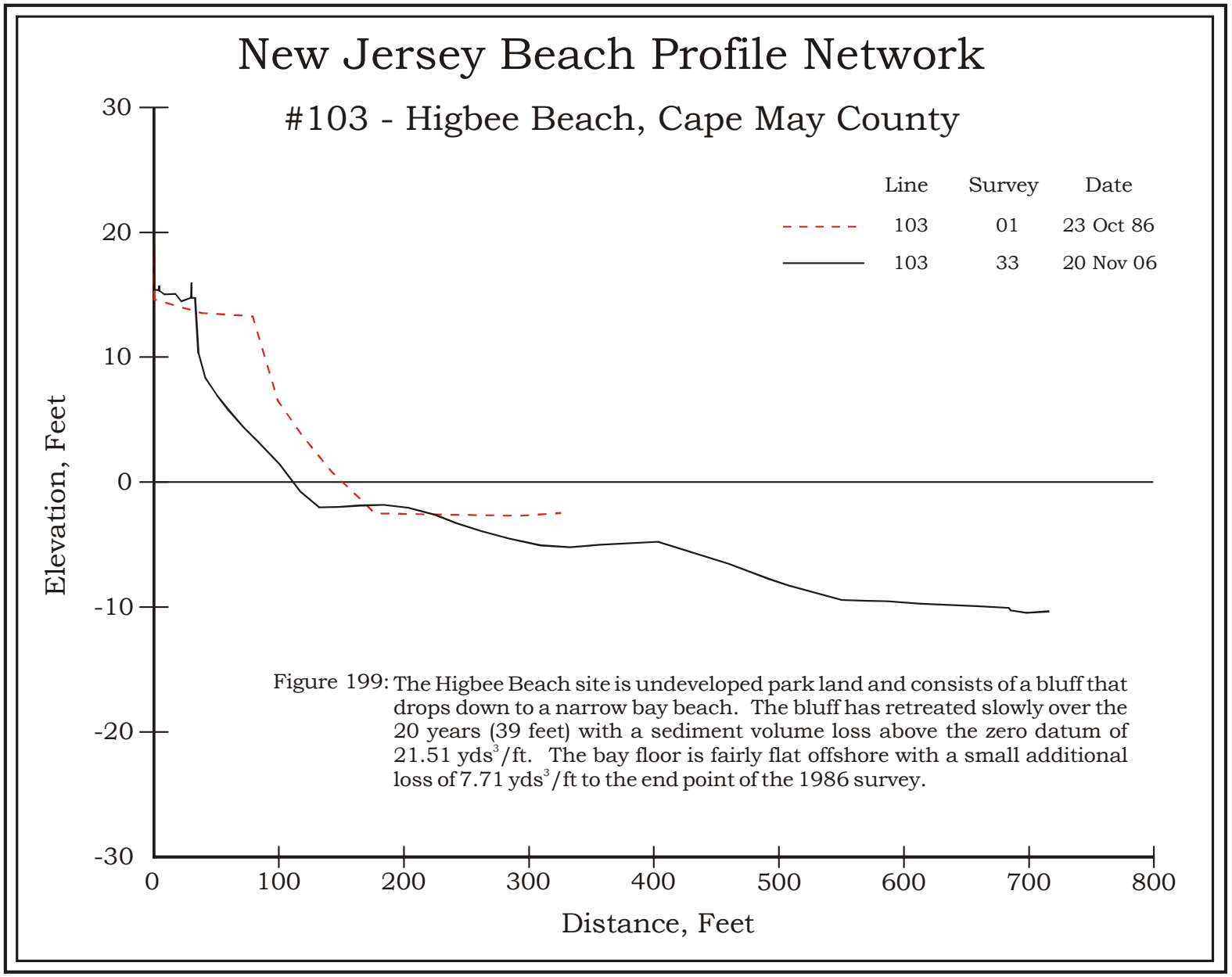


Figure 199: The Higbee Beach site is undeveloped park land and consists of a bluff that drops down to a narrow bay beach. The bluff has retreated slowly over the 20 years (39 feet) with a sediment volume loss above the zero datum of 21.51 yds^3/ft. The bay floor is fairly flat offshore with a small additional loss of 7.71 yds^3/ft to the end point of the 1986 survey.

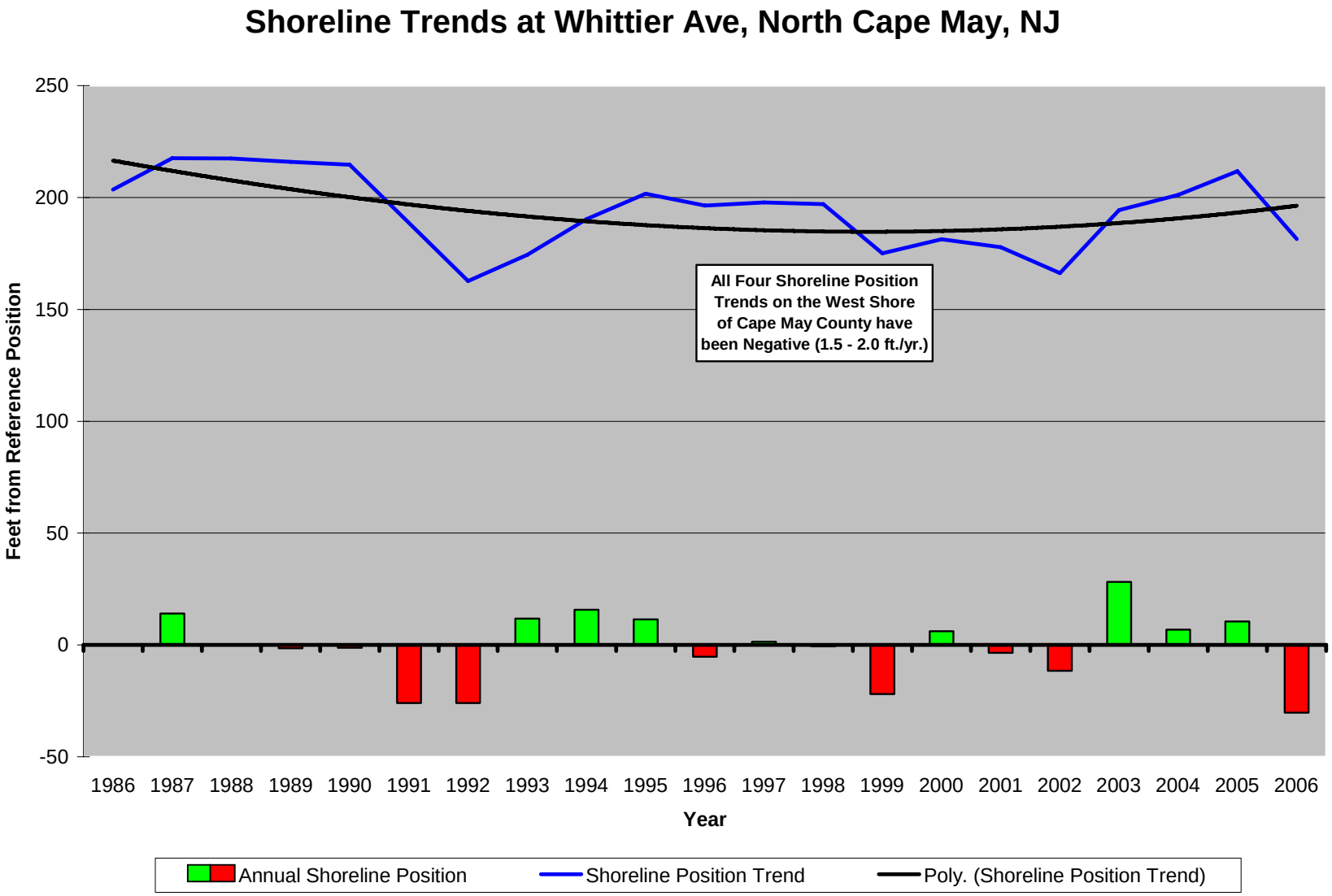


Figure 200. Site 102. The negative shoreline trend was less at Whittier Avenue in North Cape May, but still in the range of 1.5 to 2.0 feet per year. This corresponds to rates determined earlier when the NJDEP historical shoreline mapping program was completed

(Farrell and Leatherman, 1989). Larger ranges of shoreline position occur due to the very low offshore slope of up to 150:1. Tiny shifts in bar position close to the beachface produce large shifts in the zero elevation intercept with the NAVD 1988 datum.

A. 

B. 

20-Year Comparison Photographs – Site 102, Whittier Avenue, North Cape May

The beach further north into Delaware Bay was slightly more stable probably due to the presence of a wide tidal shelf that restricts wave approach at all by high tide. In 1991 the beach supported a dune with a narrow strip of sand between in and the low tide terrace offshore (A). This feature shows the best on the cross section below. The dune grew higher (B) as sand moved into the feature and the terrace supports low amplitude sand bars that migrate around as the wave pattern changes.

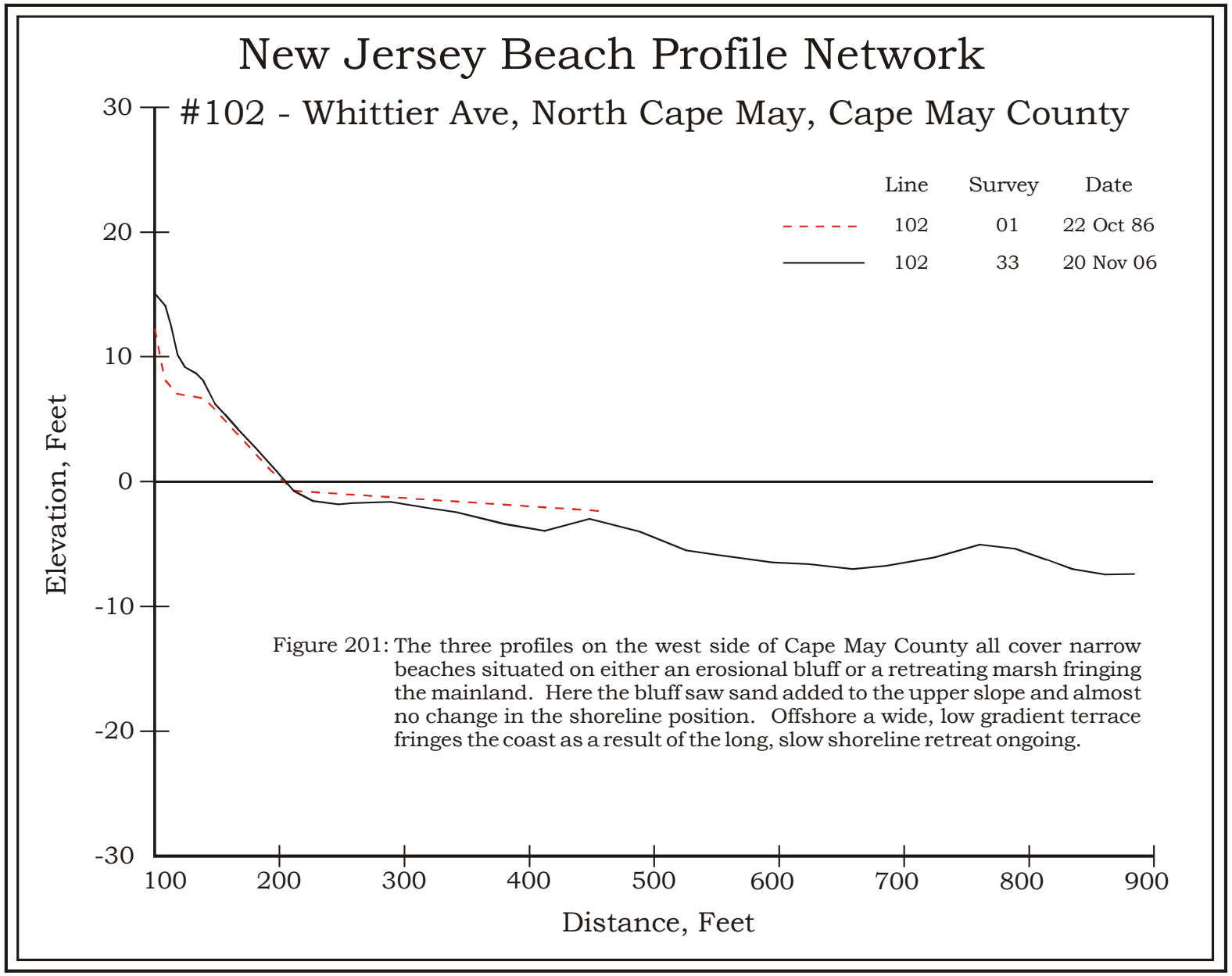


Figure 201: The three profiles on the west side of Cape May County all cover narrow beaches situated on either an erosional bluff or a retreating marsh fringing the mainland. Here the bluff saw sand added to the upper slope and almost no change in the shoreline position. Offshore a wide, low gradient terrace fringes the coast as a result of the long, slow shoreline retreat ongoing.

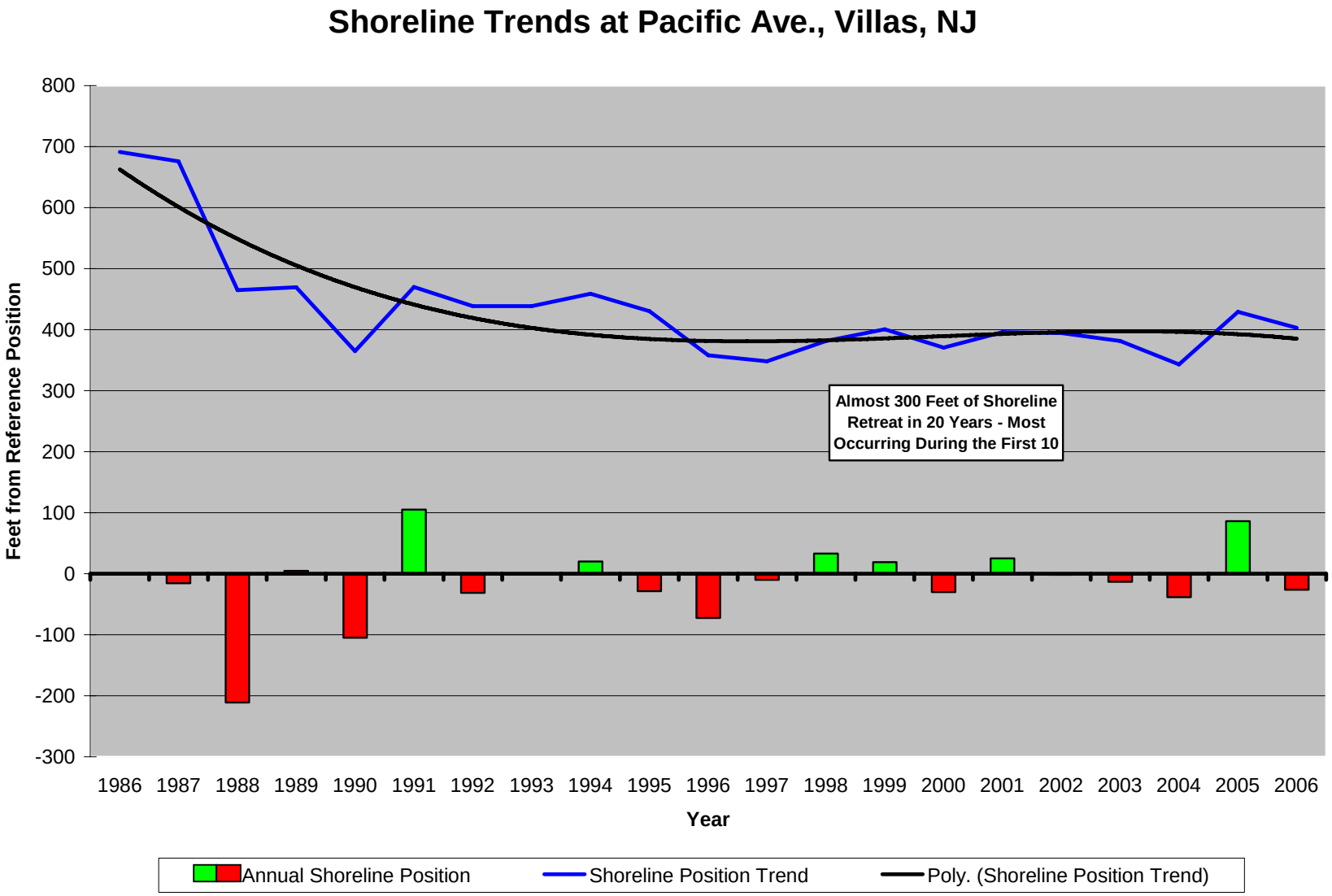


Figure 202. Site 101. Large shoreline changes occurred prior to 1996 with only one year with an advance (1991). The post 1996 performance was nearly level with little change noted. The net change was nearly 300 feet over 20 years.

A. 

B. 

20-Year Comparison Photographs – Site 101, Pacific Avenue, Villas
The exposed terrace shows in the 1991 photograph (A) along with piles of dead vegetation on the upper beach. This material decays but also captures sand to allow plant growth in some locations where waves don't come in a carry it away before it is established. The right photograph (B) shows the same dune and beach. Little erosion took place since the 2006 dune slope is seaward of that present in 1986.

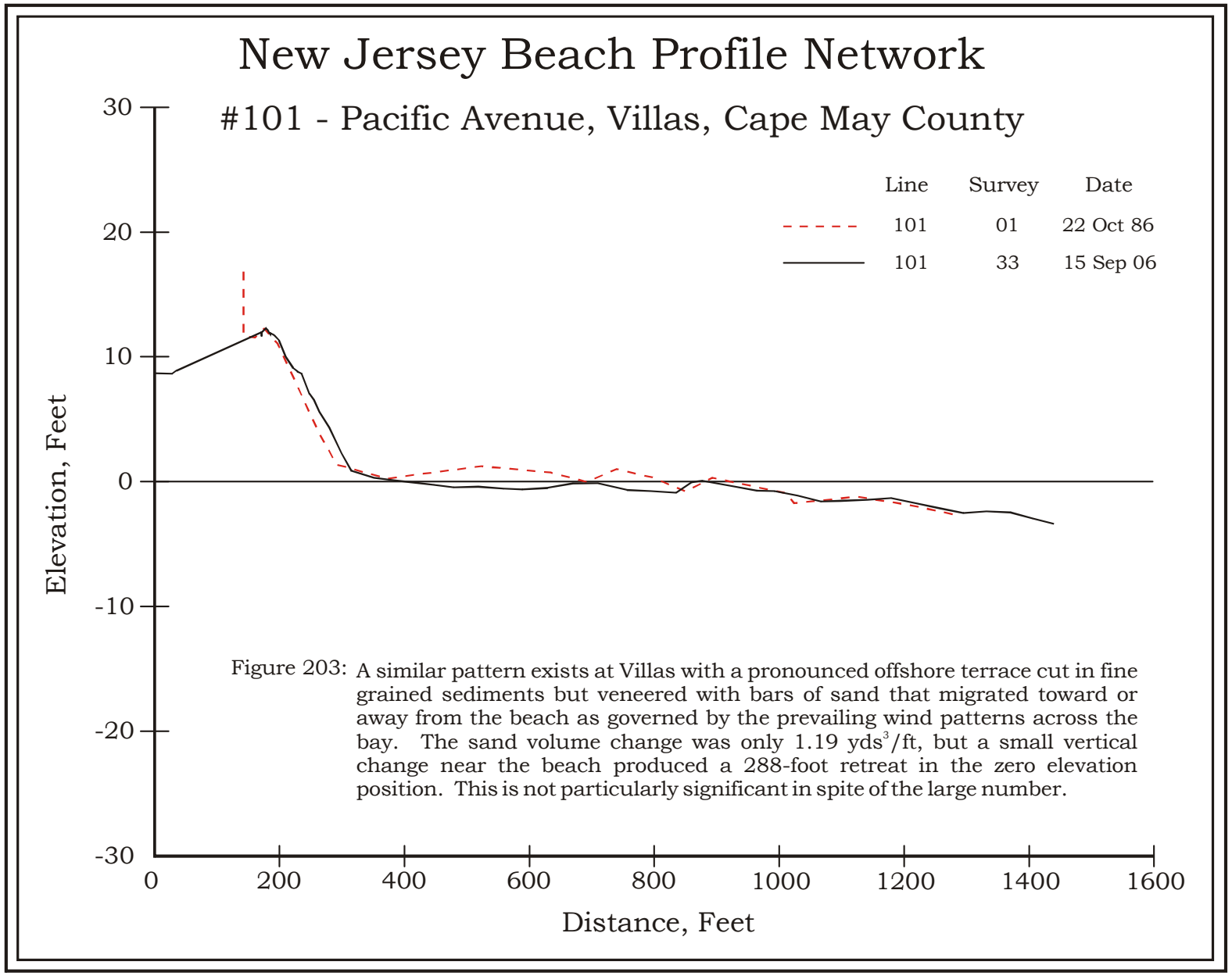


Figure 203: A similar pattern exists at Villas with a pronounced offshore terrace cut in fine grained sediments but veneered with bars of sand that migrated toward or away from the beach as governed by the prevailing wind patterns across the bay. The sand volume change was only 1.19 yds^3/ft, but a small vertical change near the beach produced a 288-foot retreat in the zero elevation position. This is not particularly significant in spite of the large number.

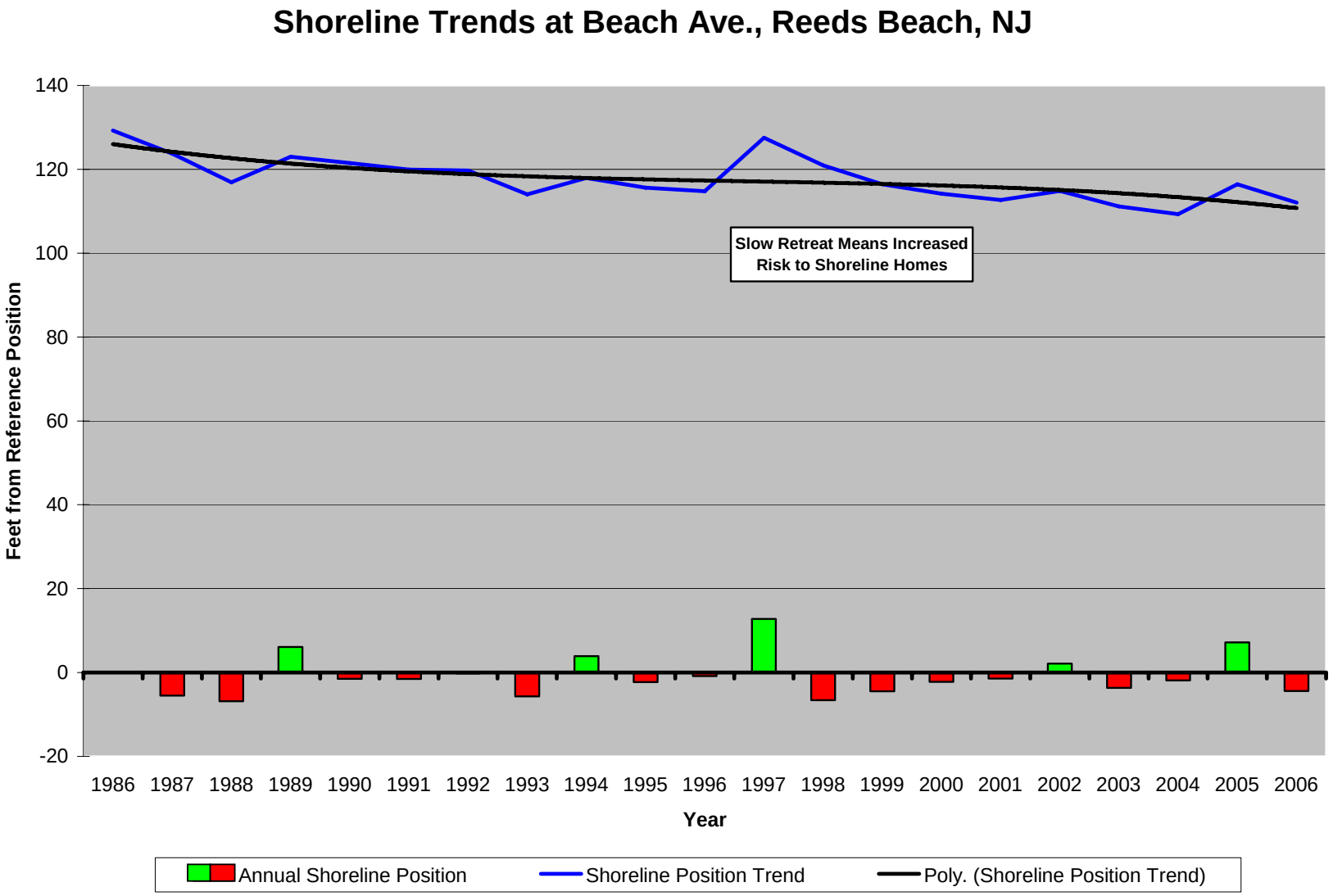


Figure 204. Site 100. The northern most NJBPN site in Delaware Bay lies just south of Bidwell Creek at the terminus of continuous sandy beach shorelines in the Bay. Slow, steady shoreline retreat has produced enough retreat to endanger homes built on the

bayshore. This site retreated 15 feet, which sound small, but given the proximity of structures to the beach, it has produced serous problems with the stability of the homes and the functioning of the septic systems for each home.

A. 

B. 

20-Year Comparison Photographs – Site 100, Beach Avenue, Reeds Beach

Reeds Beach is at the northern terminus for sand transport along the western Cape May County shoreline. The Bidwell Creek Inlet traps the sand so that all the remaining shoreline is eroding salt marsh exposed at the water's edge. In 1991 the beach was on the road and into the marsh east of the road (A). In 2006 this process had continued to the point where the road gets buried in sand at spring high tides. Efforts are underway to remedy the sand-starved situation.

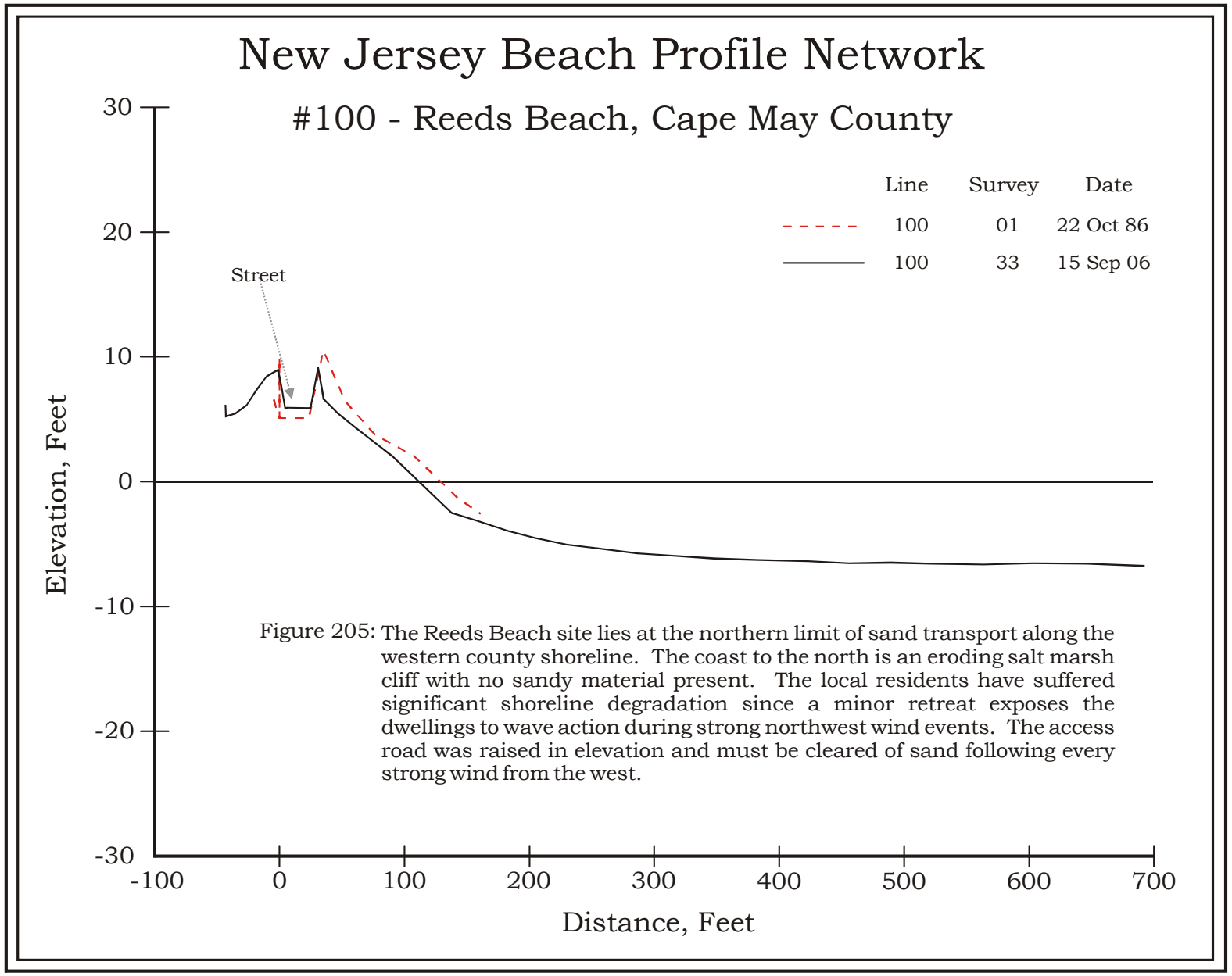


Figure 205: The Reeds Beach site lies at the northern limit of sand transport along the western county shoreline. The coast to the north is an eroding salt marsh cliff with no sandy material present. The local residents have suffered significant shoreline degradation since a minor retreat exposes the dwellings to wave action during strong northwest wind events. The access road was raised in elevation and must be cleared of sand following every strong wind from the west.

SUMMARY OF CAPE MAY COUNTY

The Cape May County oceanfront consists of a series of four barrier islands, north to south Ocean City (Peck's Beach), Strathmere and Sea Isle City (Ludlam Island), Avalon and Stone Harbor (Seven Mile Island) and the Wildwoods and Lower Township (Five Mile Island). Northeast storms have had the dominant impact on the Cape May County beaches because even as hurricanes slammed into Florida and the New Orleans in 2005, they left the Mid-Atlantic States unscathed. The worst events during the past 20 years were a pair of northeasters that occurred in October 1991 and December 1992. The fear was real that NJ was about to feel the wrath of a truly stormy winter. However, this has yet to transpire.

Recent local projects were concluded in February 2001 in the Borough of Avalon, (306,000 cubic yards) and Upper Township with assistance from the State of New Jersey (461,000 cubic yard restoration of the northern Strathmere beach on Ludlam Island in late 2001). The Borough of Cape May Point is part of the Lower Cape May Meadows to Cape May Point Ecosystem Restoration and Shore Protection Project. Cape May Point had two beach cells augmented with submerged breakwater sills installed between the outer tips of the adjacent groins with sand supplied to the cells using trucked-in material. The Cape May Meadows portion of this project was completed in early 2005 with 800,673 cubic yards of fill placed between the WWII bunker, the State Park and around the point to Cell #6 in Cape May Point.

Beach nourishment activity continued as both major ACOE projects completed maintenance at Ocean City (third cycle in 2000 with 1.35 million cubic yards placed) and the fourth periodic maintenance completed January 2004 (1.40 million cy). At Cape May City the fourth cycle in 1999 placed 400,000 cubic yards of sand, 267,000 cubic yards were added in March 2003, 283,000 cubic yards added in November 2004 with the 7th scheduled maintenance for the fall 2006.

Maintenance Contracts Completed in Ocean City:
Initial Construction Sand Volume = 5,741,000 Cu. Yds.

December 1994	606,000 cubic yards
August 1995	1,400,000 cubic yards
August 1995	360,000 cubic yards (south end) non-Federal effort
October 1997	800,000 cubic yards
December 2000	1,351,000 cubic yards (north end)
November 2000	303,000 cubic yards (south end) non-Federal effort
January 2004	1,400,000 cubic yards

The Philadelphia District is in the Planning and Engineering Design (PED) phase of project development for Great Egg Harbor Inlet to Townsend's Inlet. The reconnaissance report was completed in April 1996. The Final Feasibility Report was complete in September 2001. The PED work is scheduled to be complete by 2005, with Congressional authorization required to proceed to construction (Philadelphia District web page http://www.nap.usace.army.mil/cenap-dp/projects/projects.htm).

The Great Egg Harbor to Townsends Inlet project is in the same situation, needing Congressional authorization to begin construction.

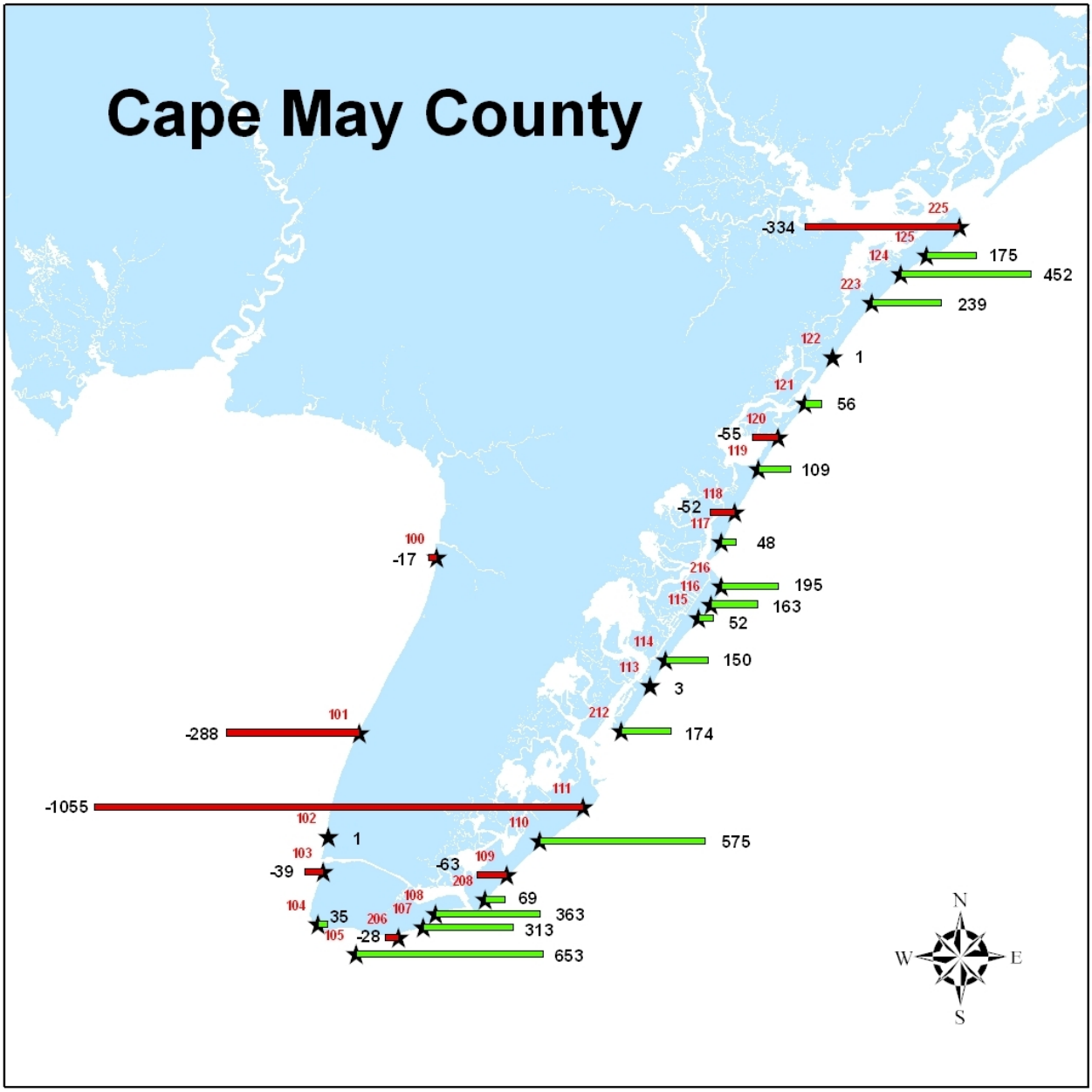
The Townsend's Inlet to Cape May Inlet shore protection project: The initial Beachfill construction within Avalon and Stone Harbor was completed in FY03. Initial construction contracts were awarded for both the Avalon and North Wildwood seawalls in FY04. Construction on the two seawalls is complete in North Wildwood and nearly complete in Avalon. Beach nourishment on the North Wildwood oceanfront beach is being considered as a joint effort between the City and the State of NJ. Studies at 15th Street in North Wildwood have documented a rapid shoreline retreat as sand has moved north into and along the inlet shoreline since December 1999.

There is an ecosystem restoration of 116 acres planned for Stone Harbor Point. The State of New Jersey and the Borough of Avalon completed a 400-foot extension of the 8th Street inlet jetty at Townsend's Inlet in 2002.

The shoreline along western Cape May County has seen shoreline retreat following episodes of strong northwest winds. There are only modest sand volume shifts, but the shoreline exists at a smaller scale so that even ten cubic-yard-per-foot changes have considerable impact. The Philadelphia District ACOE is moving toward an Ecosystem Restoration and Protection project for Reeds Beach to Pierces Point along the Delaware Bay shoreline of Cape May County. The project covers 6,800 feet of shoreline and entails a one-time placement of sand for horseshoe crab and shorebird habitat. FY 01 funds of $135,000 were added and were used to complete the PED. FY03/04/05 funds were appropriated for construction. A Limited Reevaluation Report (LRR), which updates costs and shows continued project viability, is being prepared for submittal to HQ for approval. On 17 Aug 04, NJDEP LURP issued a favorable Federal consistency determination for the construction of this project.

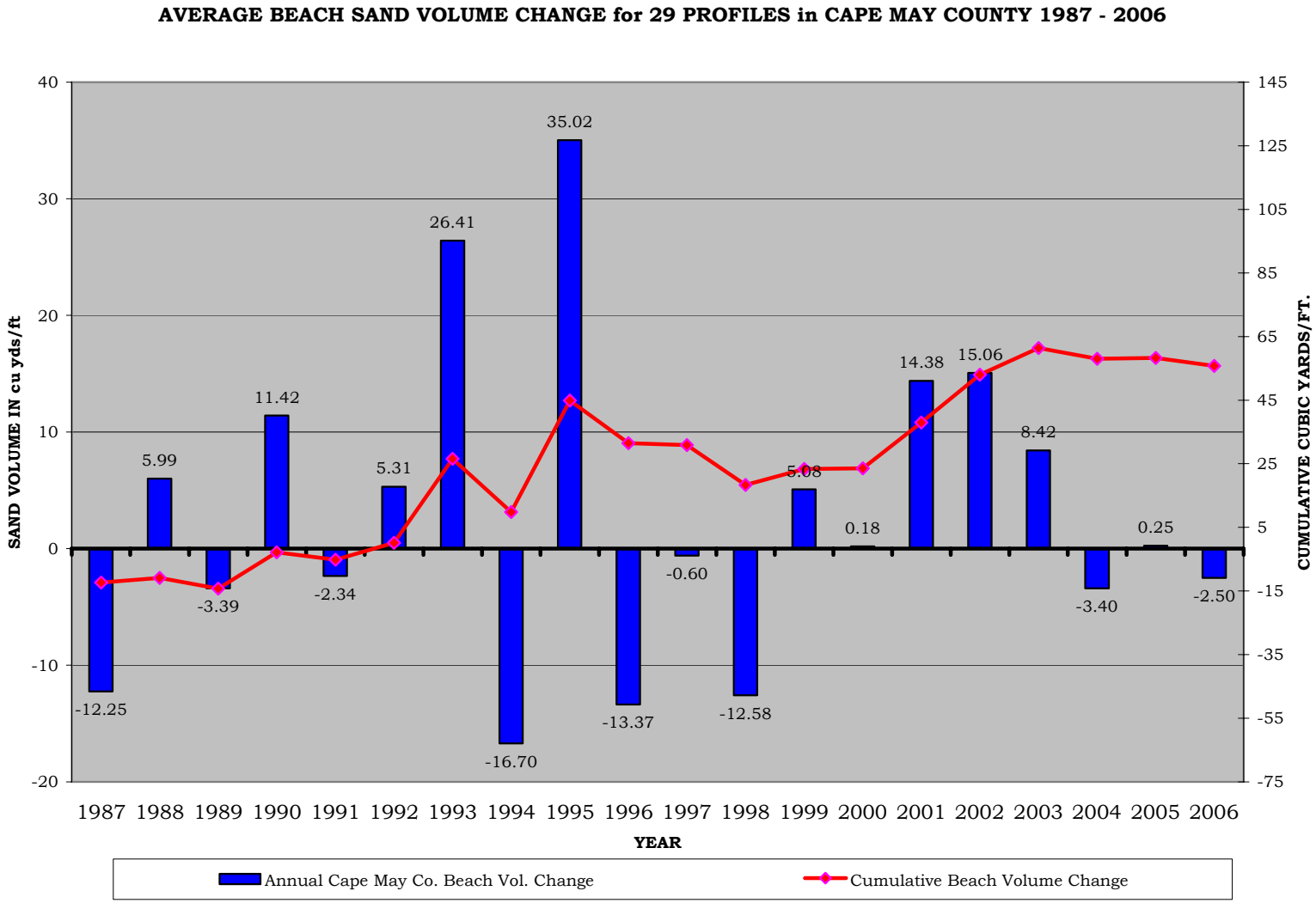
The Villas and Vicinity Ecosystem Restoration and Protection project continued with PED funding from FY 02. This is also a one-time sand nourishment of 29,000 feet of shoreline within Middle and Lower Townships, Cape May County. FY 01 funds of $155,000 were added and used to complete PED. FY 04 funds were added to initiate construction. Before actual construction can begin a Project Cooperation Agreement (PCA) must be signed and real estate acquired. At present there is no Congressional funding for any of these proposed projects primarily due to the Water Resources Development Act (WRDA) being stalled in the 107th Congress in spite of being passed by both houses. As of publication of this report the WRDA bill died with the 107th Congress and it will be up to interested stakeholders to revive the Water Resources Development Act in the 108th Congress as a new piece of financial legislation.

The summary illustrations below show the trends in shoreline position (illustration 7) where the impact of both State – local and Federal projects is evident. The average sand volume present on the 29 Cape May County sites also demonstrates the impact of beach nourishment. The county beach sand volume increased by 55.77 yds^3/ft. over the 20-years due to multiple efforts along the county oceanfront shoreline.



Summary Illustration 7. Map showing the 29 site locations in Cape May County with the 20-year shoreline change showing at each site. The green bars are proportionally scaled to show the number of feet of shoreline advance and the red bars show the scaled amount of shoreline retreat relative to the site's reference position. Profile site location numbers are shown in red and the shoreline change is shown in black.

1. Ocean City, Avalon/Stone Harbor, Cape May City and Cape May Point received Federal shore protection projects since 1989-90.
2. The huge loss and gain at the two northern profiles in Wildwood are due to dramatic changes in the tidal channel of Hereford Inlet since 1998 where over 1,000 feet of North Wildwood beach sand moved into the inlet and south into the City of Wildwood.
3. Site 225 at Great Egg Inlet advances immediately following each beach nourishment on the oceanfront, but retreats as the sand supply derived from the fill declines at the site.



Summary Illustration 8: Beach nourishment was very active in Cape May County with most communities sponsoring State – local projects and four Federal projects undertaken, starting in 1990. The cumulative effort was an impressive increase in average site sand volume by 2006 (55.77 yds^3/ft.). Big spikes in 1993 and 1995 were due to multiple community responses to severe northeasters in 1991 and 1992.

Cape May County New Jersey Beach Volume Changes
Fall 1986 to Fall 2006 for 30 Sites – Taken From NJBPN Reports

Site Number	Fall Beach Sand Volume Change Each Year																				86-06 AVERAGE	Beach Only (cu feet)/ft
PROFILE	F 1987	F 1988	F 1989	F 1990	F 1991	F 1992	F 1993	F 1994	F 1995	F 1996	F 1997	F 1998	F 1999	F 2000	F 2001	F 2002	F 2003	F 2004	F 2005	F 2006		
225									118.56	-114.31	-78.62	-85.81	-41.83	55.06	-48.02	-44.21	-18.84	13.62	-23.20	-31.38	-24.92	-68.24
125	-3.48	-1.97	-12.58	5.05	11.47	113.71	-36.28	-137.27	39.96	-38.29	-0.25	22.68	-41.61	-14.64	101.25	-55.54	-11.37	92.84	-45.28	-49.43	-3.05	41.37
124	-15.24	5.74	-5.67	5.45	-8.90	-44.65	301.64	-3.12	109.41	1.81	-5.23	-33.25	37.87	-23.58	-5.82	-6.37	25.96	19.80	-1.01	-26.97	16.39	158.80
123	-28.81	4.95	3.20	4.67	1.48	-15.06	132.55	-18.21	50.66	8.31	1.27	8.27	-4.19	7.14	16.23	25.93	-32.14	5.54	14.63	-0.41	9.30	121.69
122	-7.56	4.66	-21.55	12.69	-9.01	-5.88	-6.41	-0.96	56.38	-21.55	-31.68	7.25	-6.53	5.63	48.39	-14.89	43.57	-9.97	-14.35	-16.58	0.58	24.06
121	-14.03	18.53	-47.91	60.90	-29.32	-78.91	-4.27	22.71	-16.83	-53.34	11.50	104.87	-1.40	2.01	122.38	-15.95	43.82	-132.01	-31.91	122.48	4.17	3.34
120	-2.22	9.22	-17.28	19.20	0.40	-49.24	11.32	-8.74	7.64	-9.86	-22.65	8.53	-9.05	-16.49	11.07	24.23	-41.84	2.83	16.34	1.38	-3.26	-22.45
119	14.15	1.44	2.15	16.55	-3.34	-3.63	-18.48	-19.43	45.09	-27.27	16.99	-7.12	14.43	15.85	-1.38	9.84	-1.30	10.12	22.11	-15.74	3.55	48.00
118	0.59	-12.07	-12.75	17.85	7.87	-16.55	-6.87	-15.40	4.94	-1.86	13.36	-27.60	13.81	-7.92	5.63	-27.39	15.63	4.10	-14.71	15.83	-2.18	-4.21
117	16.49	-22.08	0.29	-12.96	-2.29	91.00	-34.88	-23.58	3.79	-8.55	-6.21	-14.50	-4.25	8.98	4.48	-1.50	11.76	-14.48	4.36	2.05	-0.10	20.66
216									126.51	-28.59	33.16	36.28	-46.80	-53.08	34.18	272.49	-82.57	-15.76	-91.70	52.74	19.74	110.94
116	27.49	-34.01	-6.44	30.48	-31.45	75.03	30.96	-70.06	49.04	-60.56	-13.34	-8.60	15.61	-40.88	13.43	181.17	-62.92	-19.23	-54.90	16.91	1.89	65.74
115	-31.05	-0.53	8.12	0.14	-48.82	-12.69	-16.56	8.33	56.47	38.15	-8.32	-11.21	22.85	-18.45	4.51	32.11	43.60	-5.20	4.17	-20.71	2.25	29.70
114	-20.88	14.75	10.16	9.94	-2.41	-43.05	27.43	-3.40	37.51	4.47	-20.22	-14.94	34.87	11.32	9.80	6.94	14.89	15.29	17.49	-6.87	5.15	69.10
113	-38.11	8.36	-12.13	0.80	-6.44	4.63	-2.46	-2.96	-2.85	-3.19	9.88	-20.66	46.89	11.02	-0.07	-6.77	123.69	-21.53	10.07	-14.36	4.19	69.97
212									51.01	44.54	-16.98	-74.30	-1.18	-7.31	19.97	82.26	185.45	-49.98	-10.36	-75.98	12.26	81.68
112	-31.25	-93.67											** NO LONGER ACTIVE **								-124.92	
111	-62.00	34.06	1.55	-32.59	52.28	-15.44	21.31	-76.41	-40.43	-15.33	-21.70	-94.25	-32.13	-50.08	-21.36	-62.47	-79.53	-85.43	3.69	6.66	-28.48	-297.93
110	-2.89	46.24	6.60	15.10	-108.13	110.32	1.59	10.18	42.35	-6.70	51.04	-34.12	56.92	36.40	5.68	18.24	-13.47	23.82	10.77	-0.61	13.47	124.61
109	-21.28	15.20	-9.12	25.61	-1.12	-15.37	-35.32	-5.60	61.63	-4.97	26.04	-72.79	36.56	28.38	8.28	29.95	-30.30	28.61	27.49	10.37	5.11	51.44
208									22.01	-6.90	15.55	-21.52	14.08	14.66	-0.42	0.58	13.04	26.32	28.75	-3.86	8.52	41.51
108	2.03	5.22	41.57	10.91	69.49	-1.69	76.66	-19.58	35.64	-18.81	33.95	-17.79	-5.59	15.25	-1.28	-24.37	28.31	12.38	-14.87	-3.69	11.19	146.83
107	-1.13	-0.02	-1.07	10.91	82.70	-4.92	43.40	-7.84	26.45	-4.55	30.97	4.80	-4.78	13.25	14.99	-15.22	-1.47	2.07	15.90	-11.30	9.66	100.94
106	-34.67	5.55	-17.62	14.13	-8.21	-30.46	-32.68	17.11	5.20	-6.10	18.59	-7.62	7.85	13.67	32.91	-5.86	14.80	46.57	2.27	-34.67	0.04	47.30
105	-4.89	27.27	19.23	32.74	-26.25	66.76	110.51	-5.93	5.76	-2.58	-43.15	32.25	31.88	-7.16	-31.12	-13.90	15.23	-37.86	84.68	-9.28	12.21	144.93
104	-12.24	-4.67	-0.01	-7.84	10.81	-12.49	-8.48	9.53	-20.36	1.75	-8.84	6.64	-7.40	5.39	15.69	-12.91	6.45	2.60	45.75	30.90	2.01	18.04
103	-14.71	7.33	-2.86	-4.11	-1.63	-3.18	3.86	0.38	-6.33	6.98	4.31	-5.84	-1.99	-3.32	1.15	-0.05	-7.41	1.22	-5.27	-1.29	-1.64	-21.51
102	-3.82	-2.84	0.06	12.31	-3.88	0.84	-7.53	1.34	14.22	3.36	5.57	-3.78	2.22	1.93	-8.44	0.99	0.49	2.91	12.21	-13.41	0.74	11.17
101	-11.82	-0.03	0.80	-20.42	23.41	-7.63	4.37	0.84	0.70	-4.70	3.77	1.85	5.42	1.66	-1.92	1.41	-2.99	-4.17	4.20	-0.44	-0.28	-3.88
100	-1.76	-2.04	-0.51	-9.37	0.47	0.96	-0.71	1.91	-0.50	1.10	0.59	1.08	0.71	-1.07	5.23	-1.05	-2.18	-1.03	-0.93	-0.79	-0.49	-3.40

	F 1987	F 1988	F 1989	F 1990	F 1991	F 1992	F 1993	F 1994	F 1995	F 1996	F 1997	F 1998	F 1999	F 2000	F 2001	F 2002	F 2003	F 2004	F 2005	F 2006	86-06 AVERAGE	86-06 BEACH VOLUME TO THE ZERO ELEVATION
CAPE MAY AVERAGE	-12.32	1.46	-3.39	11.42	-2.34	5.31	26.41	-16.70	35.02	-13.37	-0.60	-12.58	5.08	0.18	14.38	15.06	8.42	-3.40	0.25	-2.50	2.79	
CUMULATIVE VOLUME	-12.32	-10.86	-14.25	-2.83	-5.18	0.13	26.54	9.85	44.87	31.50	30.90	18.32	23.40	23.57	37.95	53.01	61.42	58.03	58.27	55.77	58.56	38.28

Table 7- Each of these tables is designed to provide the reader/viewer with all the information distilled from 20 years of beach surveys at the 100 NJBPN sites along the coast of New Jersey. The red columns represent the site locations, which are presented in the County Site Map (figure 73). The data are the calculated dune, beach and offshore sand volume changes for each site for each year. These data are averaged across time at the right-hand, black-typeface column (labeled "86-06 AVERAGE") to give the average sand volume for each site over 20 years time. The blue column is the sand volume change for just the beach to the zero elevation datum (NGVD29). A set of new sites was added in 1995 to fill gaps in coverage or cover beaches close to each NJ inlet.

The two bottom rows of numbers represent:

a) The average annual Monmouth County sand volume change.
b) The cumulative sum of these averaged changes.

Cape May County New Jersey Shoreline Changes
Fall 1986 to Fall 2006 for 30 Sites – Taken From NJBPN Reports

Site Number	Fall Shoreline Position Change Each Year																				86-06 Shoreline Change
PROFILE	F 1987	F 1988	F 1989	F 1990	F 1991	F 1992	F 1993	F 1994	F 1995	F 1996	F 1997	F 1998	F 1999	F 2000	F 2001	F 2002	F 2003	F 2004	F 2005	F 2006	AVERAGE	(feet)
225									303.82	-264.50	-90.17	-91.77	-93.79	146.07	-130.53	-58.34	-20.44	0.43	39.48	-24.10	-23.65	-333.83
125	-0.01	0.00	-98.46	34.87	61.70	467.70	-59.47	-192.82	44.65	-63.92	23.52	6.05	-48.43	-12.85	118.83	-71.79	-38.29	130.00	-58.97	-67.63	8.73	174.67
124	-48.48	0.09	-63.15	47.67	-17.89	-62.83	462.76	23.93	85.26	58.41	-21.40	-82.01	63.58	-45.05	-128.94	194.08	-53.47	34.16	-8.58	13.85	22.60	451.98
123	-30.03	-6.94	7.01	-6.89	12.56	-24.58	150.57	-18.95	51.91	-12.38	-12.41	99.80	-20.72	-11.29	-12.77	1.17	-8.37	-32.60	154.30	-40.49	11.95	238.94
122	-35.12	4.66	-75.50	61.02	-53.67	-12.51	2.53	27.66	62.51	-13.16	-68.65	-0.19	14.53	-4.40	93.60	-37.63	34.15	-11.93	30.46	-25.89	-0.38	1.28
121	-23.24	19.31	-119.40	140.44	-13.93	-120.15	-42.85	25.43	2.74	-52.40	-4.75	51.59	53.39	80.25	76.02	-40.09	73.13	-232.81	59.28	123.73	2.78	55.69
120	1.99	32.36	-61.58	49.17	-16.93	-11.96	-7.49	15.47	-8.09	37.09	-30.00	-24.95	-25.67	-24.35	68.25	23.09	-70.45	16.06	-8.48	-8.37	-2.74	-54.85
119	6.45	-5.27	-7.19	52.47	-12.24	-15.47	37.28	-16.96	67.11	-96.46	20.14	41.47	1.76	-6.67	27.87	-4.94	-59.12	68.40	5.09	5.32	5.45	109.05
118	-18.91	-6.61	-24.86	53.78	-3.00	-4.33	18.72	-13.75	1.41	-35.21	-12.88	80.40	0.66	-80.67	14.86	-53.58	37.09	13.34	-67.83	49.73	-2.58	-51.65
117	30.31	-56.32	-20.47	-17.19	-7.28	191.32	-40.43	5.60	20.18	-63.13	-13.91	27.50	10.06	-9.32	-3.59	-41.93	83.49	-34.04	9.74	-22.35	2.41	48.25
216									64.27	-70.00	64.44	57.16	-61.55	-110.30	78.07	321.48	-88.06	-42.93	-93.63	75.85	16.23	194.81
116	196.94	-133.00	17.32	119.83	-93.48	124.87	-1.48	-47.95	39.37	-99.05	-40.53	72.84	-39.30	-52.88	88.43	142.85	-31.67	-35.14	-23.43	-41.39	8.16	163.15
115	-1.34	-8.71	26.81	20.55	-69.12	12.20	-43.25	-44.79	105.71	62.83	-41.82	27.41	-3.59	-67.25	-7.00	84.42	97.40	2.18	-36.46	-31.22	4.25	52.27
114	-83.38	61.88	30.28	-0.64	-28.07	-36.56	13.22	-12.75	59.74	-27.76	11.20	18.39	-5.26	57.51	13.05	-37.28	56.60	-11.38	49.74	21.39	7.50	149.93
113	-140.74	46.16	-12.36	-11.79	-10.96	-2.43	36.26	-9.09	-25.99	-4.71	36.90	9.97	12.80	20.26	-40.29	24.14	206.27	-53.97	-7.88	-69.29	0.16	3.26
212									84.15	-40.74	34.76	-55.42	5.67	-8.16	2.37	54.47	247.45	-82.85	8.60	-75.92	14.53	174.38
112	-62.80	-83.42												** NO LONGER ACTIVE **							-146.22	
111	-151.88	79.78	-25.72	-90.08	-68.99	-67.54	107.56	-80.03	-132.04	-2.75	-9.77	-91.05	-93.17	-62.52	-82.53	-76.63	-170.29	-27.90	-20.05	10.94	-52.73	-1054.65
110	24.78	94.57	6.76	75.96	-160.76	99.91	34.46	68.57	32.58	-6.12	105.66	-31.62	71.60	-25.50	99.86	67.33	15.43	-21.05	92.21	-70.11	28.73	574.52
109	-221.44	33.46	-46.72	64.15	89.10	-148.98	24.50	-3.26	33.62	-35.25	31.99	-10.07	39.35	42.44	17.87	31.54	-41.95	25.02	5.93	5.32	-3.17	-63.39
208									14.52	-64.19	44.46	4.44	0.75	86.07	-11.34	-22.07	-45.64	57.47	17.71	-13.59	5.72	68.60
108	1.76	19.93	98.09	5.43	126.54	-6.32	123.21	-41.19	36.82	-29.82	80.09	-71.16	10.72	28.90	-9.91	-2.56	10.30	15.20	-15.17	-18.36	18.13	362.53
107	-12.77	-4.41	3.66	18.69	174.41	3.56	66.25	-19.95	17.78	7.40	54.55	-26.01	5.75	2.83	24.42	14.82	-21.16	-13.45	35.31	-18.54	15.66	313.12
106	-111.42	17.74	-44.63	36.39	-3.78	-64.59	-60.35	22.98	6.26	-16.30	32.36	-3.54	-18.93	38.35	20.75	-15.51	43.85	51.98	4.84	14.97	-2.43	-28.32
105	-16.21	58.54	33.69	89.07	18.73	139.17	24.54	190.48	182.26	-33.79	-95.86	-74.16	-39.59	174.27	-82.55	13.97	31.86	-107.30	167.09	-21.48	32.64	652.72
104	-17.01	-7.74	6.50	-20.35	22.35	-24.57	3.36	-0.69	-36.83	11.53	-9.55	17.91	-13.88	2.83	16.27	-7.09	16.11	-2.47	26.35	51.66	1.73	34.68
103	-22.34	16.96	-3.38	-1.14	-0.95	-8.67	8.45	-0.33	-8.13	-8.13	7.97	-13.29	4.52	-6.94	9.05	-3.75	-9.41	-7.75	4.55	-13.03	-2.79	-39.36
102	14.03	-0.19	-1.48	-1.26	-26.00	-26.00	11.79	15.80	11.43	-5.30	1.39	-0.67	-21.99	6.19	-3.54	-11.53	28.16	6.79	10.49	-30.22	-1.11	1.49
101	-15.36	-211.01	4.87	-104.78	104.98	-31.14	-0.05	20.28	-28.61	-72.18	-9.95	33.36	19.13	-30.01	25.36	-1.69	-12.87	-38.38	86.08	-25.95	-14.40	-287.91
100	-5.52	-6.85	6.13	-1.49	-1.57	-0.23	-5.68	3.89	-2.31	-0.86	12.78	-6.61	-4.50	-2.26	-1.44	2.12	-3.69	-1.87	7.17	-4.40	-0.86	-17.17
AVERAGE	-28.53	-1.73	-14.55	24.56	0.87	14.79	34.58	-3.30	37.45	-32.44	3.47	-1.18	-6.07	4.33	9.67	16.86	10.57	-11.61	16.34	-8.61	-1.52	65.32

Table 8 - The individual change in the position of the zero elevation point along each survey profile at each site shows the variation in shoreline location with time and as a result of major beach restoration efforts or storm events. This position is derived from the topography on the beach relative to the location of the site reference monument. This "shoreline" is located where the surveyed profile line crosses the zero datum elevation defined by the National Geodetic Vertical Datum of 1929 (the datum used when NJBPN was established in 1986). The red columns are the site location numbers, the black columns are each year's shoreline position movement landward (-) or seaward (+) from the previous year. The last black type column is the average shoreline movement over the 20-year period, and the blue column is a direct comparison of the shoreline position in 1986 with that present in 2006. This shoreline change comparison covers the entire 20 years in one step.

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Glossary of Coastal Terms

Accretion - The addition of material by natural processes.

Aeolian Accretion - The accretion that results from wind driven processes.

Backshore - The area of the beach profile landward of the berm and seaward of upland dunes or bluffs.

Beachface - Also known as foreshore. The area of the beach exposed to regular wave action.

Berm - The nearly horizontal portion of the beach formed at the high water line as waves deposit material. A beach may have no berm or multiple berms.

Bulkhead - A structure that is built to retain or prevent the slumping of land at the influence of water and wave action. Bulkheads are typically made of wood, steel, or aluminum.

Cross-shore Transport - The transfer of sand perpendicular to the shoreline, or along the profile. A bar migrating onto the beach is an example of cross-shore transport.

Current - The flow of water.

Downdrift - The dominant direction of movement of littoral materials.

Datum - A reference level from which elevations are measured.

Dry Beach - The area of beach between the water and dune toe that is commonly used for recreating. Also referred to as recreational beach.

Dune - Unconsolidated hills or mounds of sand. Dunes are the result of aeolian processes and may have vegetation ranging from sparse to dense. Vegetation greatly stabilizes a dune.

Eddy - A circular current running contrary to the main current.

Erosion - The removal of material by natural processes.

Foredune - The most seaward of the dune ridge along the profile.

Geotube - A geotextile fabric tube filled with sand, typically used to retain material or to dissipate wave energy.

Groin - A shore-perpendicular erosion control structure, usually made of wood or rock. This structure acts to slow the process of littoral transport.

Hurricane - A tropical cyclone in the Northern Hemisphere, with sustained winds over 74 mph.

Jetty - A shore-perpendicular erosion control structure similar to a groin, however it is used to control the movement of an inlet or channel.

Littoral Current - Current that moves parallel to shore, that results from the approach of waves not being perpendicular to the shoreline.

Littoral Drift - Also known as longshore transport. Movement of material in the longshore direction, resulting from the littoral currents.

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Longshore Transport - Also known as littoral drift. Movement of material in the longshore direction, resulting from the littoral currents.

NGVD - (the datum of 1929) A common elevation reference developed from a specific model of the Earths' surface.

Onshore - In the direction of the shoreline; landward.

Offshore - In the direction opposite of the shoreline; seaward.
The region of the beach profile seaward of the first bar.

Neap Tide - A tide having significantly reduced variations from mean tide levels. Neap tides occur near quarter moon stages.

Nearshore - Region of beach profile extending from the berm seaward through the offshore.

Northeaster - Dominant type of coastal winter storm event experienced in New Jersey, with winds from the northeast that exceed 30 mph.

Revetment - Cover of stone placed on or along a shoreline to protect a slope or shore structure.

Ridge - A low elevation, near shore parallel continuous mound of sand, pushed onshore by wave action.

Riprap - Line of rocks placed randomly along a slope or structure for protection.

Runnel - A continuous area of lower elevation than, but parallel to and adjacent to, a ridge(s).

Scarp - A near vertical feature created through the erosion of material from the lower portion of a slope or bluff.

Scour - Underwater removal of material through currents and wave action.

Seawall - Structure that separates the land and water.

Shoreline - The narrow area of land in contact with the water. When referring to a profile plot, the point where the profile crosses the line representing the datum.

Spring Tide - Tide with the most extreme variations from mean tide levels. Spring tides occur at new or full moon stages.

Swale - A long, narrow, generally shallow depression between ridges.

Swash - The area of beachface exposed to breaking wave energy as waves come ashore.

Storm Surge - The abnormal rise in local sea level that accompanies a hurricane or other major storm event.

Updrift - In the direction opposite of the dominant movement of littoral materials.

Wrack - Debris deposited on the beach by wave action.

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