New Jersey Beach Profile Network

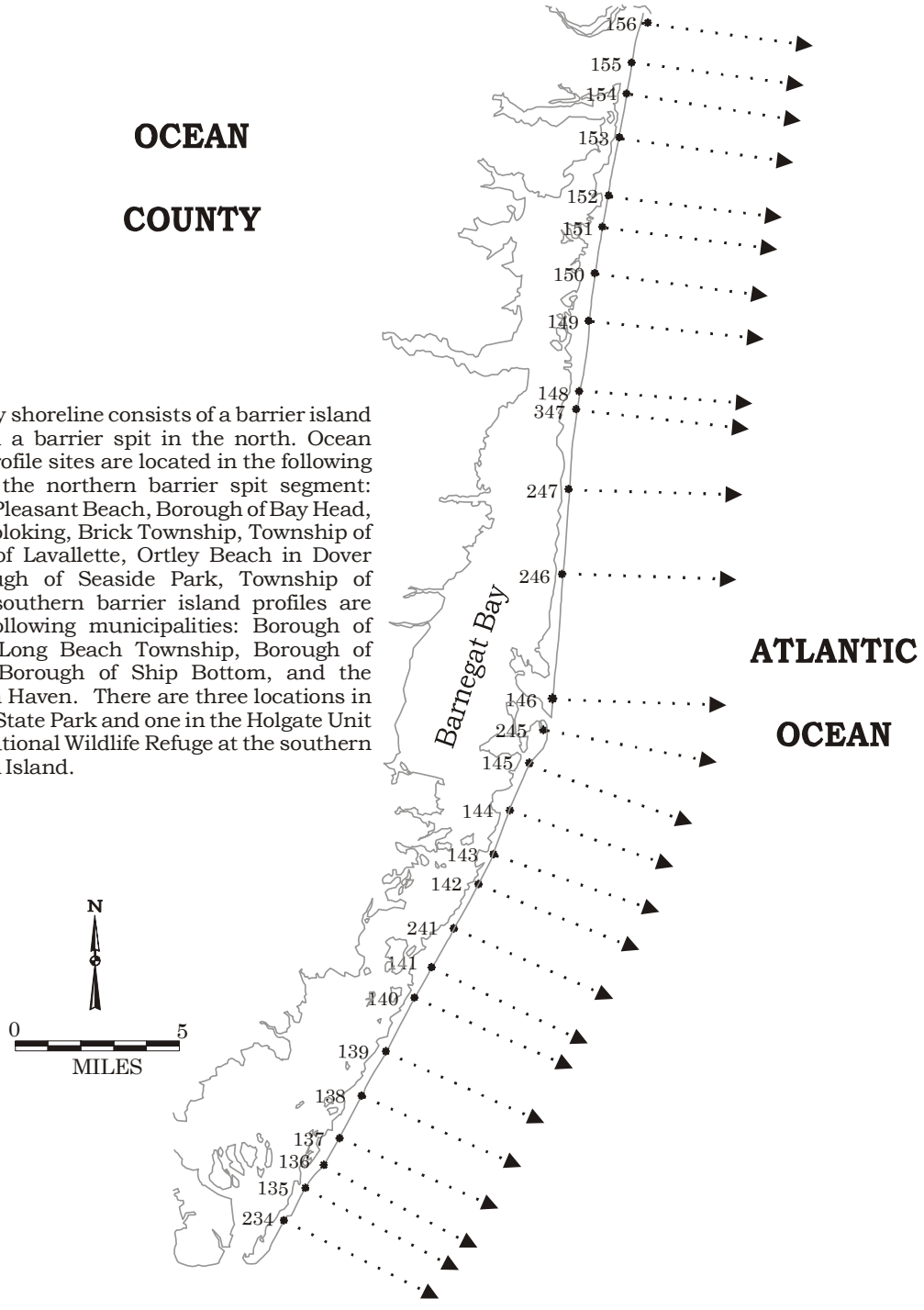
Ocean County

Manasquan Inlet to Little Egg Inlet

NJBPN Profile #'s 156 - 234

New Jersey Beach Profile Network
Ocean County Profile Site Locations

Figure 73



The Ocean County shoreline consists of a barrier island in the south and a barrier spit in the north. Ocean County NJBPN profile sites are located in the following communities on the northern barrier spit segment: Borough of Point Pleasant Beach, Borough of Bay Head, Borough of Mantoloking, Brick Township, Township of Dover, Borough of Lavallette, Ortley Beach in Dover Township, Borough of Seaside Park, Township of Berkeley. The southern barrier island profiles are located in the following municipalities: Borough of Barnegat Light, Long Beach Township, Borough of Harvey Cedars, Borough of Ship Bottom, and the Borough of Beach Haven. There are three locations in the Island Beach State Park and one in the Holgate Unit of the Forsythe National Wildlife Refuge at the southern end of Long Beach Island.

Interpreting 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.

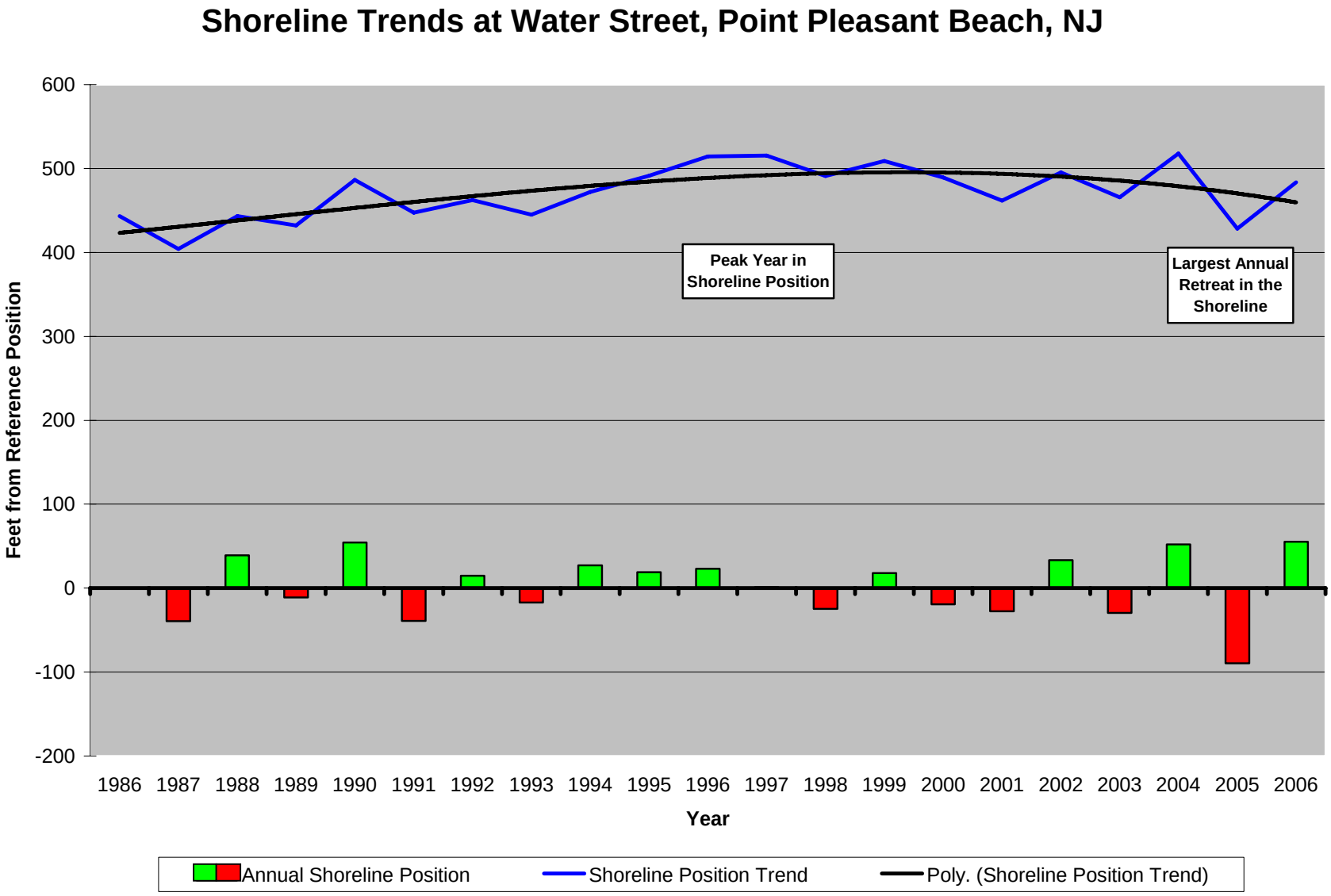


Figure 74 – Site 156. The northernmost site in Ocean County is positioned just south of the Manasquan Inlet. Protected by the jetties, the beach remained wide and changed little with storms or even trends following the Monmouth County shore protection project. The

shoreline trend was positive during the 20-year interval with a series of maximum positions seen in 1996, 1997, 1999 and 2004 all beyond 500 feet distant from the reference point landward of the boardwalk. The net change was a 50-foot advance in the position of the zero elevation shoreline position. The year 2005 saw the largest shoreline retreat with partial recovery in 2006. No major beach nourishment projects have taken place in Point Pleasant so changes were caused by natural processes related to the comparative frequency between littoral current activity going south (northeast storms) to that going north (southeast winds). Retreat is due to northeast activity, advance is related to the dominance of southeast wind-driven currents that push sand north where the inlet jetty traps and collects sand, adding to the beach width.

20-Year Comparison Photographs – Site 156, Water Street, Point Pleasant
The 2006 view to the north (right) from the berm crest shows the south jetty of Manasquan Inlet and the wide, dry beach preserved in its shadow toward the northeast. This beach is heavily used for recreation during the summer, with frequent raking and no effort to develop a no dune system exists. The majority of the shoreline at this site is also privately owned. The photograph on the left shows the conditions of the beach in 1988.

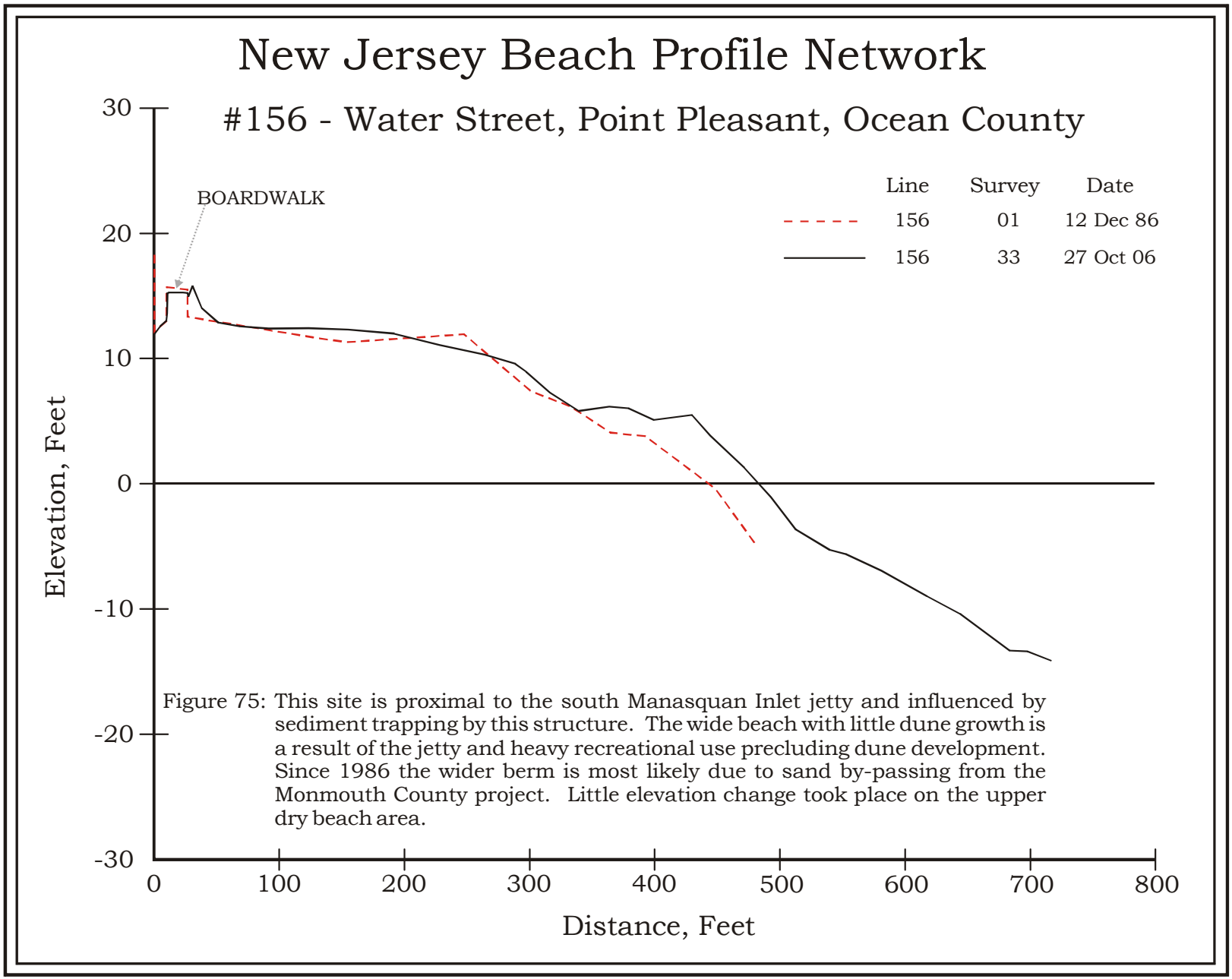


Figure 75: This site is proximal to the south Manasquan Inlet jetty and influenced by sediment trapping by this structure. The wide beach with little dune growth is a result of the jetty and heavy recreational use precluding dune development. Since 1986 the wider berm is most likely due to sand by-passing from the Monmouth County project. Little elevation change took place on the upper dry beach area.

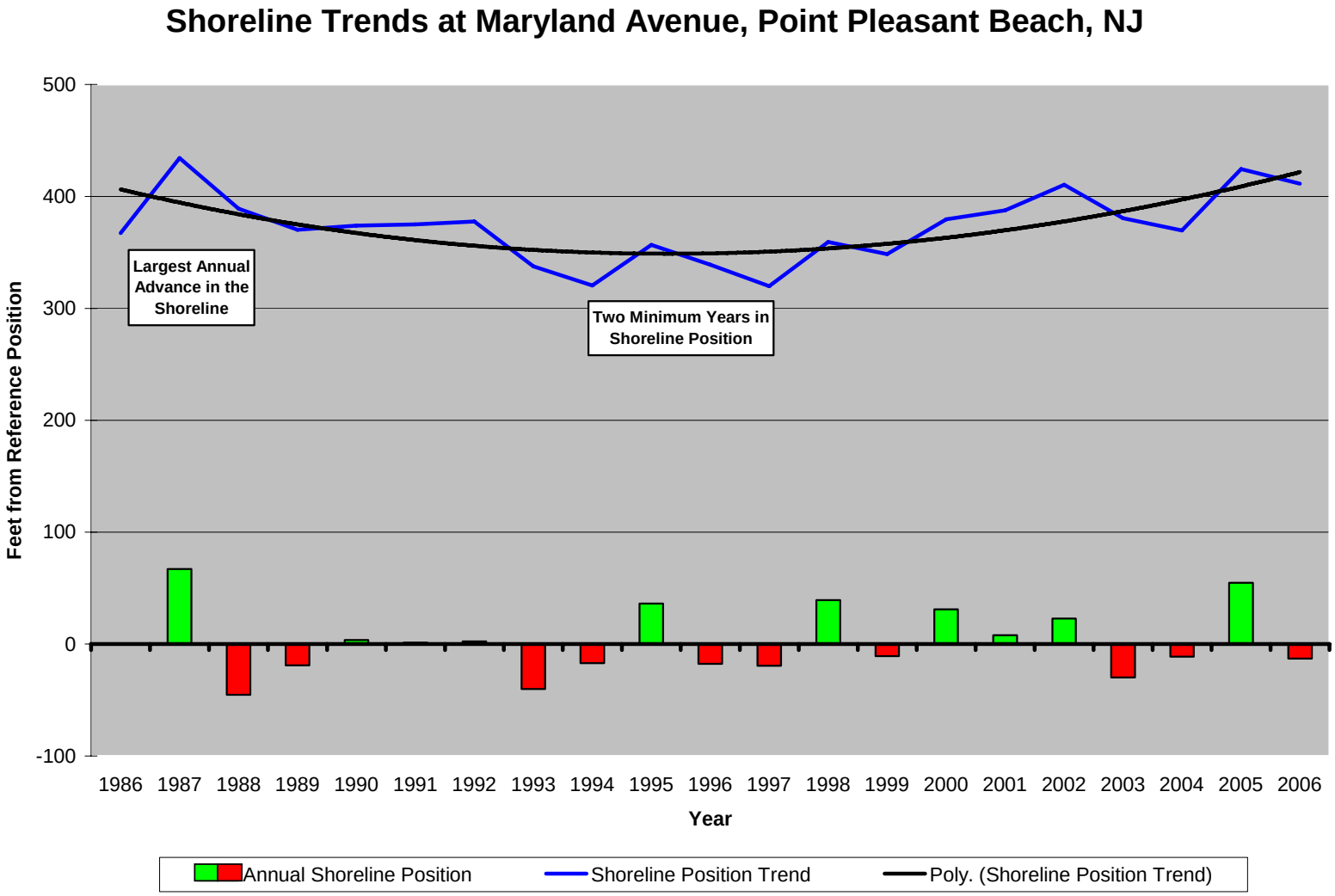


Figure 76 – Site 155. This profile well south of the Manasquan Inlet, the beach behaved more in tune with the general climate for the interval. Storms produced retreat in 1991 to 1993 followed by slow recovery to the 2005 position. Both 1987 and 2005 showed nearly the same maximum advance position in the shoreline. The minimum was seen in 1994 and 1997. There has been no influence by beach nourishment activities from here south along the northern Ocean County shoreline.

A. 

B. 

C. 

20-Comparison Photographs – Site 155, Maryland Avenue, Point Pleasant

This shoreline segment is protected by a massive dune in terms of both width and height (C, taken in 2006)). Established prior to monitoring in 1986, this feature has gained sand volume in spite of a relatively narrow beach. The beach width improved since 1986 but not in a steady fashion. In 2005, there was a substantial advance in the position of the shoreline coupled with a wider berm. Photos A and B show the beach conditions in 1990 and 2006, respectively.

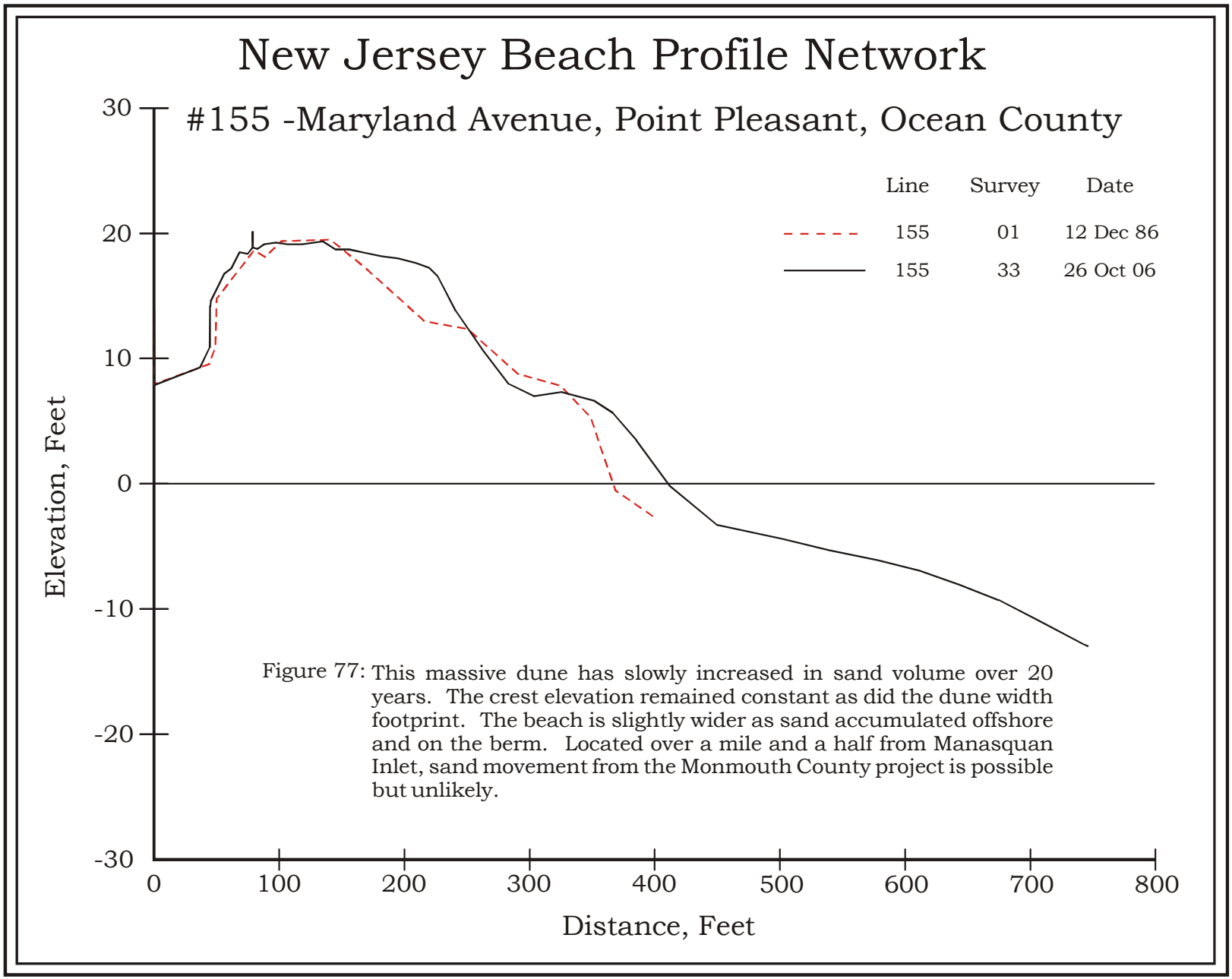


Figure 77: This massive dune has slowly increased in sand volume over 20 years. The crest elevation remained constant as did the dune width footprint. The beach is slightly wider as sand accumulated offshore and on the berm. Located over a mile and a half from Manasquan Inlet, sand movement from the Monmouth County project is possible but unlikely.

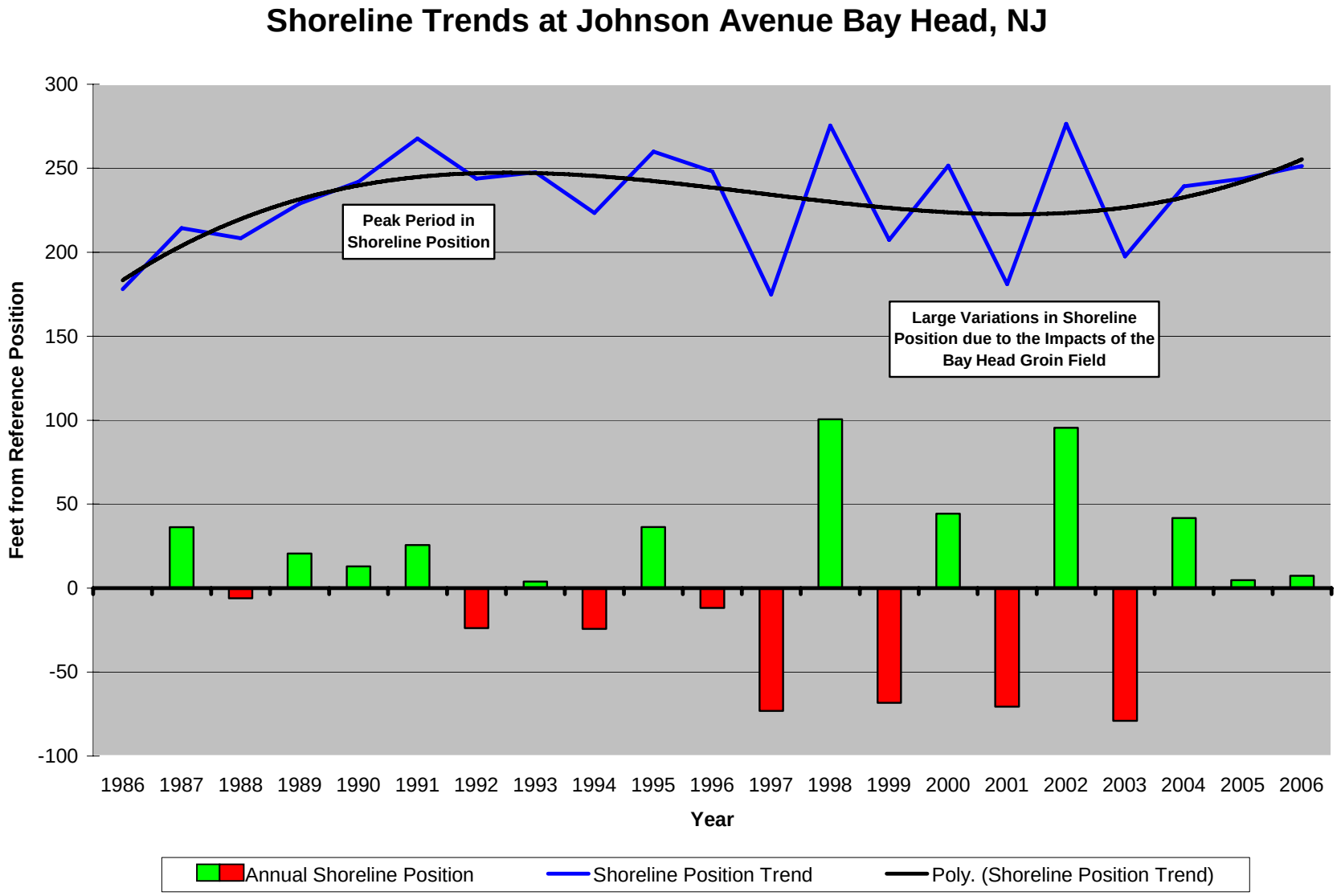


Figure 78 – Site 154. In Bay Head the variations in shoreline position were quite large with a 20-year trend of seaward advance. The 1992 Storm caused shoreline retreat with serious overwash of the tiny dune exposing the rock seawall core. Fortunately, the rock

revetment extended across about 1,600 feet of shoreline and prevented extensive damage to properties and infrastructure. This structure was exposed and scoured on both sides as waves overtopped the feature sending water and sand into the streets and adjacent properties. A dune was rebuilt after the storm to a more reasonable size and has grown larger from natural aeolian processes since. There was a yearly oscillation in shoreline position between 1997 and 2004 significant in that it represents changes in the direction of longshore transport by waves whether toward the groin field (north) or away from it (south). This produces large shifts in the shoreline depending on the direction of dominant drift for sand.

20-Year Comparison Photographs – Site 154, Johnson Avenue, Bay Head
The revetment is partially shown on the left side of the 1991 photograph (left side) and lies directly under the photographer's feet and extends north and south in the 2006 photograph (left). Exposed completely in December of 1992, the beach was deeply scoured directly seaward of the rocks and overwash topped the rock crest and washed all the dune sand down the street into route 35. Reconstruction initiated development of a substantial dune today (right) enhancing storm protection, but fortunately similar intense storm events have not occurred along the Jersey shore since.

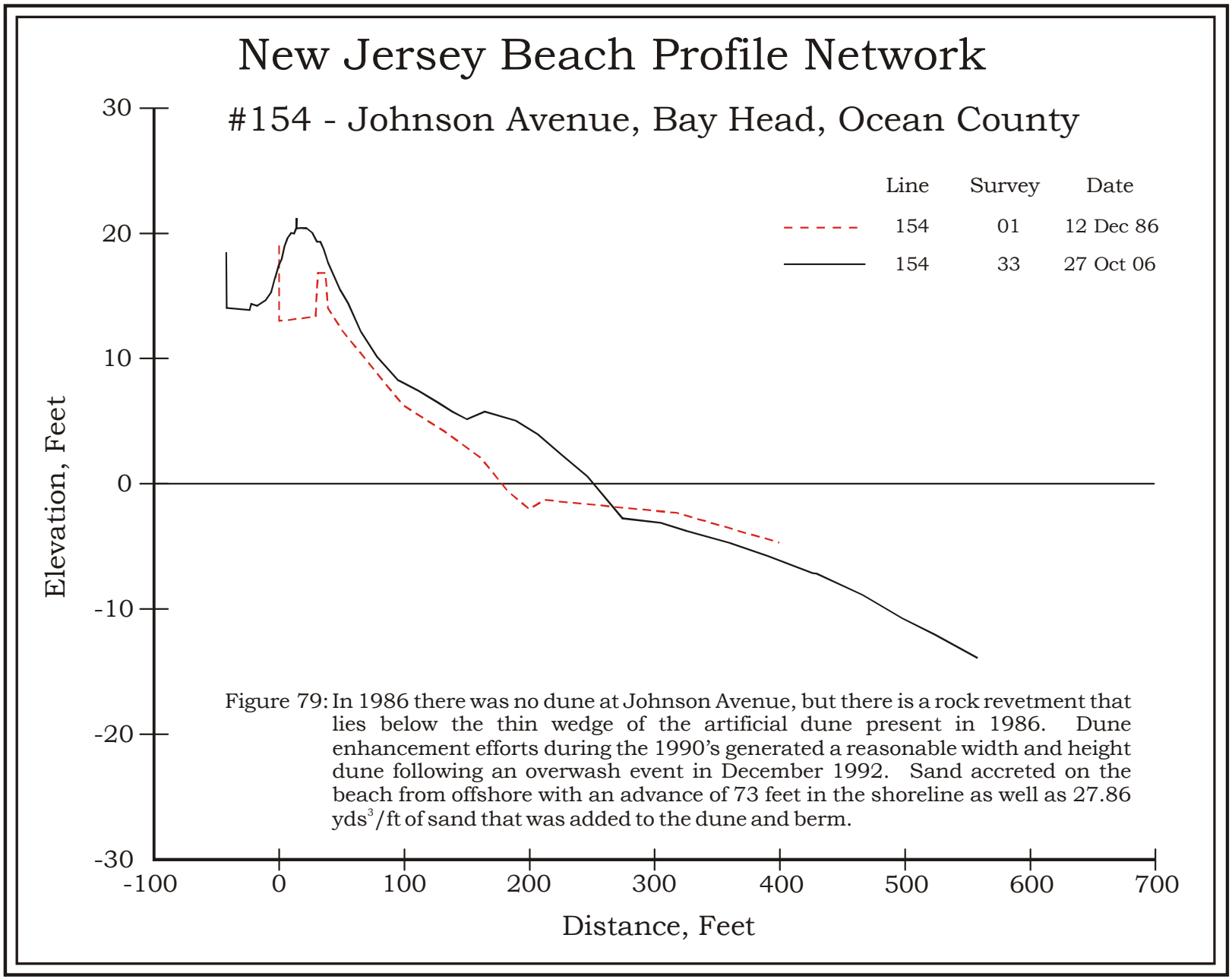


Figure 79: In 1986 there was no dune at Johnson Avenue, but there is a rock revetment that lies below the thin wedge of the artificial dune present in 1986. Dune enhancement efforts during the 1990's generated a reasonable width and height dune following an overwash event in December 1992. Sand accreted on the beach from offshore with an advance of 73 feet in the shoreline as well as 27.86 yds^3/ft of sand that was added to the dune and berm.

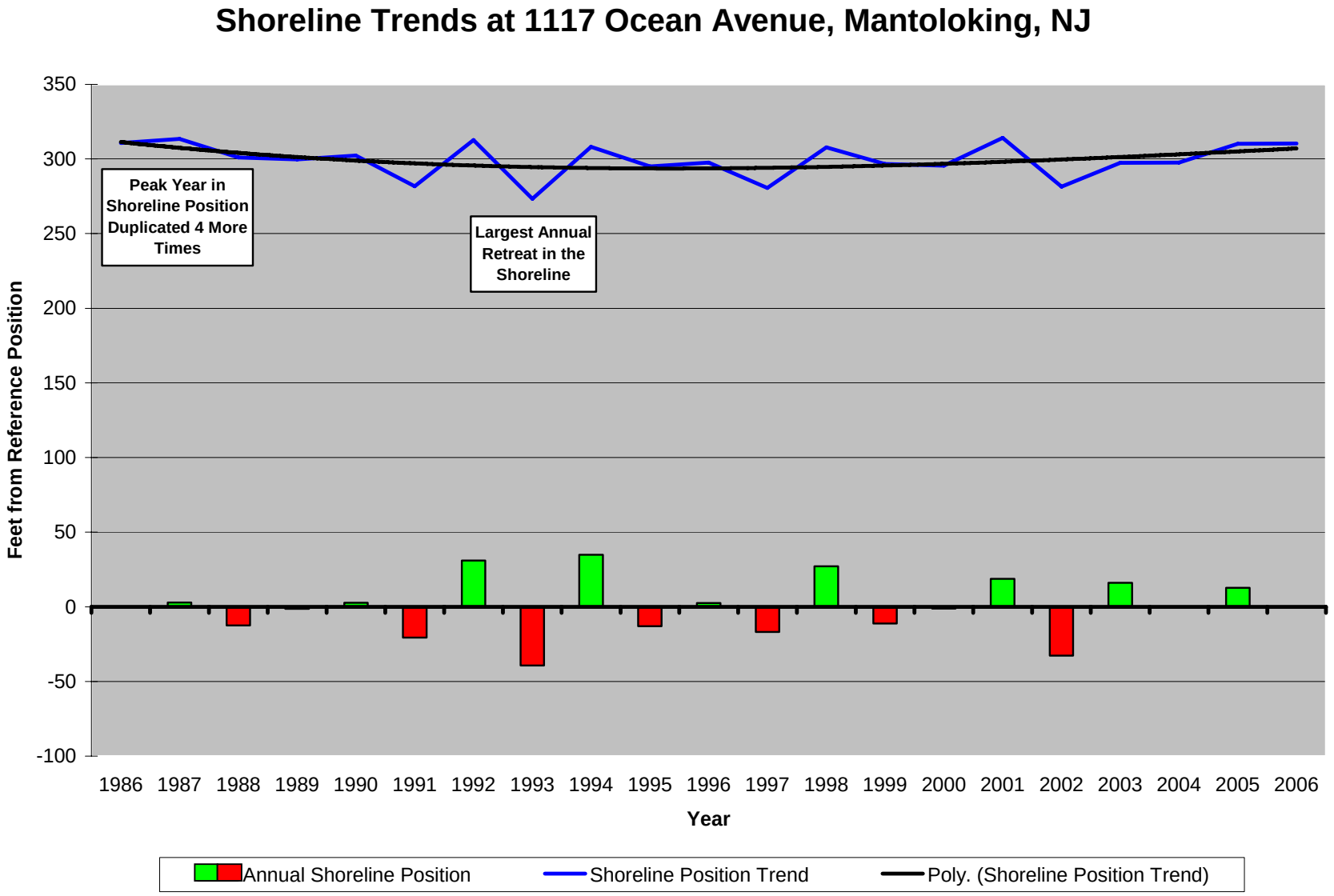


Figure 80 – Site 153. The Mantoloking Borough has no hard structures in its beach; therefore the shifts in shoreline position are far more muted and related to individual storm impacts and seasons with higher than average storm activity. The long-term trend is nearly flat over 20-year study period, a fairly rare occurrence along the NJ ocean coast.

20-Year Comparison Photographs – Site 153, 1117 Ocean Avenue, Mantoloking
The 1992 northeast storm damaged the dune severely enough to erode through the crest. Restoration efforts have continued to date (right). The linear vegetation boundary represents the 2005–2006 winter erosion of the dune with the dune slope sand put back using a bulldozer to harvest sand from the storm recovery deposit on the beach. The 1992 scarp was about 25 feet landward of the most recent storm activity. Although the shoreline position has been relatively stable the beach width is insufficient to support further dune growth and marginally sufficient for supporting the current dune system, resulting in frequent erosion and vertical scarping of the seaward slope even during modest to moderate storm events.

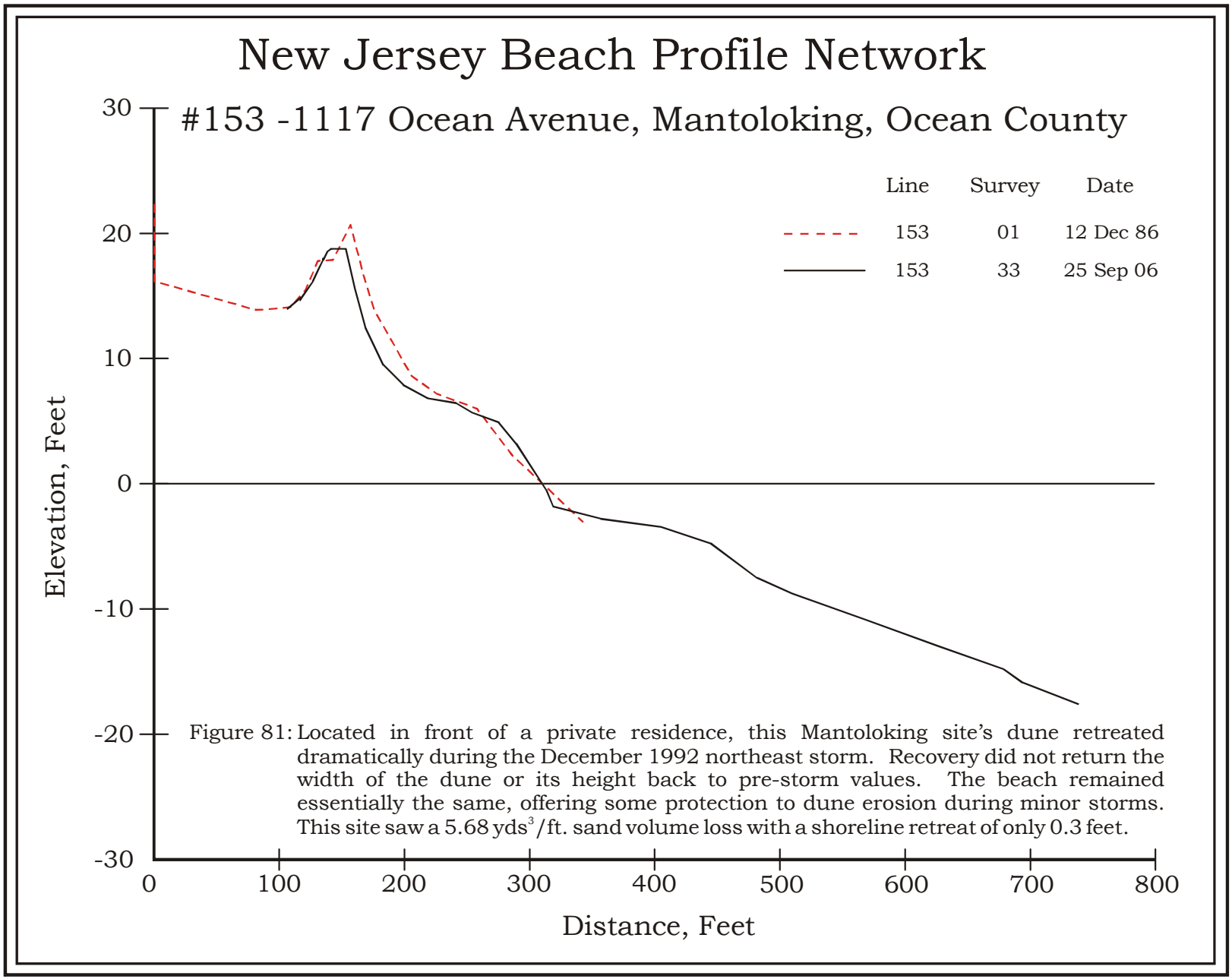


Figure 81: Located in front of a private residence, this Mantoloking site's dune retreated dramatically during the December 1992 northeast storm. Recovery did not return the width of the dune or its height back to pre-storm values. The beach remained essentially the same, offering some protection to dune erosion during minor storms. This site saw a 5.68 yds^3/ft. sand volume loss with a shoreline retreat of only 0.3 feet.

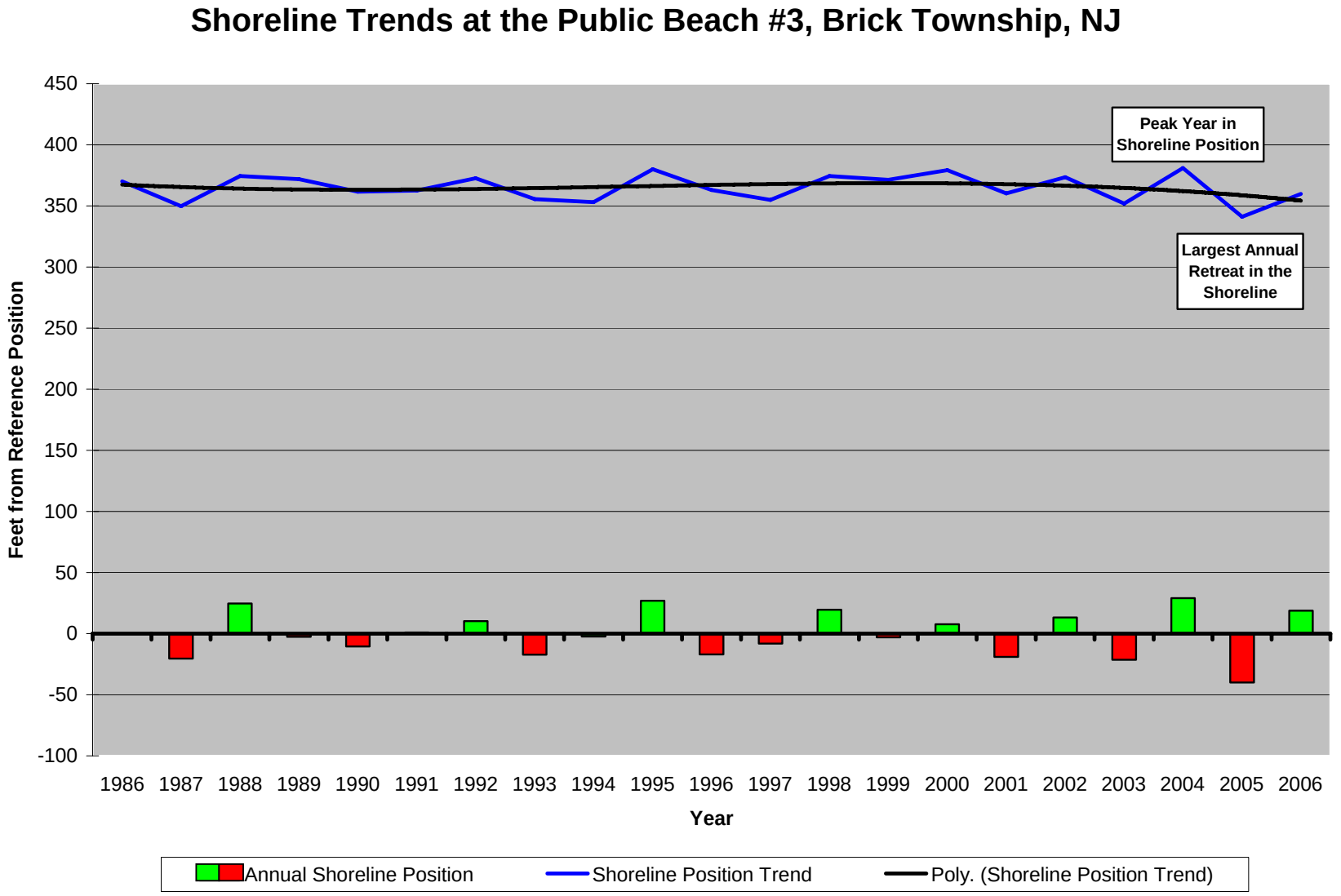


Figure 82 – Site 152. The lack of hard structures in Brick Township continued the trend of minimal shoreline shifts from year to year. The site showed a retreat of about 15 feet in 20 years with no observable pattern. In fact, the best and worst years in terms of shoreline position occurred in 2004 and 2005.

20-Year Comparison Photographs – Site #152, Public Beach #3, Brick Township
The 2006 view from the dune crest in front of the public use building for the beach (right). The dune was built naturally as a result of sand accumulation around snow fencing erected as the facility was opened in 1986 (left – 1990). Today a substantial dune and generous beach exists at this public use area. The beach's width has not changed significantly during the 20-year time interval.

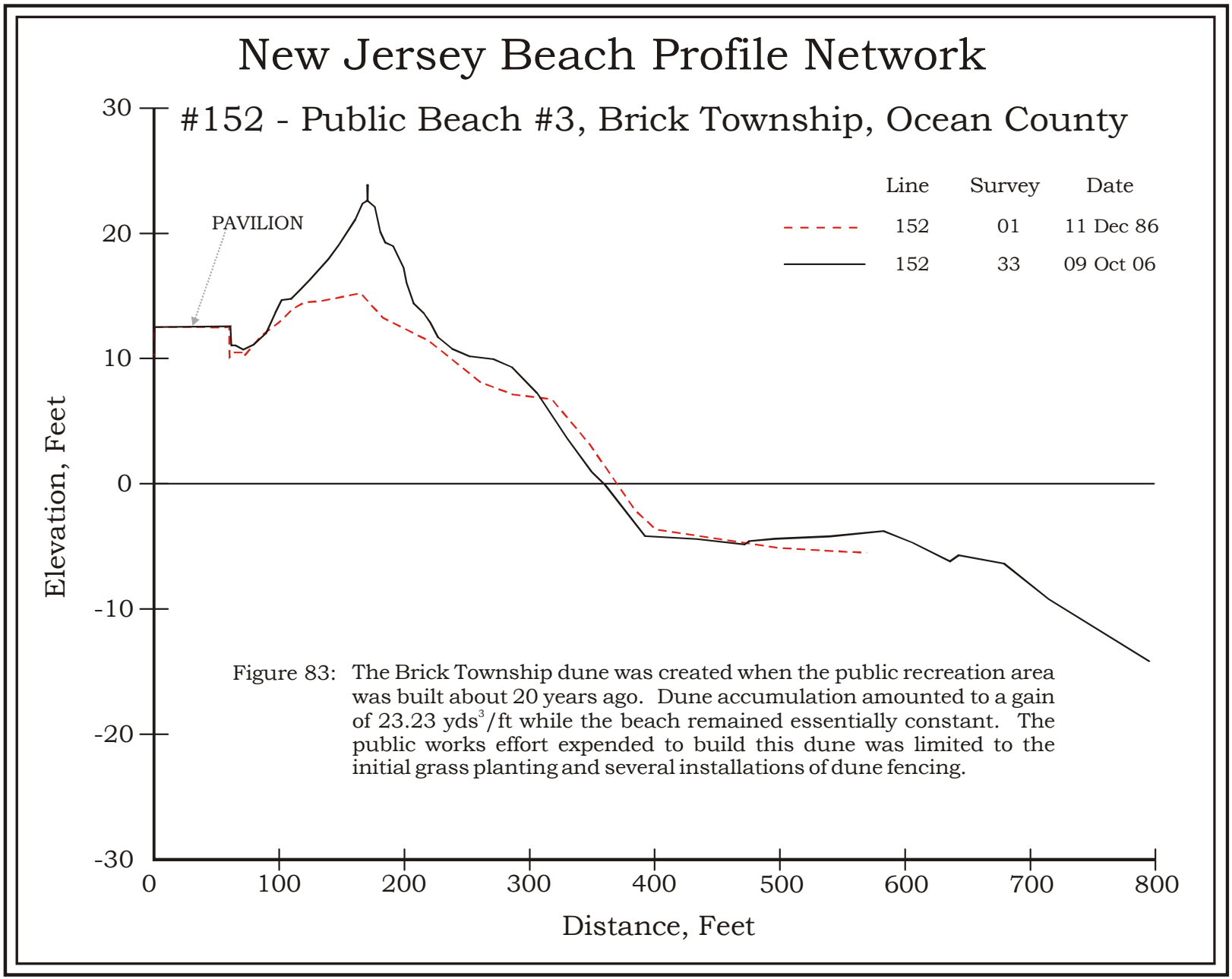


Figure 83: The Brick Township dune was created when the public recreation area was built about 20 years ago. Dune accumulation amounted to a gain of 23.23 yds^3/ft while the beach remained essentially constant. The public works effort expended to build this dune was limited to the initial grass planting and several installations of dune fencing.

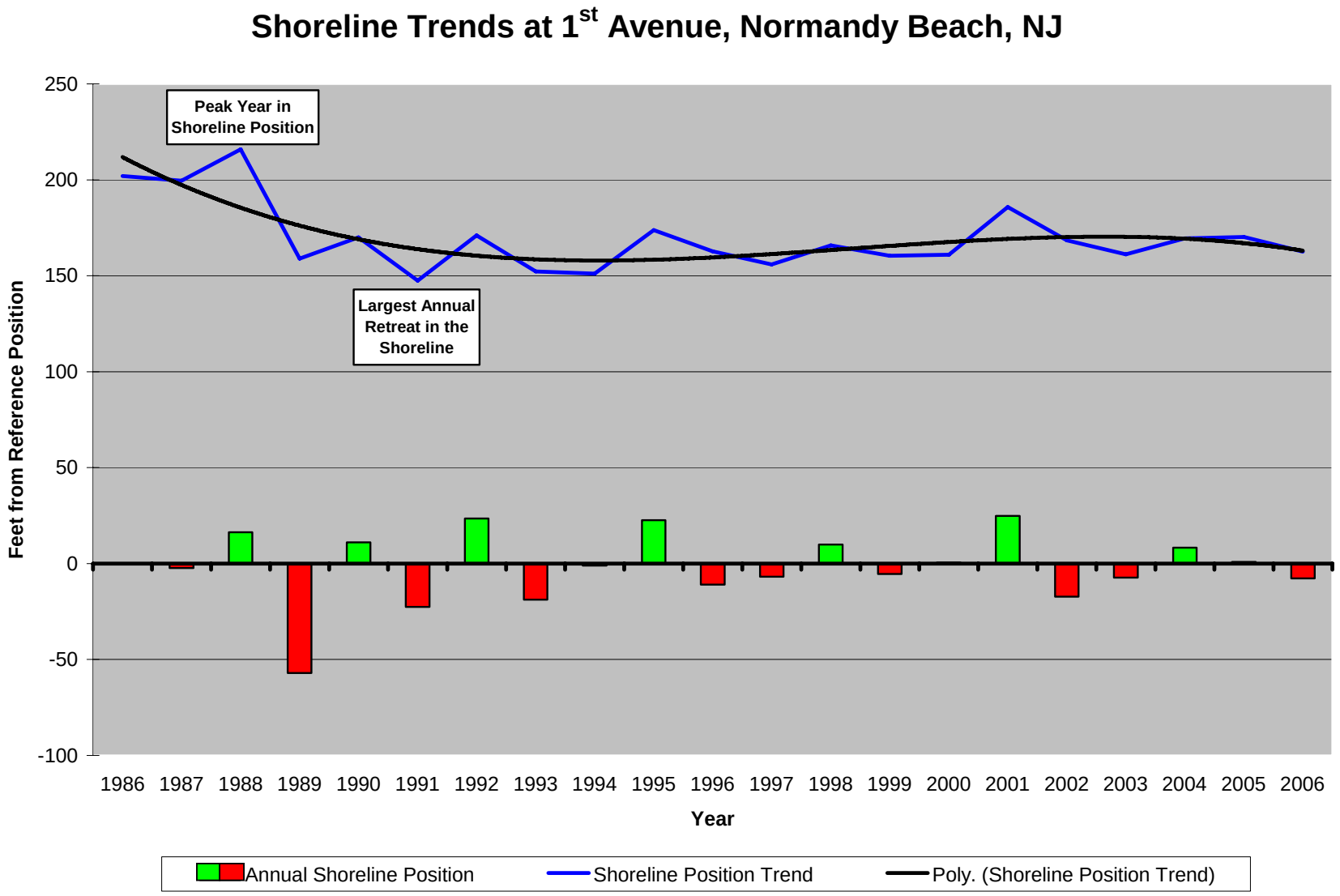


Figure 84 – Site 151. The beach at Normandy's First Avenue saw a rapid shoreline retreat that stabilized by 1992/93 and subsequently advanced slightly until 2006. The largest retreat occurred in 1989; a year with no significant storms. 50-foot shoreline retreats along the Ocean County shoreline are by no means rare, but do demand attention if not reversed almost immediately because of the narrow beaches.

20-Year Comparison Photographs – Site 151, 1st Avenue, Normandy Beach

The dune toe lies within easy reach of ocean waves during a storm. The 1992 storm caused seaward slope erosion and overwash that pushed sand onto the landward slope. Fortunately there have been few storms since 1992 and the dune has not been called upon to defend the development positioned landward of the feature. No sand has been placed on this beach during the past 20 years. The pictures above depict the beach conditions in 1991 (left) and 2006 (right).

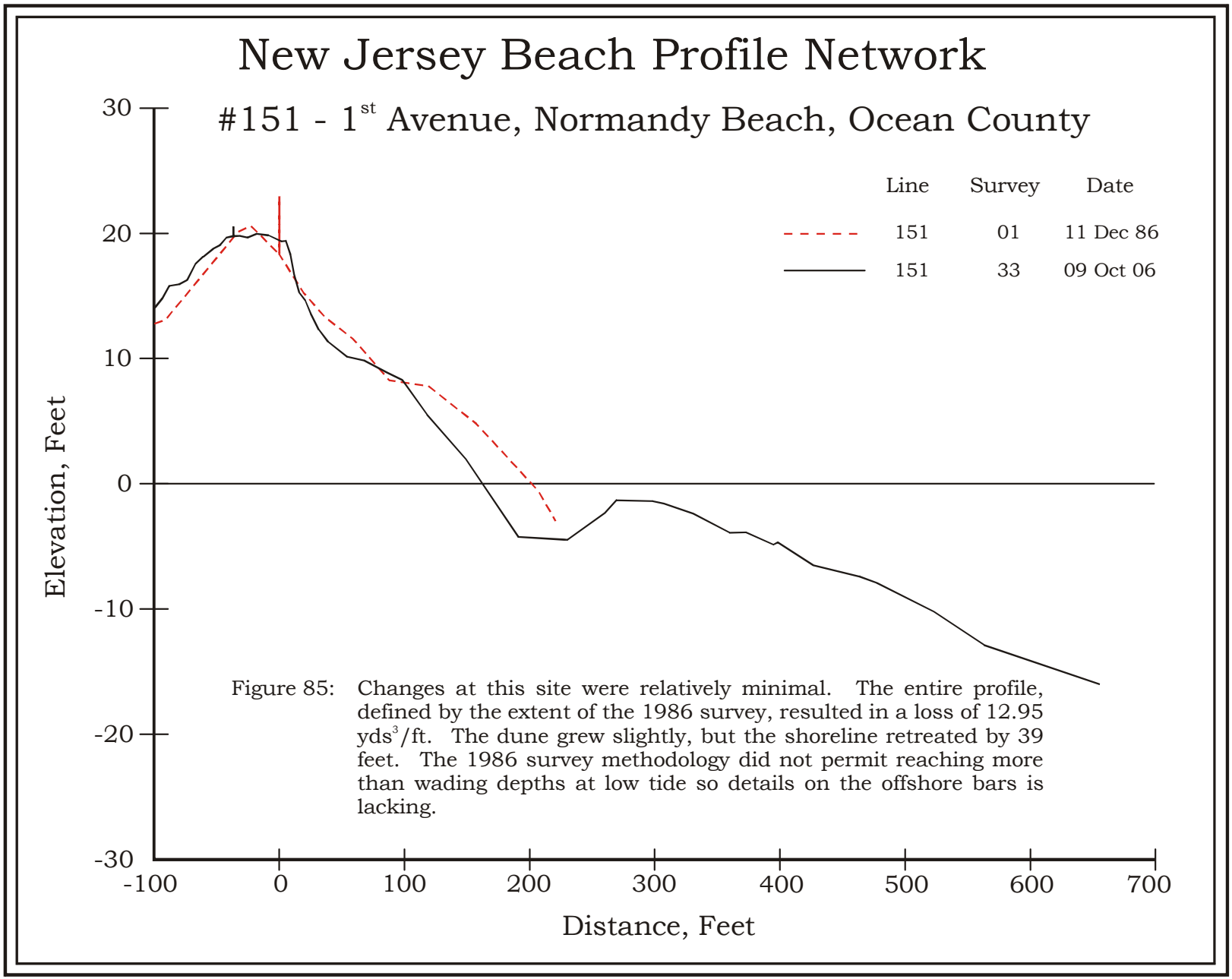


Figure 85: Changes at this site were relatively minimal. The entire profile, defined by the extent of the 1986 survey, resulted in a loss of 12.95 yds^3/ft. The dune grew slightly, but the shoreline retreated by 39 feet. The 1986 survey methodology did not permit reaching more than wading depths at low tide so details on the offshore bars is lacking.

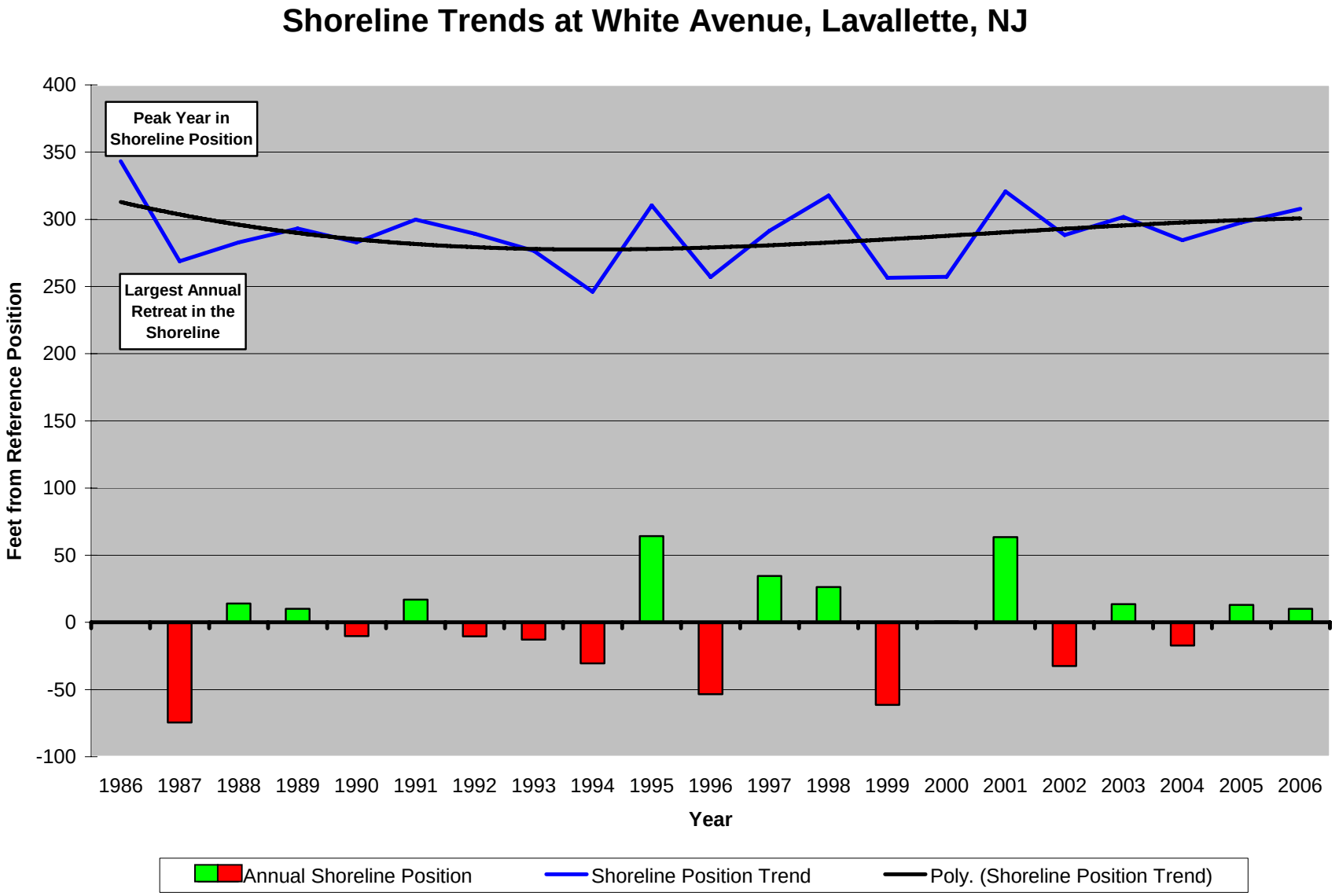


Figure 86 – Site 150. This site saw a dominant period of retreat in shoreline position from 1986 to 1994, followed by an oscillating trend between gains and losses. By 2003, the beach began to stabilize, due to calm conditions and this trend continued through fall 2006.

20-Year Comparison Photographs – Site 150, White Avenue, Lavallette

The beach backs up to the dune toe that the community expended effort to enhance between 1986 and 1995. Sand has accumulated nearly continuously with each survey raising the crest elevation and width of the dune. The crest elevation has increased by 10 feet and the seaward toe advanced 50 feet across the beach. The feature's ability to resist storm erosion is much greater now, but the beach is narrow to the point where minor storm waves are able to reach the toe of the dune. Additional beach width is needed to support further growth and adequately protect the feature from small storms, ensuring its stability and effectiveness to resist larger storm events when they occur.

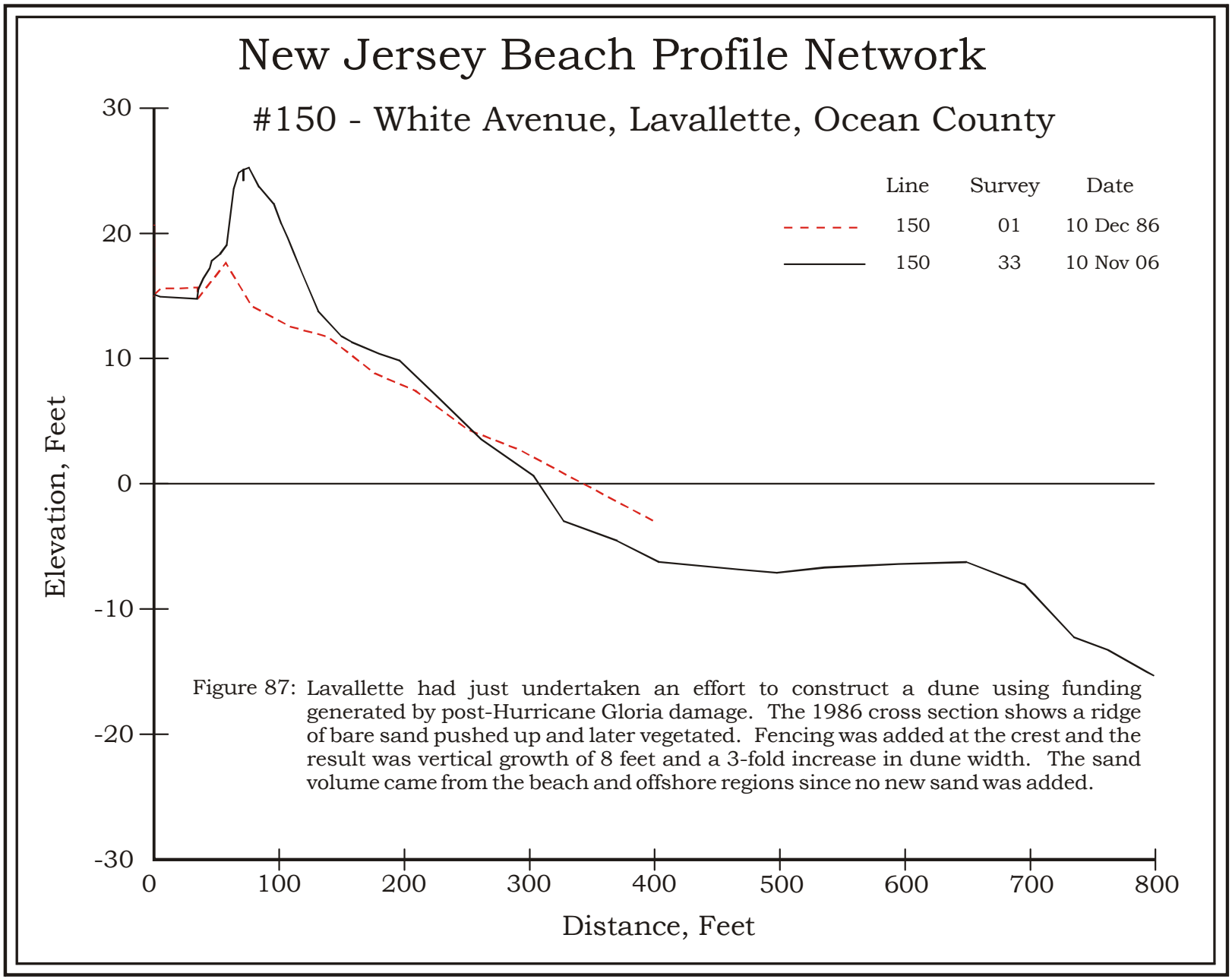


Figure 87: Lavallette had just undertaken an effort to construct a dune using funding generated by post-Hurricane Gloria damage. The 1986 cross section shows a ridge of bare sand pushed up and later vegetated. Fencing was added at the crest and the result was vertical growth of 8 feet and a 3-fold increase in dune width. The sand volume came from the beach and offshore regions since no new sand was added.

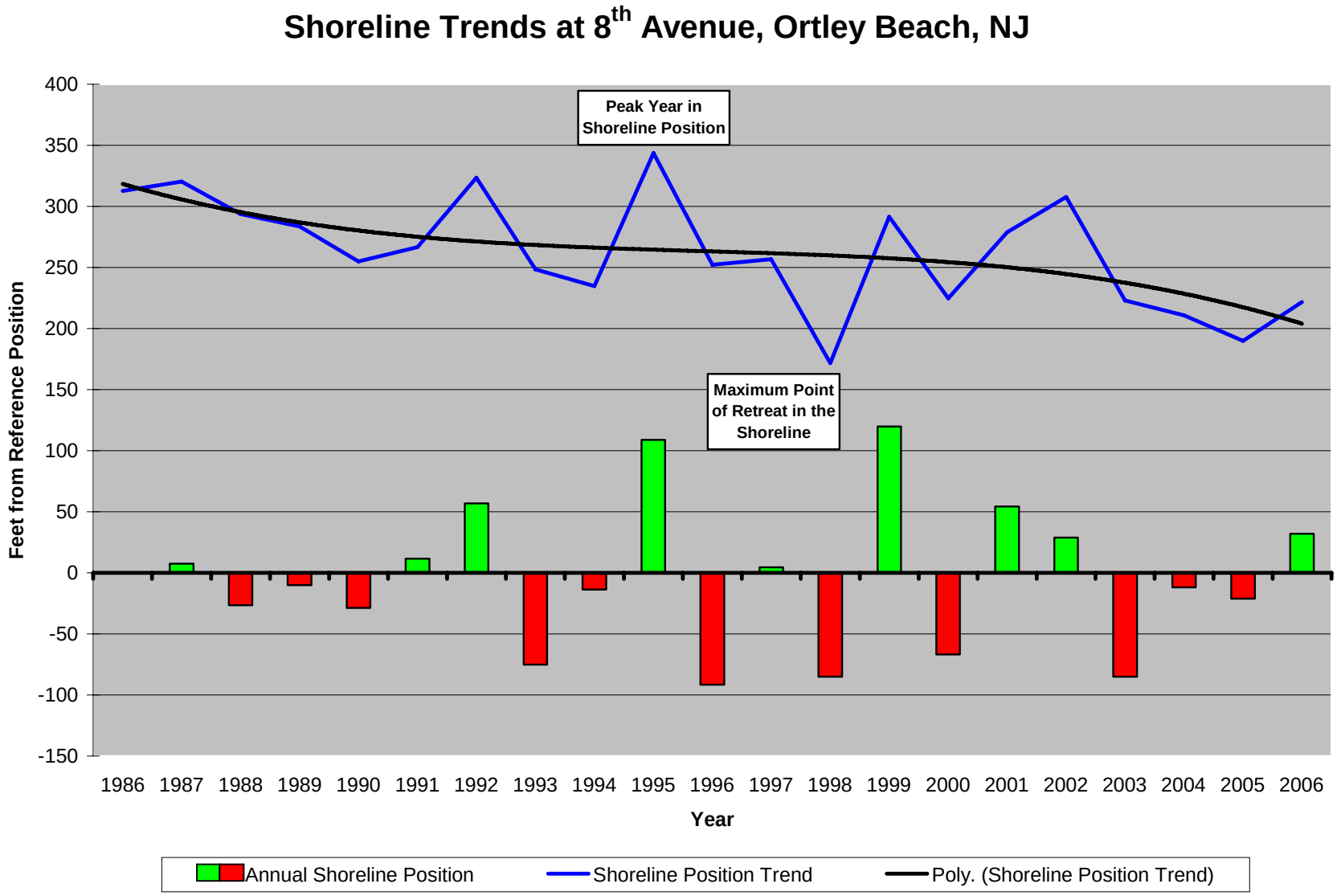


Figure 88 – Site 149. The Ortley Beach site suffered extensive excursions in shoreline position, but the long-term trend was retreat in the amount of 85 feet. The greatest cumulative advance was seen in 1995 followed by the greatest retreat in 1998 for a total shift of 170 feet followed again in 1999 with the single year shoreline advance. These episodic large oscillations in shoreline position make the dune

vulnerable to storm attack in spite of subsequent advances in the shoreline position. The beach is relatively narrow across this section of Ocean County so that major retreats in beach width even temporary bring the surf precariously close to seaward dune toe. An increase in the beach width would allow the dune system to expand and enhance storm protection, for the dune system, public infrastructure and ocean front properties.

20-Year Comparison Photographs – Site 149, 8th Avenue, Ort1ey Beach

Looking north from the dune crest (right photograph), the beach at the end of the summer in 2006 was wider than it had been for several years. The cross section shows the extent of beach loss as a result of shoreline retreat, which allowed minor erosion on the seaward slope. There was some growth in dune crest elevation, but overall degradation of the beach has increased the risk level for storm damage. The picture on the left depicts the conditions of the dune and beach in 1989.

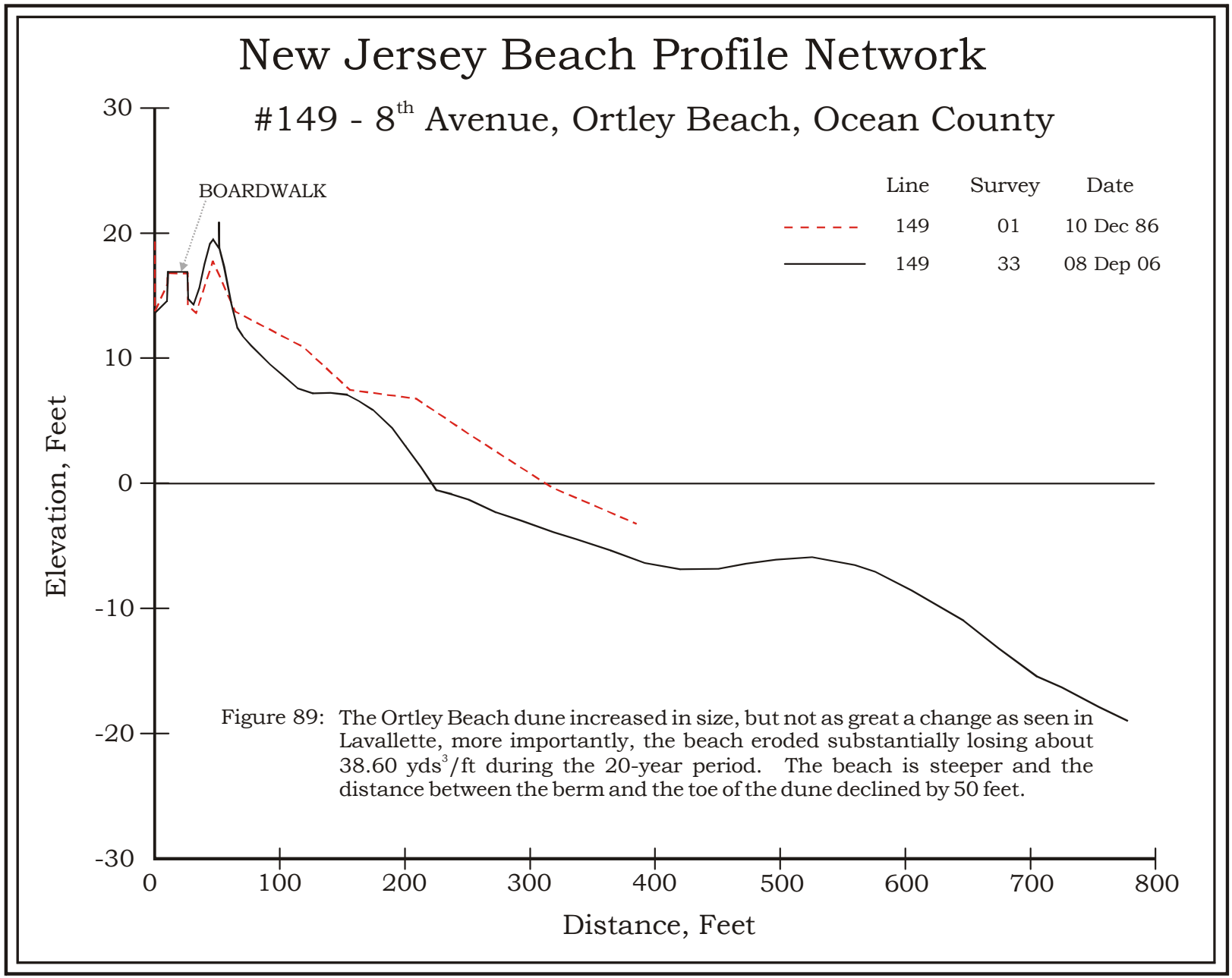


Figure 89: The Ortley Beach dune increased in size, but not as great a change as seen in Lavallette, more importantly, the beach eroded substantially losing about 38.60 yds^3/ft during the 20-year period. The beach is steeper and the distance between the berm and the toe of the dune declined by 50 feet.

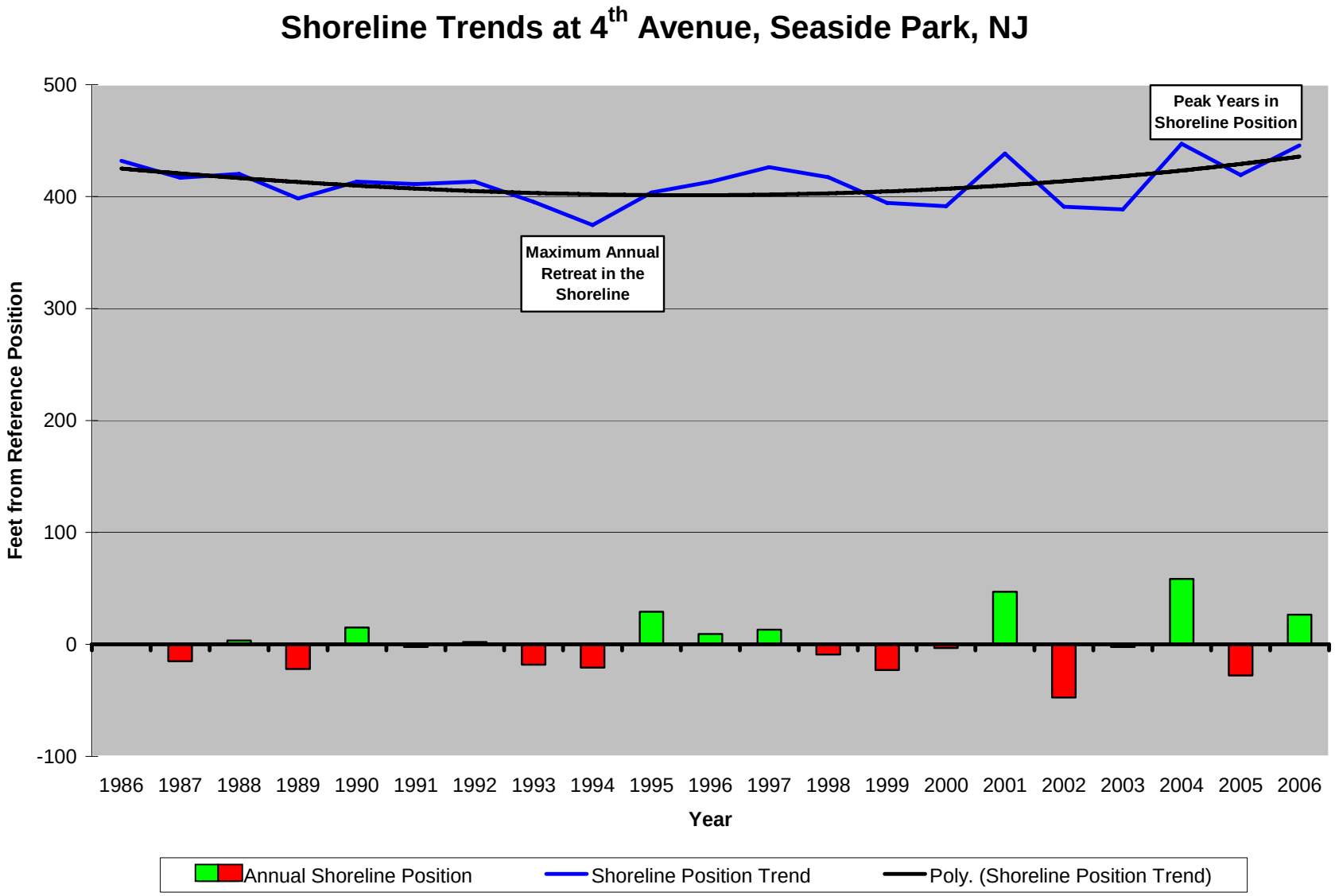


Figure 90 – Site 148. The shoreline trend was positive at Seaside Park with a modest advance in shoreline position over 20 years. The annual variation was relatively small leading up to 2006. The dune system has flourished with the wider beaches and stable shoreline.

20-Year Comparison Photographs – Site 148, 4th Avenue, Seaside Park
This 2006 view (right) across the dune from the crest shows the beach and expanse of the dune system that comprise the Seaside Park beach. As the cross section shows, the dune crest is twice as high 20 years later and the beach elevation and width has improved the storm protection situation significantly for the boardwalk, public infrastructure and oceanfront properties. The view of the ocean from the boardwalk was obstructed in 2006, however, the photograph from 1989 (left) shows that this was not always the case.

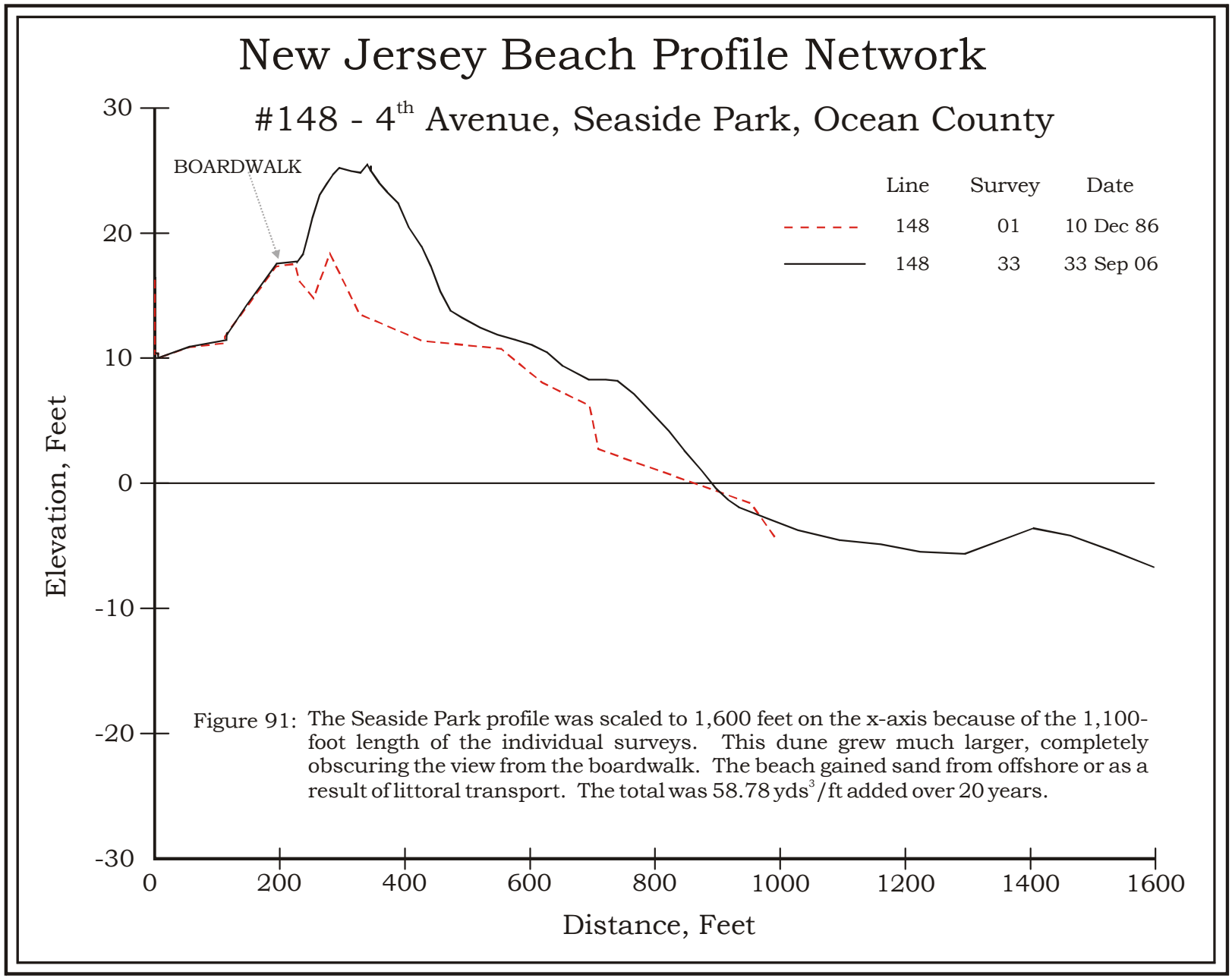


Figure 91: The Seaside Park profile was scaled to 1,600 feet on the x-axis because of the 1,100-foot length of the individual surveys. This dune grew much larger, completely obscuring the view from the boardwalk. The beach gained sand from offshore or as a result of littoral transport. The total was 58.78 yds^3/ft added over 20 years.

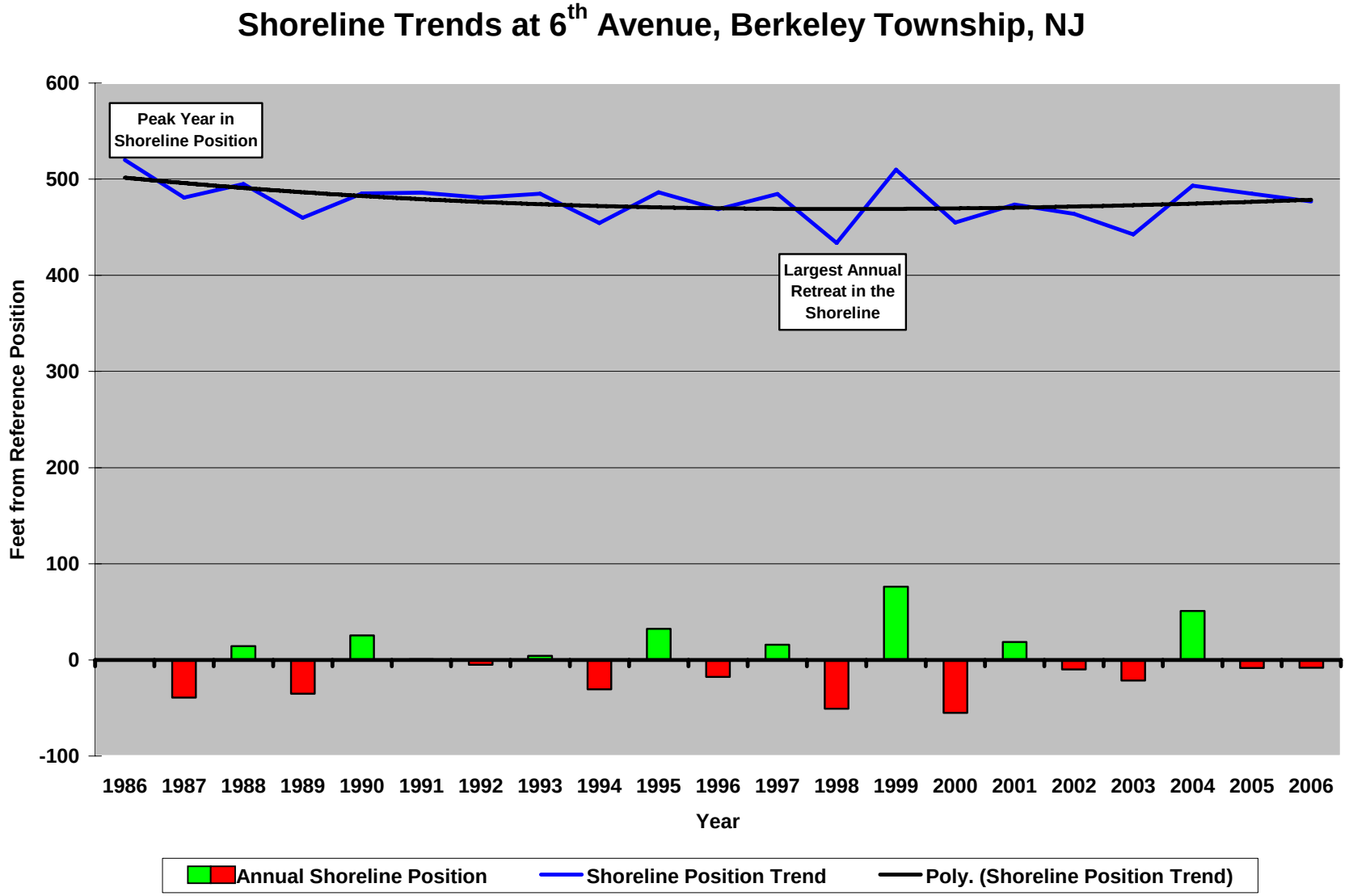


Figure 92 – Site 347. The Berkeley Township site has maintained a relatively constant shoreline position with a very slow retreat in the 20-year trend. The largest annual change occurred between two years (1998 and 1999). The profile was shifted slightly during the fall

2005 survey in effort to better capture the proper dune configuration. Prior to 2005, this site was know at Site #147, it is now referred to as Site #347.

20-Year Comparison Photographs – Site 347, 6th Avenue, Midway Beach
The view to the north from the dune crest at 6th Avenue in Berkeley Township shows the gap in the dune for the access path and the beach when the berm was relatively wide at the end of the summer of 2006 (right). The 1986 survey line ran down the center of the access path causing the site to be shifted south several feet to include the dune that had been developed on site. This comparison is evident in the cross section below. The picture on the left was taken in 1989.

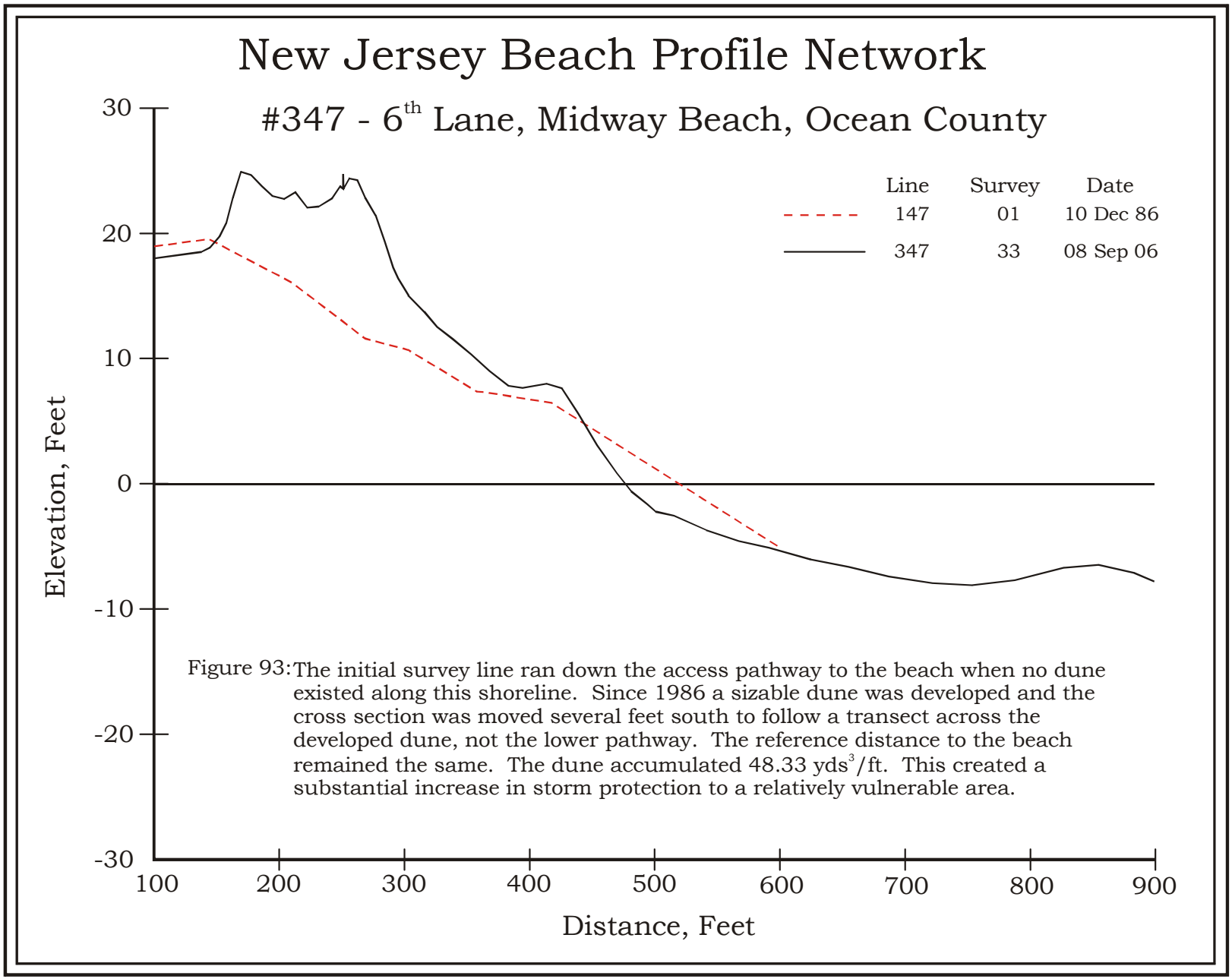


Figure 93: The initial survey line ran down the access pathway to the beach when no dune existed along this shoreline. Since 1986 a sizable dune was developed and the cross section was moved several feet south to follow a transect across the developed dune, not the lower pathway. The reference distance to the beach remained the same. The dune accumulated 48.33 yds^3/ft. This created a substantial increase in storm protection to a relatively vulnerable area.

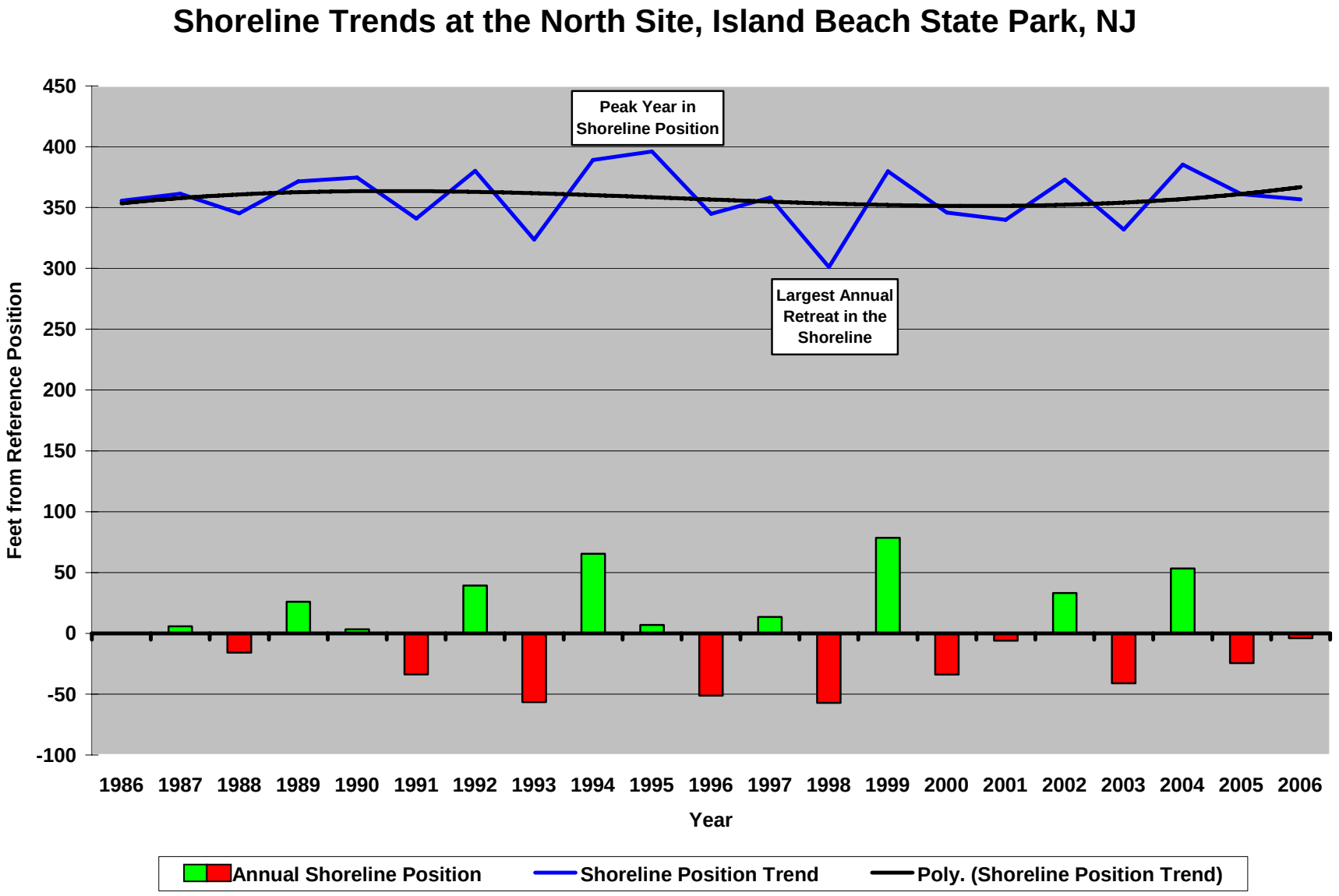


Figure 94 – Site 247. This site, along with sites #246 and #146 are within the Island Beach State Park and cover a totally natural dune/beach system. The trend was modestly positive with a 15-foot shoreline advance over 20 years.

20-Year Comparison Photographs – Site 247, Northernmost Profile, Island Beach State Park
A major shift in dune position occurred during this study interval. An isolated storm breach in the dune system after the December 1992 northeast storm and wind deflation on the backside of the dune present in 1989 (left) caused the dune crest to incrementally shift seaward to its present location by 2006 (left).

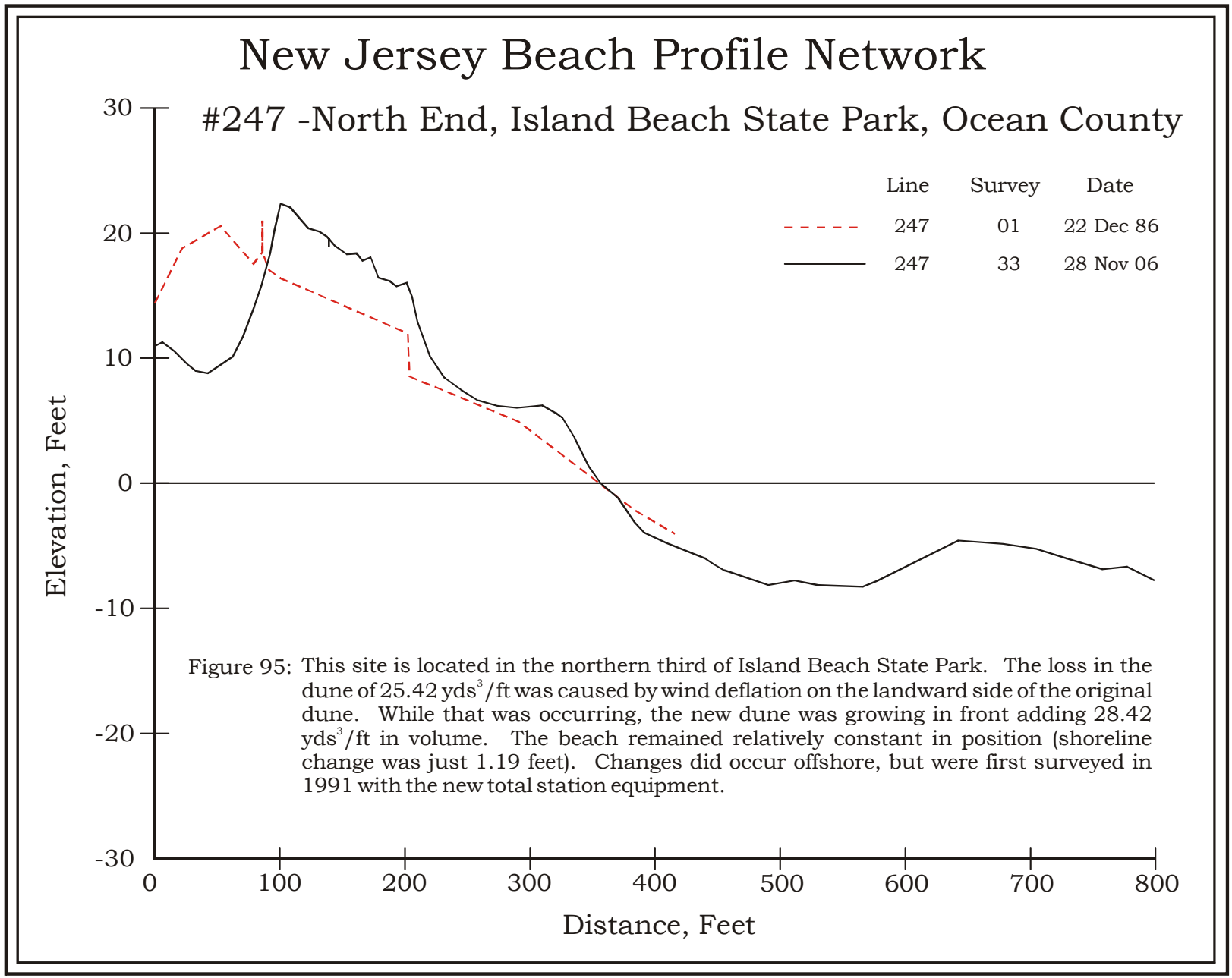


Figure 95: This site is located in the northern third of Island Beach State Park. The loss in the dune of 25.42 yds^3/ft was caused by wind deflation on the landward side of the original dune. While that was occurring, the new dune was growing in front adding 28.42 yds^3/ft in volume. The beach remained relatively constant in position (shoreline change was just 1.19 feet). Changes did occur offshore, but were first surveyed in 1991 with the new total station equipment.

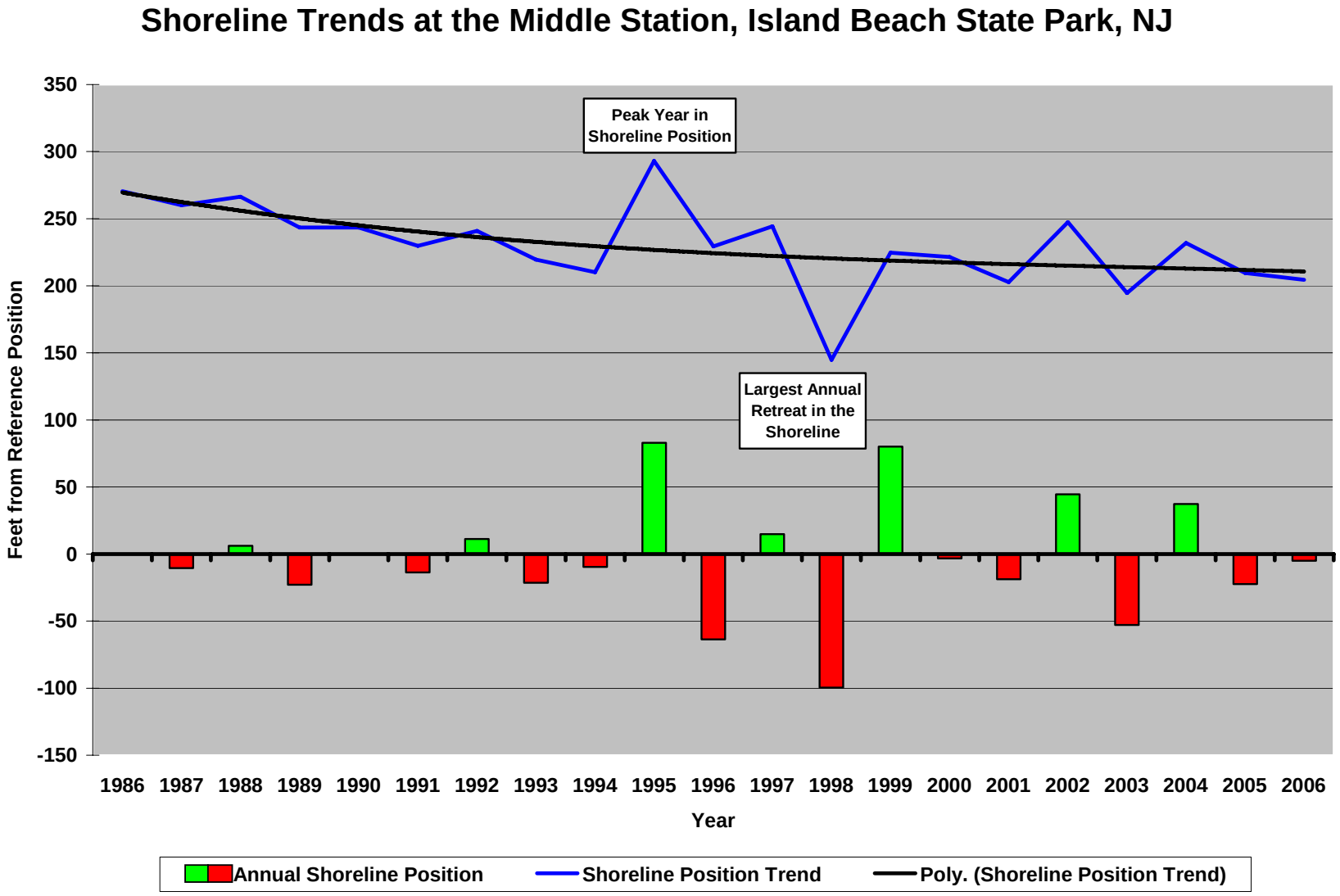


Figure 96 – Site 246. This profile site incurred marginal gains and losses until 1994 when more drastic changes began to occur. The largest losses were seen in 1996 and 1998 while the largest gains were seen in 1995 and 1999. Overall, this profile saw a shoreline retreat by the end of the 20-year study interval.

20-Year Comparison Photographs – Site 246, Middle Profile in Island Beach State Park
By 2006 the dune had grown significantly in size while the beach suffered minor losses. The photographs above were taken in 1995 (left) and 2006 (right). The vegetation growth line seen in the 1995 photo marks the location of the vertical scarp line left after the powerful 1991 and 1992 northeast storms eroded the seaward dune slope and caused the dune to retreat. Fencing installed after theses events, visible in 1995, have been buried as the foredune developed seaward restoring much of the seaward slope losses. Aeolian processes have transported a substantial amount of sand over the dune crest and landward slope raising the dune elevation several feet. The current beach width is marginal for supporting further seaward advancement of the dune system as storm wave run up can easily reach the dune toe causing erosion and damage that removed portions of the lower fence line seen in the 2006 photo.

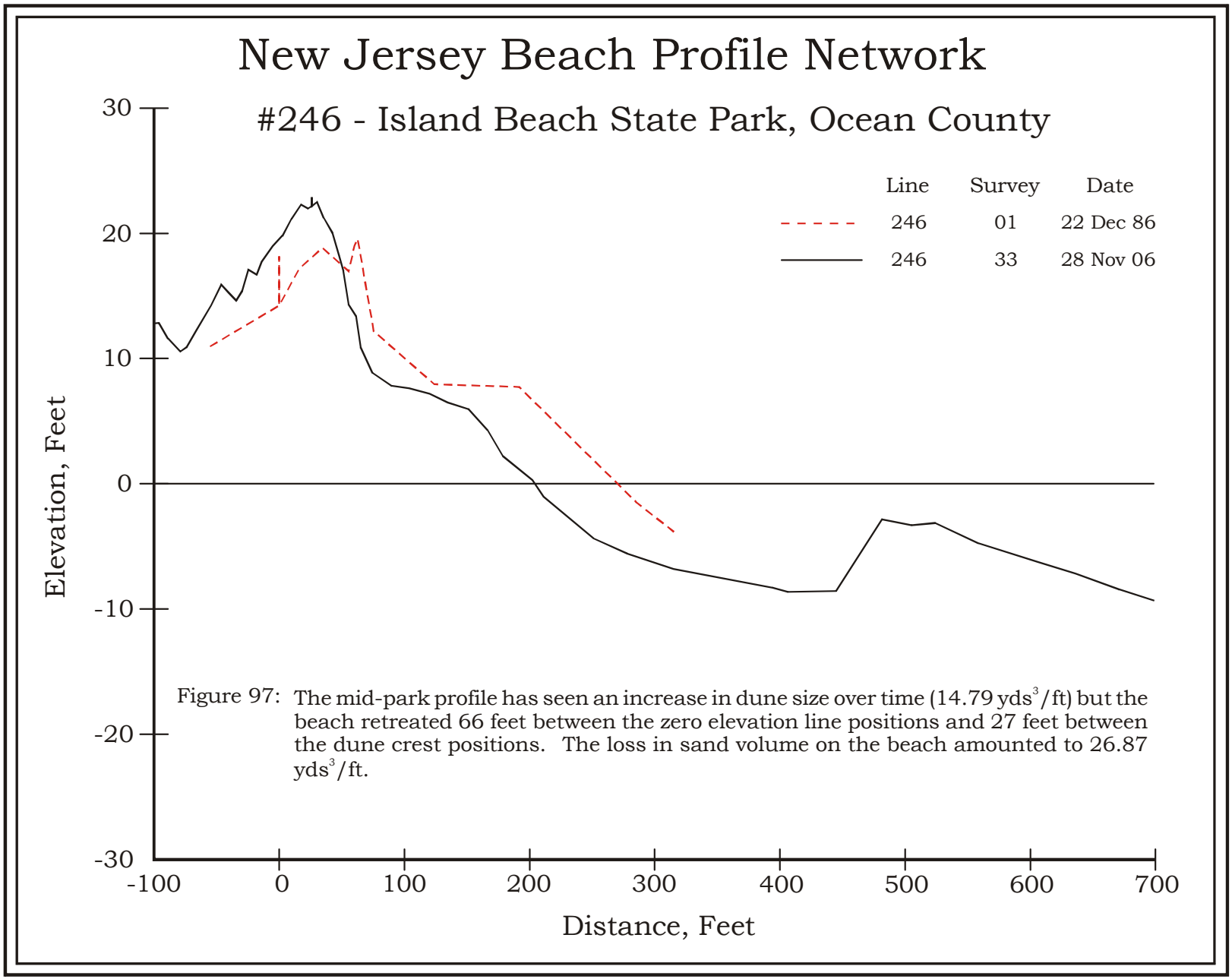


Figure 97: The mid-park profile has seen an increase in dune size over time (14.79 yds^3/ft) but the beach retreated 66 feet between the zero elevation line positions and 27 feet between the dune crest positions. The loss in sand volume on the beach amounted to 26.87 yds^3/ft.

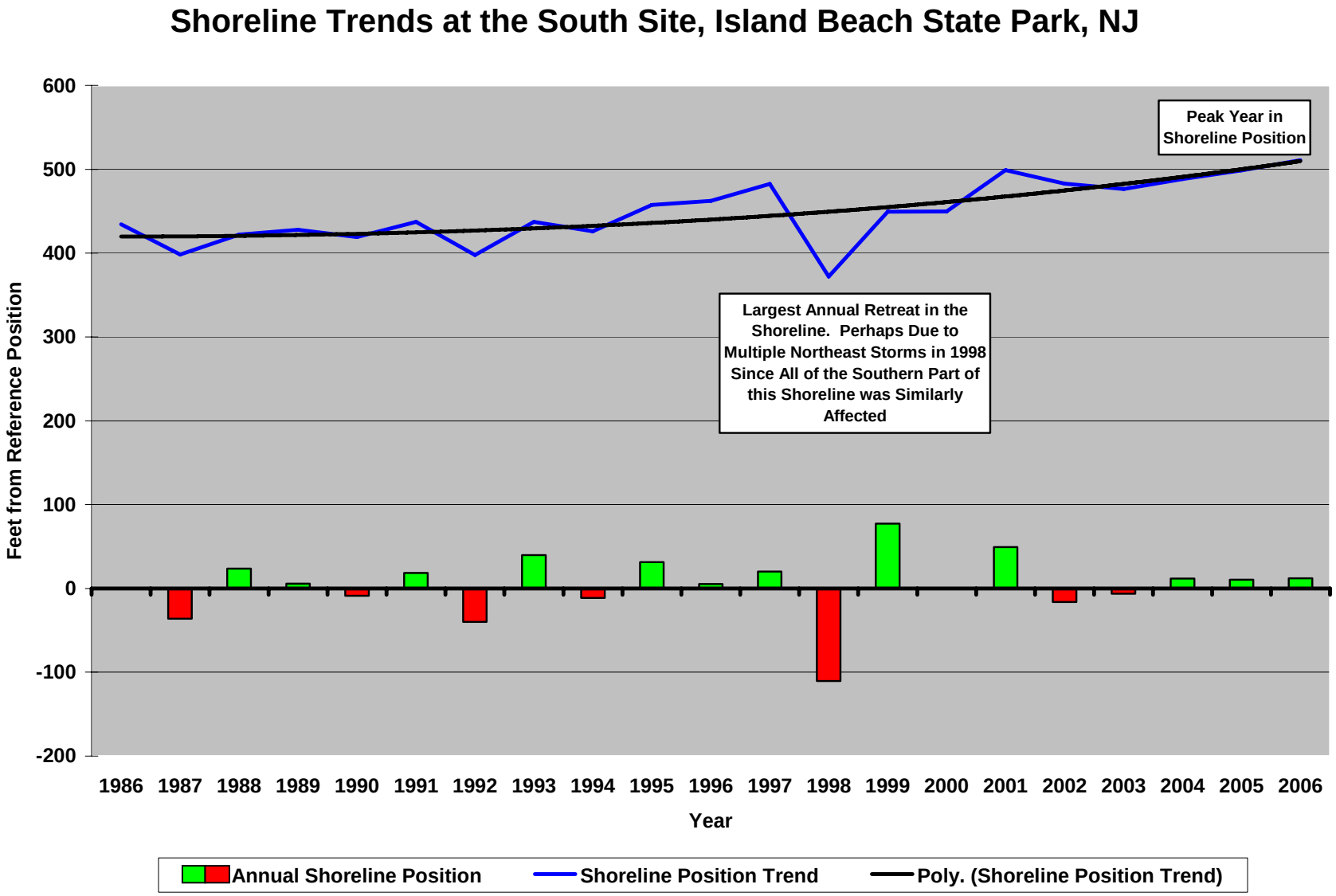


Figure 98 – Site 146. The south site of the State Park beach saw shoreline advance during the 20-year interval. The trend was one of gradual advance in the shoreline position with a broad growth in a new foredune that almost equals the original dune in size and height.

20-Year Comparison Photographs – Site 146, Southernmost Site, Island Beach State Park
The 2006 photograph on the right shows the wide foredune slope that has accumulated since 1986. The extent and scope of the accretion can be seen in the cross section plot shown below. The 109.17 yds^3/ft of sand volume was added to the beach most likely due to trapping of the sand by the north jetty of Barnegat Inlet. This is the last site south before the inlet, located about a half mile north of the jetty. The additional sand volume produced the shoreline position advance, increasing the beach width, which allowed the dune growth to continue unimpeded by wave run up. The picture on the left shows the conditions of the beaches during the 1989 survey.

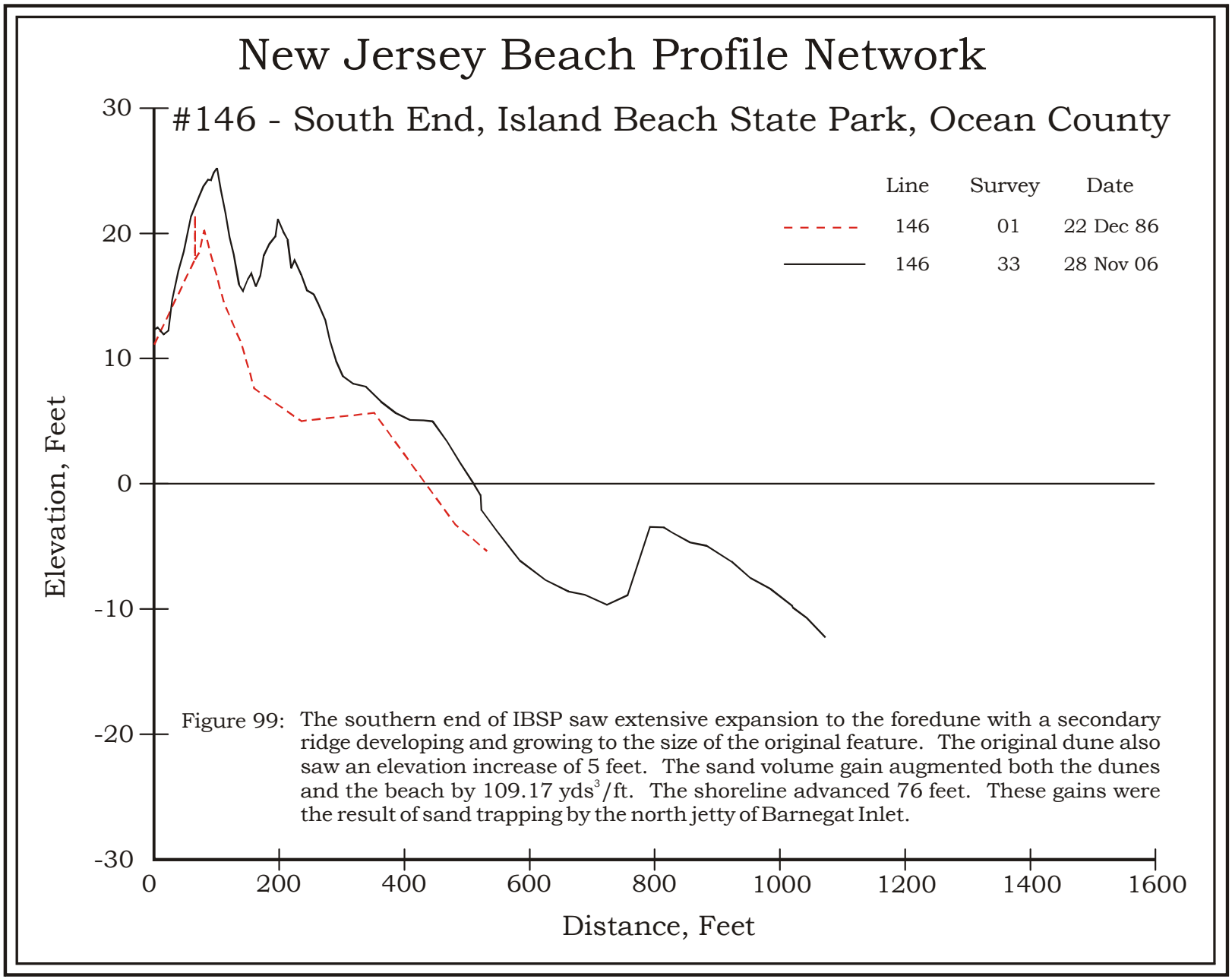


Figure 99: The southern end of IBSP saw extensive expansion to the foredune with a secondary ridge developing and growing to the size of the original feature. The original dune also saw an elevation increase of 5 feet. The sand volume gain augmented both the dunes and the beach by 109.17 yds^3/ft. The shoreline advanced 76 feet. These gains were the result of sand trapping by the north jetty of Barnegat Inlet.

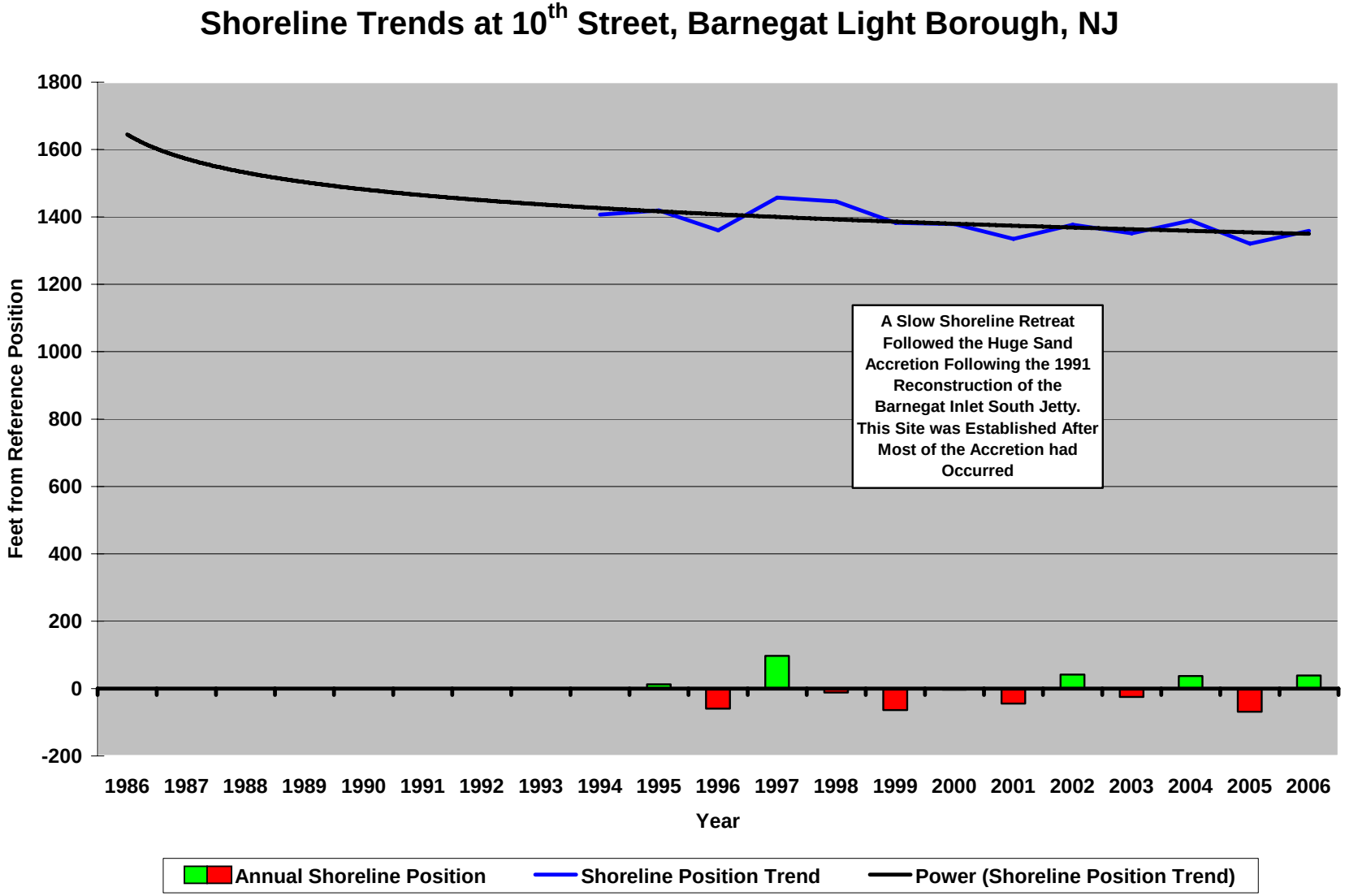


Figure 100 – Site 245. This site was established in 1994 to follow changes associated with Barnegat Inlet, the trend does not show the huge gains achieved prior to 1994. Since then, the trend has been relatively flat with a slow retreat in the shoreline position. Due to the sheltered nature of the site from northeast storm waves, the annual changes are rather small in magnitude.

20-Year Comparison Photographs – Site 245, 10th Street, Barnegat Light

Viewing the northernmost Long Beach Island profile location at 10th Street in Barnegat Light Borough requires aerial photography because of the shear size of the changes related to changing the south jetty to Barnegat Inlet from 1988 to 1991. This huge project by the US Army Corps of Engineers realigned the south jetty from an angled position starting at 8th Street in the Borough to a parallel orientation to the north jetty starting at Barnegat Lighthouse. The left photograph was taken in 1982 prior to any construction. The new jetty was built along the red alignment without removal of the old south jetty. The parallelism was designed to reduce the extensive shoaling and meandering of the main channel that caused frequent fatal boating accidents along with a need for repetitive dredging. The right photograph was taken in 2003 and shows the vast deposit of ebb-tidal delta sand seen along the lower edge of the left photo and the transfer of sand north along the shoreline to the new jetty. The old jetty shows in the water as a trace in the 2003 view extending back to the old shoreline. Vegetation growth is changing the region into a maritime forest and providing phenomenal storm protection for the homes exposed to erosion in 1982, but it has effectively removed some of the economic value attributable to a waterfront home.

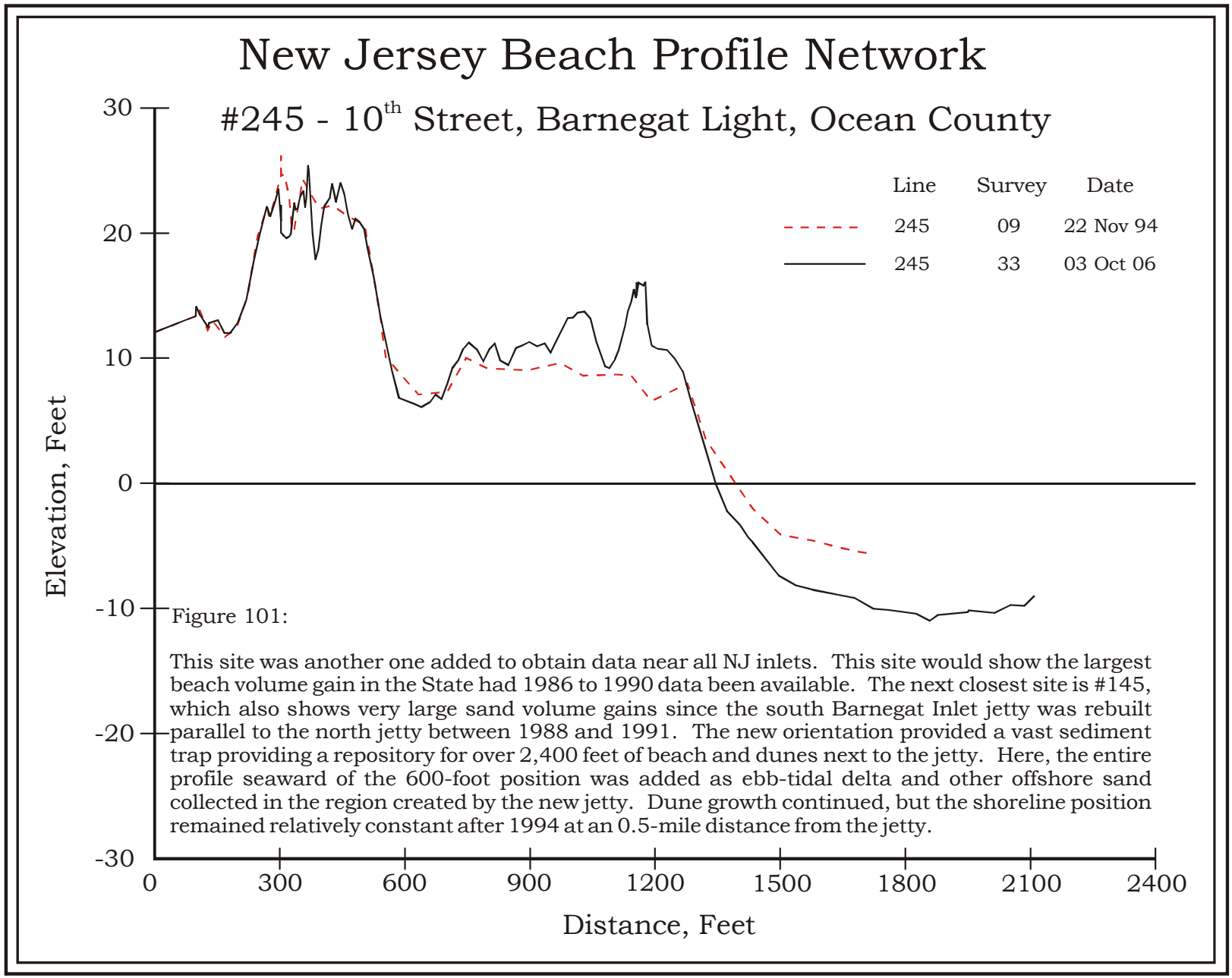


Figure 101:

This site was another one added to obtain data near all NJ inlets. This site would show the largest beach volume gain in the State had 1986 to 1990 data been available. The next closest site is #145, which also shows very large sand volume gains since the south Barnegat Inlet jetty was rebuilt parallel to the north jetty between 1988 and 1991. The new orientation provided a vast sediment trap providing a repository for over 2,400 feet of beach and dunes next to the jetty. Here, the entire profile seaward of the 600-foot position was added as ebb-tidal delta and other offshore sand collected in the region created by the new jetty. Dune growth continued, but the shoreline position remained relatively constant after 1994 at an 0.5-mile distance from the jetty.

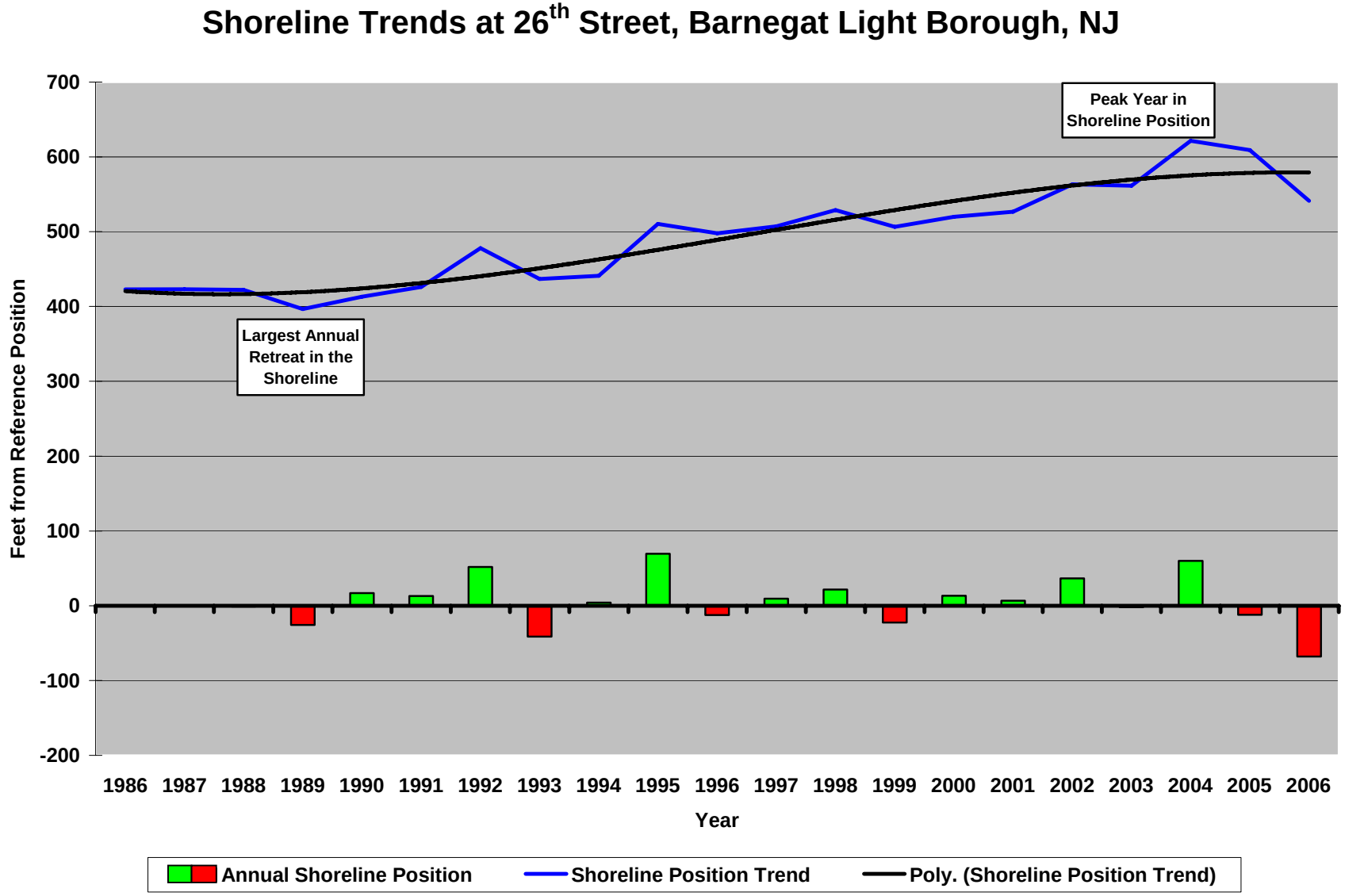


Figure 102 – Site 145. This profile was the closest to Barnegat Inlet in 1986 and reflects the advance in shoreline position that started in 1990. Some retreat began in 2005 and 2006, but this site has the second largest increase in shoreline position and beach volume along

Long Beach Island. There were few large annual changes in the shoreline position due to the jetty sheltering effect discussed in the previous Figure (100 and 101) descriptions.

20-Year Comparison Photographs – Site 145, 26th Street, Barnegat Light

The photograph on the right (taken in 2006) shows a view to the south that illustrates the huge expanse of dune that developed as the shoreline advanced when sand was transferred north along and onto the beach from offshore. The magnitude shows in the cross section below as the dune crest moved almost a hundred feet seaward and supported a berm on portions of the 1986 profile that was offshore in 2 feet of water at that time. The picture on the left was taken during the 1989 survey. The alteration in location of the south rock jetty to Barnegat Inlet produced the largest sand accumulation seen along the NJ shoreline in the past 20 years.

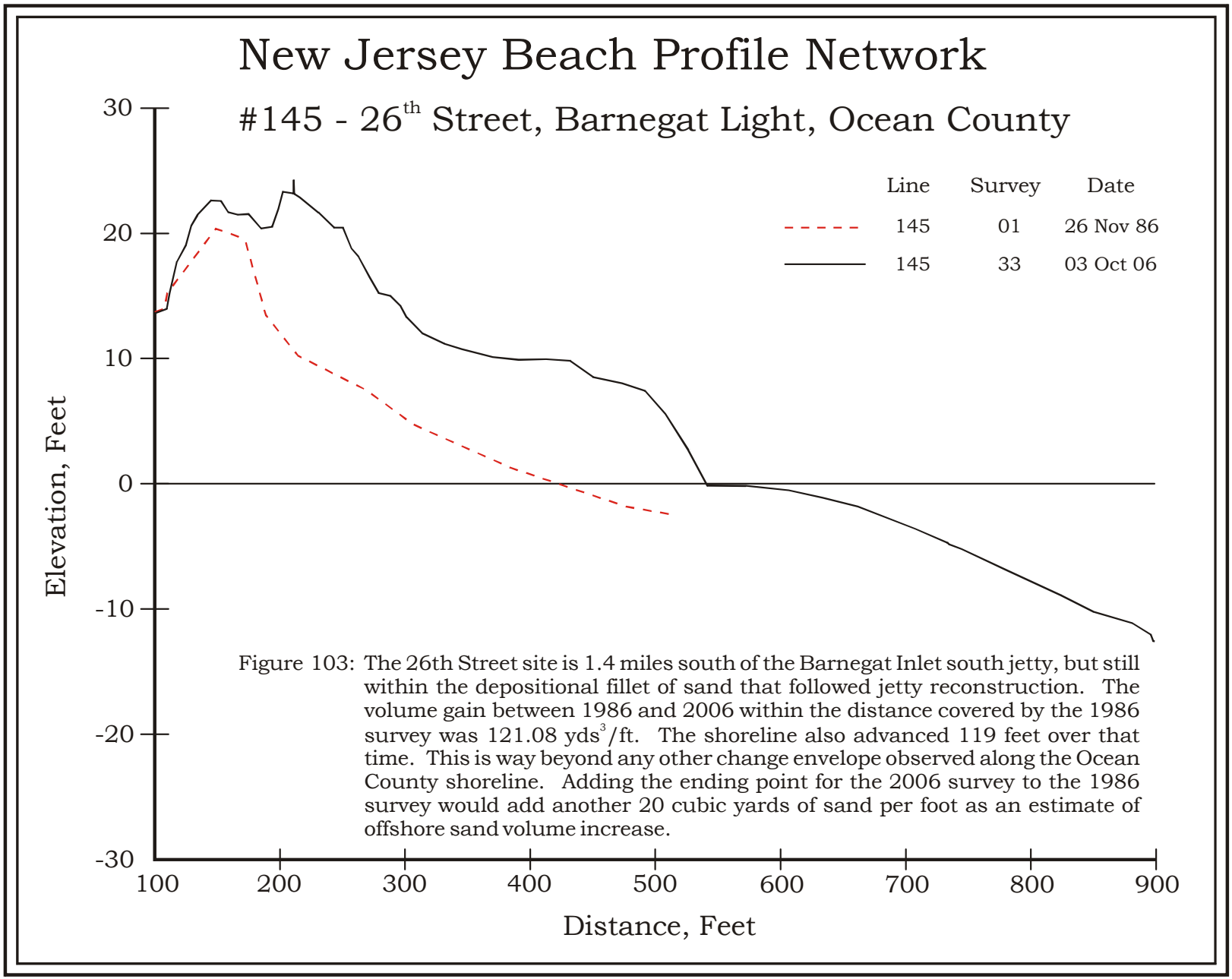


Figure 103: The 26th Street site is 1.4 miles south of the Barnegat Inlet south jetty, but still within the depositional fillet of sand that followed jetty reconstruction. The volume gain between 1986 and 2006 within the distance covered by the 1986 survey was 121.08 yds^3/ft. The shoreline also advanced 119 feet over that time. This is way beyond any other change envelope observed along the Ocean County shoreline. Adding the ending point for the 2006 survey to the 1986 survey would add another 20 cubic yards of sand per foot as an estimate of offshore sand volume increase.

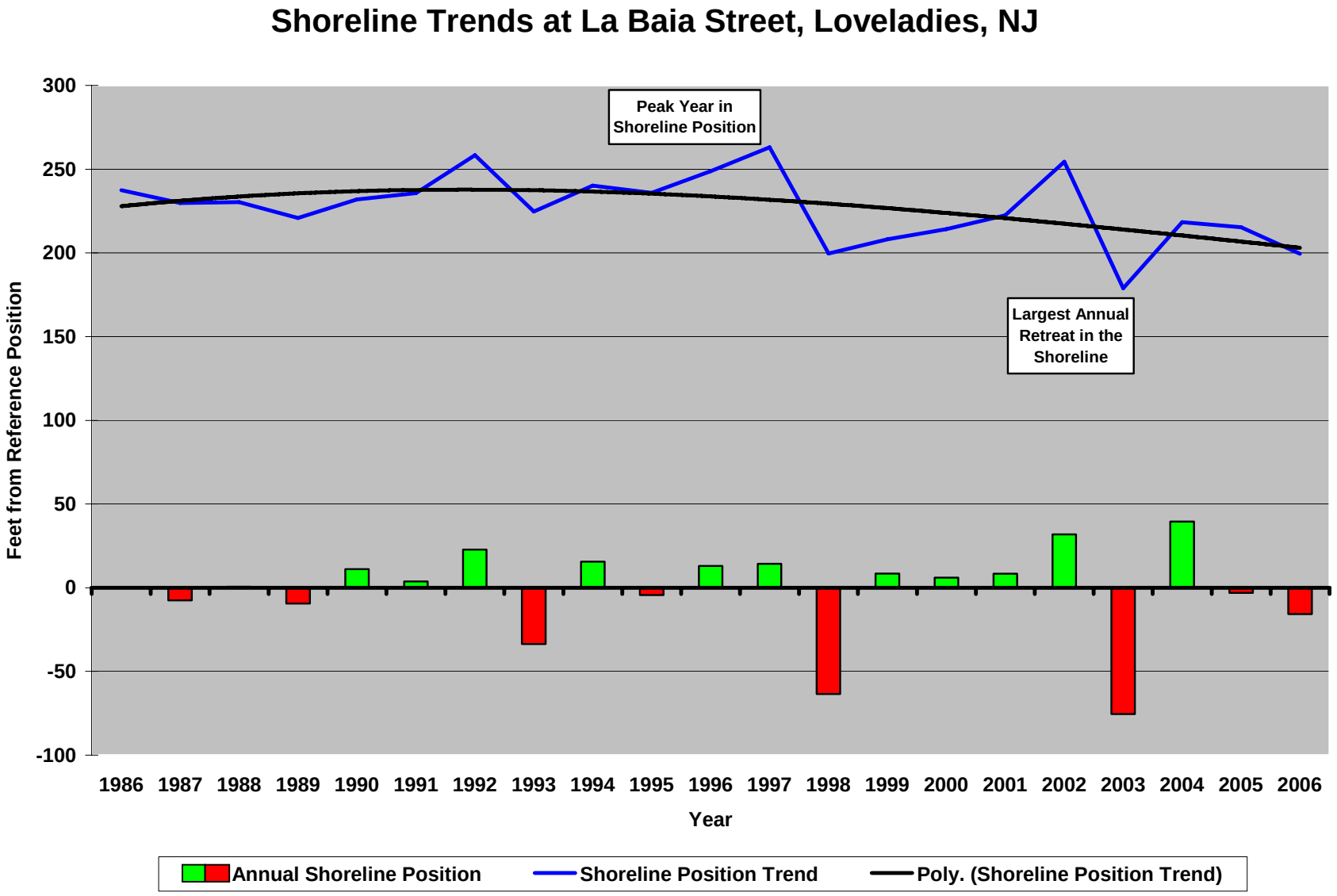


Figure 104 – Site 144. South in Loveladies, the shoreline trend was one of retreat as the large scale picture of the northern end of Long Beach Island adjusted to the new inlet jetty location. The large deposit produced a broad, curved shoreline retreat for a mile or so south of

the neutral point between deposition to the north and erosion to the south. Here the shoreline retreated by 40 feet, an amount guaranteed to cause significant problems to this shoreline's storm resistance.

20-Year Comparison Photographs – Site 144, La Baia Street,
Site 144 did not directly receive sand from a State-sponsored truck-in fill completed in 1995, but material did migrate north along this beach. 465,000 cubic yards of mainland quarry sand was hauled over 18 months to beaches between Loveladies and Harvey Cedars. Redistribution has spread this material along the oceanfront across multiple times the distance of initial placement. Note the retreat in both the berm crest and dune seaward slope generated by the shift in regional shoreline configuration. The photographs above were taken in 1991 (left) and 2006 (right).

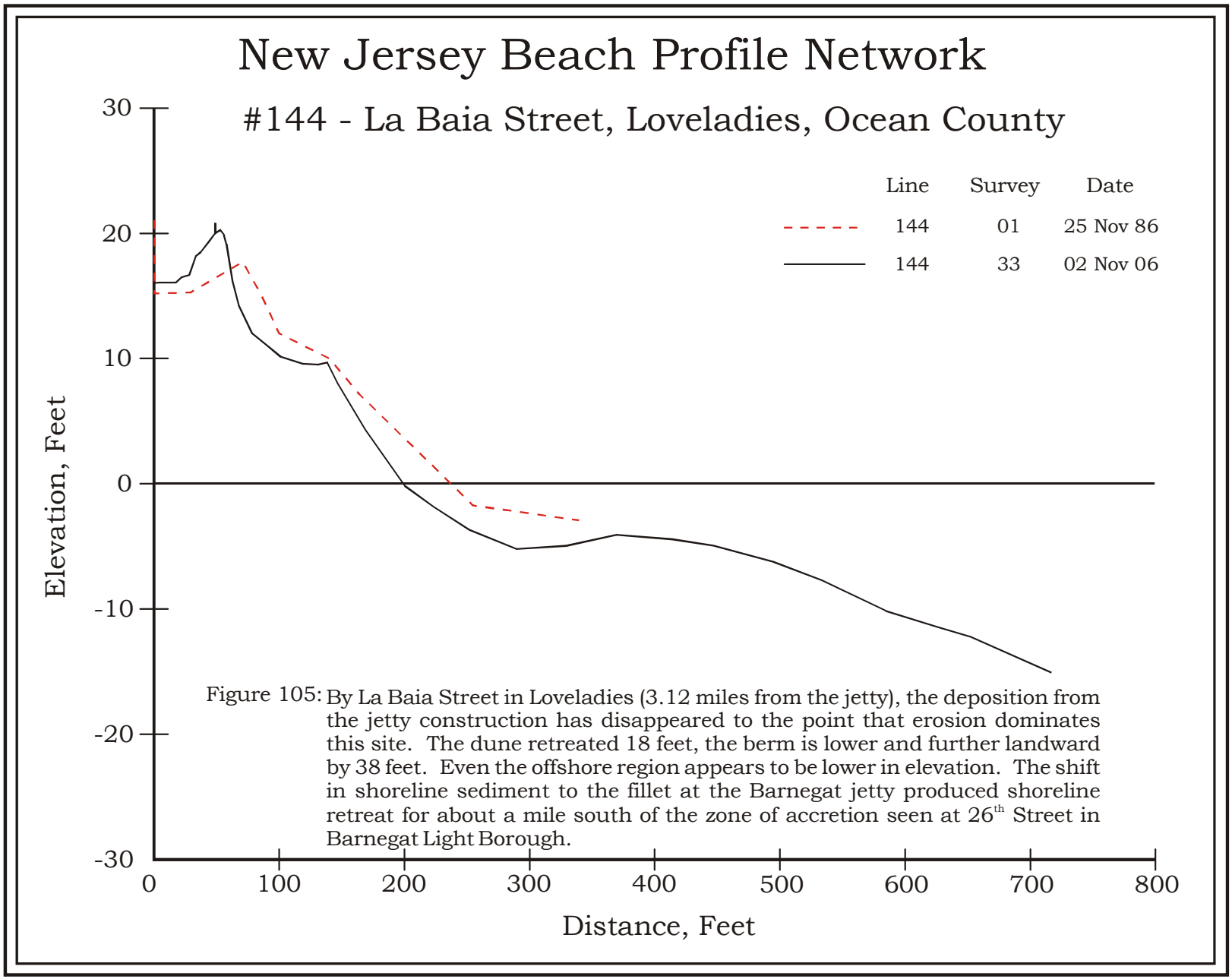


Figure 105: By La Baia Street in Loveladies (3.12 miles from the jetty), the deposition from the jetty construction has disappeared to the point that erosion dominates this site. The dune retreated 18 feet, the berm is lower and further landward by 38 feet. Even the offshore region appears to be lower in elevation. The shift in shoreline sediment to the fillet at the Barnegat jetty produced shoreline retreat for about a mile south of the zone of accretion seen at 26th Street in Barnegat Light Borough.

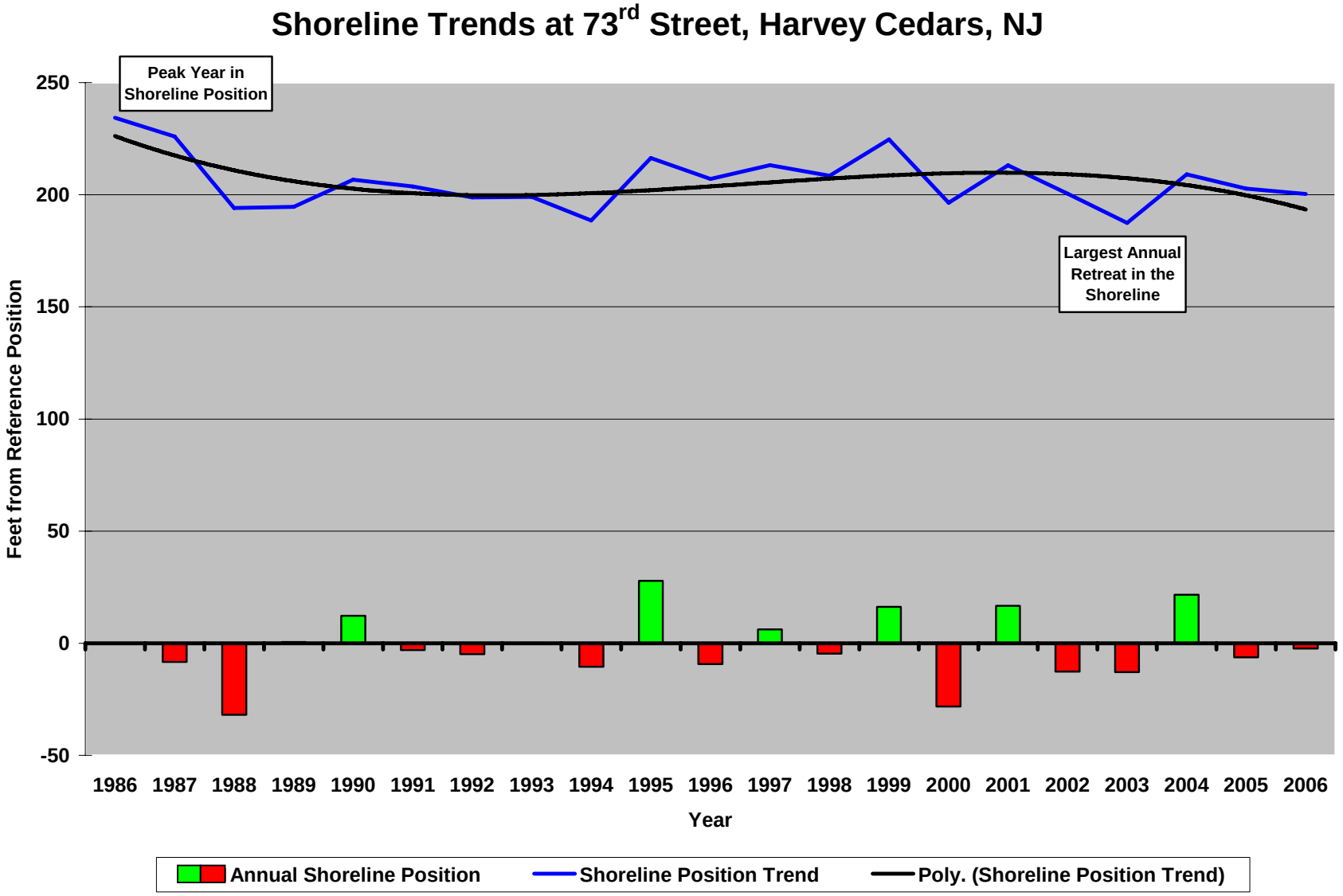


Figure 106 – Site 143. In spite of the impact of 465,000 cubic yards of sand added to the beach in 1994 -95 during a state and local sponsored project, the shoreline position at this site retreated approximately 50 feet over the 20-year period. The advance produced by the

beach nourishment project shows in the 1995 survey and is maintained until 2000 when erosion pushed the shoreline position back nearly to that present in 1994. By 2006 the majority of the positive impact from the project was gone, which is not to impugn the value of the effort because had it not been done, the shoreline may have been 40 feet further landward precariously exposing dune system, shorefront infrastructure and property to storm damage.

20-Year Comparison Photographs – Site 143, 73rd Street, Harvey Cedars

The photographs above were taken in 1991 (left) and 2006 (right). This view toward the north shows the dramatic reduction in dune width between site 145 and the two just to the south. The beach is relatively wide in this fall 2006 photograph as summer accretion was still in place. The dune's seaward slope has retreated about 20 feet since 1986 along with the zero elevation position.

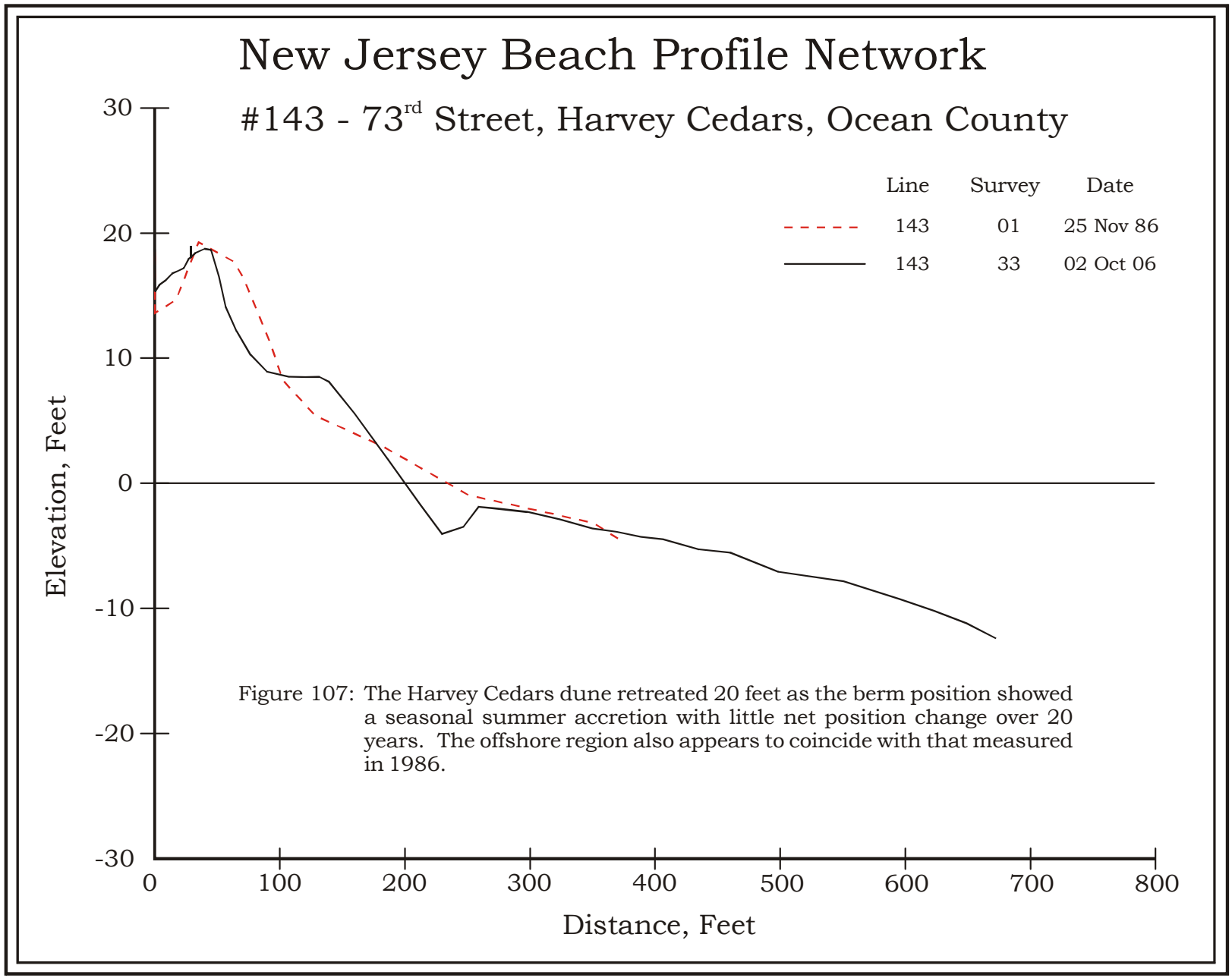


Figure 107: The Harvey Cedars dune retreated 20 feet as the berm position showed a seasonal summer accretion with little net position change over 20 years. The offshore region also appears to coincide with that measured in 1986.

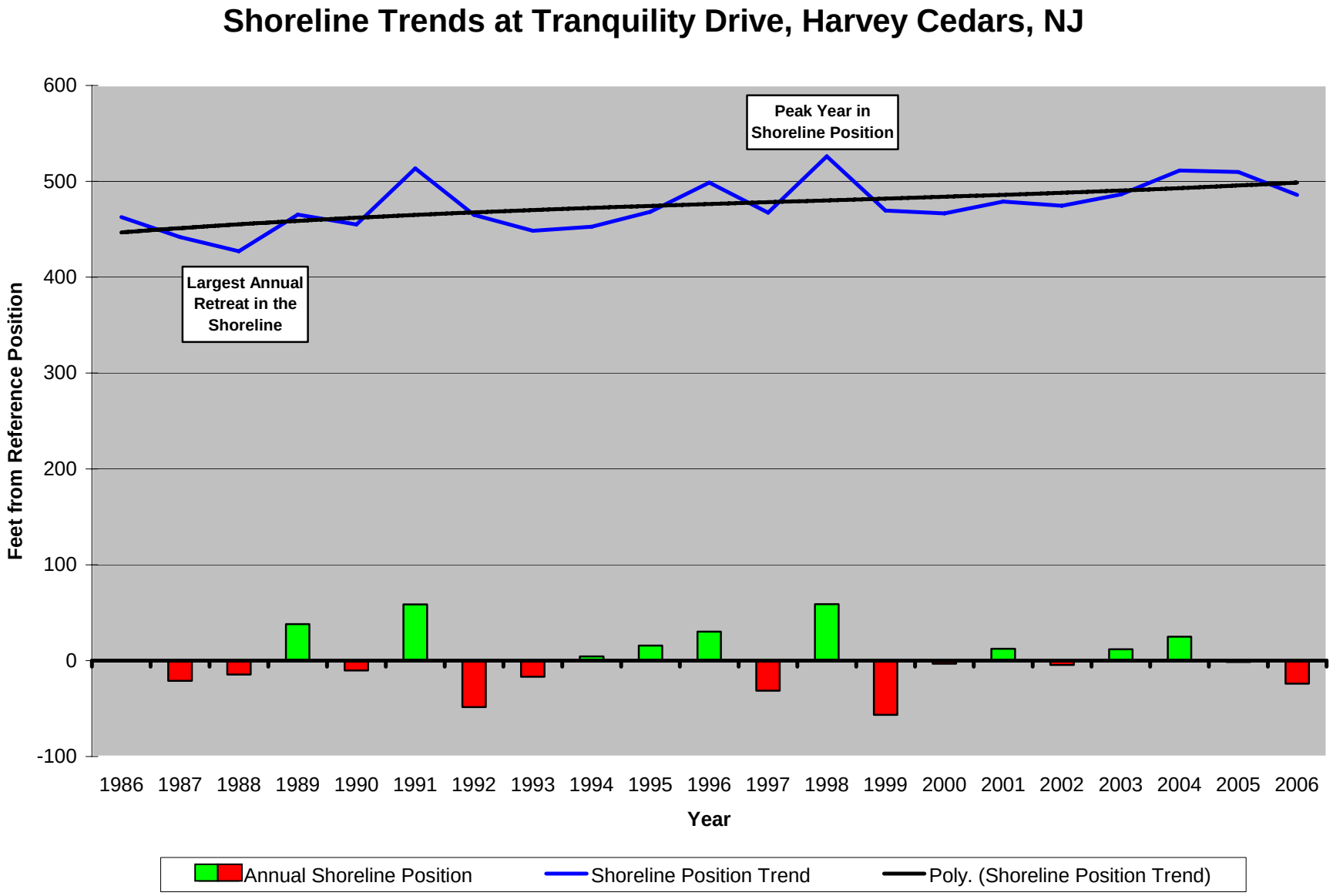


Figure 108 – Site 142. The negative shoreline trend reversed at Tranquility Drive with approximately 50 feet of advance in 20 years.

20-Year Comparison Photographs – Site 142, Tranquility Drive, Harvey Cedars

This dune contains about twice the sand volume it had in 1986. This site is south of the inlet dynamics that dominate regional changes along the Long Beach Island shoreline sites to the north (both positively and negatively). The beach elevation is much higher and the dune system is growing as a result of sand accumulation both from natural processes and enhanced by the 1994 state and local beach nourishment project. The photographs above were taken 1991 (left) and 2006 (right).

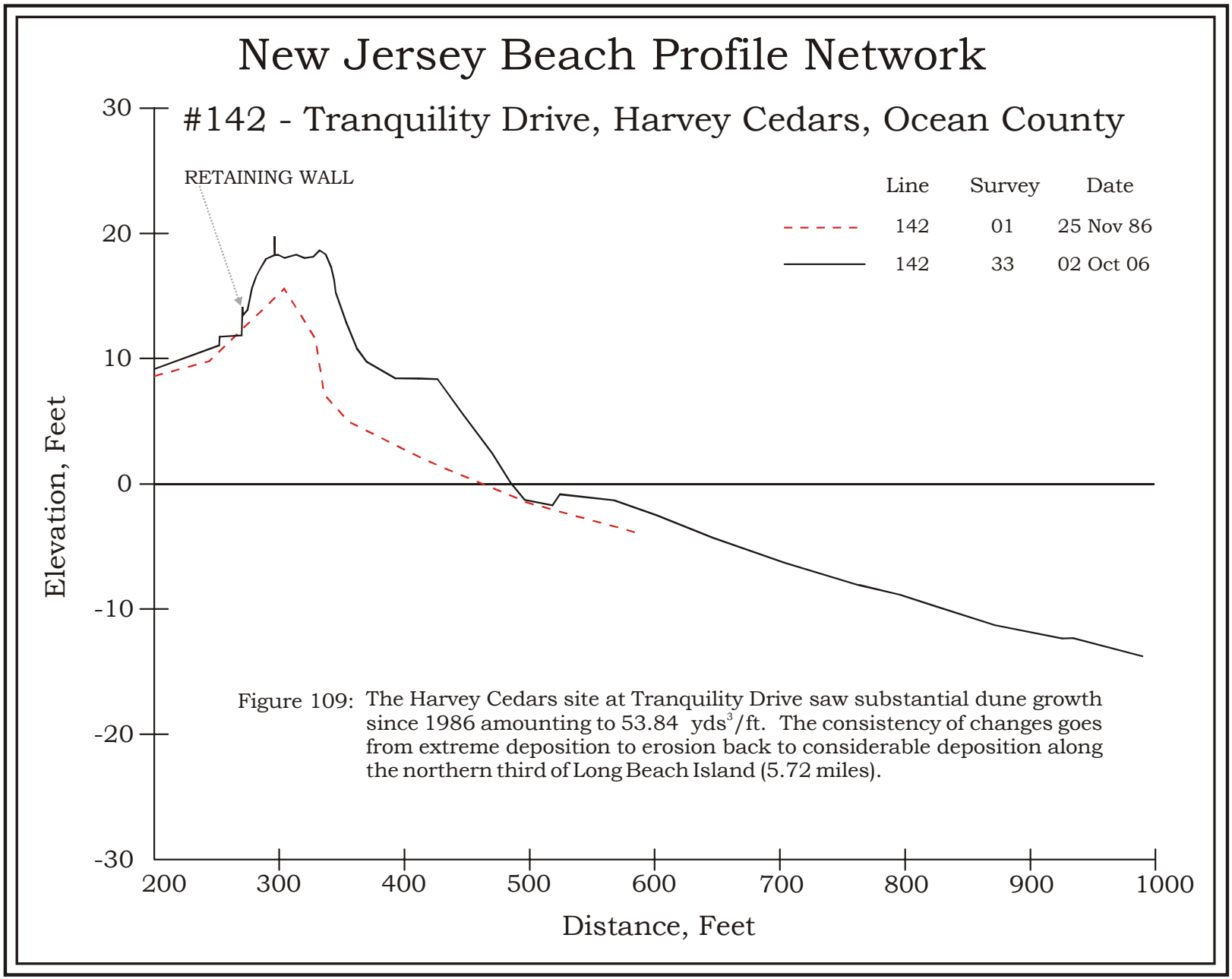


Figure 109: The Harvey Cedars site at Tranquility Drive saw substantial dune growth since 1986 amounting to 53.84 yds^3/ft. The consistency of changes goes from extreme deposition to erosion back to considerable deposition along the northern third of Long Beach Island (5.72 miles).

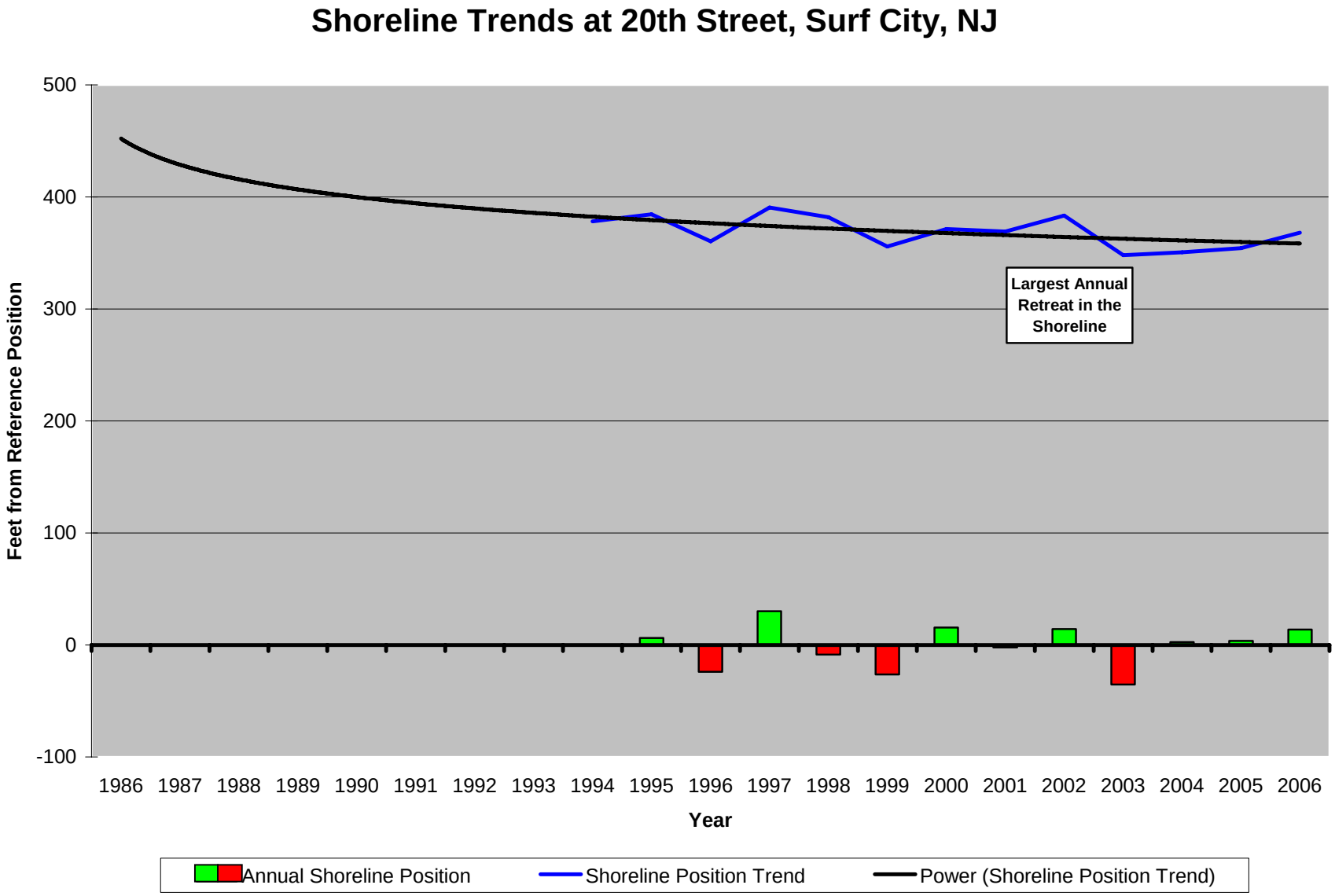


Figure 110 – Site 241. This profile was established to fill a gap in the data collection along the island; this site saw a minor retreat over the 13 years of study. The shoreline position trend was progressively negative. The 2007 ACOE project is not shown in the trend analysis.

20-Year Comparison Photographs – Site 241, 20th Street, Surf City

This site was established in 1994 to fill a gap in municipality coverage on Long Beach Island. The beach width in the 1995 photo (left) reflects summer accretion and there is plenty of sand on the beach with a healthy dune system. The beach width is slightly narrower in the 2006 photo, allowing wave run up to reach the dune toe. The orange tinted sand seen on the seaward dune slope combined with the absence of dune fencing and plants are evidence of recent storm damage erosion. The practice of bulldozing beach sand back up to the scarp is regularly used to repair the dune. The cross section shows modest dune crest deposition and loss in beach width prior to the 2007 ACOE beach nourishment project.

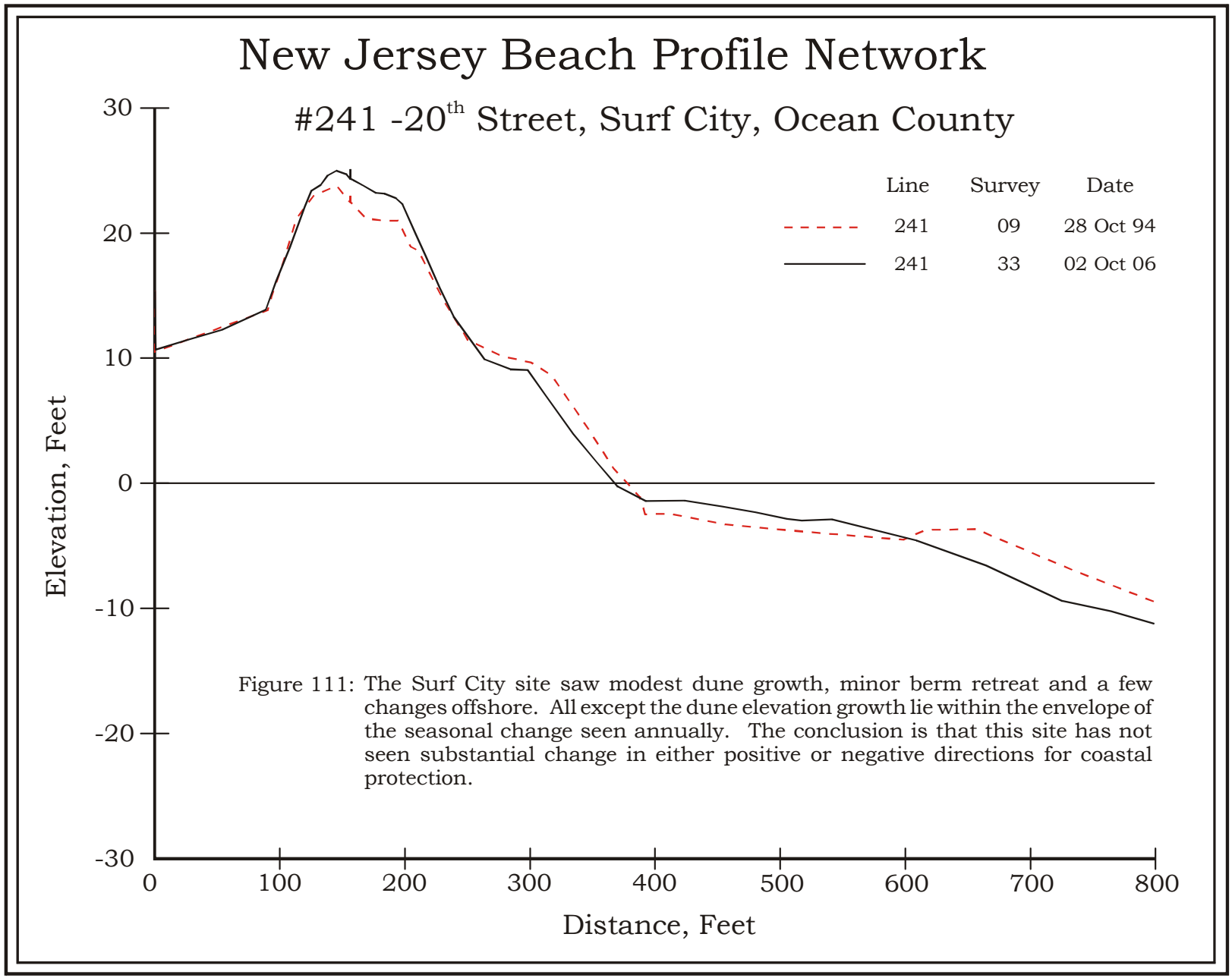


Figure 111: The Surf City site saw modest dune growth, minor berm retreat and a few changes offshore. All except the dune elevation growth lie within the envelope of the seasonal change seen annually. The conclusion is that this site has not seen substantial change in either positive or negative directions for coastal protection.

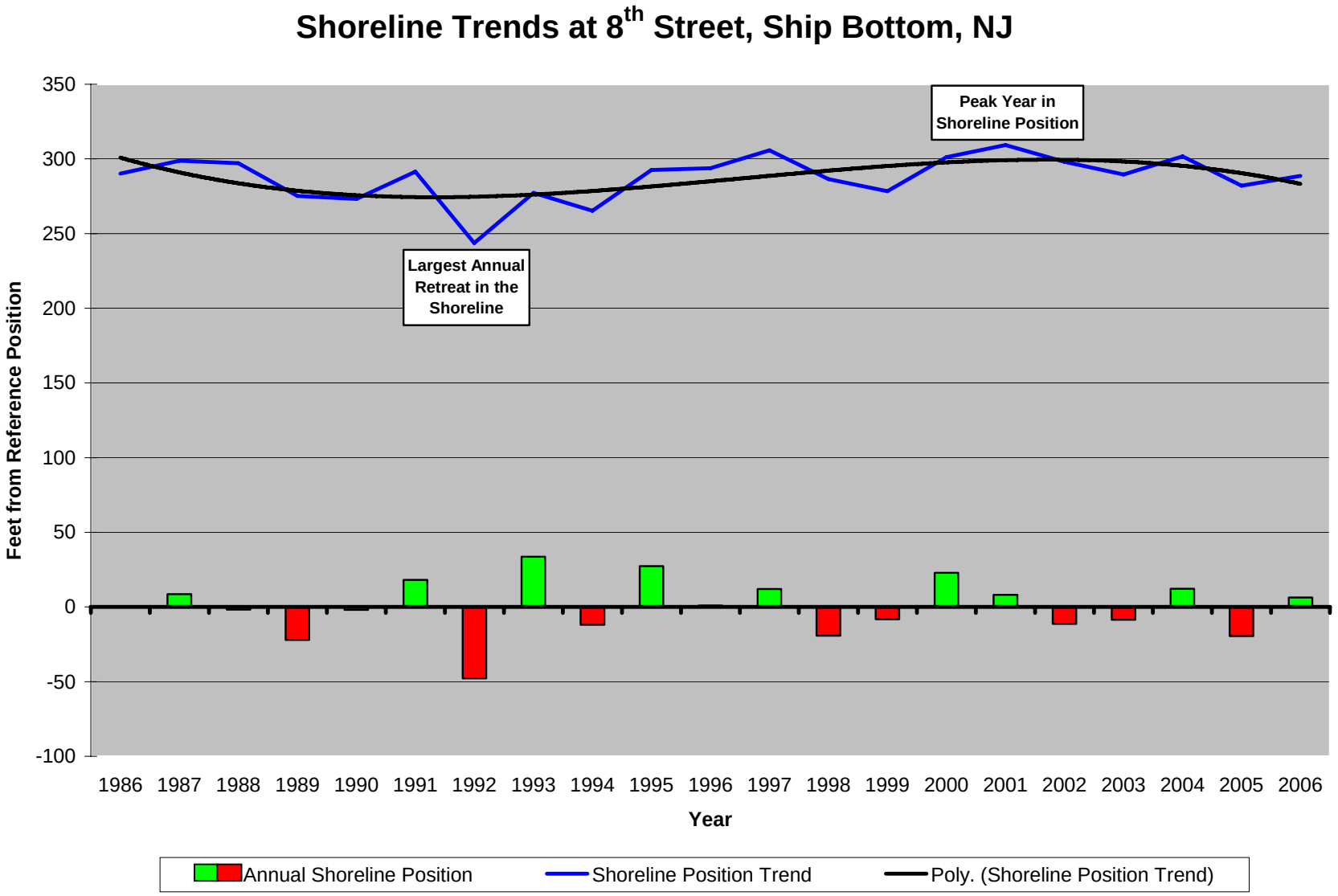


Figure 112 – Site 141. The Ship Bottom beach width changes were in response to storm activity without a clear long-term trend direction. The 1992 northeast storm produced the maximum shoreline retreat with incremental recovery several years following achieving full recovery by 1997. The maximum seaward shoreline position was observed in 2001, and was followed by gradual retreat.

20-Year Comparison Photographs – Site 141, 8th Street, Ship Bottom

The 2006 view (right) across the dunes and beach shows the width of protection provided at this site. The dune nearly doubled in volume as the seaward slope advanced seaward by 35 feet. The actual shoreline position did not shift much over 20 years. The picture on the left shows the conditions of the beach during the 1991 survey. Early colonizing plants are seen in the 1991 photo spreading seaward onto the upper beach starting the aeolian process that created the fore dune ridge seen in the 2006 photo. The site has been slightly accretional during the 20 year study interval with intermittent episodes of storm related erosion.

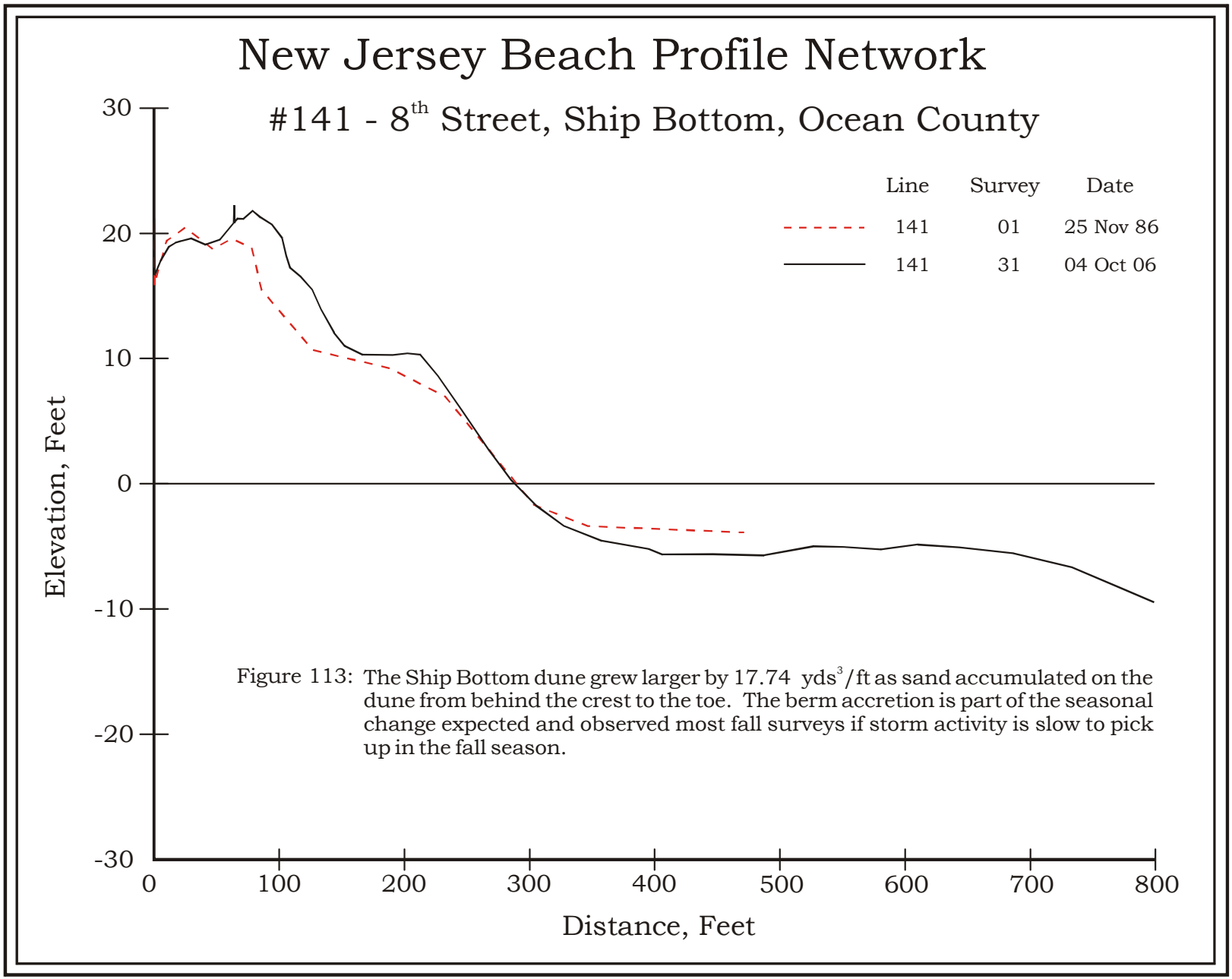


Figure 113: The Ship Bottom dune grew larger by 17.74 yds^3/ft as sand accumulated on the dune from behind the crest to the toe. The berm accretion is part of the seasonal change expected and observed most fall surveys if storm activity is slow to pick up in the fall season.

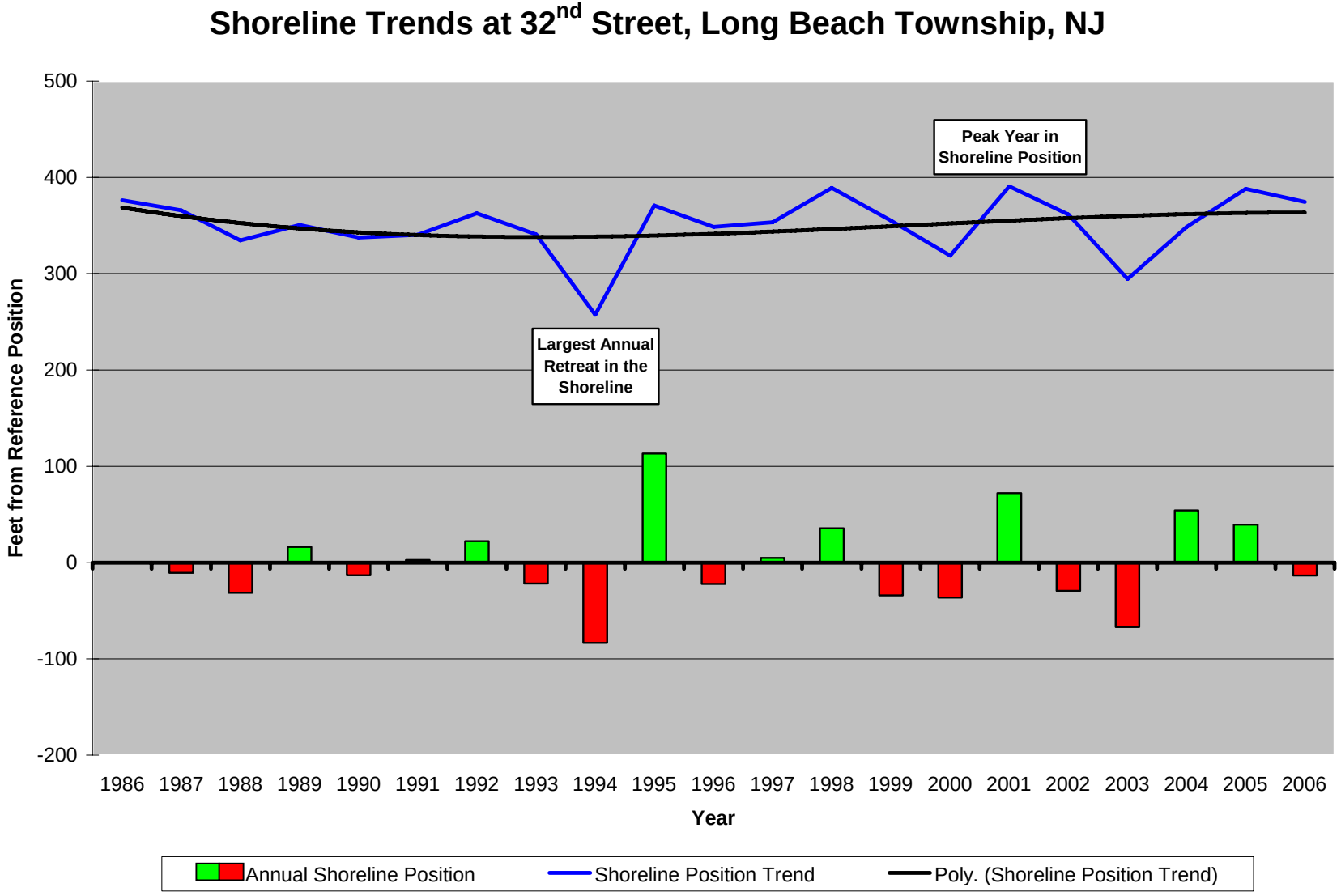


Figure 114 – Site 140. This site showed a larger than usual annual shoreline variation, especially in 1994. The loss is unrelated to any significant storm and the 1995 recovery is equally surprising. Loss and gain in subsequent years continued this level of variability ultimately leaving the shoreline exactly where it was in 1986.

20-Year Comparison Photographs – Site 140, 32nd Street, Long Beach Township

The dune toe merges very gradually with the beach at this location. The dune growth was substantial over the 20-year interval. Sand was added from the landward toe to the seaward toe raising the crest elevation several feet. The installed fencing has been buried by accretion and dune grass has flourished collecting more aeolian sand. Once again the shoreline position remained relatively stable with episodes of substantial variations but ending the 20 year period essentially where it was in 1986. The photographs above were taken in 1989 (left) and 2006 (right).

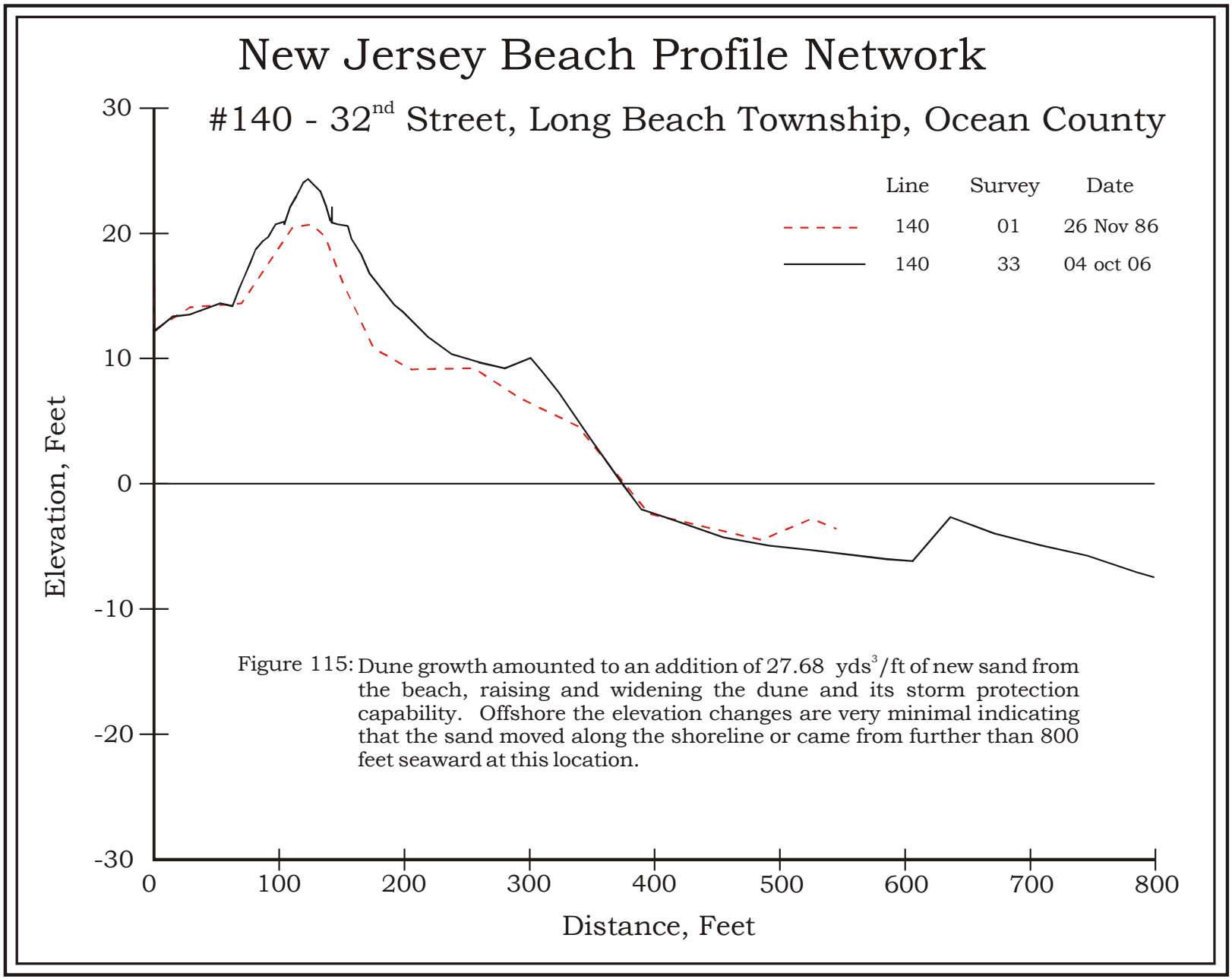


Figure 115: Dune growth amounted to an addition of 27.68 yds^3/ft of new sand from the beach, raising and widening the dune and its storm protection capability. Offshore the elevation changes are very minimal indicating that the sand moved along the shoreline or came from further than 800 feet seaward at this location.

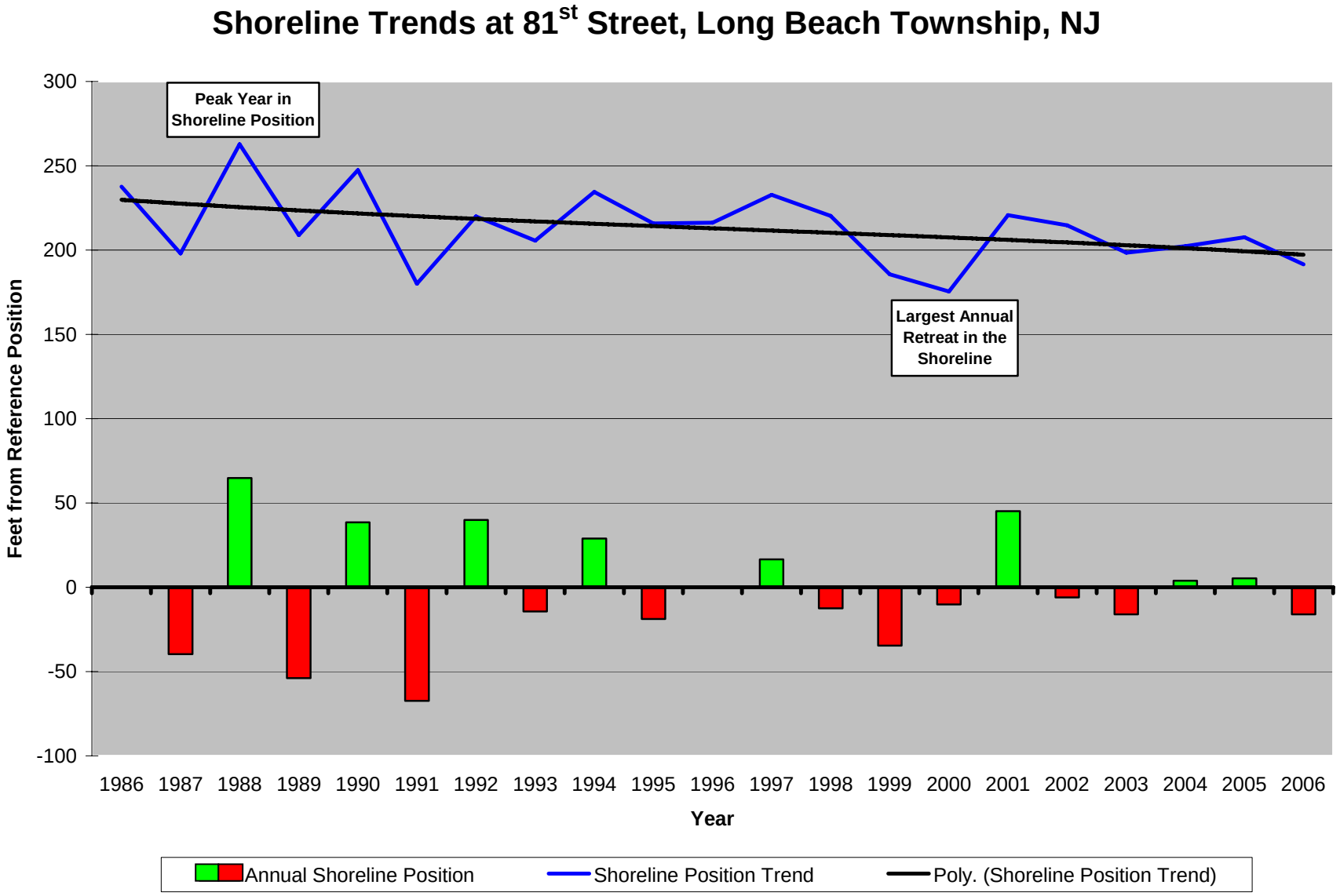


Figure 116 – Site 139. Oscillatory shoreline movement marked the first 10 years at this site. The advances or retreats were in the range of 40 to 60 feet and are fairly large for Long Beach Island. The trend, however, was negative in the amount of 35 feet.

20-Year Comparison Photographs – Site 139, 81st Street Long Beach Township

The variability of the beach and dune width along the Long Beach Island shoreline means that risk of severe storm damage also varies greatly. Here the dune is very narrow and the beach slopes seaward from the dune toe placing the oceanfront properties at risk to potential storm damage from a moderate strength event. The pictures above were taken in 1991 (left) and 2006 (right). The height of the dune has grown in recent years as relatively calm seas have prevailed but the dune width is essentially the same. The modest growth provides limited protection from a severe storm but has prevented modest storm events of the last decade from causing property damage. Opportunity for natural seaward advances of the dune toe are very limited by the narrow width of the beach.

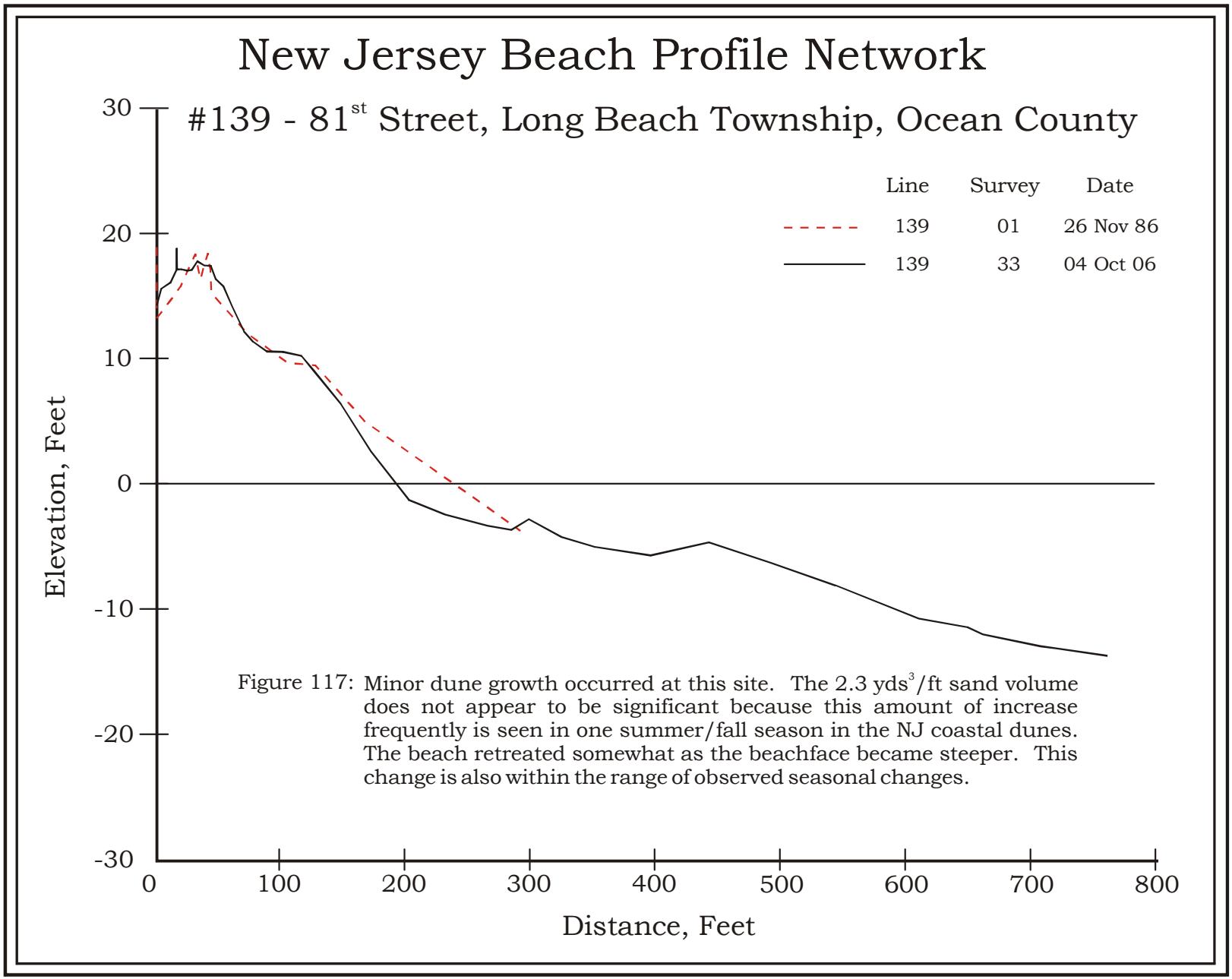


Figure 117: Minor dune growth occurred at this site. The 2.3 yds^3/ft sand volume does not appear to be significant because this amount of increase frequently is seen in one summer/fall season in the NJ coastal dunes. The beach retreated somewhat as the beachface became steeper. This change is also within the range of observed seasonal changes.

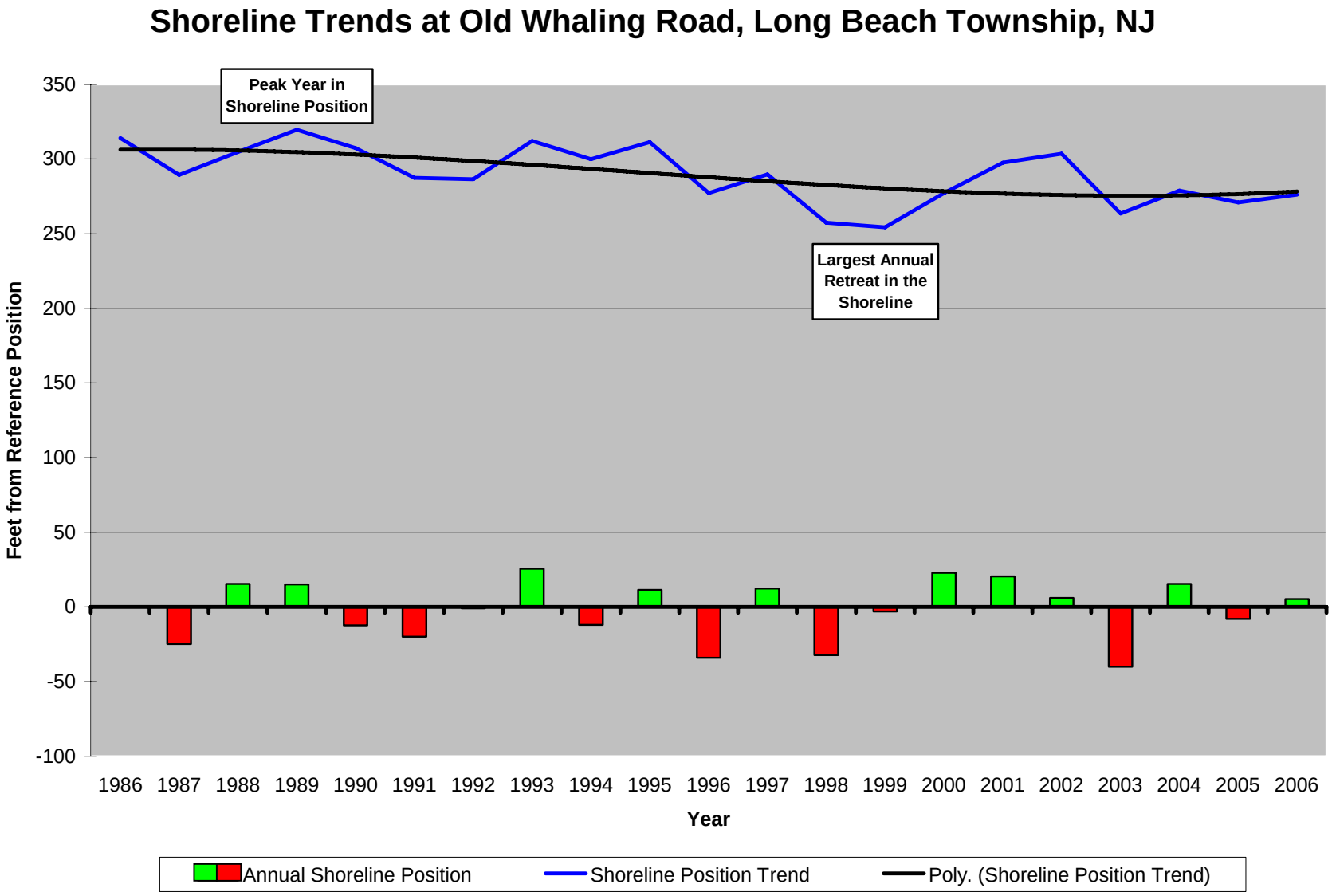


Figure 118 – Site 138. The shoreline retreat documented at this site amounted to a 20-year shift of 30 feet that appeared to be progressive, except for a trio of years where advances occurred between 2000 and 2002.

20-Year Comparison Photographs – Site 138, Old Whaling Road, Long Beach Township
Variable maximum dune elevations may determine which homes get damaged and which survive intact after a severe storm in this region. There are considerable variations in the crest elevation that will produce breaching in the low sections. The beach is fairly narrow and the dune toe did retreat somewhat in its position. Additional sand accretion did raise the crest elevation by 3 feet adding some bulk to the shore protection quality of the feature along the profile line. The beachface retreated about 30 feet between 1986 and 2006. The photographs above were taken in 1991 (left) and 2006 (right).

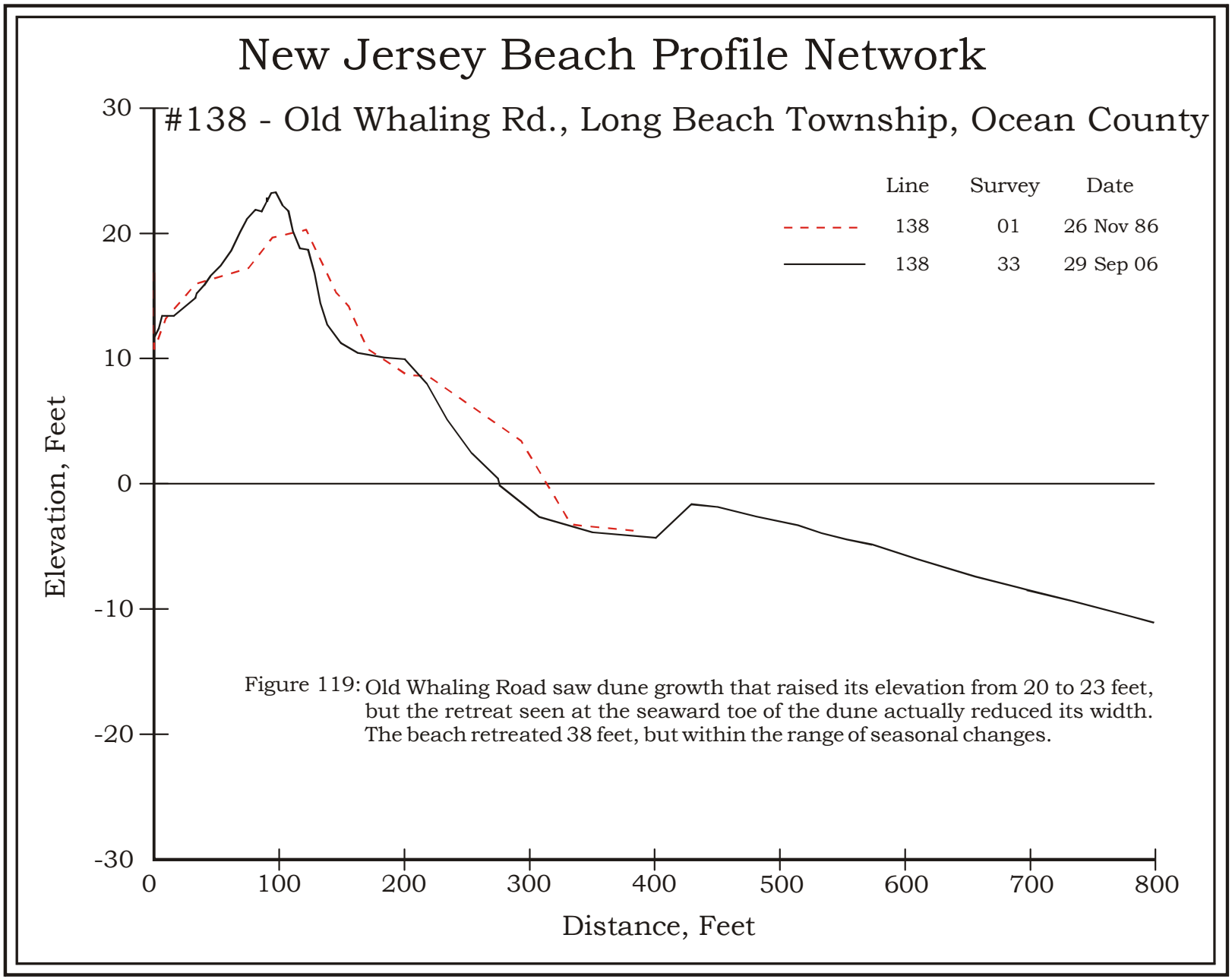


Figure 119: Old Whaling Road saw dune growth that raised its elevation from 20 to 23 feet, but the retreat seen at the seaward toe of the dune actually reduced its width. The beach retreated 38 feet, but within the range of seasonal changes.

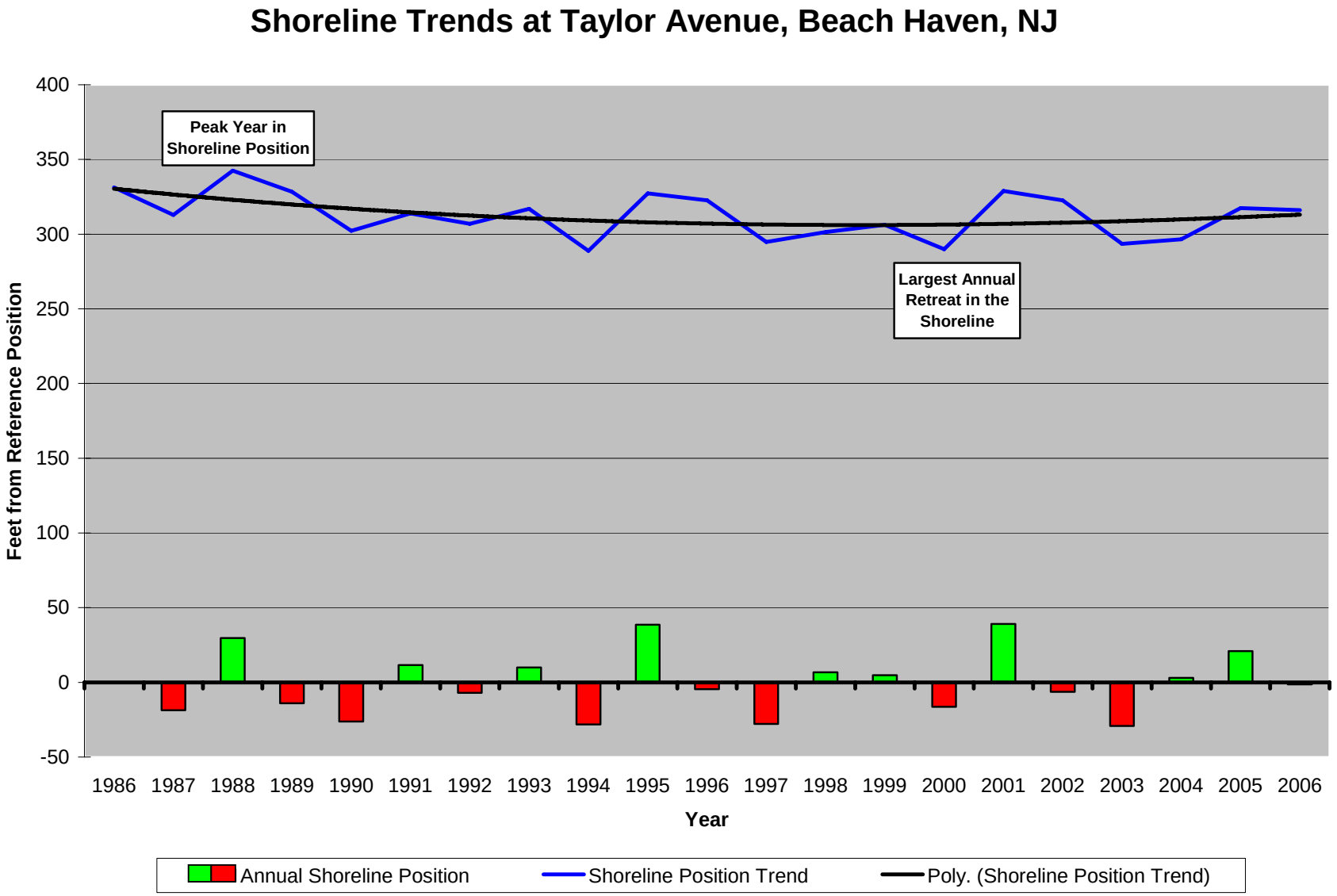


Figure 120 – Site 137. The shoreline trend line at Taylor Avenue declined during the first decade then leveled out for the second with variations occurring within seasonal ranges. Annual variations remained relatively small in the range of 25 feet.

20-Year Comparison Photographs – Site 137, Taylor Avenue, Beach Haven

Over the 20 years of study, 25 cubic yards of sand was added to the dune field. A substantial fore dune ridge developed around installed fencing adding width and height to the feature. This provides reasonable protection for the ocean front properties and infrastructure from moderate storms. The shoreline remained nearly in the same location over the 20 year study period. The photographs above were taken in 1991 (left) and 2006 (right). The exposed fences in 1991 have been nearly completely buried with a subsequent straight line fence added to gather additional sand and prevent beach patrons from walking across the feature.

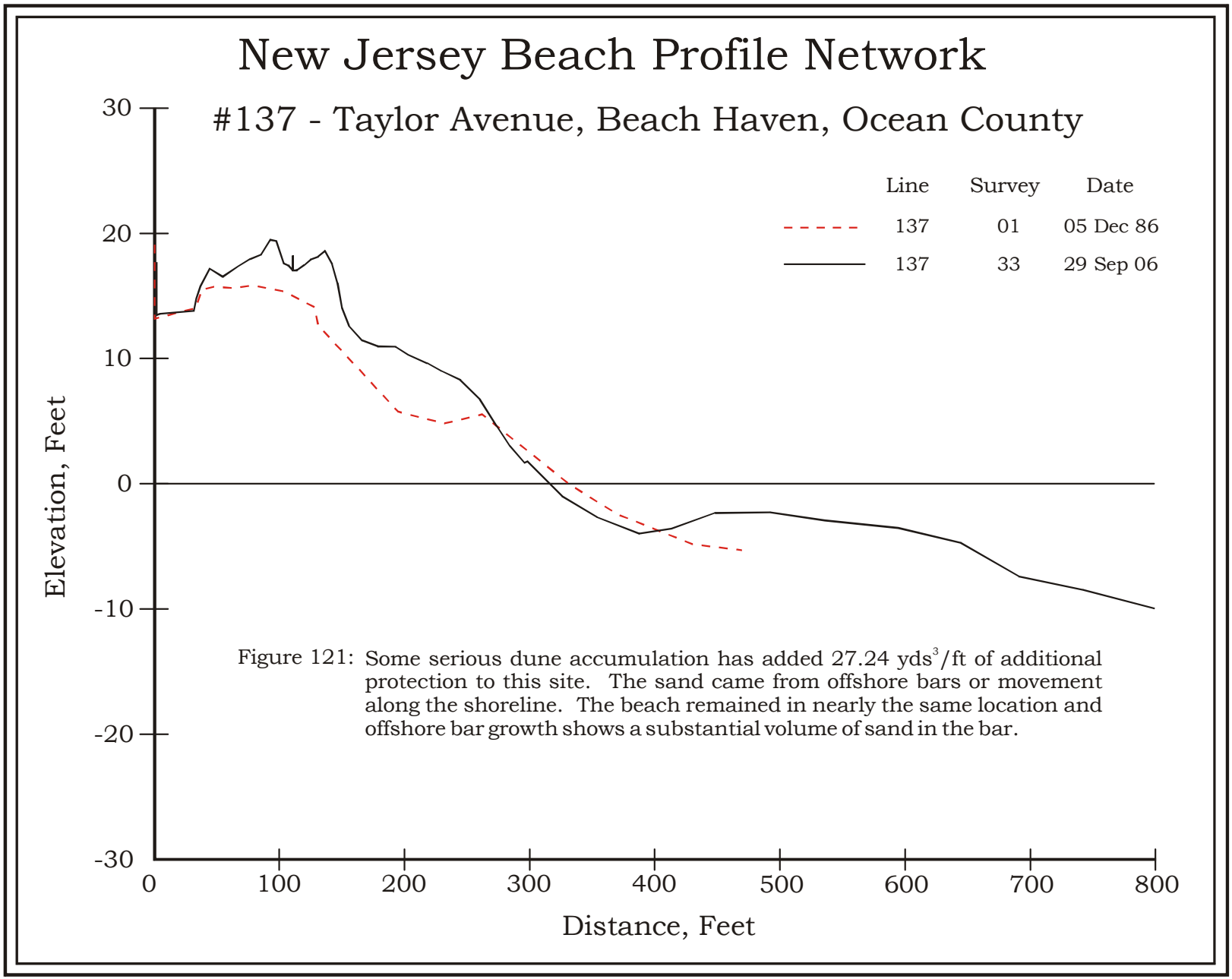


Figure 121: Some serious dune accumulation has added 27.24 yds^3/ft of additional protection to this site. The sand came from offshore bars or movement along the shoreline. The beach remained in nearly the same location and offshore bar growth shows a substantial volume of sand in the bar.

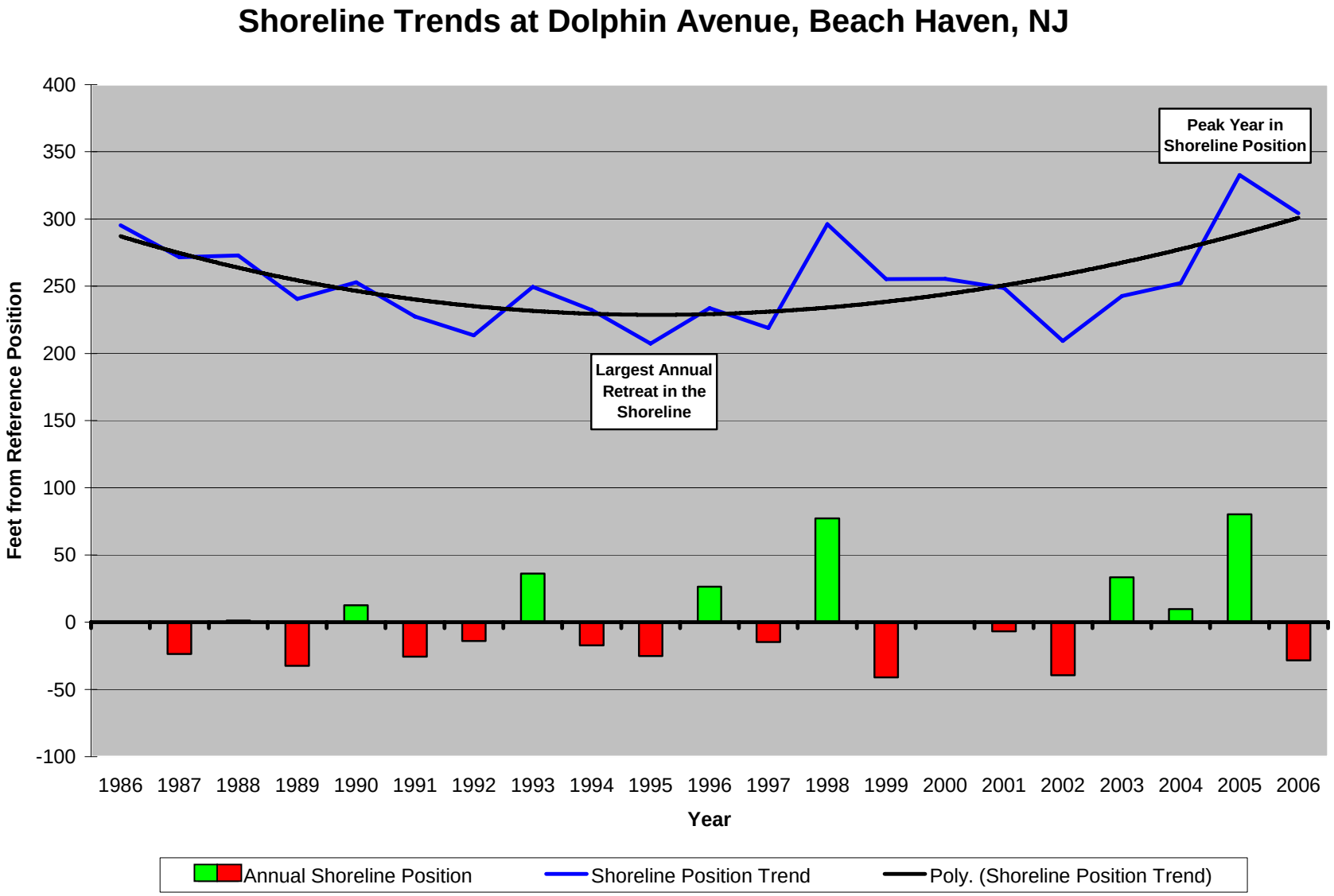


Figure 122 – Site 136. The Dolphin Avenue site retreated to a point 215 feet from the reference at the zero elevation position, and then advanced to a peak in shoreline location in 2005 only to shrink landward by 2006. The trend line returned to the 1986 position by 2006.

20-Year Comparison Photographs – Site 136, Dolphin Avenue, Beach Haven

The photograph on the right shows the 2006 view to the south near the dune toe at Dolphin Avenue. The dune grew higher by 3 feet and wider by approximately 10 feet. The beach in 2006 remained fairly wide late in the summer season prior to any winter storm activity. The photograph on the left was taken during the fall of 1991. The photos below show the impact of the proximity that the northern homes had on the width of the dune (lower left) compared to the affect of a greater setback, which yielded much wider dunes to the south.

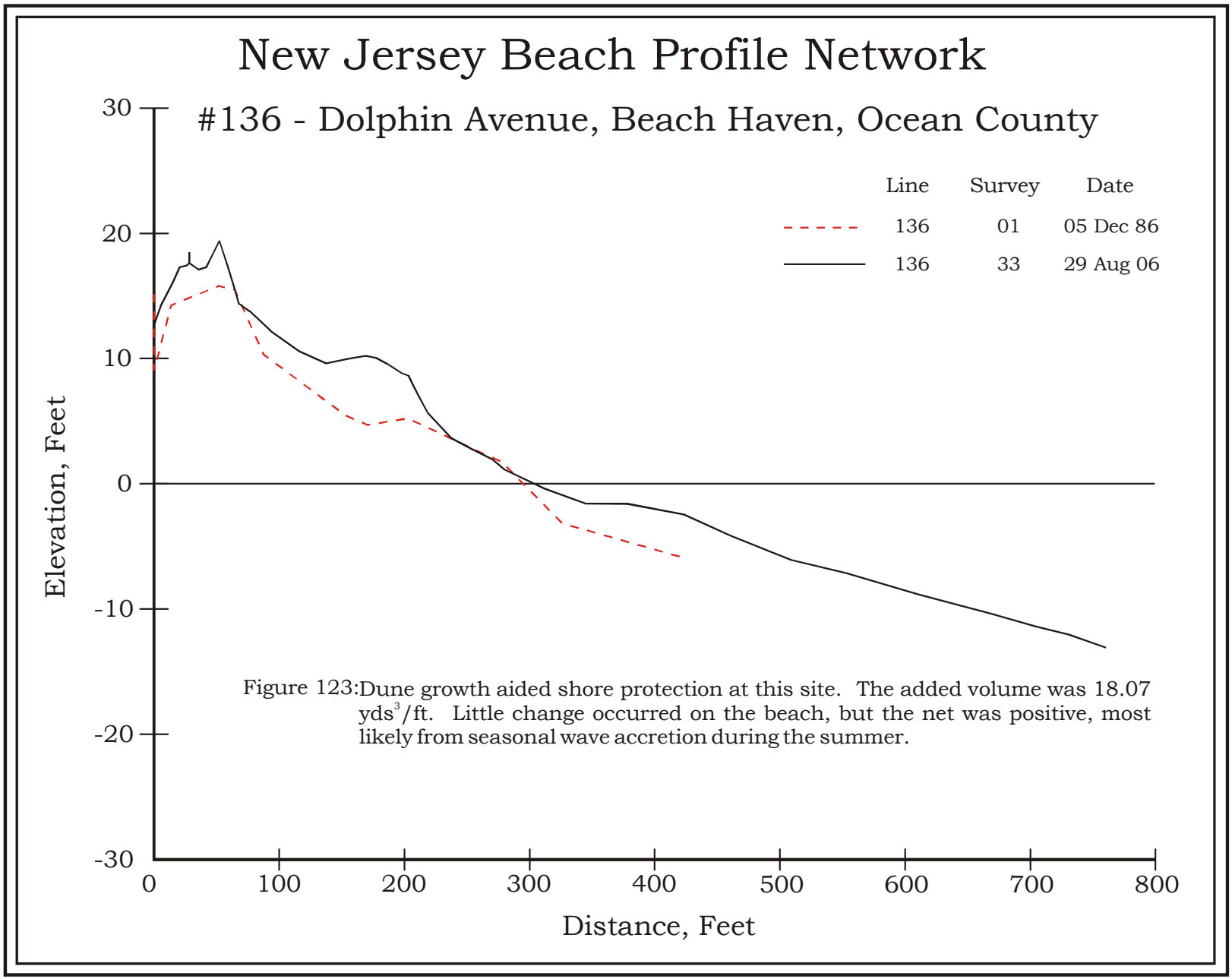


Figure 123: Dune growth aided shore protection at this site. The added volume was 18.07 yds^3/ft. Little change occurred on the beach, but the net was positive, most likely from seasonal wave accretion during the summer.

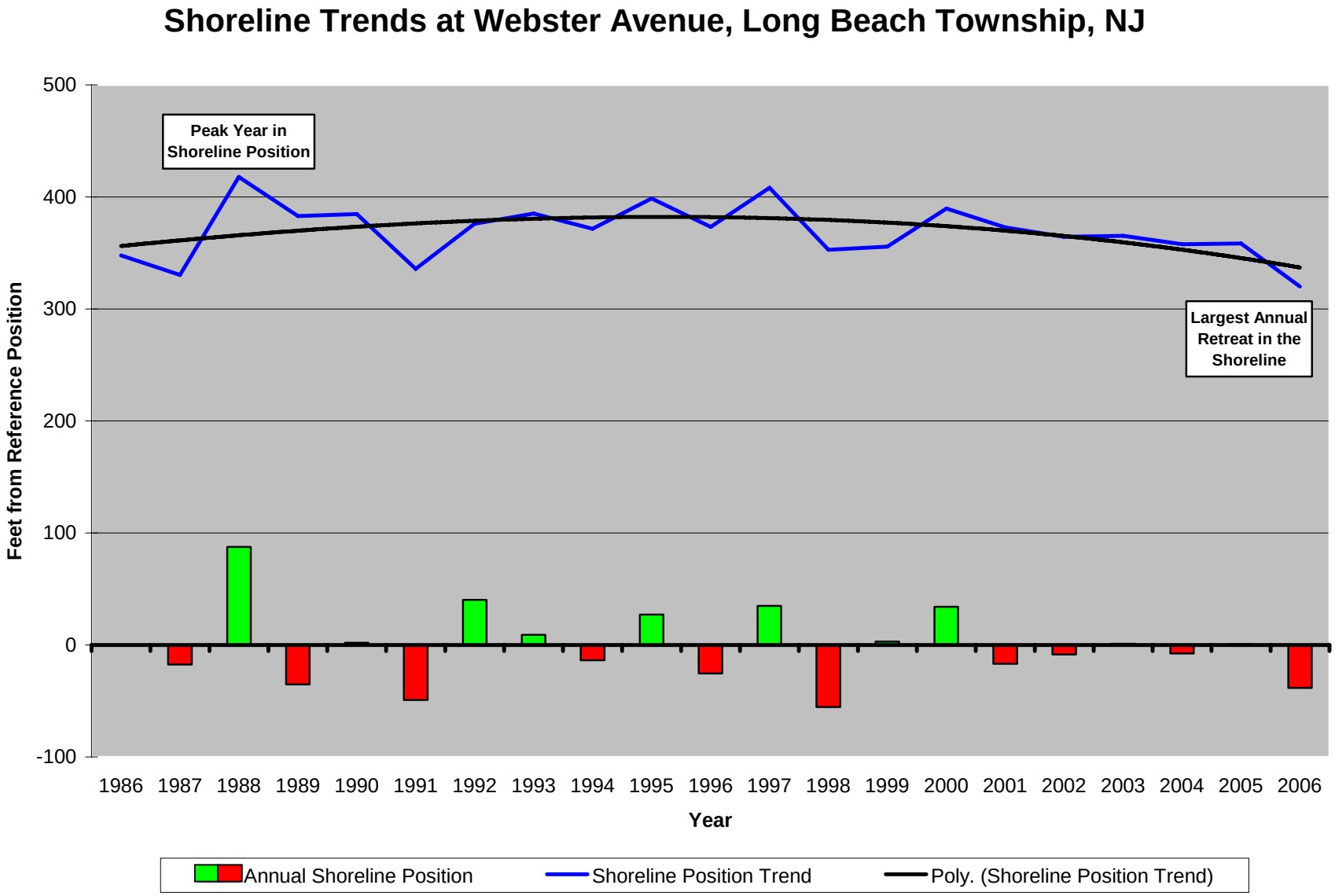


Figure 124 – Site 135. Modest levels of annual change dominate this site. After a initial period of modest advance a six-year shoreline recession trend caused the shoreline position to retreat slightly landward of the 1986 position by the end of the 20-year study period.

20-Year Comparison Photographs – Site 135, Webster Avenue, Long Beach Township

At this site the narrow beach has resulted in several episodes of significant dune slope erosion. The dune scarp shown in the 2006 photo (right) is an example of this erosion that has produced a low level of storm protection along this beach. The narrow beach with its limited sand source has slowed natural recovery and little mechanical efforts were evident to repair the damage, resulting in repetitive and cumulative storm damages. The dune crest and width have retreated significantly as a result of these erosional episodes. The beach itself has retreated over time, pulling back about 25 feet. The dune profile shows the erosional trend in the plot below. The picture on the left was taken during the fall of 1991 survey prior to the significant dune erosion.

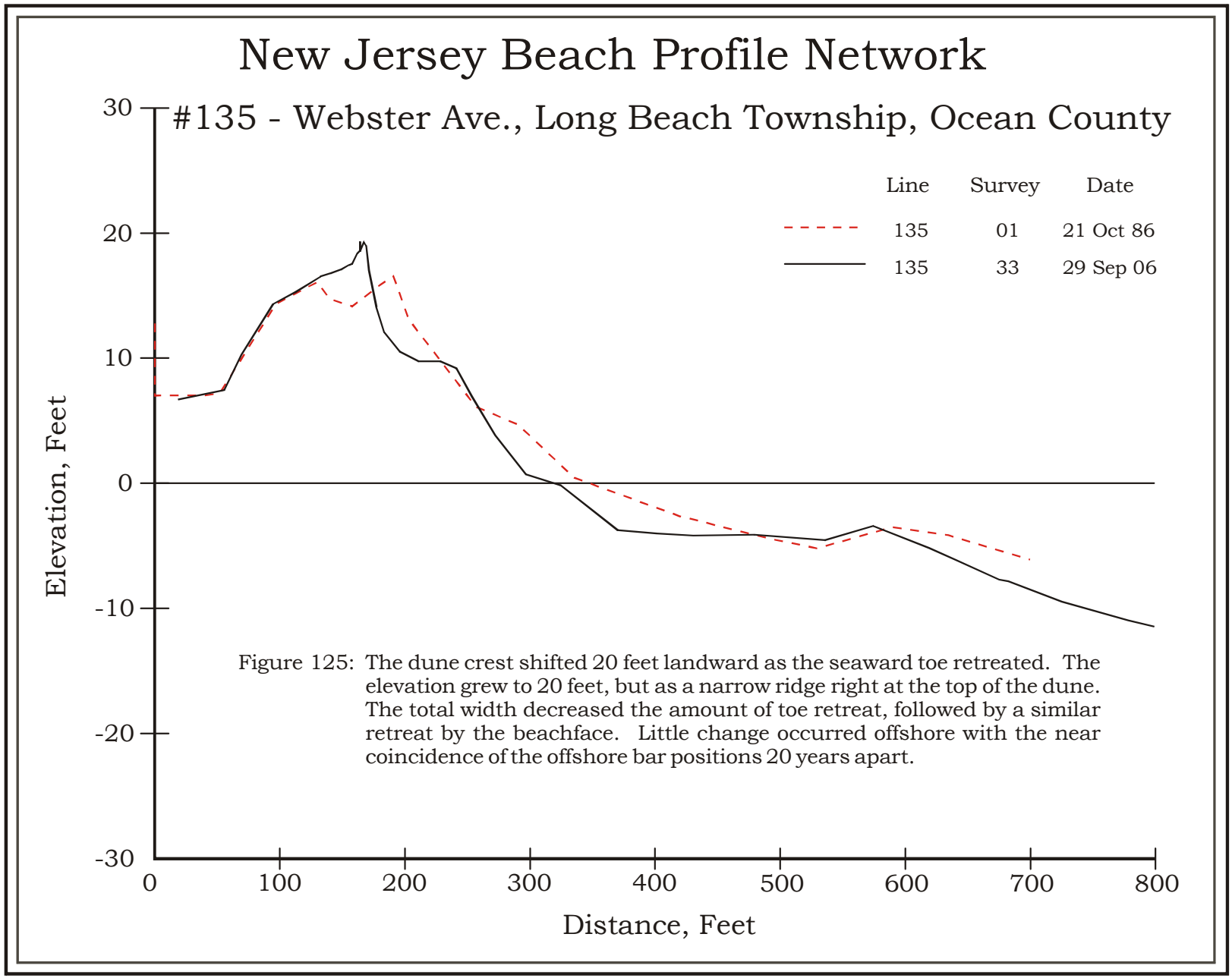


Figure 125: The dune crest shifted 20 feet landward as the seaward toe retreated. The elevation grew to 20 feet, but as a narrow ridge right at the top of the dune. The total width decreased the amount of toe retreat, followed by a similar retreat by the beachface. Little change occurred offshore with the near coincidence of the offshore bar positions 20 years apart.

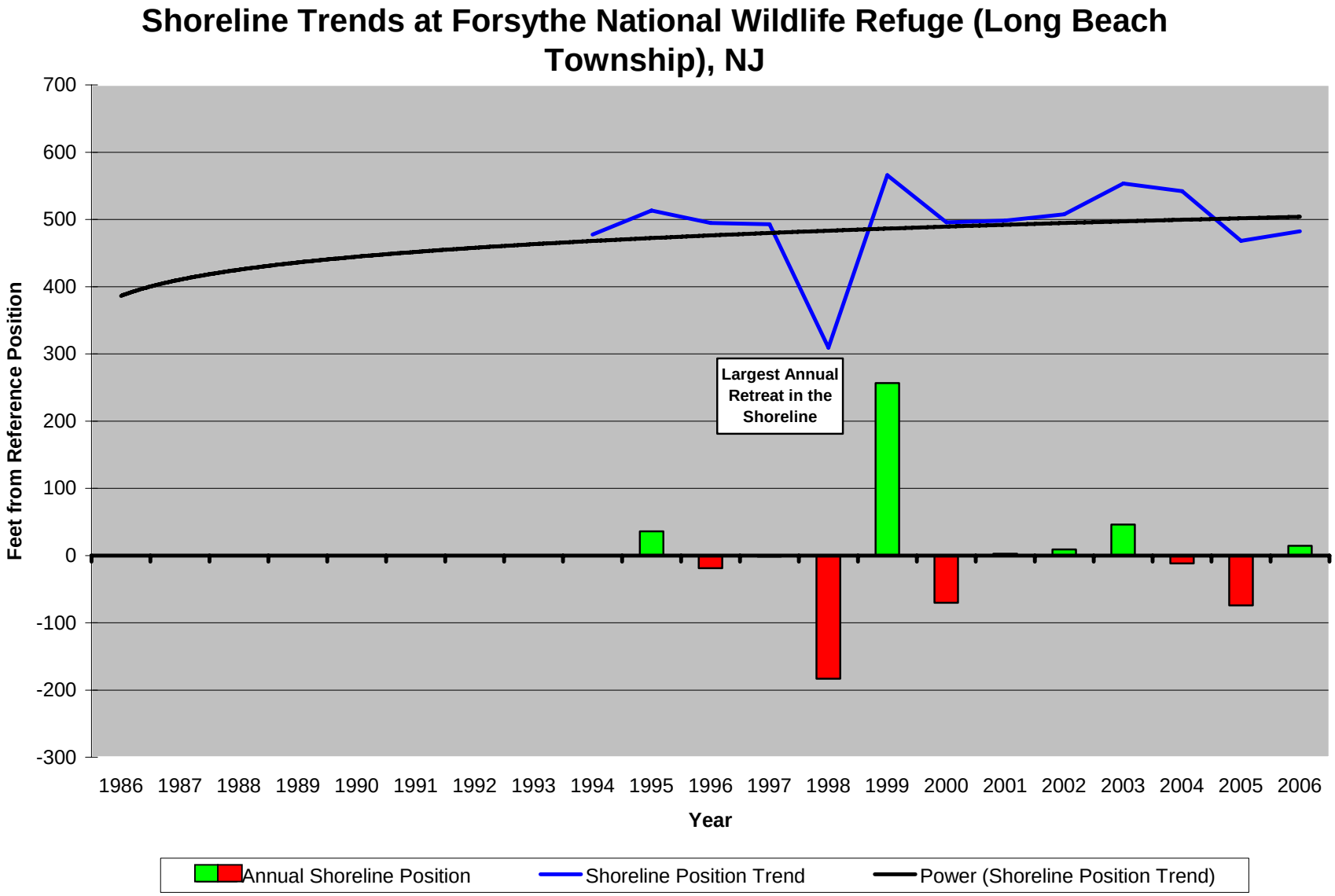


Figure 126 – Site 234. 1998 and 1999 produced the largest shoreline variation during the 12-year study interval. This site was added to the program in 1994 at the entrance to the Forsythe National Wildlife refuge to gain insight on beach changes south of the developed area

of Beach Haven. There were two early spring northeast storms in 1998 causing substantial shoreline retreat, but natural summer recovery restored the beach to a normal width range. The huge advance in 1999 of 260 feet relates to the welding of an offshore bar to the beach derived from sand moving south around the terminal groin located just north of the site and sand deposited offshore during the earlier storm events.

20-Year Comparison Photographs – Site 234, Forsythe National Wildlife Refuge, Long Beach Township

Sand arrives at this site infrequently, but in large quantities as it migrates around the groin into an area of natural beach that extends south for over 2 miles to Little Egg Inlet. Since this segment is Federal land, the State NJBPN project did not continue south to the spit tip. No data were collected on Little Beach Island for the same reasons. The pictures above were taken in 1995 (left) and 2006 (right).

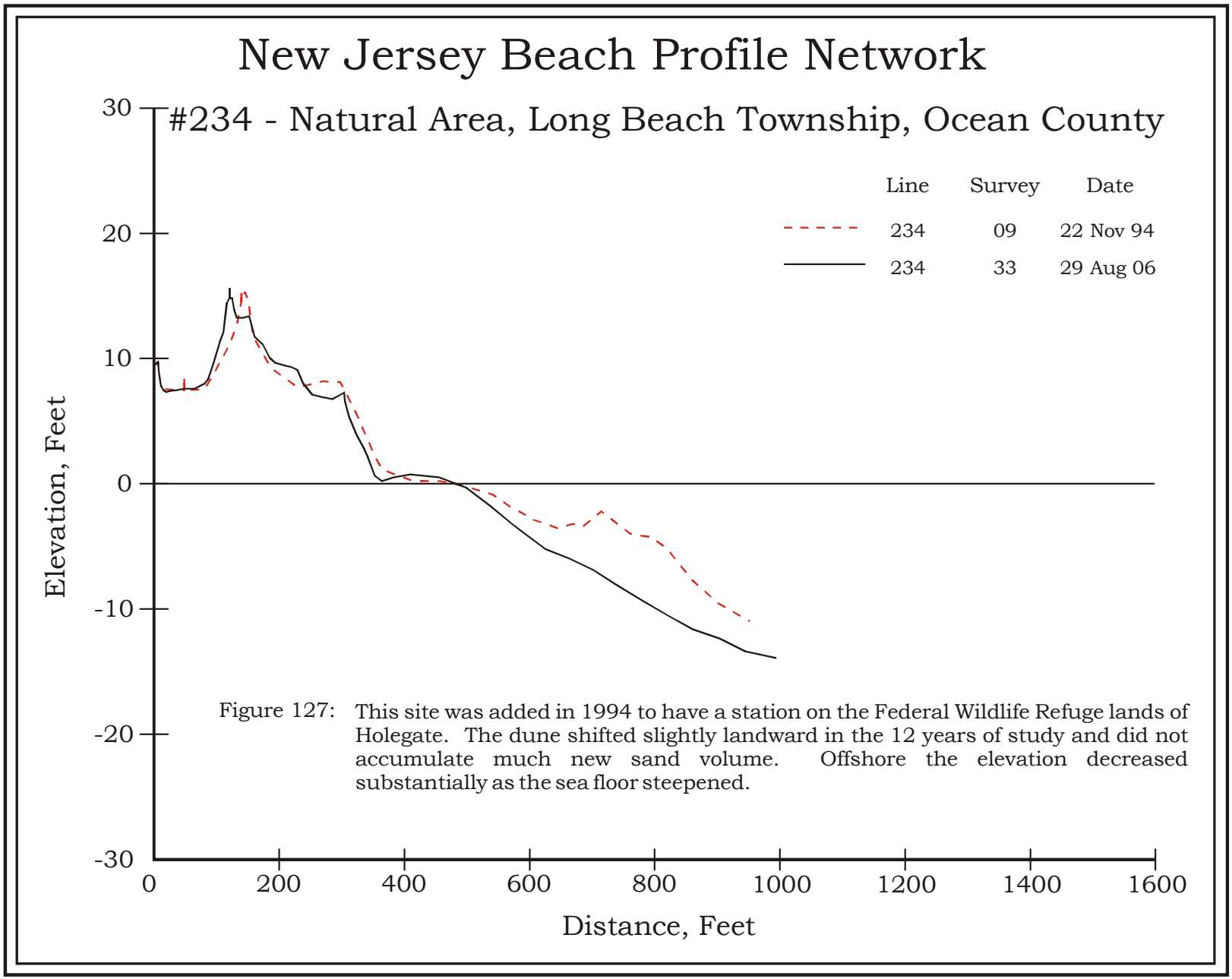


Figure 127: This site was added in 1994 to have a station on the Federal Wildlife Refuge lands of Holegate. The dune shifted slightly landward in the 12 years of study and did not accumulate much new sand volume. Offshore the elevation decreased substantially as the sea floor steepened.

SUMMARY OF OCEAN COUNTY:

The northern Ocean County shoreline extends from Pt. Pleasant Beach at Manasquan Inlet where the uplands sedimentary bluff disappears from exposure at the modern beach in Bay Head and continues south as the geologically modern sand spit to Barnegat Inlet, located at the southern end of the magnificently natural 9.75-mile Island Beach State Park. The thirteen NJBPN monitoring sites in the northern segment indicate this shoreline has been remarkably stable. Much of the shoreline is open to free littoral sand transport and is positioned on the New Jersey coast where the average northerly and southerly littoral transport rates essentially balance over time. Northeast storms tend to move sand south toward the Barnegat Inlet jetty, while southeast events tend to move the sand north toward the Manasquan Inlet. Large depositional fillets at both the southern jetty at Manasquan Inlet and at the northern jetty of Barnegat Inlet tend to document this sand transport balance. Sand might move north for extended time intervals, but any northeast storm will rapidly adjust the transport rate to the south to balance the equation. This is a zone of near-equilibrium in littoral transport processes and relatively long-term beach stability appears to be the result, although the beach width is relatively narrow limiting further dune development and storm protection for adjacent private properties and public infrastructure along the developed region.

The southern 21-mile section of Ocean County is known as Long Beach Island with fourteen NJBPN monitoring sites, which record beach changes within the 18-mile developed region of the northern most barrier island in New Jersey. It is the longest barrier island in New Jersey and historically has been divided by storm events in up to three separate islands. Today it is a highly developed region made up of six municipalities with the southern 3 miles preserved by the Holgate Unit of the Edwin B. Forsythe National Wildlife Refuge. The dune system varies in width from very narrow to truly vast. The most extreme case of the latter is the northernmost site on the island at 10th Street in Barnegat Light where as of November 2005 the dune width had reached 1285 feet (at the #245 profile site) as a direct result of the southern jetty re-orientation at Barnegat Inlet (completed in 1991, Philadelphia District Corps of Engineers). Conversely, the profile at Dolphin Avenue in Beach Haven, located along the southern portion of the island, has a dune width of only 90 feet. Any significant storm event would substantially erode this dune volume and it is clear that a severe storm would overwhelm the dune and wash across the island to Barnegat Bay.

The undeveloped area in Holgate is under management by the Edwin B. Forsythe Wildlife Refuge with the main office in Atlantic County. Long-term shoreline changes have impacted this area more than other regions because the shoreline has no shore protection structures and lies in a down-drift direction from the 97-groin field along the rest of Long Beach Island. There is a 700 to 900-foot westward offset in the shoreline position between 1899 and 1994, by far the largest in Ocean County. This was due to the opening of “Beach Haven” Inlet in 1920 followed by the southern migration of this new inlet over the next 30 years effectively erasing the detached segment of Long Beach Island. This truncated segment of Long Beach Island became known as Tucker’s Island, which vanished by 1950, but the northern side of the new inlet migrated south as well, into a position considerably landward of the shoreline prior to the inlet opening. The comparison of the 1899 pre-inlet opening shoreline with the post-migration position in 1994 yields a progressively greater landward displacement from Dolphin Avenue south to the tip of the spit.

The 27 Ocean County cross sections showed that seasonal changes vary considerably with storm climates and summer accretion. A series of profiles for the fall 2005 surveys run over a time period from August 30, 2005 to December 7, 2005 that effectively bracket a pair of northeast storms that

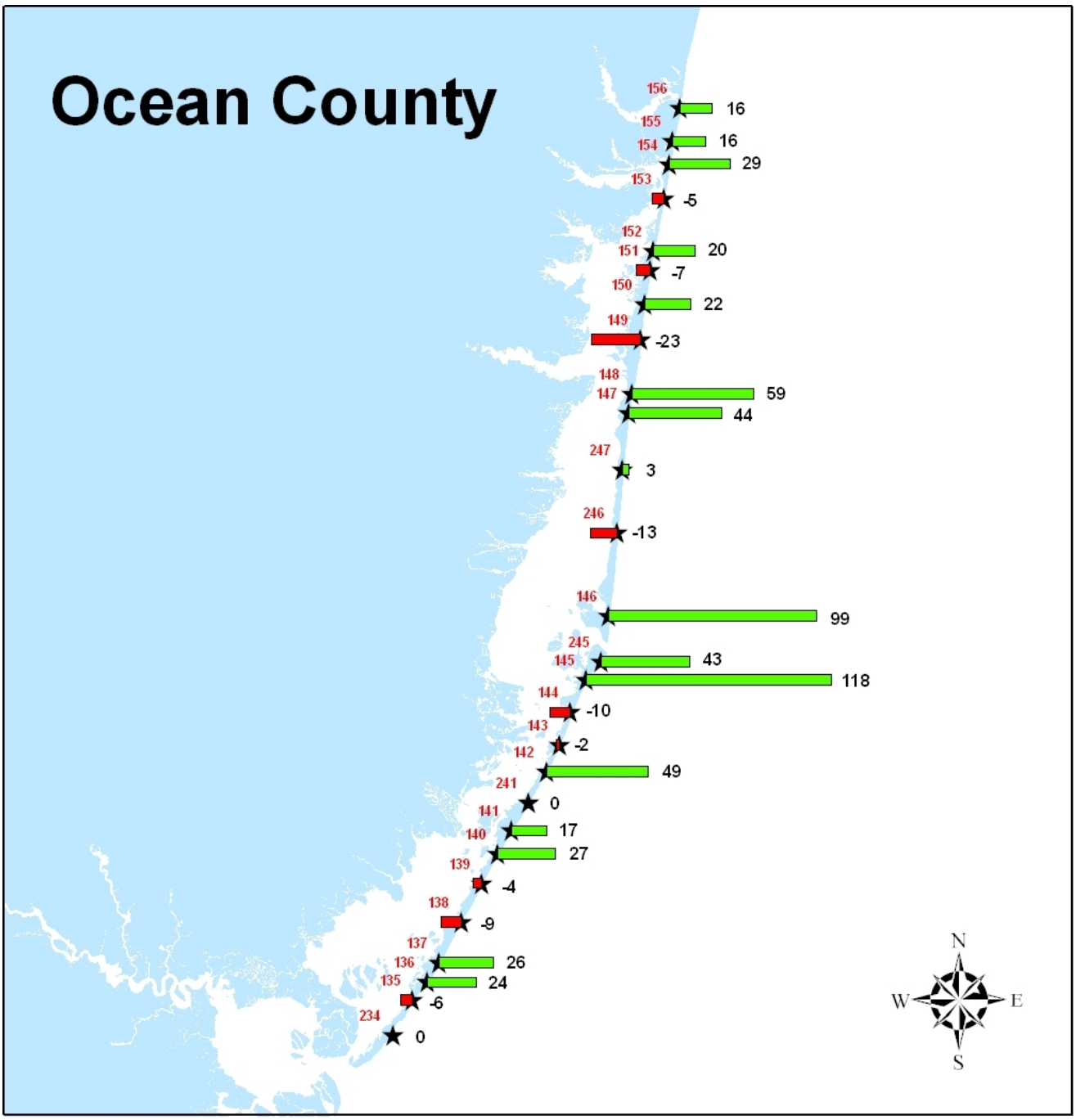
were quite efficient in eroding the beach and transporting large volumes of sand seaward. Dunes were scarped and in a few places, homes were undermined so that the waves washed freely beneath the buildings. Sand was hauled onto the island from mainland sand quarries and dumped along the most severely eroded areas. Municipalities acted later to bulldoze sand from the beach to the dune to repair the eroded toe slope.

Those profiles run prior to the storms show a well-developed summer berm and wide beach with a near flat offshore slope because all the offshore sand is piled on the beach. Those surveyed following the storms show a tiny recovery berm on the beach, but a cut into the dune toe slope and a much larger than normal offshore bar in deeper water from those the past several winters. Surveys generally go to (-)14 to (-)16 feet of water and sand was moved further seaward by these two events as witnessed by deposition of up to 4 feet of sand at the seaward most end of the profile line surveyed. This year the averages for all of Ocean County are presented in the Seasonal Sand Volume and Shoreline Change tables at the front of this section of the report. The two summary illustrations below show the dramatic difference between results following massive beach nourishment in Monmouth County and changes almost solely due to natural changes. The Ocean County shoreline (Summary Illustration 3) shows several sites where the shoreline advanced substantially for reasons other than beach nourishment (Barnegat Inlet jetty reconstruction). However as Illustration 4 shows, the cumulative sand volume trend was a small gain of 7.56 yds^3/ft

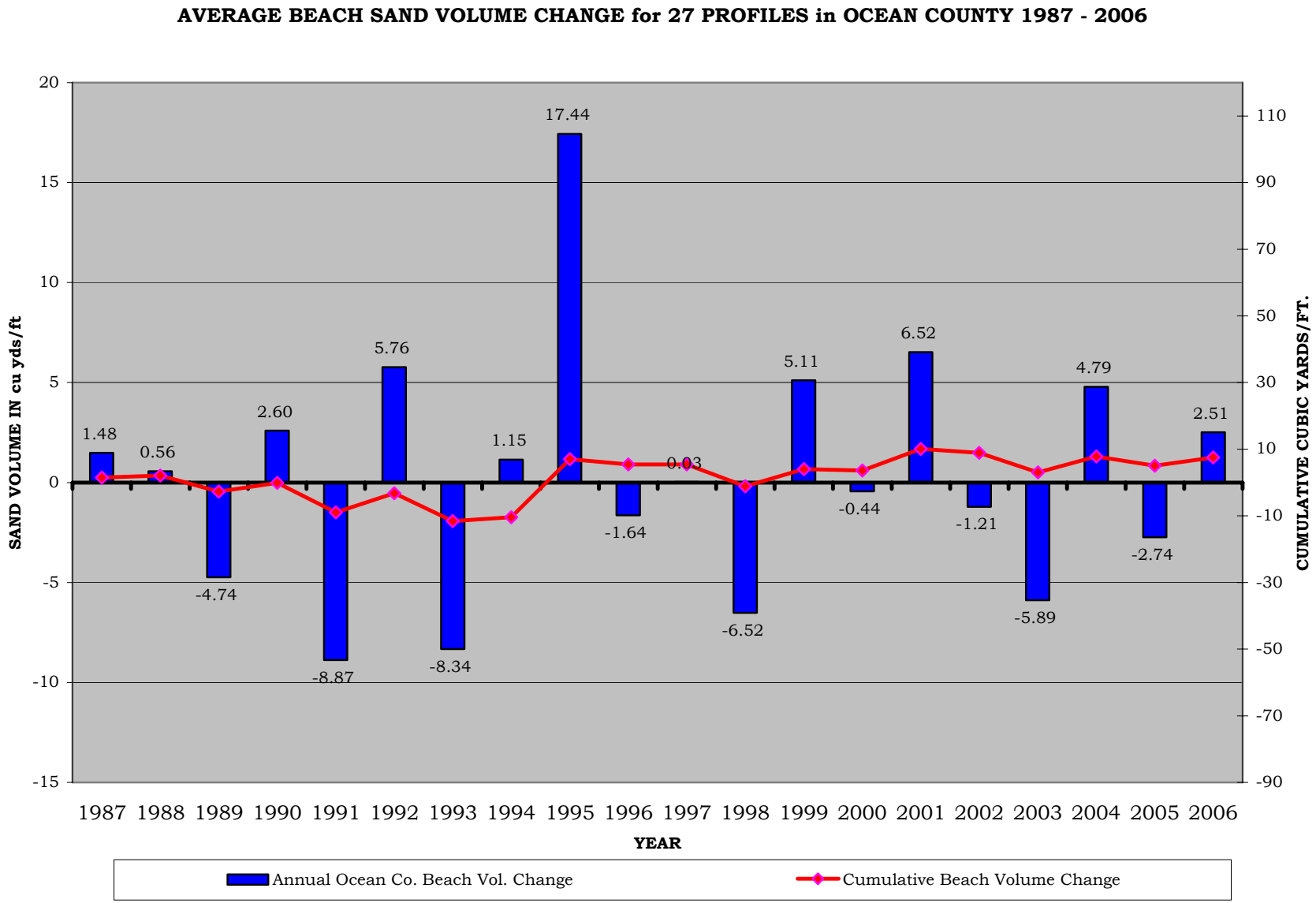
As this report is being written, the US Congress had funded going to construction on the Long Beach Island Shore Protection project developed by the US Army Corps of Engineers (ACOE) Philadelphia District. Funding was sufficient to start with hauling sand by truck to Harvey Cedars and hydraulically pump sand onto Surf City beaches. The Water Resources Development Act of 2006 (WRDA) recently passed by Congress includes authorization for funding of this project to restore the developed portion of the Long Beach Island shoreline. The project will not include the wide segment from the Barnegat Inlet jetty to about 26^{th} Street in Barnegat Light Borough and will stop at the end of development in Beach Haven at the border with the Forsythe Refuge.

The WRDA bill of 2006 also continues funding to move the Northern Ocean County Shore Protection project closer to a Planning and Engineering Design (PED) document to be submitted to the US Army Corps of Engineers Commander in Washington, DC. This document is required prior to seeking construction funding. As of publication of this report Congress has enacted the WRDA of 2006 and funding for this project will depend on the NJ State Congressional delegation's ability to insert funds into future budgets for these shore protection efforts and to be able to maintain the existing projects already completed.

Two summary illustrations below show the trend of the shoreline positions for all 27 county sites, and while advance out weighed retreat by 17 to 8 and two with zero change, the only large changes were related to sediment trapping by the Barnegat Inlet jetties (particularly the reconstructed south jetty). The sand volume trend was modestly positive over the 20-year time (7.56 $yds^3/ft.$). This was by far the least volume of sediment added to the New Jersey oceanfront beaches and was completely the result of massive beach restoration under cooperation among the local communities, the State of New Jersey and the US Army Corps of Engineers.



Summary Illustration 3: The Ocean County shoreline very recently received its first substantial beach restoration project funded by the federal government. This was confined to Surf City, Long Beach Island, NJ. The majority of the shoreline changes were natural as sand moved onto or off the beach or was transported north or south by littoral currents. The State of NJ conducted a large truck-fill in Harvey Cedars in 1994 – 1995, but that material was distributed along the adjacent shoreline so it does not appear as a shoreline advance. Large advances around Barnegat Inlet were due to the jetty reconstruction on the Long Beach Island side and trapping on the north side.



Summary Illustration 4: The sand volume trends in Ocean County reflect minimal beach restoration effort (1995) with large scale beach fills. The trend went negative as a result of the 1991 and 1992 northeasters, but recovered by 2006 to post a small gain of 7.56 yds^3/ft.

Ocean County New Jersey Beach Volume Changes
Fall 1986 to Fall 2006 for 27 Sites – Taken From NJBPN Reports

Site Number	Fall Beach Sand Volume Change Each Year																				86-06 AVERAGE	Beach Only (cu feet)/ft	PROFILE
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			
156	-12.80	15.73	-6.84	29.84	-24.28	14.32	-14.76	6.42	36.54	14.43	-12.96	-24.52	25.56	-25.04	-15.11	21.65	-24.54	24.11	-59.83	37.95	0.29	15.55	156
155	20.32	-27.92	-12.90	4.53	0.53	-0.68	-50.06	0.41	38.15	-11.33	-11.24	17.22	3.33	16.64	11.48	-0.92	-5.60	-17.06	16.84	-4.42	-0.63	15.61	155
154	5.88	0.73	-1.06	16.40	-2.50	-6.92	5.09	1.24	1.80	14.10	-27.58	14.47	0.23	-4.66	-8.50	6.06	3.10	-6.24	8.20	-6.10	0.69	28.92	154
153	7.16	-13.53	-4.36	4.84	-31.26	30.32	-38.71	11.86	18.69	-12.58	2.65	2.19	-9.00	-0.76	1.15	-17.14	22.46	-17.38	2.58	0.34	-2.02	-5.34	153
152	-1.21	11.01	-11.76	6.57	-2.16	4.97	-11.06	-8.93	30.63	-12.35	1.37	-12.88	11.32	0.17	7.80	3.54	-19.09	9.32	-22.61	22.10	0.34	20.04	152
151	-2.04	0.97	-23.83	16.66	-34.97	12.07	13.55	7.87	6.36	-1.53	-9.31	13.52	-12.33	-1.76	10.76	13.33	-9.14	-11.38	25.38	-26.38	-0.61	-6.96	151
150	-4.87	9.74	0.61	-0.61	-13.74	-10.14	-3.07	-9.91	39.24	-41.54	39.88	-4.85	-23.61	14.75	16.17	-13.80	22.63	-24.90	28.64	-22.46	-0.09	22.13	150
149	1.40	-6.97	0.47	-12.10	-11.09	22.87	-22.07	1.47	4.85	-7.51	2.17	-49.51	40.38	-13.37	-0.61	12.28	-15.85	-24.19	5.36	2.46	-3.48	-23.36	149
148	6.38	0.51	-6.80	6.39	-19.91	14.76	-1.14	-12.02	19.02	13.15	-14.30	37.04	-43.69	19.25	-6.17	-9.30	35.30	23.83	-16.93	8.73	2.71	58.58	148
147	-5.20	12.34	-21.53	14.20	10.28	-0.83	16.51	-18.87	1.83	14.77	-9.19	4.48	38.06	-13.37	-10.73	-5.92	-11.68	45.83	-17.02	-0.82	2.16	44.31	147
247	8.52	-10.32	8.62	3.64	-9.65	13.93	-59.28	52.89	2.42	-24.73	-42.00	3.02	43.24	-12.50	8.20	-2.41	-4.85	23.20	4.31	-1.58	0.23	2.98	247
246	4.38	8.70	-22.47		0.96	17.44	-37.45	11.79	45.05	-1.38	-33.01	-31.20	37.13	-9.82	-14.59	21.13	-13.36	20.89	-9.57	2.87	-0.13	-12.69	246
146	-0.11	8.67	-7.59	0.83	6.64	-38.86	32.97	-5.04	20.63	16.03	-9.27	-4.85	16.61	-4.10	46.19	-21.37	14.48	11.55	7.34	17.76	5.43	99.47	146
245									10.94	-15.02	91.20	-44.17	-28.15	3.89	-18.08	19.87	-21.83	30.68	-55.25	15.34	-0.88	42.54	245
145	17.19	-2.31	-7.95	-6.66	-3.97	35.08	-25.94	22.35	29.95	7.92	24.53	-6.43	11.09	21.33	20.33	16.19	-3.92	-15.28	-7.47	14.08	7.01	117.50	145
144	-2.20	1.27	-6.35	10.81	-8.64	5.74	-18.56	21.88	-5.03	0.46	12.63	-35.66	17.32	-10.08	2.43	19.04	-38.68	10.98	0.33	-9.26	-1.58	-9.77	144
143	-0.50	-9.71	-6.05	7.26	-5.19	-14.47	10.56	-2.75	19.97	0.63	3.63	-9.19	10.46	-1.49	7.35	-9.53	-15.18	-2.14	2.24	10.03	-0.20	-1.63	143
142	13.54	-3.42	27.83	-30.12	14.98	-7.92	-9.27	13.30	21.49	-0.75	-14.34	34.03	-4.07	-0.63	21.09	-23.64	26.67	-16.99	-3.25	4.99	3.18	48.50	142
241									0.89	-17.05	28.46	-29.06	-3.40	17.69	-4.43	0.23	-22.89	1.18	3.60	11.19	-1.13	-0.34	241
141	-5.16	1.44	0.73	-1.95	10.04	-56.00	46.88	-9.25	18.51	21.71	-3.41	4.89	-20.00	43.02	-23.08	-9.57	11.81	0.36	11.15	-12.45	1.48	17.05	141
140	0.90	-16.00	10.45	-7.37	3.42	30.34	-23.17	-21.30	39.72	6.96	15.08	-1.31	-7.90	-8.02	31.08	-14.07	-34.10	47.28	3.95	5.32	3.06	27.44	140
139	-12.27	15.42	-5.93	3.96	-33.06	30.34	-21.75	13.30	12.27	-7.14	6.02	-37.62	-14.18	10.28	31.92	0.76	-12.48	1.38	-6.01	-23.41	-2.41	-3.92	139
138	-14.51	5.99	-2.26	-2.47	-7.11	16.38	-0.60	-14.16	8.20	-13.97	8.59	-11.12	4.12	-9.35	11.16	10.91	-30.83	20.24	-9.07	19.30	-0.53	-9.49	138
137	5.27	10.53	-5.09	-6.88	-15.08	3.05	2.75	-14.98	22.21	0.34	-15.11	8.32	12.65	-10.80	13.76	-2.89	-20.40	9.86	15.65	11.17	1.22	25.68	137
136	5.79	-4.04	-9.19	4.52	-21.57	-3.20	10.57	-5.06	-4.40	11.67	-14.22	15.53	6.88	-6.31	-2.51	-0.11	10.89	-1.96	22.72	7.52	1.18	23.65	136
135	-0.39	4.69	-0.56	-2.57	-15.66	25.72	-2.08	-14.98	39.84	-16.36	8.73	-45.27	11.37	-6.91	9.49	-12.70	-31.01	3.54	-10.00	-3.16	-2.91	-5.95	135
234									-8.95	16.72	-28.10	16.86	14.53	-19.93	29.49	-34.29	29.19	-17.34	-15.37	-13.25	-2.54	0.03	234

	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
OCEAN AVERAGE	1.48	0.56	-4.74	2.60	-8.87	5.76	-8.34	1.15	17.44	-1.64	0.03	-6.52	5.11	-0.44	6.52	-1.21	-5.89	4.79	-2.74	2.51	0.56	
CUMULATIVE VOLUME	1.48	2.04	-2.70	-0.10	-8.98	-3.22	-11.55	-10.41	7.03	5.39	5.42	-1.10	4.01	3.57	10.09	8.88	3.00	7.79	5.04	7.56	8.11	19.65

Table 3 - 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.

Ocean County New Jersey Shoreline Changes
Fall 1986 to Fall 2006 for 27 Sites – Taken From NJBPN Reports

Site Number | Fall Shoreline Position Change Each Year | 86 to 06 change in the shoreline

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)	PROFILE
156	-39.27	39.31	-11.16	54.27	-39.05	14.83	-17.21	27.08	19.12	22.93	1.26	-24.53	17.82	-19.33	-27.62	33.48	-29.45	52.00	-89.60	55.22	2.01	40.09	156
155	67.10	-45.26	-18.85	3.67	1.27	2.44	-40.04	-17.04	36.23	-17.65	-19.27	39.38	-10.72	31.05	8.00	22.94	-29.75	-11.09	54.71	-12.96	2.21	44.15	155
154	36.30	-5.93	20.62	12.99	25.65	-23.86	3.86	-24.22	36.47	-11.80	-73.17	100.55	-68.17	44.27	-70.56	95.48	-78.95	41.65	4.71	7.43	3.67	73.30	154
153	2.84	-12.55	-1.30	2.64	-20.62	30.95	-39.30	34.79	-13.06	2.45	-16.90	27.13	-11.16	-1.14	18.61	-32.66	16.04	0.13	12.71	0.09	-0.02	-0.30	153
152	-20.34	24.71	-2.52	-10.39	0.95	10.20	-17.29	-2.38	26.85	-16.95	-8.07	19.50	-3.03	7.80	-19.01	13.24	-21.44	29.11	-39.94	18.72	-0.51	-10.28	152
151	-2.34	16.39	-57.04	11.11	-22.58	23.51	-18.70	-1.07	22.56	-11.01	-6.76	9.86	-5.44	0.56	24.87	-17.31	-7.31	8.28	0.81	-7.71	-1.97	-39.31	151
150	-74.49	14.09	10.20	-10.20	16.90	-10.37	-12.91	-30.41	64.22	-53.38	34.55	26.29	-61.33	0.82	63.53	-32.50	13.46	-17.22	13.06	10.20	-1.77	-35.48	150
149	7.54	-26.57	-10.03	-28.66	11.62	56.88	-75.10	-13.63	108.90	-91.56	4.63	-84.99	119.72	-66.84	54.27	28.84	-84.90	-11.88	-21.13	31.97	-4.55	-90.91	149
148	-15.08	3.38	-21.88	15.04	-2.30	2.20	-18.05	-20.62	29.10	9.34	13.20	-8.97	-22.89	-3.10	47.10	-47.50	-2.28	58.49	-27.85	26.47	0.69	13.80	148
147	-39.22	14.32	-35.23	25.38	0.62	-5.06	4.16	-30.68	32.20	-17.79	15.92	-50.81	76.20	-55.00	18.66	-9.76	-21.43	50.90	-8.48	-8.02	-2.16	-43.14	147
247	5.63	-15.98	26.04	3.28	-33.66	39.27	-56.62	65.47	6.92	-51.15	13.38	-57.13	78.60	-33.91	-5.93	33.11	-41.00	53.40	-24.44	-4.09	0.06	1.19	247
246	-10.52	6.20	-22.81		-13.74	11.20	-21.39	-9.50	83.02	-63.57	14.87	-99.60	80.02	-3.28	-18.70	44.62	-52.81	37.30	-22.38	-5.02	-3.30	-66.08	246
146	-36.07	23.69	5.63	-8.66	18.41	-39.75	39.67	-11.31	31.32	5.08	20.20	-110.50	77.15	0.28	49.37	-16.19	-6.28	11.82	10.44	12.03	3.82	76.35	146
245									12.53	-59.33	97.44	-11.58	-63.78	-3.00	-44.53	41.83	-24.75	37.40	-69.00	38.65	-4.01	-48.12	245
145	0.55	-1.07	-25.65	16.73	12.95	51.79	-41.31	4.22	69.53	-12.47	9.34	21.70	-22.47	13.29	6.85	36.62	-1.97	60.03	-12.07	-67.97	5.93	118.60	145
144	-7.60	0.59	-9.47	11.05	3.72	22.73	-33.71	15.49	-4.36	13.01	14.27	-63.46	8.51	6.04	8.29	31.91	-75.53	39.55	-3.11	-15.83	-1.90	-37.89	144
143	-8.35	-31.95	0.53	12.19	-3.07	-4.87	0.19	-10.50	27.81	-9.28	6.17	-4.71	16.24	-28.30	16.65	-12.66	-12.93	21.60	-6.34	-2.42	-1.70	-34.00	143
142	-21.04	-14.62	38.07	-10.19	58.58	-48.52	-16.76	4.44	15.55	30.27	-31.34	58.94	-56.54	-3.19	12.50	-4.37	11.86	24.86	-1.42	-23.96	1.16	23.11	142
241									6.27	-24.00	30.09	-8.54	-26.22	15.61	-2.24	14.22	-35.27	2.49	3.77	13.85	-0.83	-9.98	241
141	8.69	-1.70	-22.02	-1.81	18.15	-47.84	33.69	-11.96	27.32	1.08	12.06	-19.25	-8.13	22.85	8.06	-11.19	-8.56	12.14	-19.52	6.35	-0.08	-1.59	141
140	-10.72	-31.18	16.24	-13.08	2.69	22.30	-21.82	-83.37	113.36	-22.27	5.02	35.68	-34.09	-36.40	71.97	-29.17	-66.97	54.20	39.26	-13.37	-0.09	-1.75	140
139	-39.64	64.76	-53.88	38.49	-67.42	39.97	-14.32	28.93	-18.78	0.40	16.56	-12.47	-34.63	-10.16	45.18	-6.06	-16.13	3.90	5.25	-16.10	-2.31	-46.13	139
138	-24.81	15.35	15.01	-12.34	-19.93	-0.89	25.57	-12.14	11.43	-34.10	12.39	-32.33	-2.97	22.84	20.44	5.97	-40.05	15.35	-7.98	5.20	-1.90	-37.99	138
137	-18.58	29.61	-13.94	-26.23	11.65	-7.01	9.99	-28.15	38.52	-4.62	-27.81	6.67	4.80	-16.35	39.03	-6.37	-29.09	3.04	20.92	-1.40	-0.77	-15.31	137
136	-23.65	1.24	-32.48	12.56	-25.62	-13.99	36.13	-17.18	-25.12	26.42	-14.63	77.21	-41.05	0.22	-6.72	-39.45	33.40	9.74	80.27	-28.28	0.45	9.00	136
135	-17.55	87.59	-35.06	1.91	-49.08	40.34	9.11	-13.62	27.22	-25.41	34.84	-55.43	2.95	33.97	-16.88	-8.40	0.97	-7.55	0.64	-38.30	-1.39	-27.75	135
234									35.96	-18.77	-1.73	-183.38	256.49	-70.24	2.61	9.30	46.07	-11.70	-74.03	14.43	0.42	5.01	234
AVERAGE	-11.69	6.43	-10.04	4.34	-4.75	6.94	-11.76	-6.56	30.41	-16.08	5.80	-14.99	9.85	-5.58	11.25	5.11	-20.93	21.03	-6.69	-0.18	-0.08	-5.24	AVERAGE

Table 4 - 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.