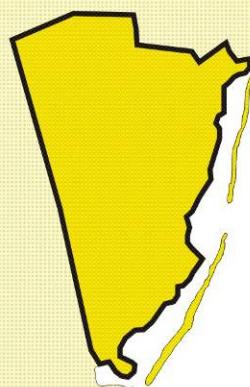




New Jersey Beach Profile Network

Ocean County

Manasquan Inlet
to Little Egg Inlet



NJBPN Profile #'s
156 - 234

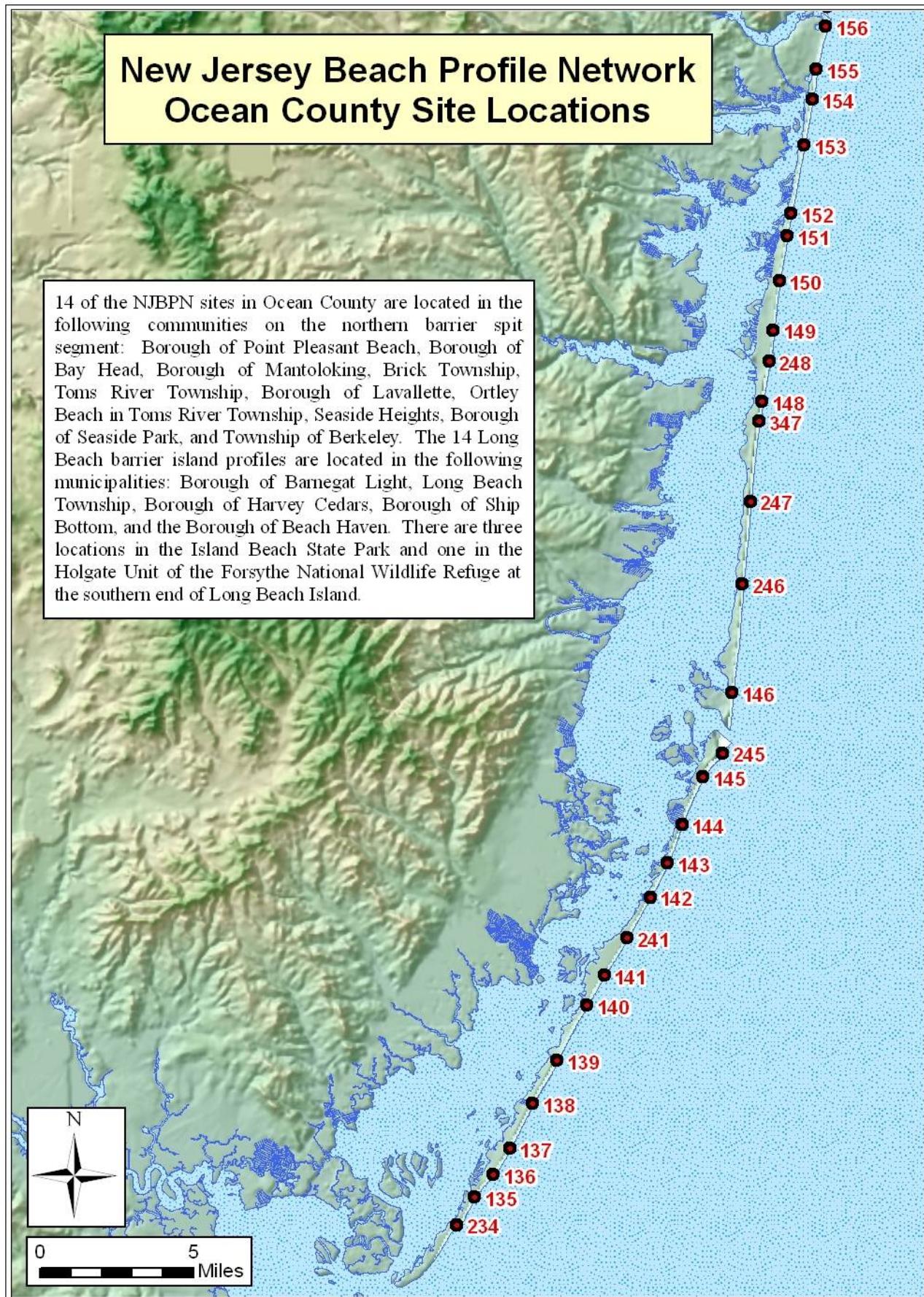


Figure 41. Locations of the 28 NJBPN profile stations in Ocean County, NJ.

Hurricane Sandy's Impact on the Ocean County Shoreline:

In general terms, all forms of damage to beaches, dunes and public or private property was significantly worse on the north side of the storm's zone of coastal landfall in Atlantic County. Southern Cape May County fared best with limited overwash, dune scarping and loss of beach elevation. Many Cape May coastal communities were beneficiaries of either USACE or NJ State co-sponsored Shore Protection Projects that yielded wider beaches and dunes designed with specific storm resistance in terms of elevation and width. Damages increased towards the region of landfall with moderate dune breaches, especially in southern Ocean City area, and damages to southern Absecon Island's oceanfront properties. Dune breaches, loss and scarping of dunes, beach width and elevation continued north into Brigantine. From the natural area of Holgate on Long Beach Island, north along the remainder of the Jersey coast the intensity dramatically increased for dune breaching and overwash and/or complete erosion of the dunes, drastic lowering of the elevation on beaches with substantial sand transport onto and across Long Beach Island or Northern Ocean County's spit. Damage to oceanfront property (public and private) increased dramatically culminating in one major breach across to Barnegat Bay in the Borough of Mantoloking generating a new inlet pathway to the bay. Two additional near breaches occurred just north of the Herbert Street cut resulting in substantial loss in private residences. Overwash decimated Ortley Beach and had severe impacts between Mantoloking and Seaside Park. Two dune cuts in Island Beach State Park swept sand across the park access highway almost to the bay. The wide beach in Point Pleasant Beach mitigated the wave damage, but the absence of any dune system along the boardwalk section allowed seawater unlimited access to the community adjoining the oceanfront. Even the large dune at Maryland Avenue saw the public access pathway used as a means of overwash into the interior depositing over 3 feet of sand on the properties and in the streets.

Individual segments of the dunes did prevent wave access, but the general trend was one where the dune eventually failed because of narrow beaches, a low pedestrian access path to the beach, or a minimal width/height of the dune itself. The erosion rate in the dunes could be gauged in Mantoloking where the southern properties in the Borough had a dune system with dunes over 24 feet in elevation and over 100 feet wide at a 20-foot elevation. These dunes survived with between 15 and 20% of the initial sand volume remaining and some sand overwash through public access pathways (Albertson Street). Elsewhere scraps of dune remained providing just enough protection to allow the residence landward of the surviving segment to escape destruction declining to situations where the inlet was cut entirely through the barrier to Barnegat Bay.

Beach/Dune Damage Assessment by Municipal Island Segment:

The 28 Ocean County New Jersey Beach Profile Network (NJBPN) monitoring sites were surveyed to provide an accurate comparison and assessment of storm related shoreline and beach volume changes. The data from the fall 2012 NJBPN survey, completed along the developed portion of Ocean County's shoreline by September 21st, provides an excellent indication of beach and dune conditions against which to show damages that occurred during the hurricane. Data collected at the 14 oceanfront beach profile locations on Long Beach Island cover the municipal beaches from Barnegat Light to the entrance of the Holgate Forsythe National Wildlife Refuge (including the three constructed USACE engineered beaches in Harvey Cedars, Surf City and Brant Beach). Volume losses from the hurricane were calculated from surveys that were conducted within days

following the storm. At the sites where the post-storm survey did not reach to the 0.0 foot (NAVD88) datum, the profile was extended seaward at a 1:20 slope to obtain the best estimate of volume losses.

It should be noted that no areas along the northern Ocean County barrier-spit shoreline have seen movement toward construction of the USACE design plan for regional shore protection. There have not been any NJ State, County or local beach replenishment projects completed prior to Hurricane Sandy. Previous storm damage has been addressed by importing mainland quarry sand in piecemeal repairs to minor breaches or beach elevation loss on a local basis. Quarry sand has been delivered to Long Beach Island accumulating vast quantities over decades. Unfortunately no comprehensive records were maintained as to how much, where it was placed or how much the cost was. The Borough of Mantoloking obtained permits to place sand mined from the Ambrose Channel leading into New York Harbor in the 1990's, but that project failed to materialize.

Point Pleasant Beach;

The two cross sections in Point Pleasant Beach demonstrated that with no dune system or a smaller, poorly vegetated dune system, there would be little resistance from the tidal surge and the associated waves to cross inland from the ocean. The entire beach and dune system along this segment of northern Ocean County experienced wide-scale overwash and breaching of dunes. The northern profile located at Water Street had no dune in front of the boardwalk, which was damaged and a large amount of sand from the beach was carried inland from wave action. Damage would have been more severe had there not been a 600-foot wide berm in front of the boardwalk. The southern profile at Maryland Avenue was significantly eroded (dune breach) with sand losses totaling 45.7 yds³/ft. along the profile due to the storm. By the time of the post-storm survey, the municipality had begun relocating sand from the berm to the former dune location.

Bay Head;

The entire beach and dune system along this segment of northern Ocean County experienced wide-scale overwash and breaching of dunes. Approximately 5,500 feet of this 9,500-foot municipal shoreline had a rock revetment constructed following the storm 50 years ago that did comparable damage to the State's shoreline. Since 1992 the rocks have been buried as the core of a continuous dune line fronting the development. The 1992 northeast storm over-topped the wall of rocks and put sand into the street ends without significant property damage. Restored shortly afterward, no storm until Sandy approached stripping the sand from the rocks. Hurricane Sandy treated the rock revetment as if it were a speed bump. Sand and water poured down each street end to the tidewater several blocks inland. The beachfront homes were still standing, but had suffered substantial structural damage in many cases ranging up to the deposition of 2+ feet of sand on the building's lot without damage to the building. Sand was being excavated from the streets two blocks inland. Where there was no rock revetment, there was greater structural damage to homes and their surroundings. Accelerated erosion occurred surrounded the larger groins present in the northern part of Bay Head due to wave energy reflecting off the north side of the structure and adding to the incident wave coming onto the beach directly. Small segments of dune remained either between the revetment and the homes or where no revetment was built. Dense vegetation or a significantly wider cross section at a high elevation seemed to make the difference in the amount of overwash seen.

Mantoloking;

The Borough of Mantoloking extends for over two miles further south and has no regional shore protection hard structures on the beach. Individual owners have constructed private rock or timber structures across the front of private homes over time. The dunes have been maintained meticulously over the past decade in an effort to maximize the municipal shore protection they afford. The crest elevation exceeded 14 feet with some as high as 25 feet. The major problem was that insufficient sand was on the coastline to provide both a major dune system and a wide beach to force waves to break early and not get close enough to break on the dune slope. By late September a municipally-sponsored dune evaluation revealed that this year the Borough's situation was about as good as it was possible to make it without a major beach nourishment project. The highest, widest dunes (24 feet elevation and over 100 feet of width at a 20-foot elevation) served to protect homes on the southern segment of the Borough from damage, but a declining width of the dune base combined with lower average elevations allowed massive failure along the remainder of the municipality. The Borough's mid-section was the most heavily impacted with three channels cut across the entire peninsula into Barnegat Bay. The worst was seen at Herbert Street where a new bridge connects with mainland Ocean County. Here a tidally flowing inlet was generated that allowed in the storm surge flood and permitted several days of tidal flow erasing at least 12 properties. A second, small cut occurred at 1117 Ocean Avenue and a third occurred at Lyman Street all mostly due to narrow, lower elevation dunes with no significant beach width to absorb some of the wave attack.

Brick Township;

The wider, higher dunes existing just north of the municipal boundary in Mantoloking continued south into Brick Township. Here there was little municipal oversight of dune maintenance so elevations, low spots and placement of access stairways to the beach were at the option of individual owners. At the municipal beach #3, the dune failed to the south on the property and waves directly impacted a multi-family building that was built very close to the beach. Overwash was evident, especially to the south toward Normandy Beach.

Toms River Township (Normandy Beach, Ortley Beach);

The northern Township shoreline fared better than did the Ortley Beach section to the south, but significant overwash occurred in this section and many oceanfront and landward homes were damaged. This was due to beach-dune widths and elevations not adequate to withstand the tidal surge and wave action produced by Hurricane Sandy. Site #151 had losses of the dune and berm where 46.1 yds³/ft. of sand were removed during the storm. The Ortley Beach cross section (site #149) was centered in the zone completely destroyed with over 5 feet of elevation stripped away in the center of Ocean Avenue. There was no evidence that the survey site was ever there. The GPS unit took the team to a spot on flat sand with only the masonry utility access column standing 5 feet above the sand surface indicating where Ocean Avenue had been. Ortley Beach had a 25-year history of shoreline retreat and sand volume loss as determined by the Coastal Center's 8th Avenue survey site. Site #149 located at 8th Avenue showed a sand volume loss of 68.7 yds³/ft. with the dune removed and pushed landward and deposited as overwash deposits. Everything was stripped away leaving a flat, featureless beach sloping into the sea.

Lavallette;

Lavallette had no dunes and suffered damage from Hurricane Gloria in 1985. The municipality developed a dune system between the paved promenade and the beach, but areas where beach accessways were carved

through the dune system created low areas allowing the intense waves riding on the evening storm surge to easily erode those areas and create a number of serious breaches. While some remnants of dunes remained following the storm in the northern portion of the municipality (proximal to site #150), beach-dune widths and elevations in areas to the south were not adequate and wide-scale overwash and breaching occurred. This caused severe damage to infrastructure and property. Following Hurricane Sandy, Site #150 had sand volume loss of 51.7 yds³/ft.

Seaside Heights;

This segment of the shoreline experienced damage to infrastructure and property as a result of having no dune system and an approximate berm width of 250-feet. The boardwalk and piers sustained heavy damage and in some places were completely destroyed. The cross-section located at Franklin Avenue (site #248) showed a sand volume loss of 39.3 yds³/ft of the beach in front of the boardwalk.

Seaside Park;

The pre- and post-storm analysis for site #148 at 4th Avenue showed that a portion of the foredune was removed during the storm; however, the remainder of the dune provided protection to the landward structures. No overwash occurred at the profile location. The dune's approximate 25-foot elevation (NAVD88) and 150-foot width (at the base) combined with a 150-foot wide beach provided adequate protection from tidal surge and wave action. As has been noted in other areas along the northern Ocean County barrier-spit, areas where beach accessways were carved through the dune system created low areas that were more easily eroded, resulting in wave overwash and sand being transported landward of the beach-dune system into the streets and private properties. While homes sustained flood damage in this segment from Barnegat Bay, loss of infrastructure and homes was minimized due to the larger beach-dune system hindering the waves that were crossing over land.

Midway Beach (Berkeley Township);

Site 347 in Midway Beach showed significant sand losses to the beach and dune but a portion of the dune remained to protect the landward homes and infrastructure. While overwash covered some of the streets and properties with sand, much of the overwash was limited to the areas proximal to street ends. These beach accessways were carved through the dune system, creating low areas that were more easily eroded, resulting in wave overwash. While homes sustained flood damage in this segment, loss of infrastructure and homes was minimized due to the larger beach-dune system.

Island Beach State Park;

At the three locations within the state park, the storm eroded sand from the foredune and berm and moved the sand into the nearshore. No dune breaching occurred at any of the sites due to the wide beaches and dune elevations that in some areas exceeded 20 feet NAVD88. There were several dune breaches with sand transported landward covering the highway serving the natural area, but no complete pathways were carved into Barnegat Bay.

Barnegat Light Borough;

The two profile sites in Barnegat Light Borough demonstrated that with a much larger than average dune system, there would be little impact from the tidal surge and the associated waves. The structure responsible for

this hefty dune system was the 1988 to 1991 reconstruction of the south jetty to Barnegat Inlet parallel to the north jetty instead of the older “arrowhead” design originally built. The result was an accumulation of sand on the south side of the new jetty advancing the shoreline seaward by 2,400 feet at the jetty. This deposit tapers narrower to the south, but still produced a 450-foot shoreline advance at site 145 located at 26th Street in the Borough. The shoreline orientation is also a factor since the wave approach was almost parallel with the beach, not perpendicular to it. As a result there was no overwash, no sand in the streets, and no direct wave impact on any home. Water reached into the dunes with the only damage done to dune fencing closest to the shoreline.

Long Beach Township (Loveladies);

The La Baia Street profile site did have dunes that survived, but at this location the public access pathway was at least 6 feet lower than the adjacent dune crests. The waves found the gap, cut it at least two house lots wider and water and sand flowed landward to the boulevard. This scenario was repeated many places where the simple expedient of having public works place sand and grade a dune cross over to the adjacent elevations could have prevented this particular overwash. Dune failure was likely related to individual access pathways to the beach from individual homes excavated below the average dune elevation. Along this segment of LBI, the dune width was higher than average.

Harvey Cedars;

Two cross sections located in Harvey Cedars crossed the 2009 Federal Shore Protection Project. In both cases the dune built seaward of the native dune experienced substantial erosion, but the crest was still intact. The wider beach helped by forcing the waves to break earlier in the approach to the dune. The sand elevation on the beach was substantially reduced with all of it retained on the shoreline, but deposited offshore. Recovery by mild weather waves pushing material back toward the shoreline was already underway within days of the storm. Since there were no direct losses due to overwash transport onto the island, there should be enough sand left to push a wedge of recovered sand up toward the dune scarp for enhanced protection from the coming winter northeast storms.

Long Beach Township (North Beach);

This segment of the township shoreline is not covered by NJBPN, but damage was apparent with overwash between homes extending landward to the Boulevard. There was no direct benefit from the fill activity on either side of this beach. Indirect sand migration along the beach did provide a measure of added width, but no enhancement to the dunes.

Surf City;

Surf City was the location of the initial Army Corps project effort in 2007. This was completed and in spite of the problems associated with including illegally dumped munitions parts in the fill sands, the net result was a survival of the dune with the crest elevation in place, but narrower in total dune width. The beach fill was reduced in width from the design plan, but sufficient to help prevent wave overwash and damage to public and private infrastructure. In spite of the fact that these fill segments had abrupt starting and stopping points creating what are called “end-effects”, each was very successful in limiting damages to private and public property located landward of the fill project.

Ship Bottom;

While no fill was placed along the Ship Bottom shoreline, the loss from the Surf City section did improve the beach width along this reach. The dunes were wider as well and the combination prevented most overwash. The 8th Street site suffered removal of the seaward slope nearly to the crest, but a wide crest and minimal low spots allowed an excellent performance of this coastal segment of the island.

Long Beach Township (Brant Beach, Beach Haven Crest, Spray Beach);

Brant Beach was the most recent segment of LBI to receive the Army Corps beach replenishment project completed in early 2012. This site showed similar results as seen in Harvey Cedars and Surf City where the dune and beach took the impact with losses to the beach width and elevation and erosion to the seaward dune slope. No overwash or wave damage was observed.

The story was different at Beach Haven Crest where the dune failed at 81st Street. The pre-Sandy photograph depicts a narrow dune with a 16-foot crest elevation. This proved insufficient to stop the wave assault and extensive damage resulted. Both beach width and dune mass are essential, working as a team to protect from wave damage because both are essentially piles of sand which do erode at fairly rapid rates. If a dune were to erode at a 10 feet per hour rate, then it would need to be 100 feet thick to withstand a 10-hour duration of a steady intense storm activity. This approximates Sandy's level of violence over two high tide intervals on Monday October 29th.

The site at Old Whaling Road was different in Spray Beach due to a wider, higher dune. About a third of the dune was eroded taking the entire seaward slope, but the height prevented overwash and the properties landward were spared.

Beach Haven;

Both survey sites in Beach Haven suffered dune failure. Overwash covered streets and properties with sand. House damage was evident at both sites. Observations north and south of both sites found remnants of dunes that remained, but in general overwash was common and extensive in its penetration across the island.

Long Beach Township (Holgate);

The site #135 at Webster Avenue was typical of the wholesale damage done as the dune system was essentially erased and washed across the island into Barnegat Bay in many cases. Sand thicknesses of 3 to 4 feet were observed on Long Beach Island Boulevard and down the side streets to the bay. Low elevation homes were destroyed and even some larger structures showed serious impacts. The practice of oceanfront owners closing in the ground level area under the first habitable floor level with a concrete floor, insulated walls, and installing the furnace, hot water heater, the air conditioner compressor, and storing a myriad of possessions in an area designated as open space to allow waves to pass under the building with minimal impact, vastly increased the damage to individual properties as the wave of debris piled up against landward structures and penetrated into other ground level spaces. Individuals found that their space under the house now contained an intertwined complex of debris densely filling the entire area under the house. Clearly the dunes were too thin, too low and the beach too narrow to block Sandy in any meaningful way.

Among all the destruction, there were several oceanfront homes that had developed a wider, higher dune that hung together allowing the survival of the house including the landscaping.

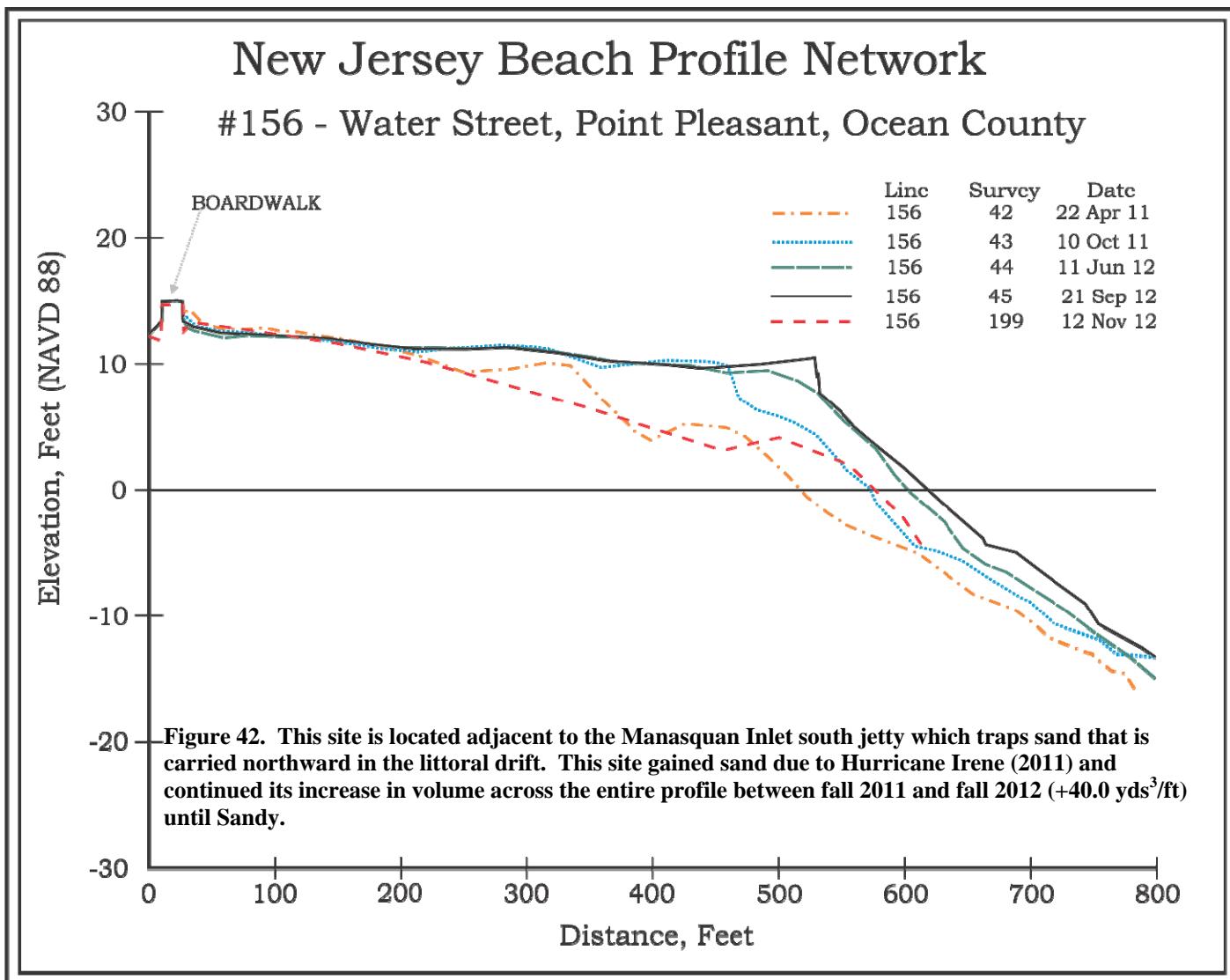
Forsythe Wildlife Refuge site;

In an effort to develop data on the NJ natural areas along the coastline the NJ Beach Profile Network includes surveys of all these natural areas. The Holgate Unit site in the Forsythe natural area was established in 1994 near the start of the spit extending a mile to the south. The entire spit has been moving landward as sand is held to the north by the pair of groins guarding the beach at the south end of development in the Township. Sandy transported sand westward across the spit into Barnegat Bay causing about a hundred feet of shoreline retreat. This retreat has been documented over the past 18 years in spite of meager efforts to stabilize the immediate shoreline with waste concrete and geo-textile bags filled with sand. This retreat will ultimately produce a similar situation to that of Longport south of 11th Street (Atlantic County) where very expensive homes have minimal beach/dune protection and depend on a low rock wall that failed to protect them. The possibility of a new inlet through the spit at Holgate always exists since there is an historical record of three breakthroughs, the last of which happened in 1920 during a severe northeast storm. Tucker's Beach became Tucker's Island and the "New Inlet" proceeded to migrate south erasing the newly formed island by 1940. The net result was a 500 to 700-foot retreat in the southern LBI shoreline landward that if repeated would render most of the Holgate section of Long Beach Township as part of the Atlantic Ocean. The solution will require both structural and sand volume enhancement to stop or slow the changes that are driven by exceptional storms.

NJBPN 156 – Water Street, Point Pleasant



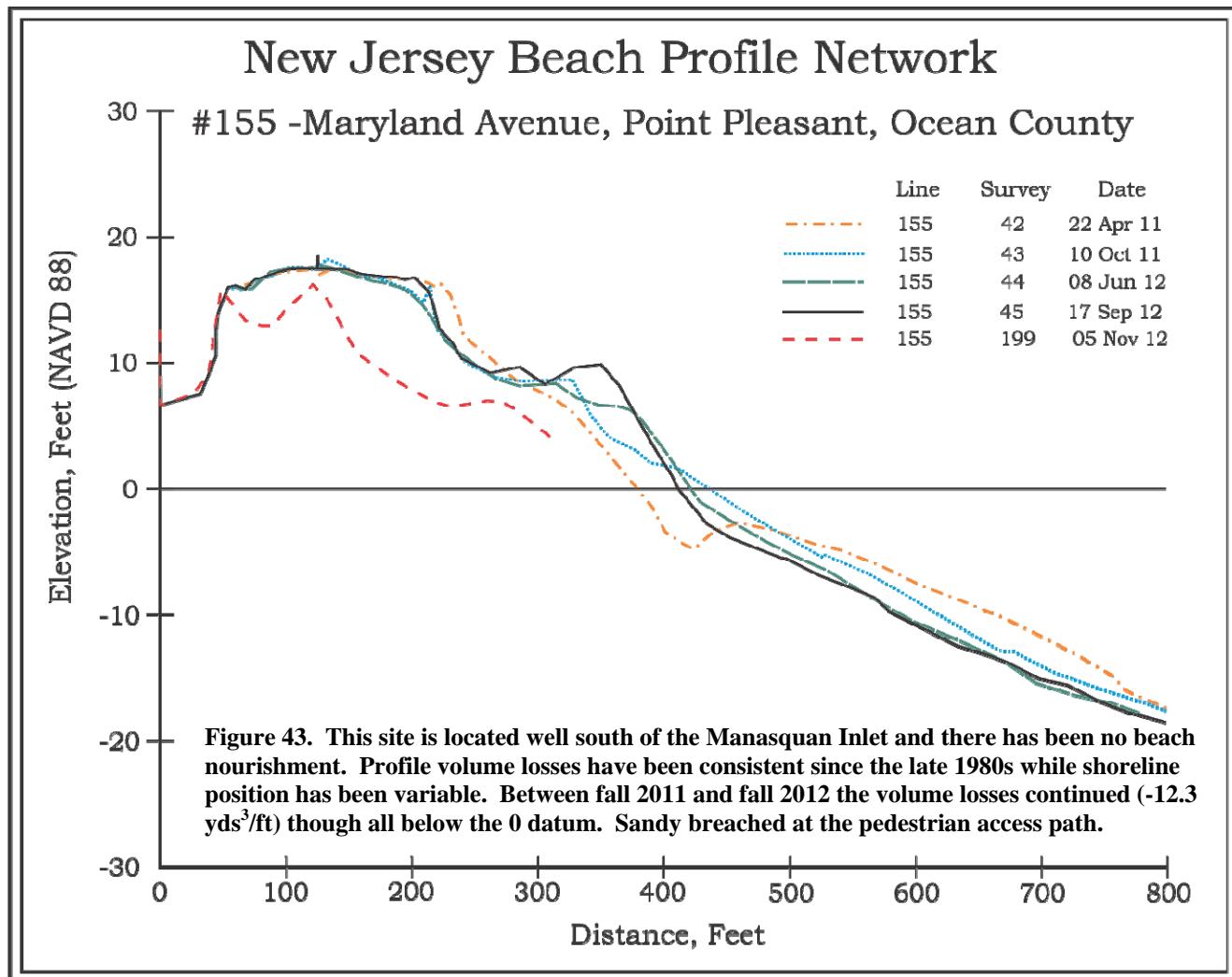
The photograph on the left was taken on September 21, 2012. The one on the right shows no noticeable change to the backbeach elevation following the storm (taken November 12, 2012). This urban beach did not have a dune system but was spared from more severe damages by the over 600-foot protective berm.



NJBPN 155 – Maryland Avenue, Point Pleasant



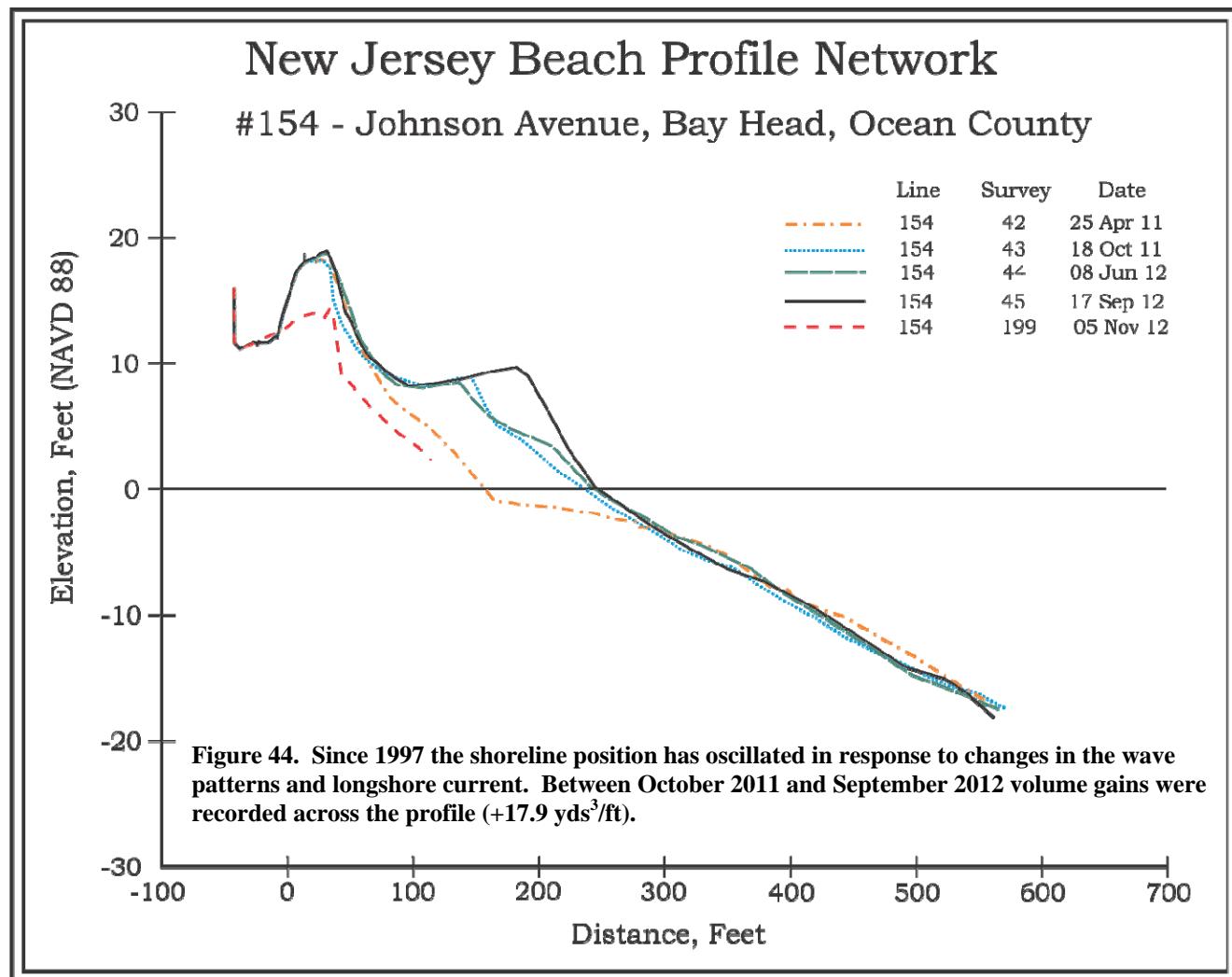
The photograph on the left shows the dune that has occurred at this site for 25 years (taken on September 17, 2012) and on the right, the damages and local restoration efforts of the former dune (taken on November 12, 2012). Lower elevation shore-perpendicular access ways may have channeled wave activity landward. The plot depicts the changes caused by the storm and the losses of the berm and poorly vegetated dune system where 45.7 yds^3/ft . of sand were removed during the storm. By the time of the post-storm survey, the municipality had begun relocating sand from the berm to the former dune location.



NJBPN 154 – Johnson Avenue, Bay Head



The photograph on the left (September 17, 2012) shows the low dunes before Sandy and on the right, post-storm conditions (November 12, 2012). The plot depicts the changes and the losses of the berm and moderate dune where $36.8 \text{ yds}^3/\text{ft}$. of sand were removed during the storm (calculated from extending the November 2012 survey to the datum at a 1:20 slope). The dune seaward of the homes was obliterated during the storm and exposed a base rubble-mound revetment layer. The beach was lowered, and sand was overwashed between the oceanfront homes and carried landward to the backbarrier.

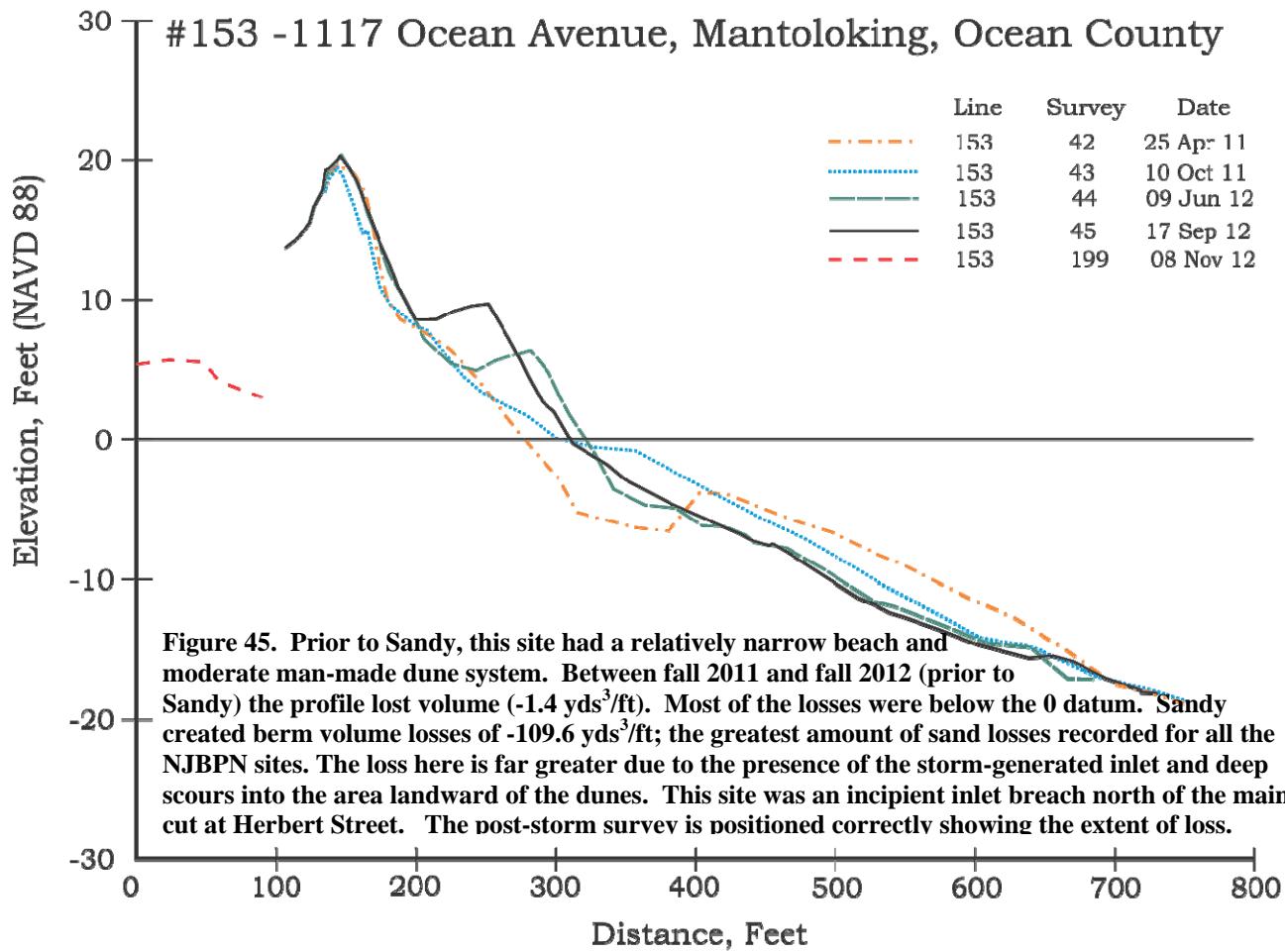


NJBPN 153 – 1117 Ocean Avenue, Mantoloking



Pre-storm conditions of the modified dune are shown in the September 17, 2012 (left). This view shows the results of the restoration effort following Hurricane Irene (August 2011). The November 5, 2012 (right) was taken at the same location. This profile location is within 300 feet from the temporary breach that opened during Sandy. The home at 1117 Ocean Avenue was completely removed from its location and the residence in the photograph was also destroyed.

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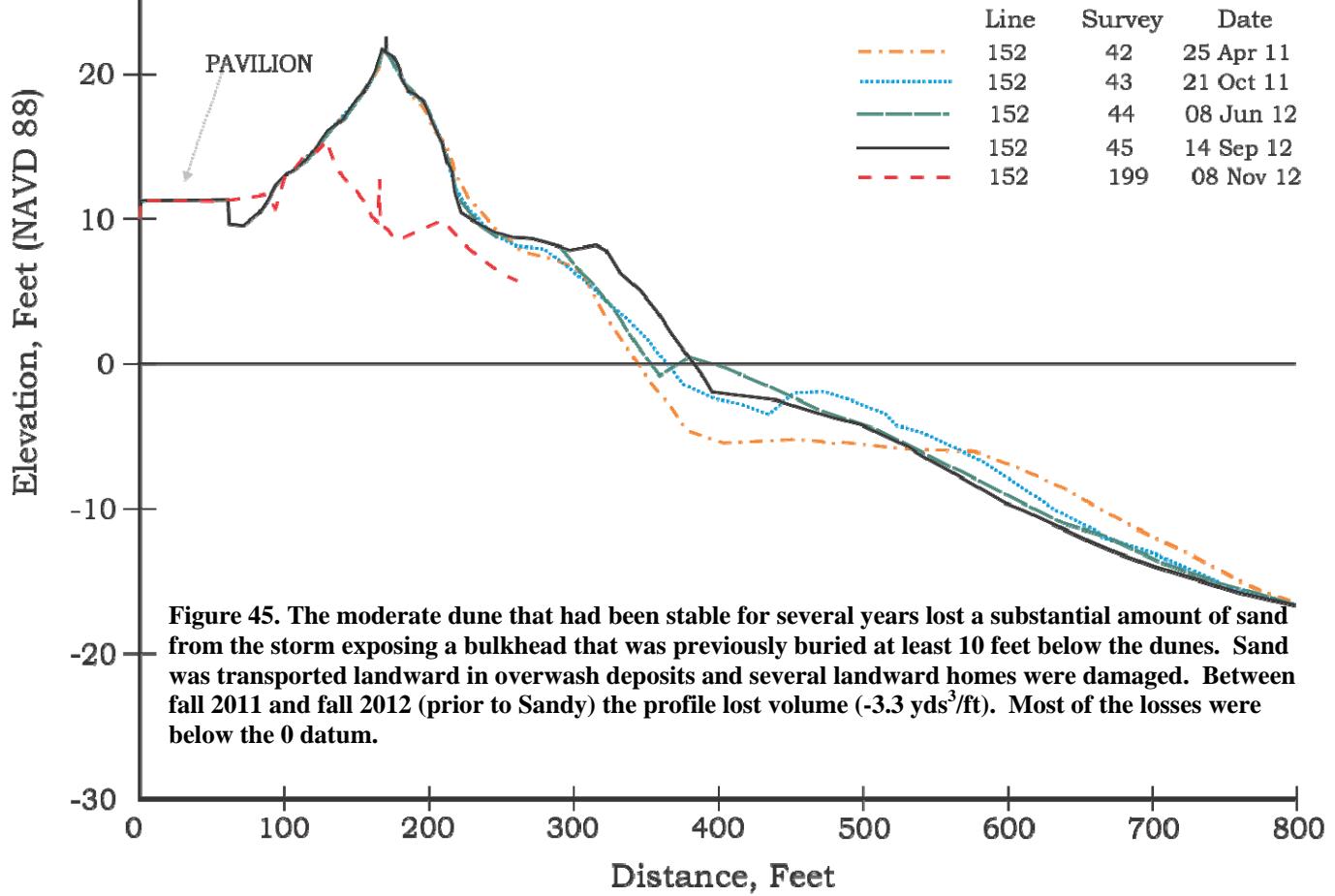
NJBPN 152 – Public Beach #3, Brick Township



The photograph on the left shows the public access way, dune, and moderate berm on September 14, 2012. The post-storm photo on the right (November 8, 2012) shows municipal efforts in protecting what was left of the former dunes.

New Jersey Beach Profile Network

#152 - Public Beach #3, Brick Township, Ocean County

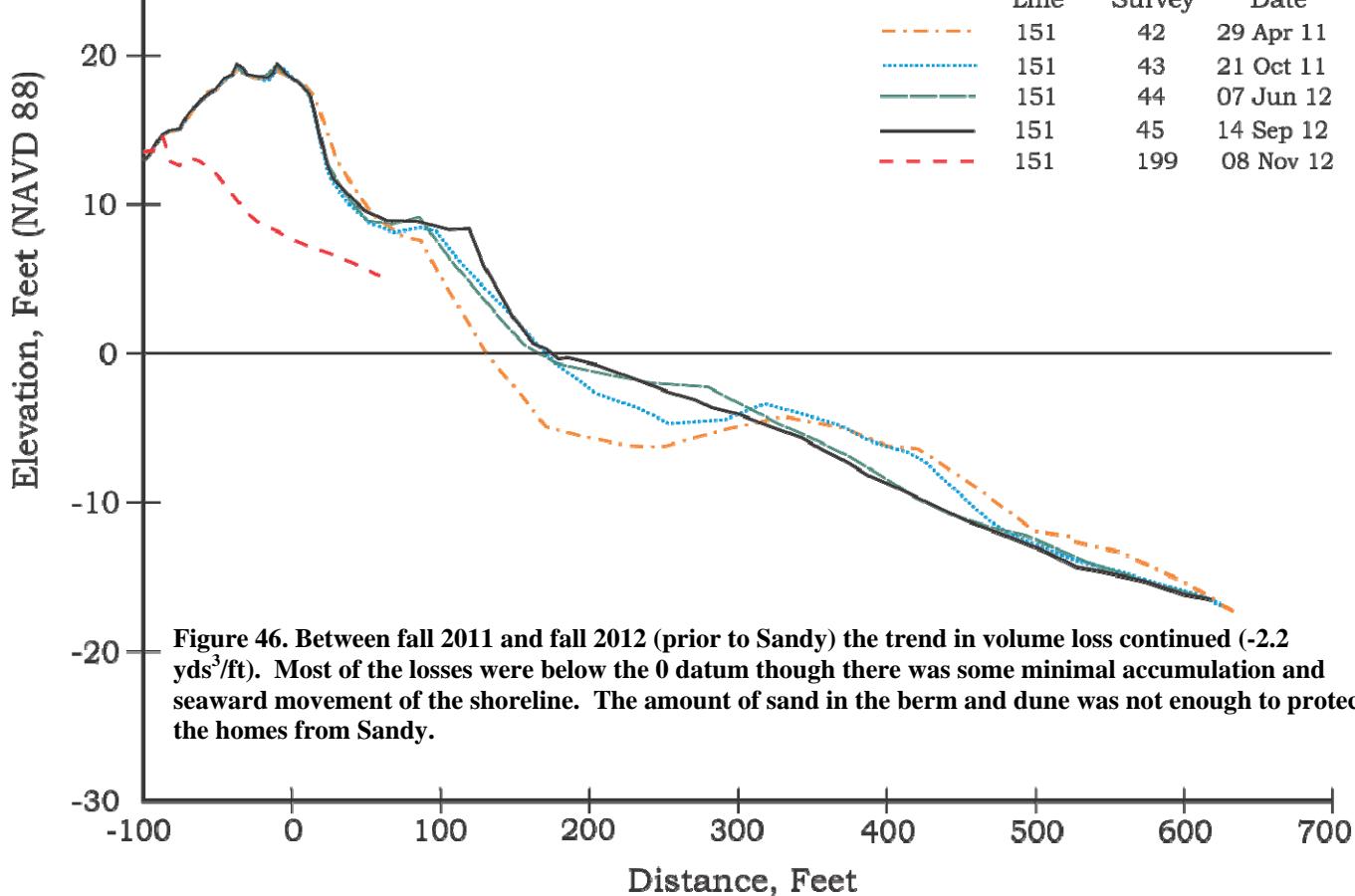
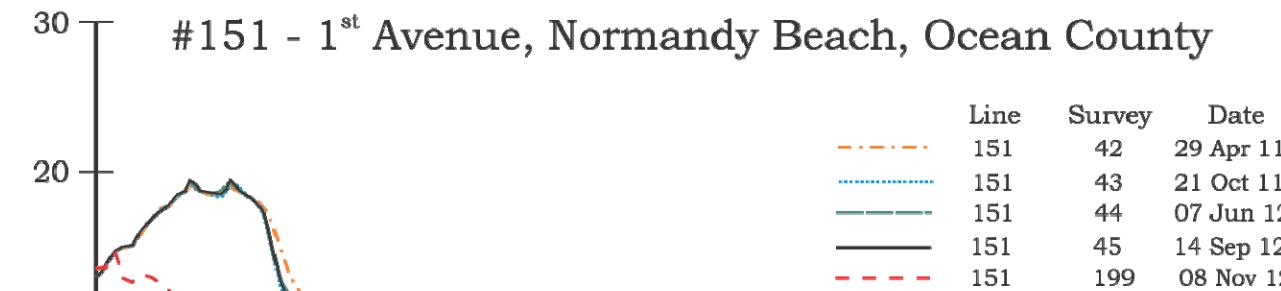


NJBPN 151 – 1st Avenue, Normandy Beach



The photograph on the left (September 14, 2012) shows the limited dune system and minimal berm prior to Sandy. On the right (November 8, 2012), the photo shows damages to structures and exposure of once-buried bulkheads following the storm. Significant overwash occurred at this site and many oceanfront and landward homes were damaged.

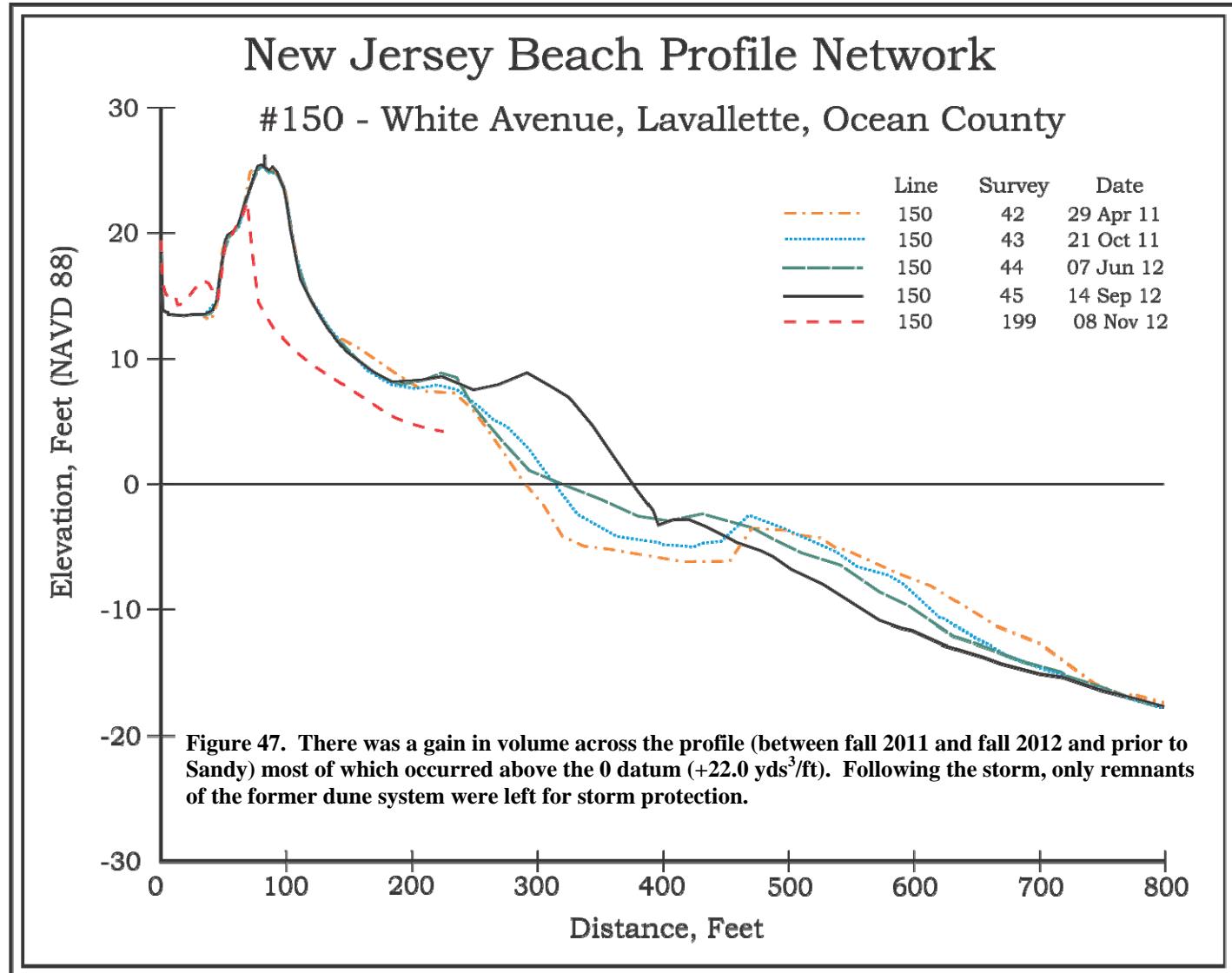
New Jersey Beach Profile Network



NJBPN 150 – White Avenue, Lavallette



The photograph on the left (September 14, 2012) shows the dune that was created over time through municipal efforts. On the right (November 8, 2012), the photo shows the losses of the berm and dune where 51.1 yds³/ft. of sand were removed during the storm. This location experienced beach and dune erosion; however, overwash only occurred where the dune was lower and breached.



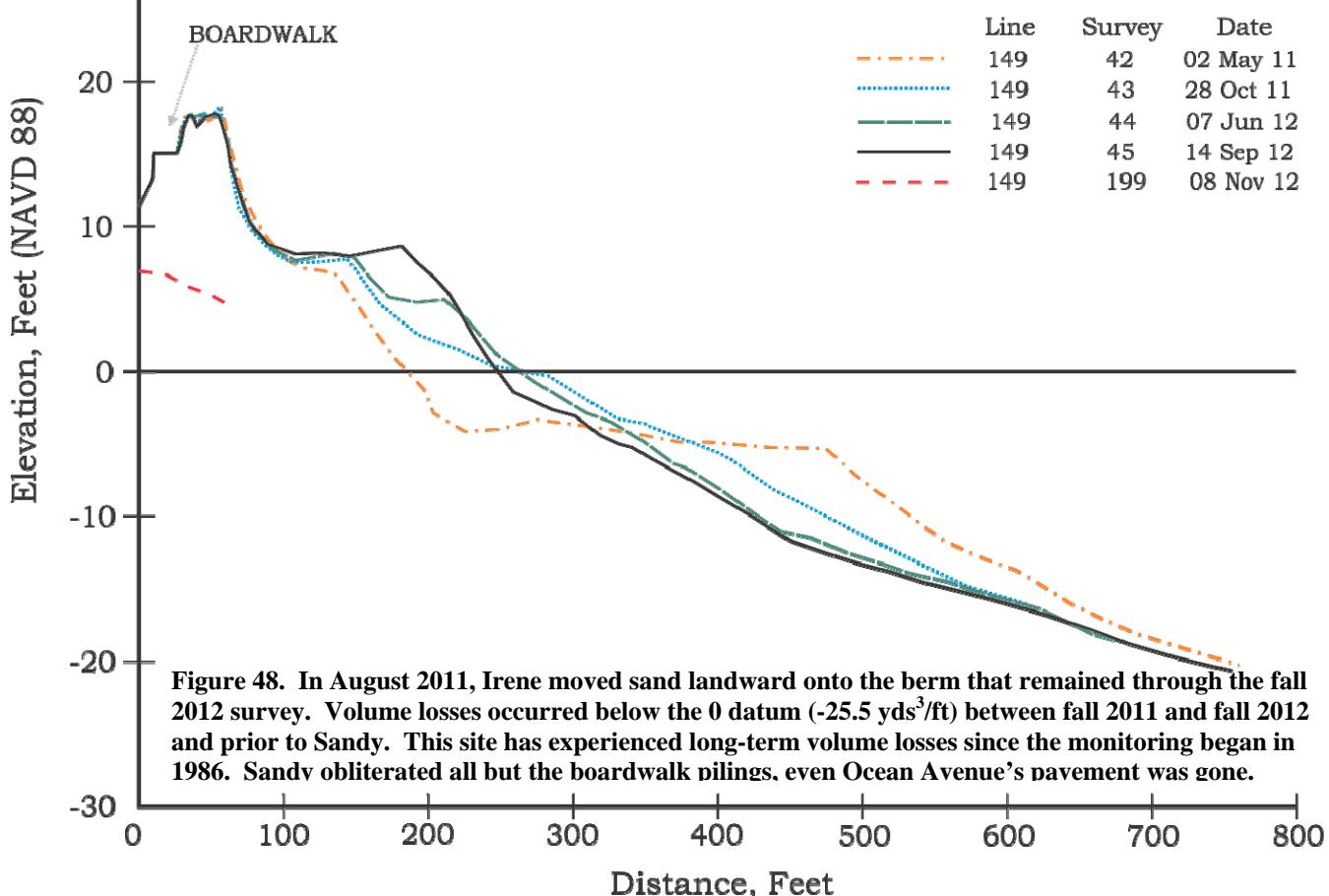
NJBPN 149 – 8th Avenue, Ortley Beach



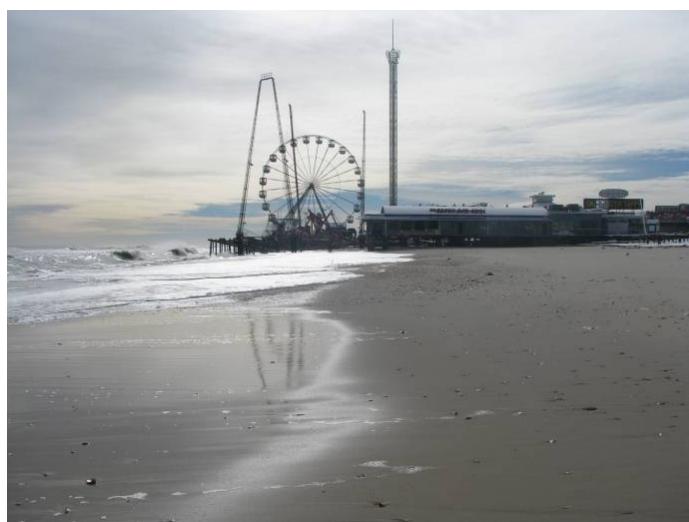
The photograph on the left (September 14, 2012) shows a modest berm and the municipal dune present prior to the storm. On the right (November 8, 2012), 68.7 yds³/ft of berm and dune were removed during the storm. Over 10 feet of dune height was pushed landward in overwash deposits. The boardwalk was located landward of the dunes (left) Ocean Avenue was destroyed as well as several homes. The photo on the right shows a classic flat beach created by the large waves.

New Jersey Beach Profile Network

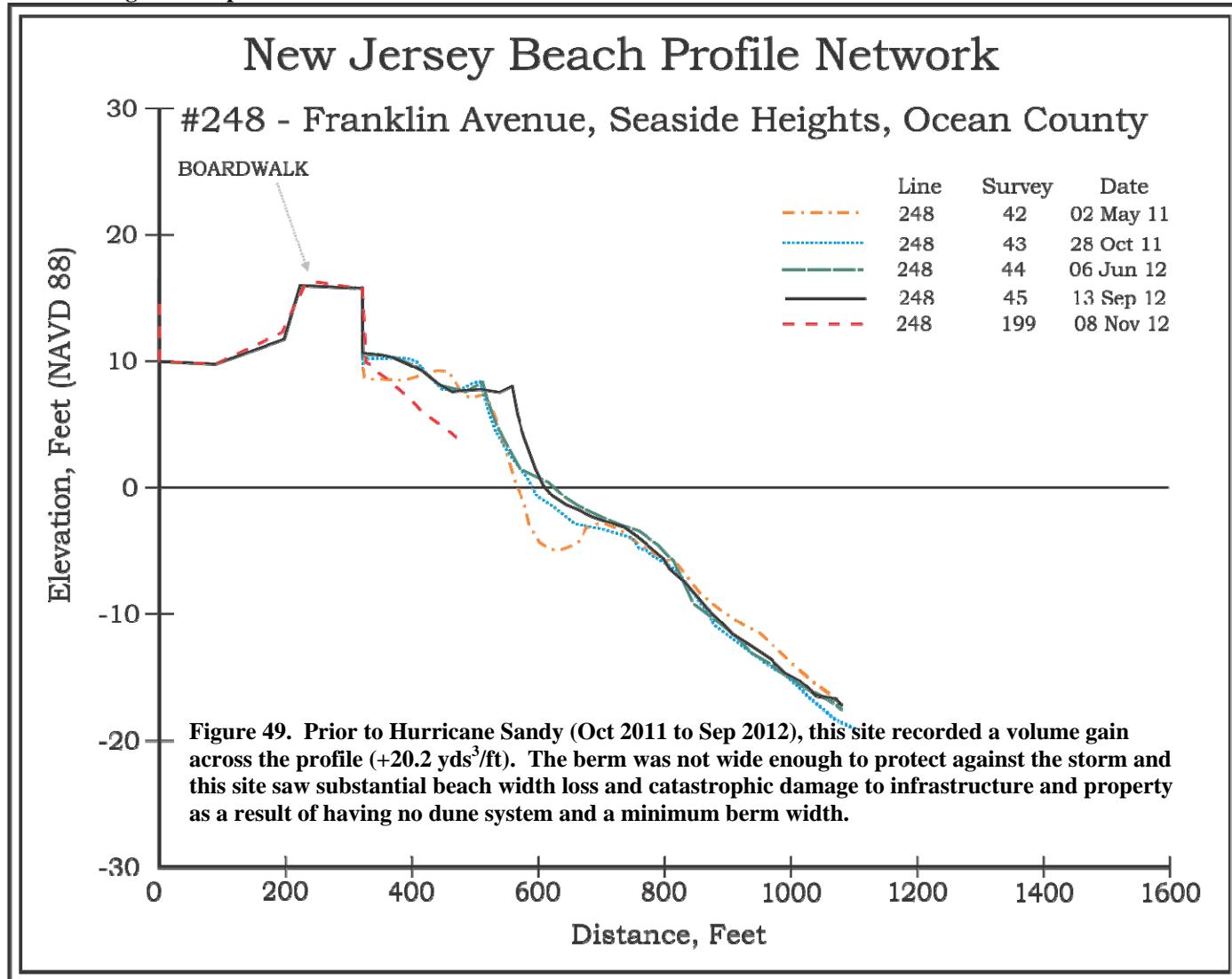
#149 - 8th Avenue, Ortley Beach, Ocean County



NJBPN 248 – Franklin Avenue, Seaside Heights



The September 13, 2012 photo on the left shows the bathing beach prior to Hurricane Sandy. The photo on the right shows the November 8, 2012 post-storm beach. This urban beach did not have a dune system and the photo on the right shows the obvious damages to the pier and amusements.



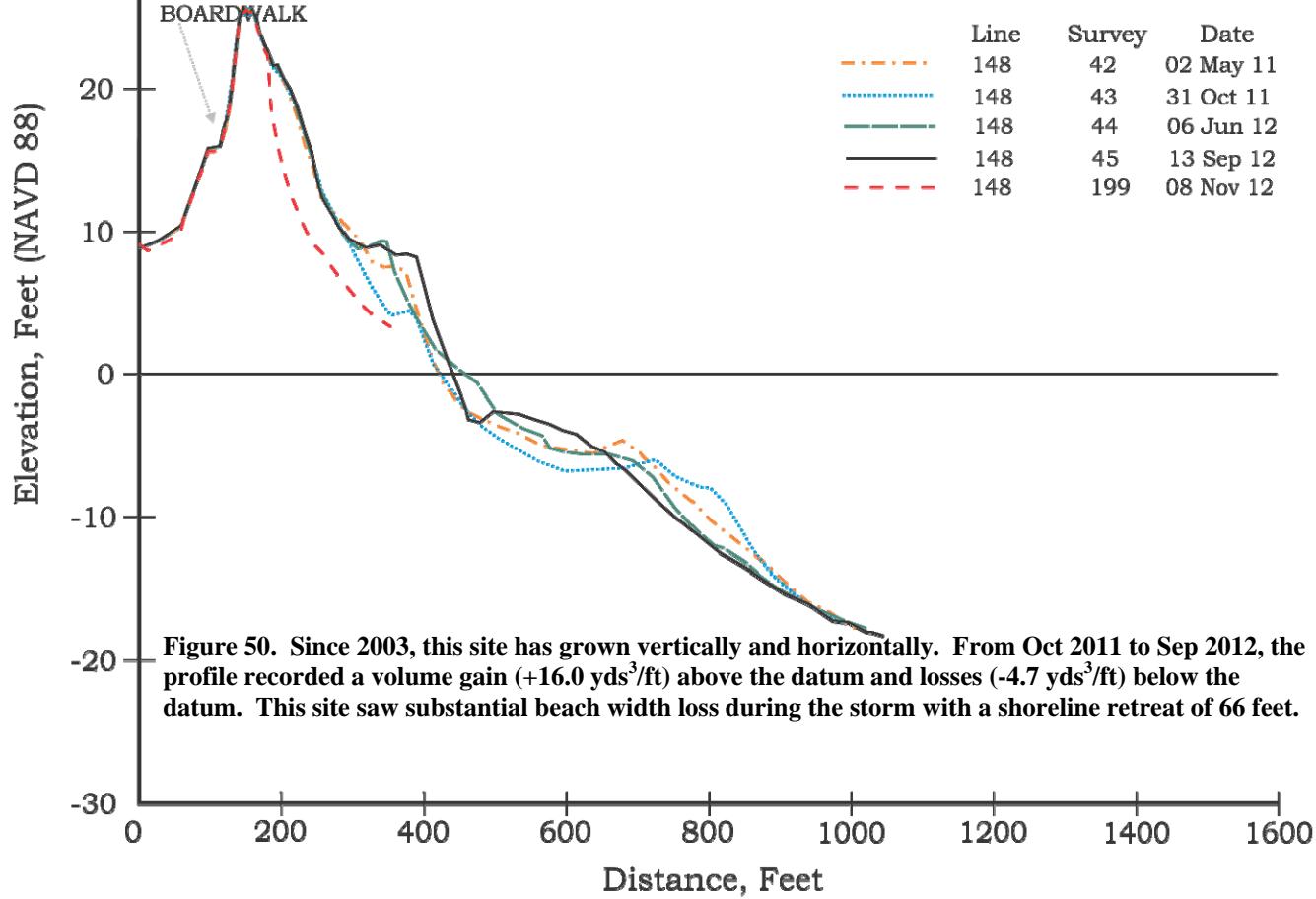
NJBPN 148 – 4th Avenue, Seaside Park



The left photograph was taken on September 13, 2012 and shows the extensive dune prior to Hurricane Sandy. On the right (taken November 8, 2012), a northeast storm had dumped snow on the shoreline nearly a week after Sandy's landfall. Although there was loss of dune from the storm, no overwash occurred at this location.

New Jersey Beach Profile Network

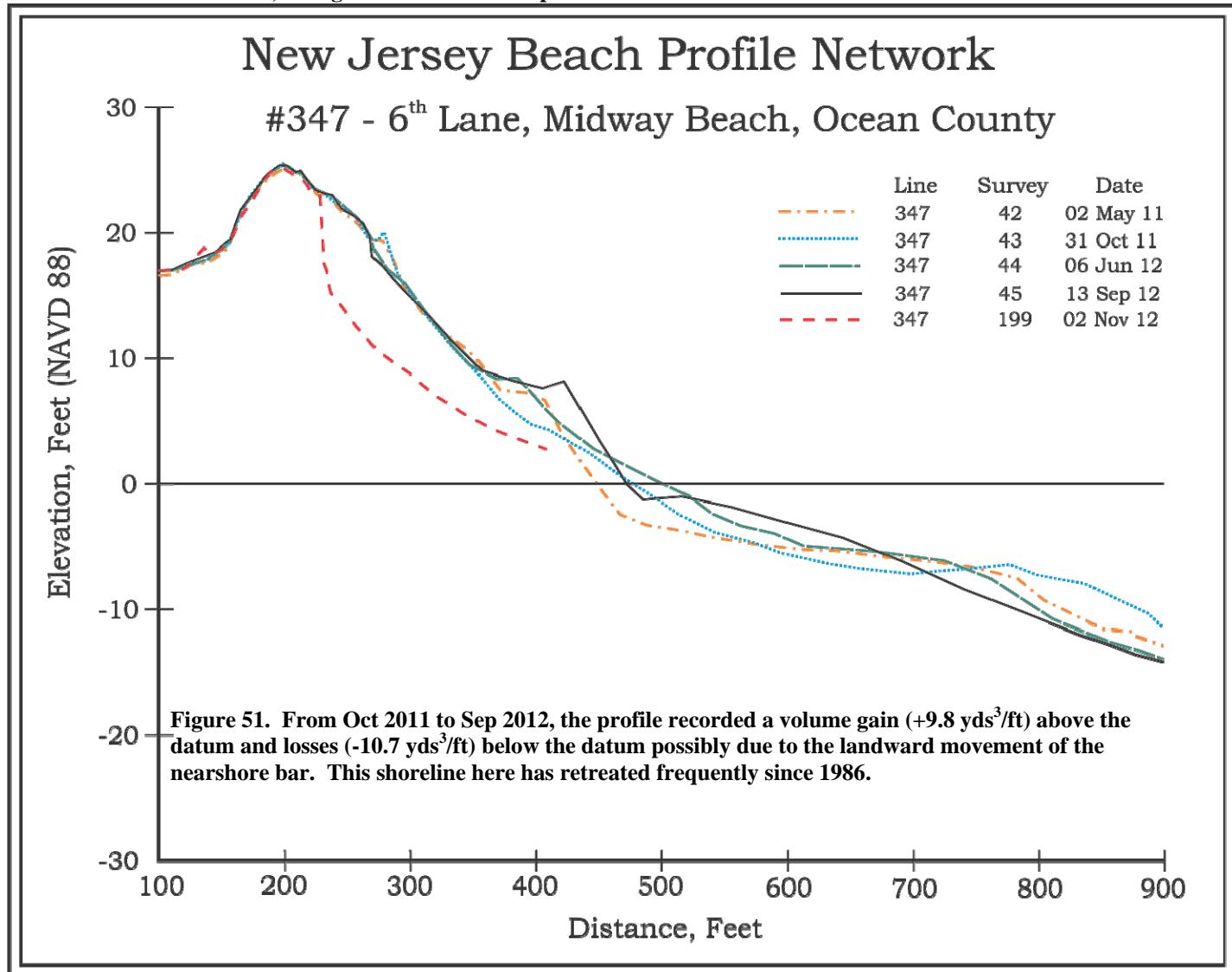
#148 - 4th Avenue, Seaside Park, Ocean County



NJBPN 347 – 6th Lane, Midway Beach



The left photograph was taken on September 13, 2012 and on the right (taken November 8, 2012), a northeast storm had dumped snow on the shoreline nearly a week after Sandy's landfall. The figure below depicts the changes caused by the storm and the losses of the berm and dune where 48.7 yds³/ft. of sand were removed during the storm. Though there were measured losses of the berm and dune, enough dune remained to protect the landward homes and infrastructure.

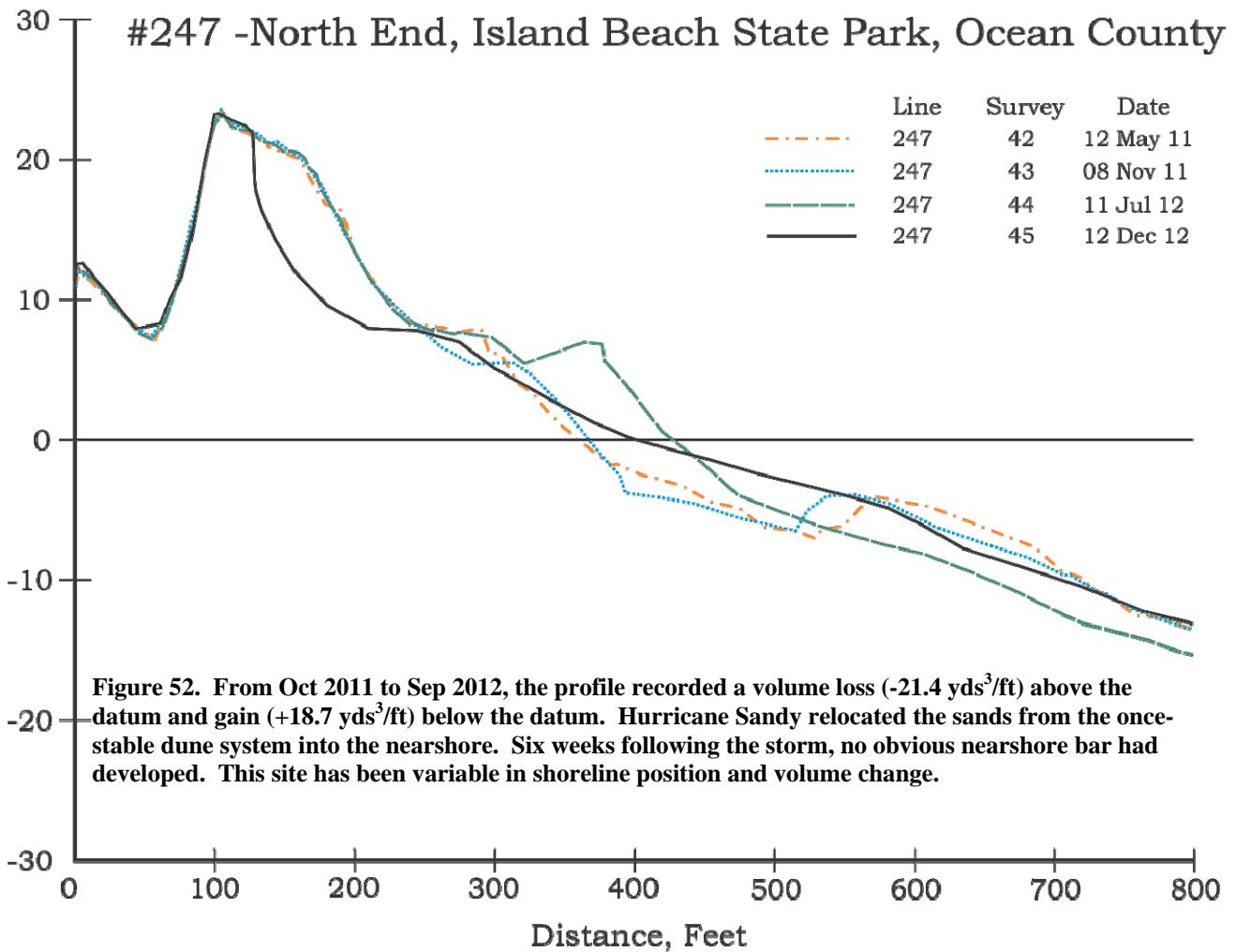


NJBPN 247 – North End, Island Beach State Park



The left photograph was taken on November 8, 2011 and shows a wide natural dune system. The right photo (taken December 12, 2012) shows the condition of the dune system nearly six weeks after Sandy's landfall.

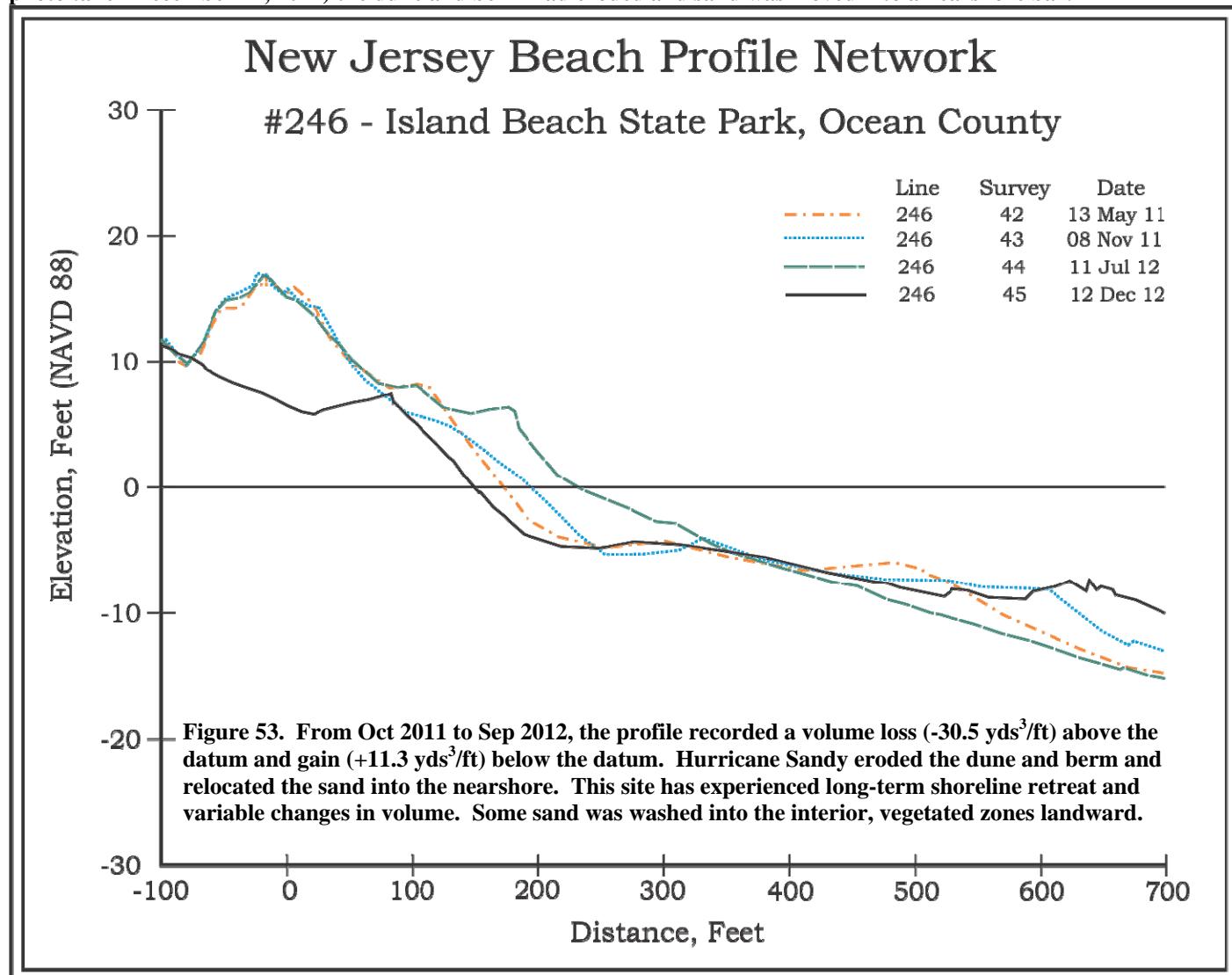
New Jersey Beach Profile Network



NJBPN 246 – Parking Lot A7, Island Beach State Park



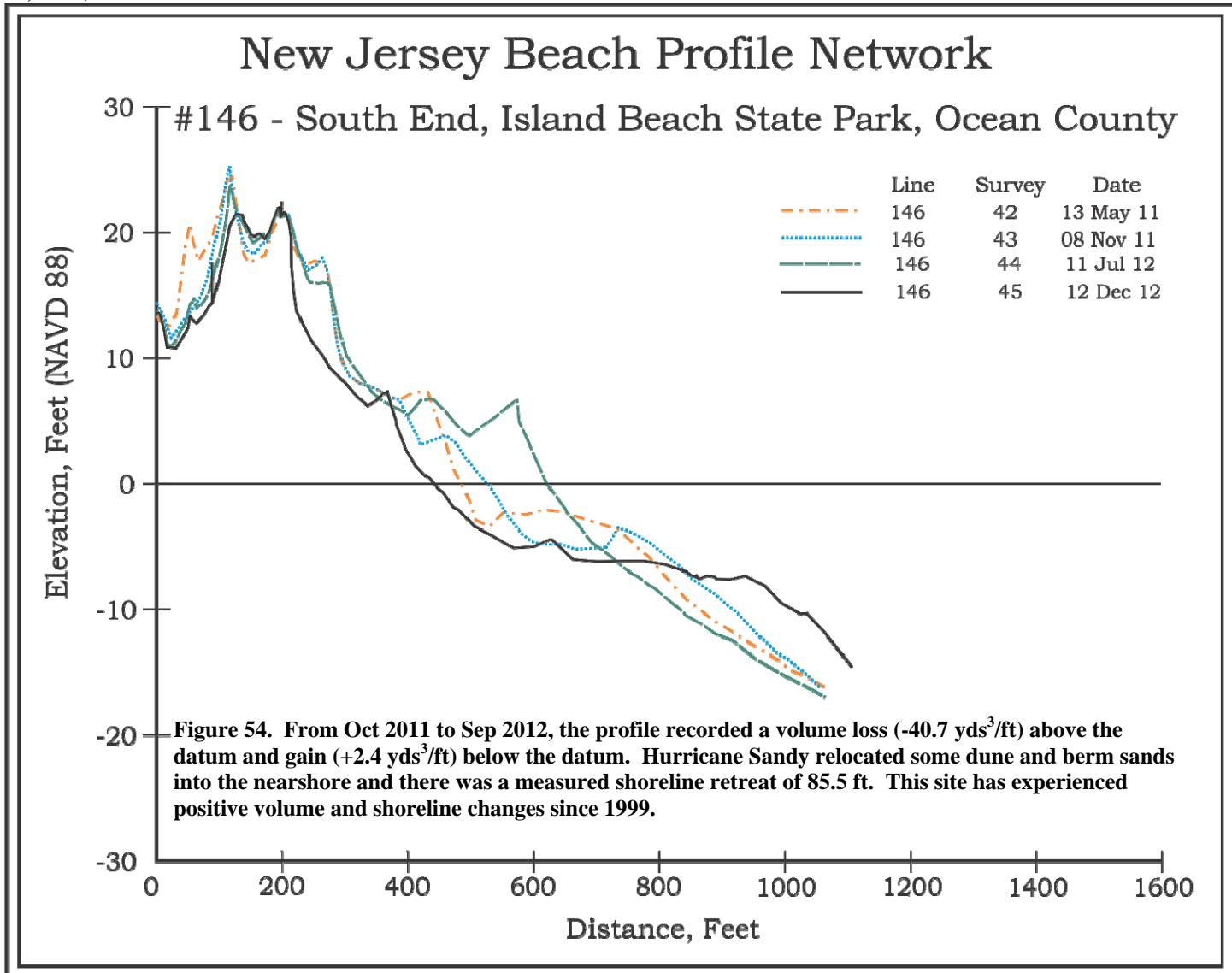
The left photograph was taken on November 8, 2011 and shows a wide natural dune system. Six weeks after Sandy, (right photo taken December 12, 2012) the dune and berm had eroded and sand was moved into a nearshore bar.



NJBPN 146 – Parking Lot A7, Island Beach State Park



This site within the state protected area is less than a mile from the north Barnegat Inlet jetty. The left photograph was taken on November 8, 2011 and shows the wide beach and natural dunes. The photo on the right, six weeks after Sandy (December 12, 2012) shows the conditions of the dune and berm.



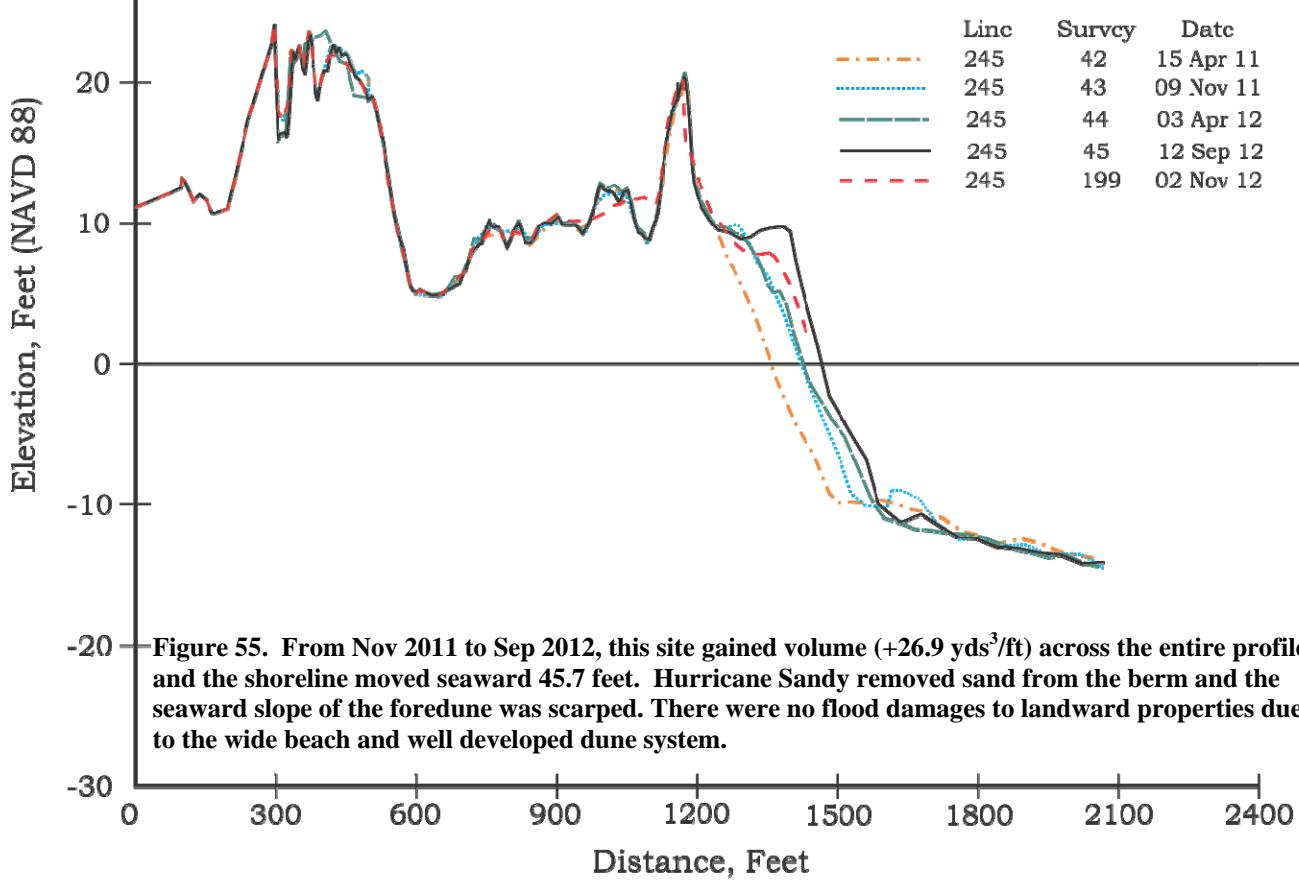
NJBPN 245 – 10th Street, Barnegat Light



This site is located approximately 1500 feet south of the Barnegat Inlet south jetty and was established to monitor the changes at the inlet. The left photo (taken on September 12, 2012) shows the dune and beach conditions before Sandy and the dense vegetation along the landward dune slope. The photo on the right (taken on November 2, 2012) shows the impact of Sandy where sand was overwashed and blown landward across the dune burying but not killing the vegetation.

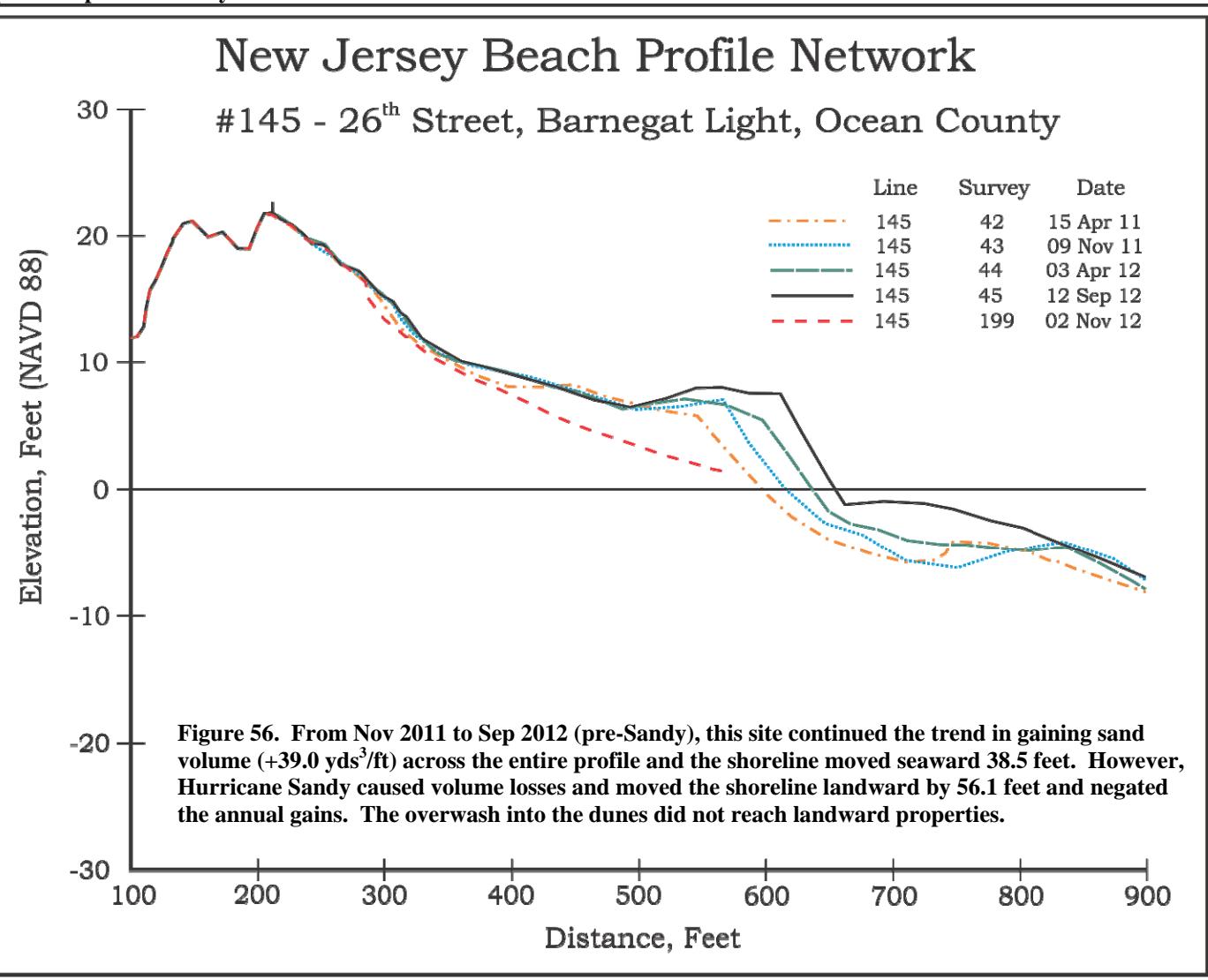
New Jersey Beach Profile Network

#245 - 10th Street, Barnegat Light, Ocean County



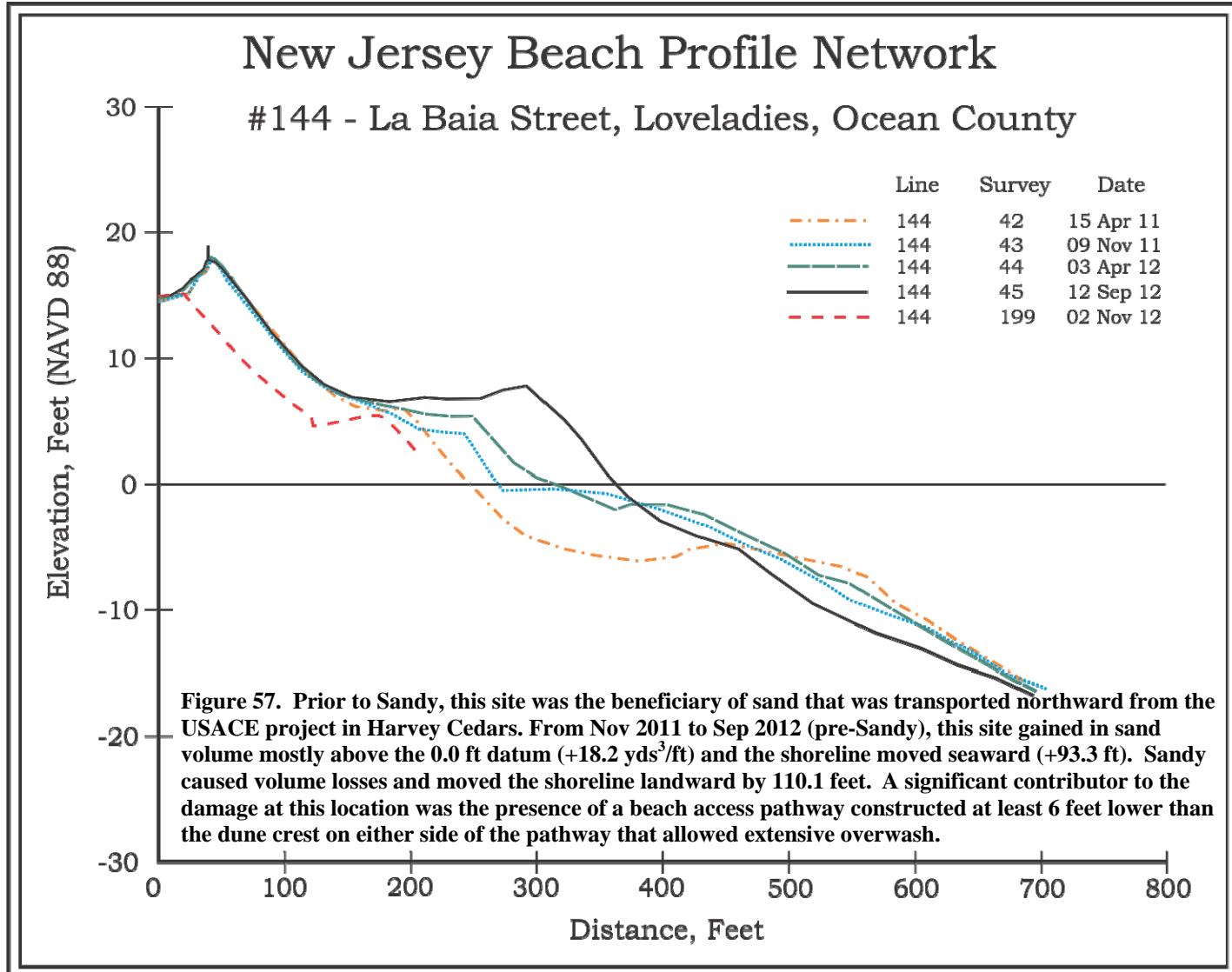


The photo on the left was taken on September 12, 2012 and shows the dune and beach conditions and dense vegetation before Sandy. In the photo on the right taken on November 2, 2012 from a similar location looking south post-Sandy the impact of the storm is evident from the sand overwashed and blown landward across the dune burying the dense vegetation seen in the September picture and by the narrower beach width.





Above are two photos taken at La Baia Street before and after Hurricane Sandy. The photo on the left (taken September 12, 2012) shows the dune and beach conditions prior to the storm. In the photo on the right (taken November 2, 2012) the impact of the storm is evident. The former dune was removed and the shoreline moved 110.1 feet landward. Sand was overwashed between the oceanfront homes and carried landward to the road.



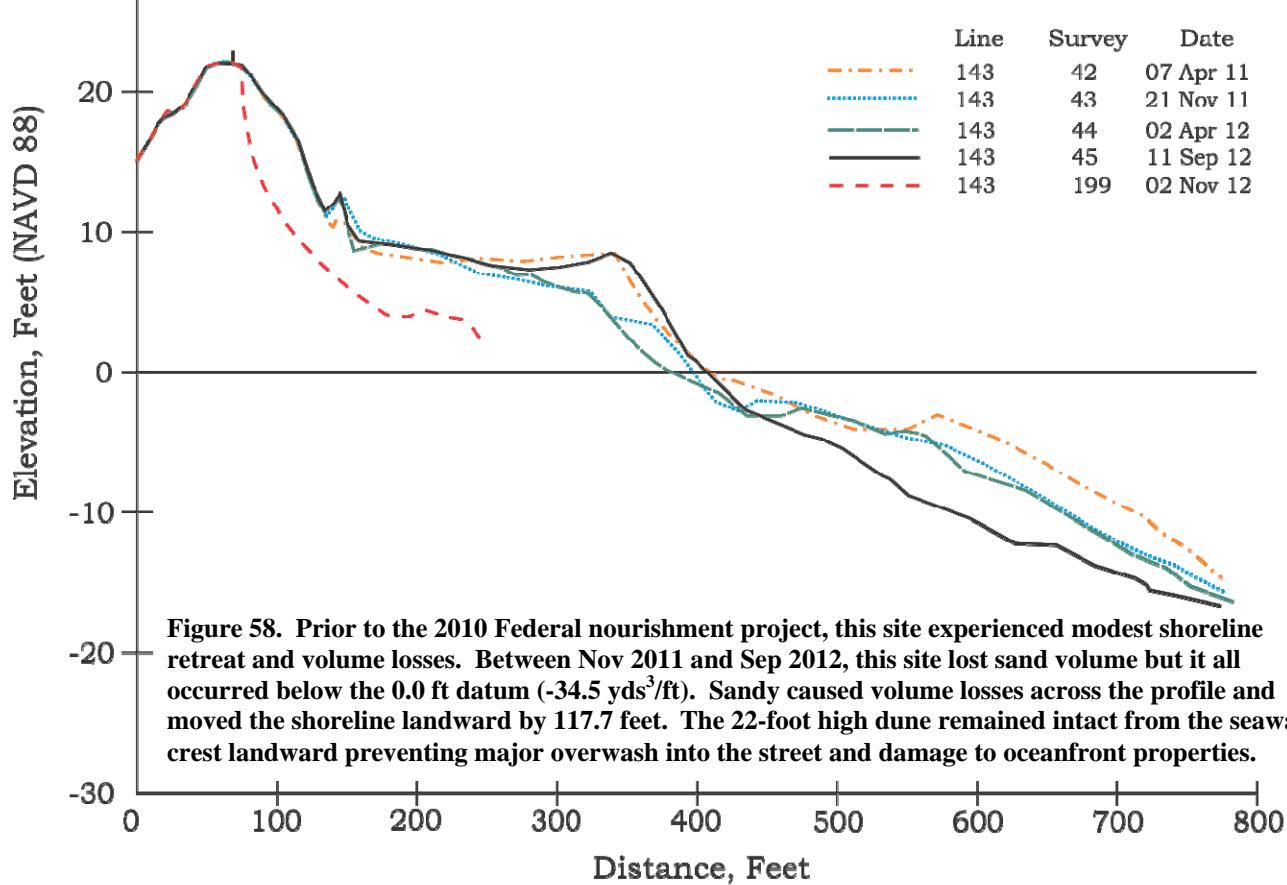
NJBPN 143 – 73rd Street, Harvey Cedars



The photo on the left was taken on September 11, 2012 while the photo on the right was taken on November 2, 2012 from a similar location looking north. This site had received sand as part of the 2010 USACE beach nourishment project for Long Beach Island. The project provided ample dune and beach width enhancement and storm protection for the oceanfront properties. The post-Sandy photo shows the impact of the storm with a significant dune scarp at the seaward crest and a narrow, lower-elevation beach remaining. However there was no evidence that sand overwashed the dune at this location.

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#143 - 73rd Street, Harvey Cedars, Ocean County

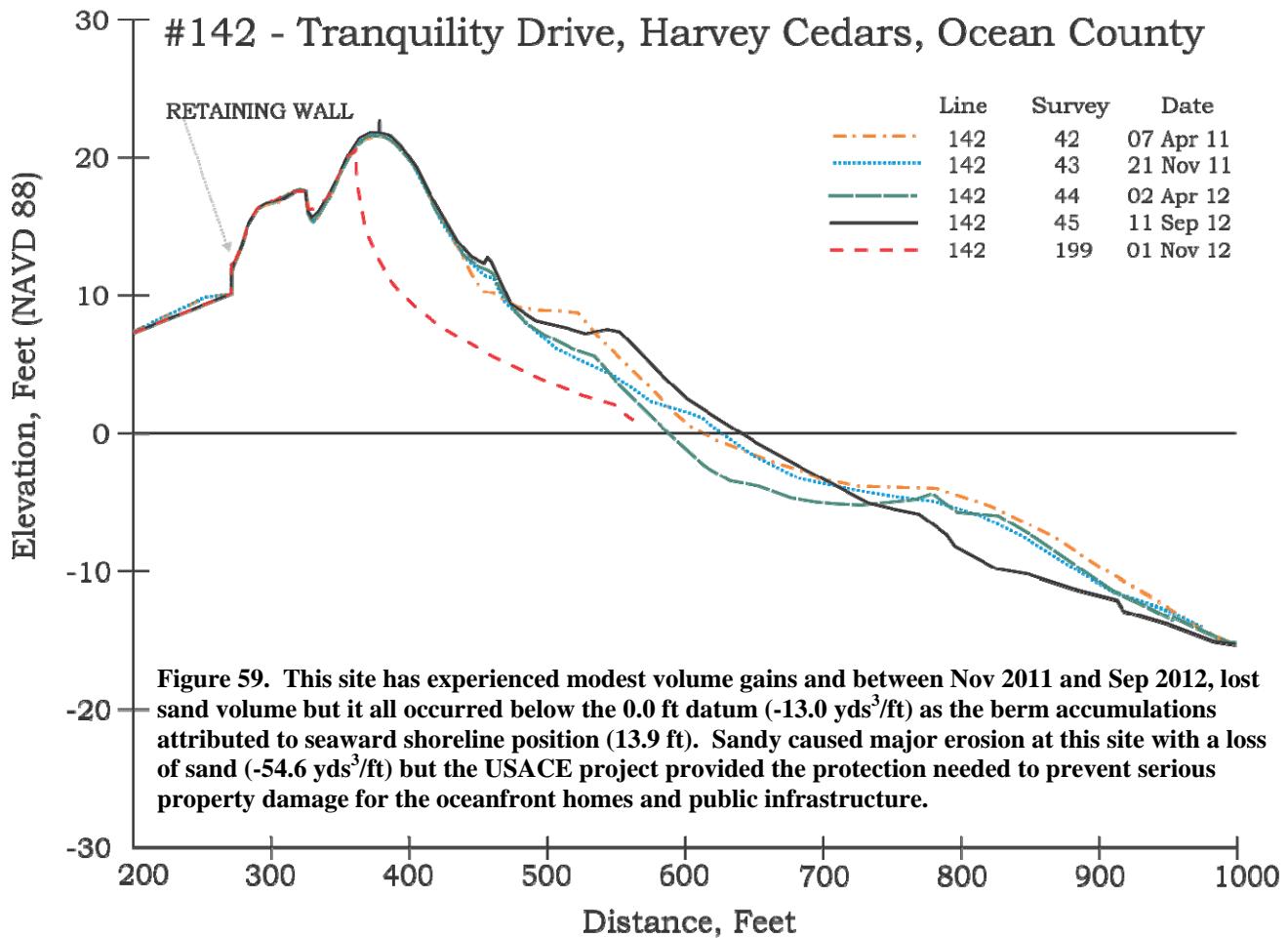


NJBPN 142 – Tranquility Drive, Harvey Cedars



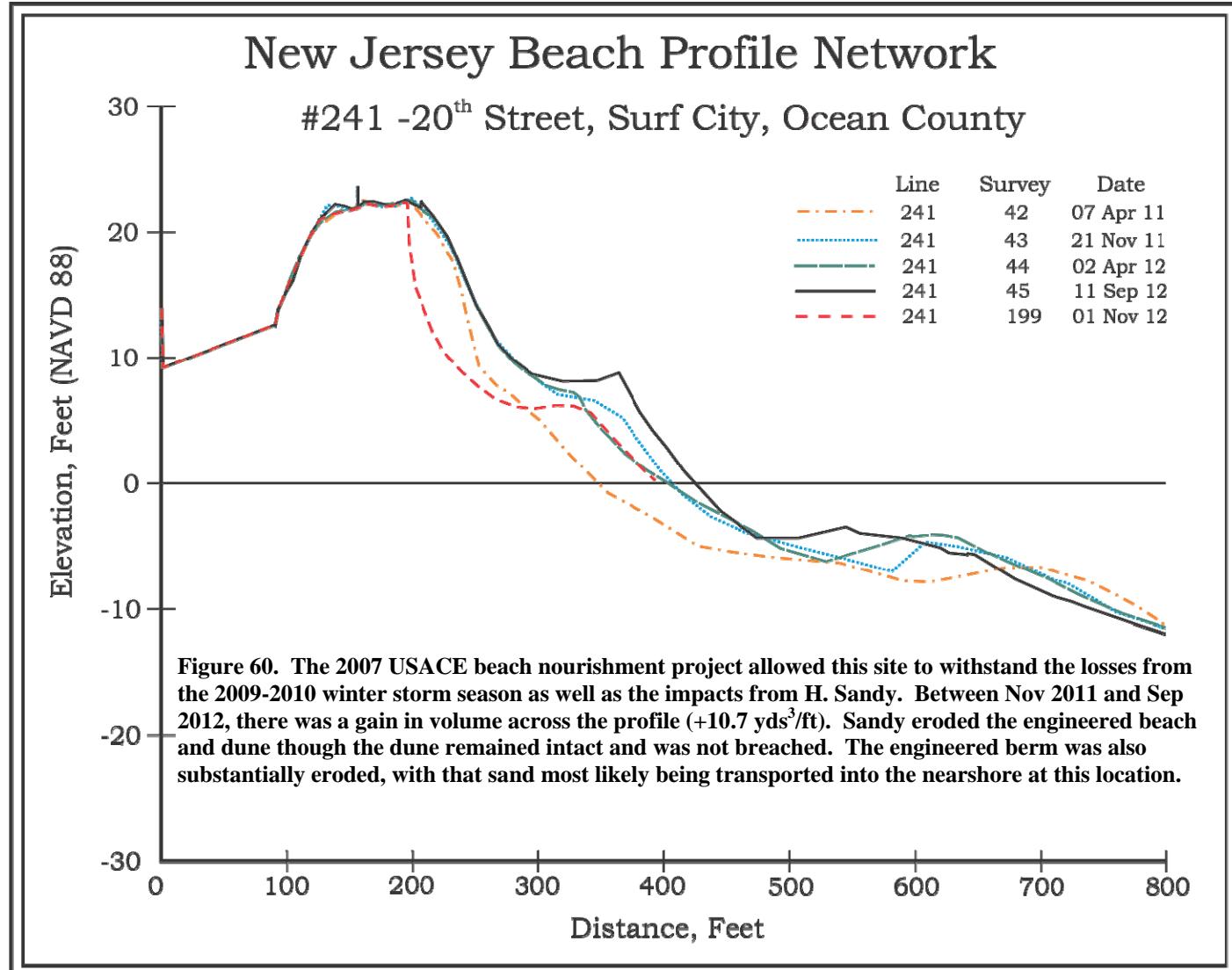
The Tranquility Drive site was included in the 2010 USACE beach nourishment project. The photo on the left was taken on September 11, 2012 and shows the dune and beach conditions of the USACE engineered beach before Sandy. On the right, the photo (taken on November 2, 2012 - post-Sandy) shows the impact of the storm by the significant loss of dune seaward of the homes and the lower and narrower beach. Despite the significant loss of dune, overwash did not occur and the oceanfront properties were protected from wave damages.

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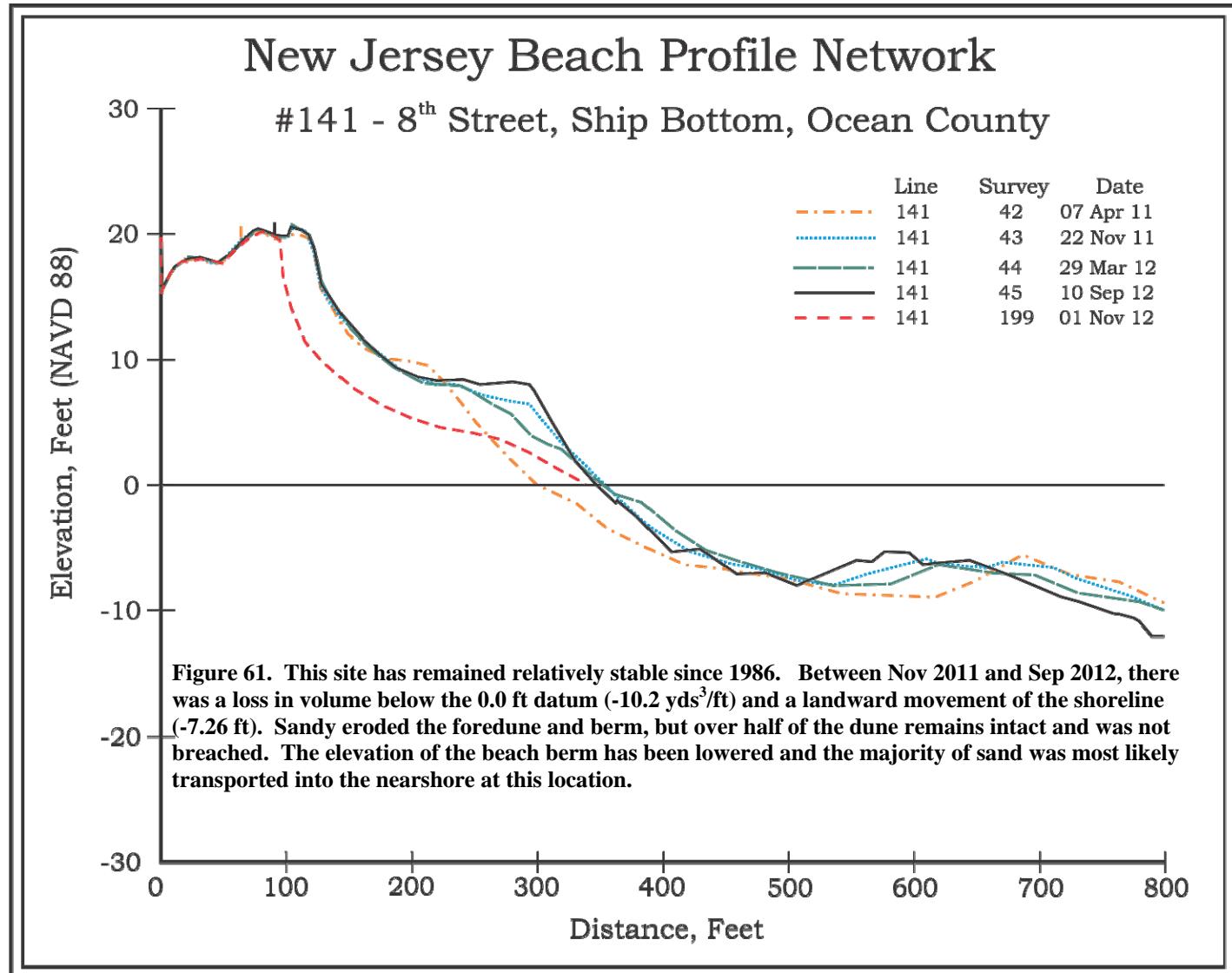
The photographs above were taken on September 11th, 2012 (left) and November 1st, 2012 (right). Both images show the view of 20th Street (site 241) looking south. This location in Surf City received a beach replenishment in 2007, which increased the sand volume and width of the dune and berm. The dune and berm both experienced substantial erosion; however no overwash occurred at this location.



NJBPN 141 – 8th Street, Ship Bottom



The photographs above were taken on September 10th, 2012 (left) and November 1st, 2012 (right). Both images show the view of 8th street (site 141) looking north. This location in Ship Bottom experienced erosion of the beach and dune from Sandy, however the dune was not breached and no overwash occurred at this location.



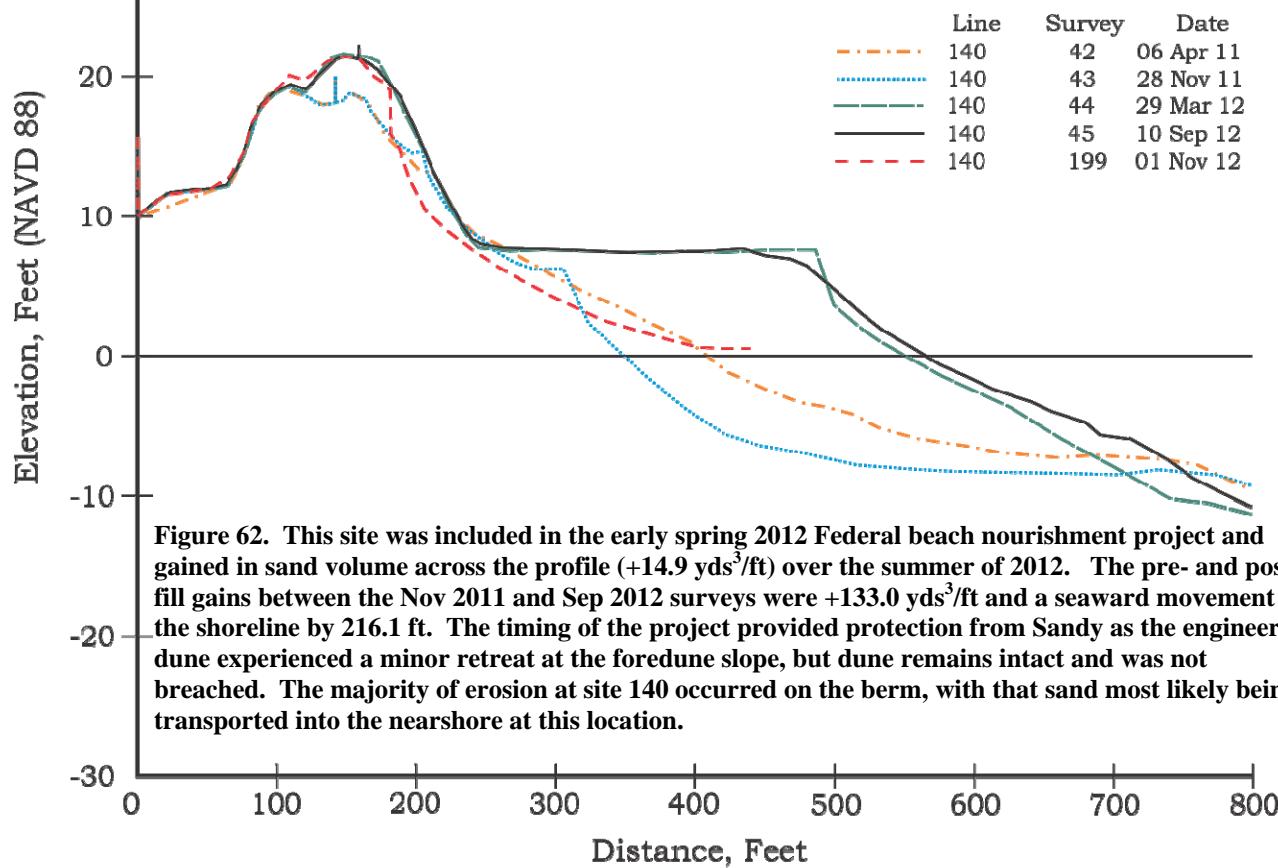
NJBPN 140 – 32nd Street, Long Beach Township



The photographs above were taken on September 10th, 2012 (left) and November 1st, 2012 (right). Both images show the view of 32nd street (site 140) looking north. This location in the Brant Beach section of Long Beach Township received beach replenishment in spring 2012, which increased the sand volume and width of the dune and berm. The foredune slope experienced minor erosion during Sandy, while the berm was severely eroded. No overwash occurred at this location. The park bench remained in its original position.

New Jersey Beach Profile Network

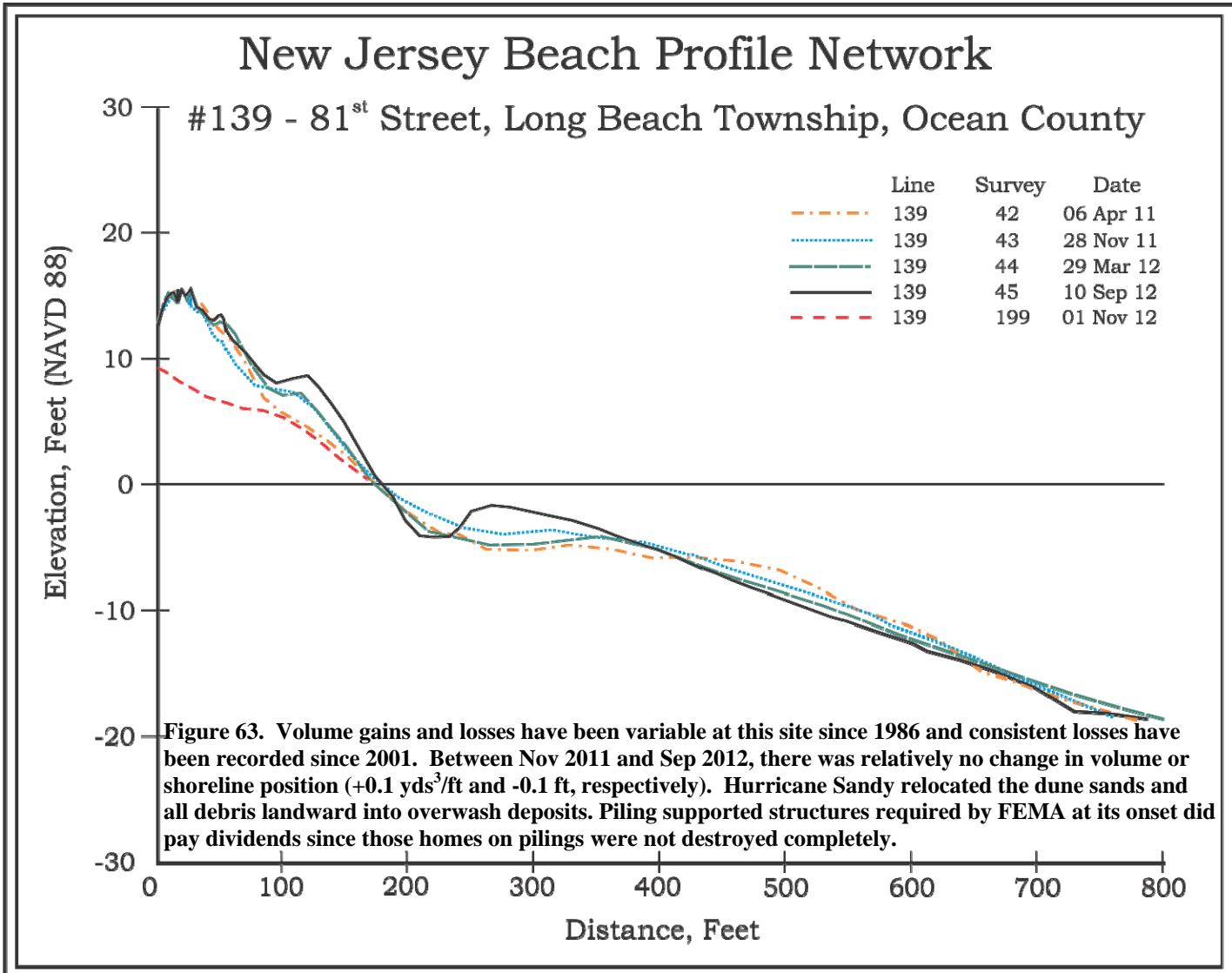
#140 - 32nd Street, Long Beach Township, Ocean County



NJBPN 139 – 81st Street, Long Beach Township



The photographs above were taken on September 10th, 2012 (left) and November 1st, 2012 (right). Both images show the view of 81st street (site 139) looking south. It is evident in the photographs that the existing dune was completely eroded away and overwash occurred, with waves pushing water and sand under the oceanfront homes and into the streets landward of them. The dune elevation was about 16 feet.

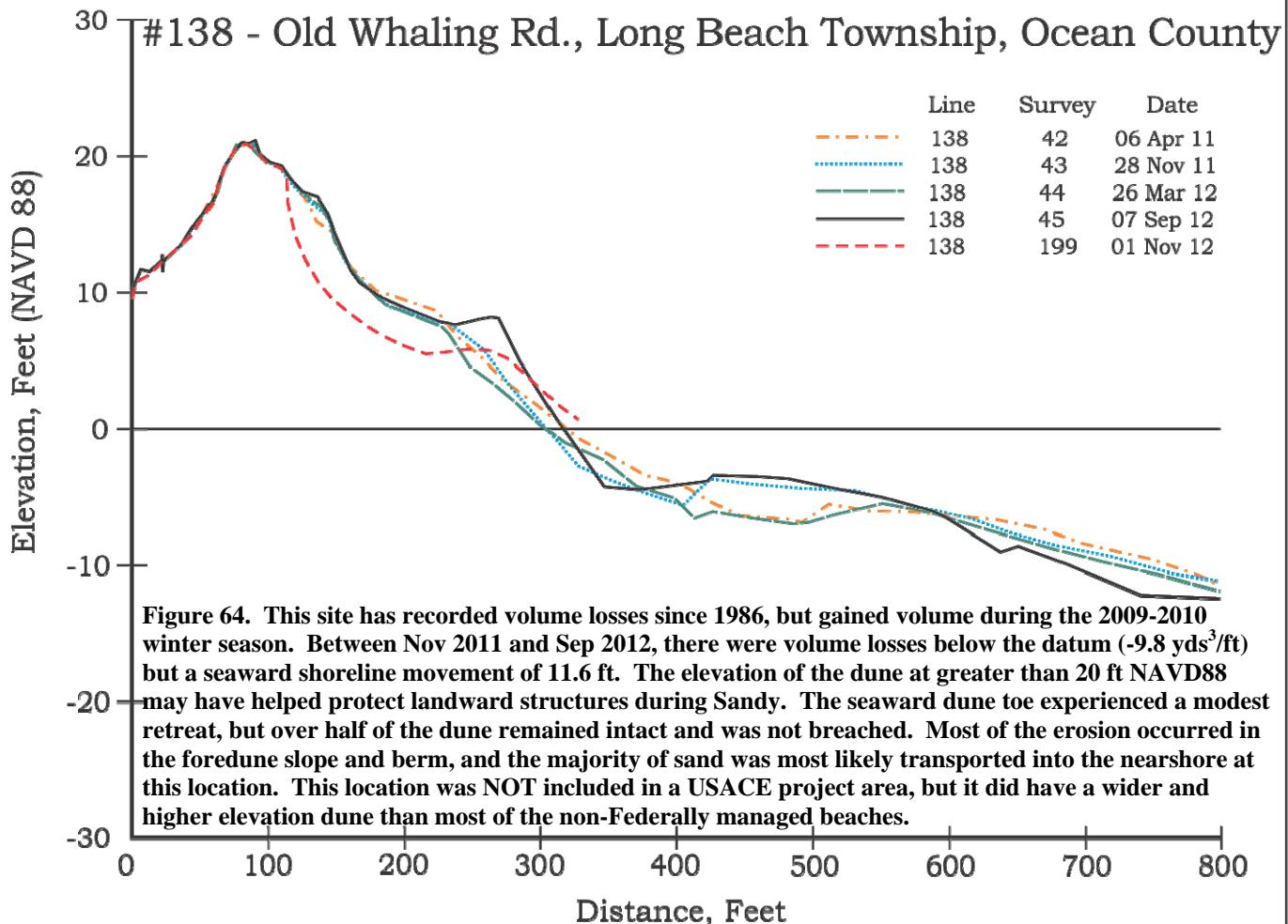


NJBPN 138 – Old Whaling Road (124th Street), Long Beach Township



The photographs above were taken on September 7th, 2012 (left) and November 1st, 2012 (right). Both images show the view of Old Whaling Road (site 138) looking south. The existing dune experienced erosion, however it was not completely removed and no overwash occurred at this location. Surprisingly, two blocks to the north a dune of comparable size and shape was eroded away and overwash occurred.

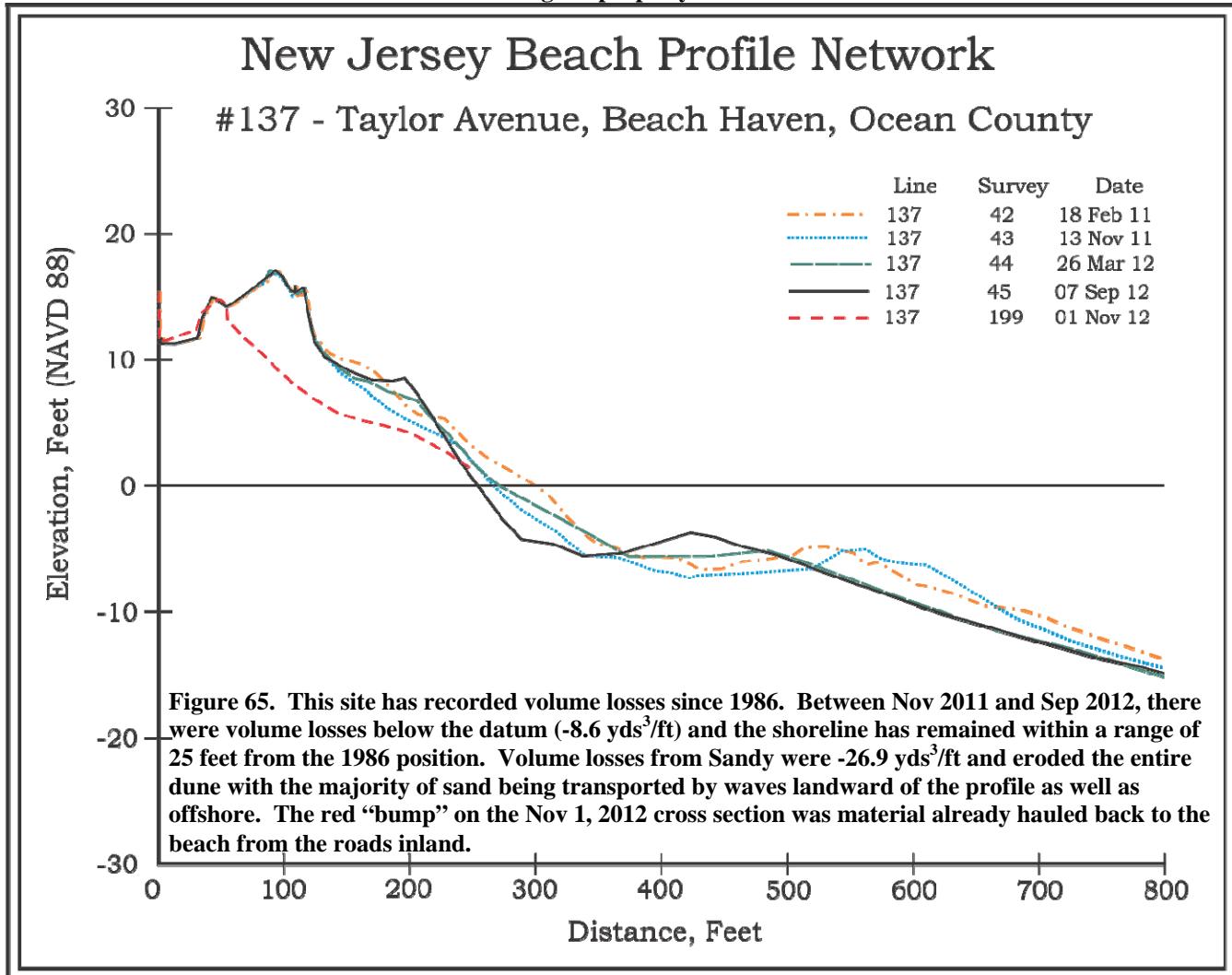
New Jersey Beach Profile Network



NJBPN 137 – Taylor Avenue, Beach Haven



The photographs above were taken on September 7th, 2012 (left) and November 1st, 2012 (right). Both images show the view of Taylor Avenue looking north. It is evident in the photographs that the existing dune was completely eroded away and overwash occurred, with waves pushing water and sand under the oceanfront homes and into the streets landward of them. The crib timber structure in the above right photograph was instrumental in saving the home from significant damage. The cribbing was back-filled with rocks and masonry debris and provided an effective barrier to direct wave impacts. The landward returns on the structure were critical in saving the property.

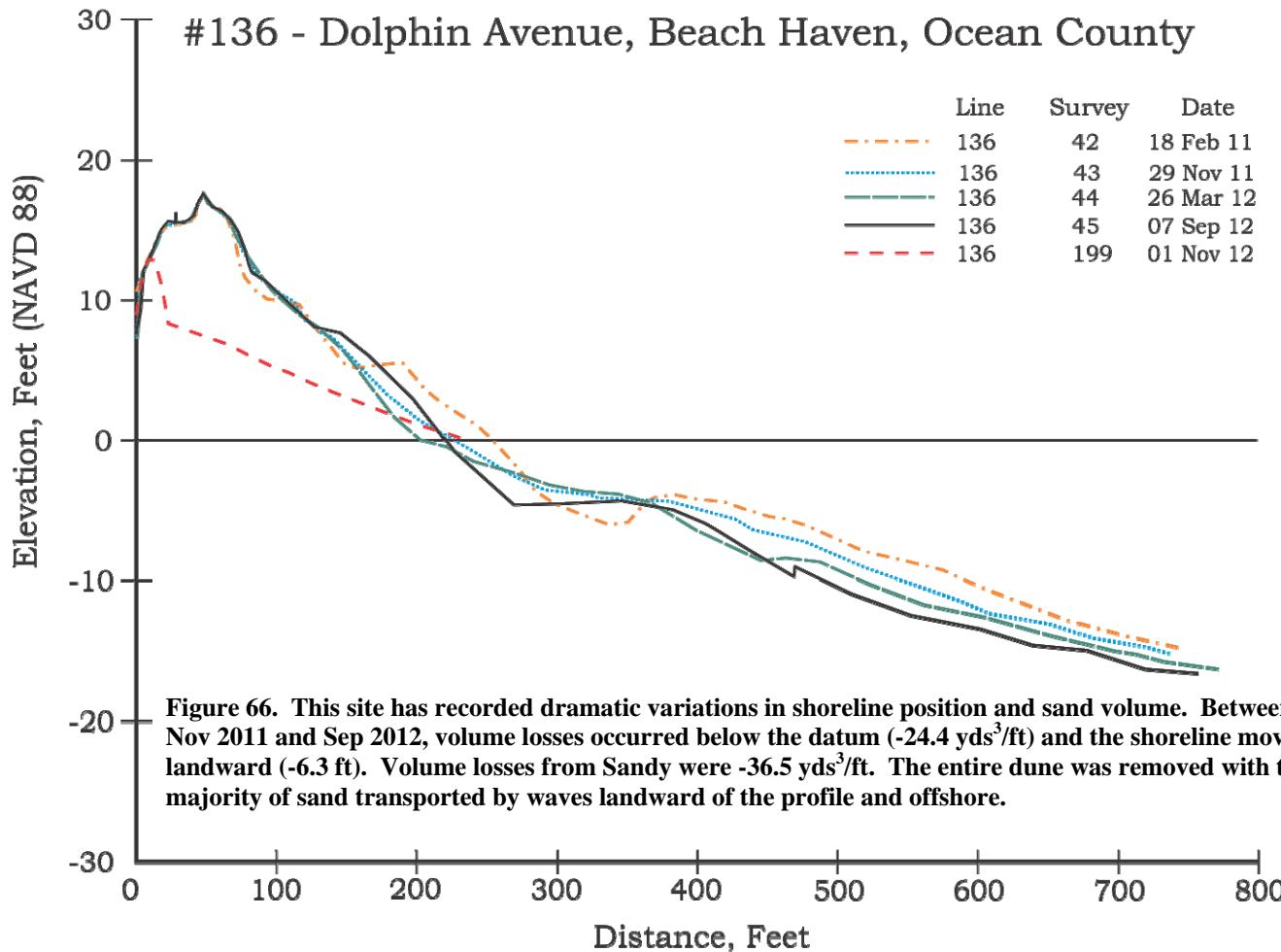


NJBPN 136 – Dolphin Avenue, Beach Haven



The photographs above were taken on September 6th, 2012 (left) and November 1st, 2012 (right). Both images show the view of Dolphin Avenue (site 136) looking north. It is evident in the photographs that the existing dune was completely eroded away and overwash occurred, with waves pushing water and sand under the oceanfront homes and into the streets landward of them. Damage was clear and very common.

New Jersey Beach Profile Network



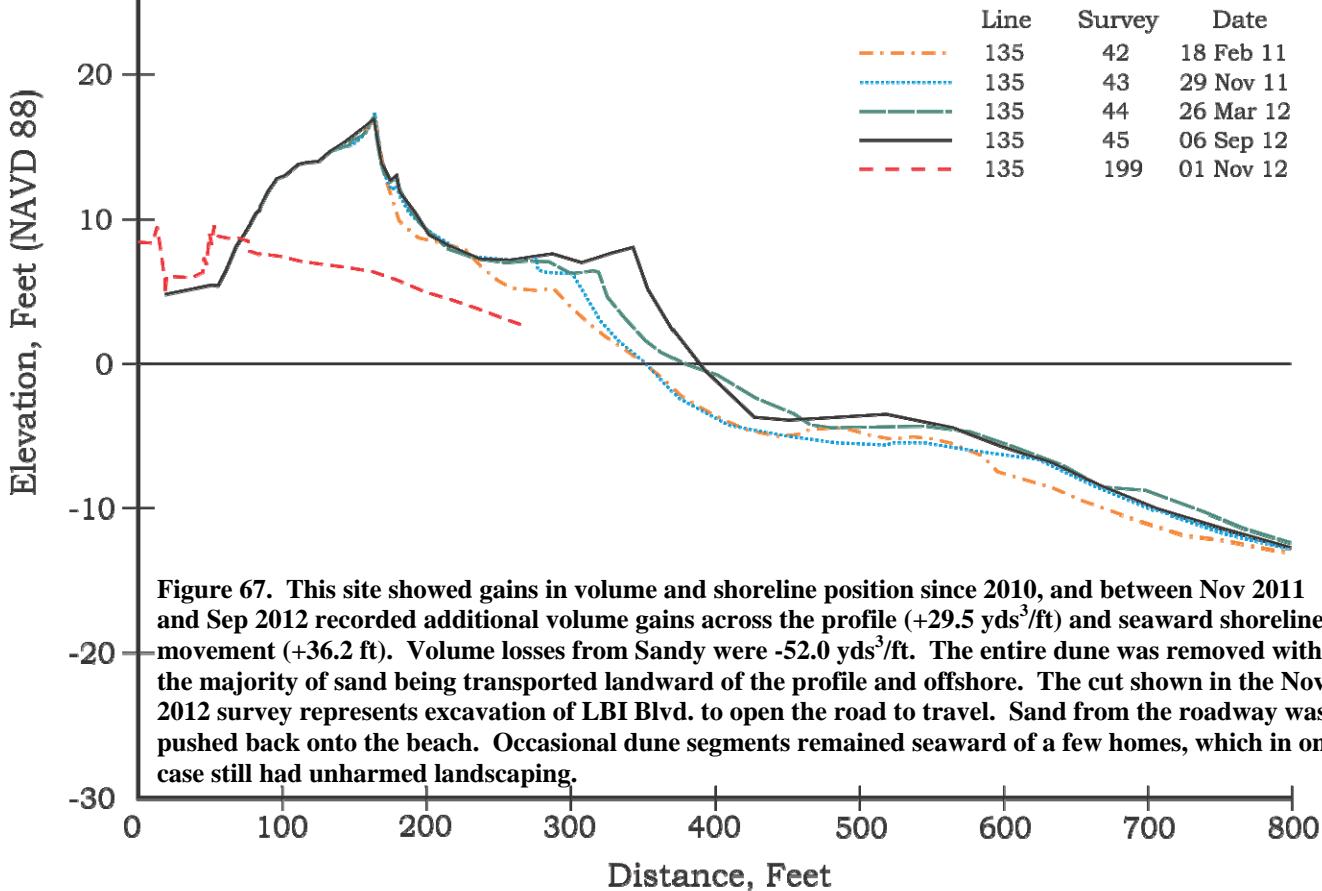
NJBPN 135 – Webster Avenue, Long Beach Township



The photographs above were taken on September 6th, 2012 (left) and November 1st, 2012 (right). Both images show the view of Webster Avenue in Beach Haven (site 135) looking south. It is evident in the photographs that the existing dune was completely eroded away and overwash occurred, with waves pushing water and sand under the oceanfront homes and into the streets landward of them exposing the timber section of an old groin that was not exposed prior to the storm.

New Jersey Beach Profile Network

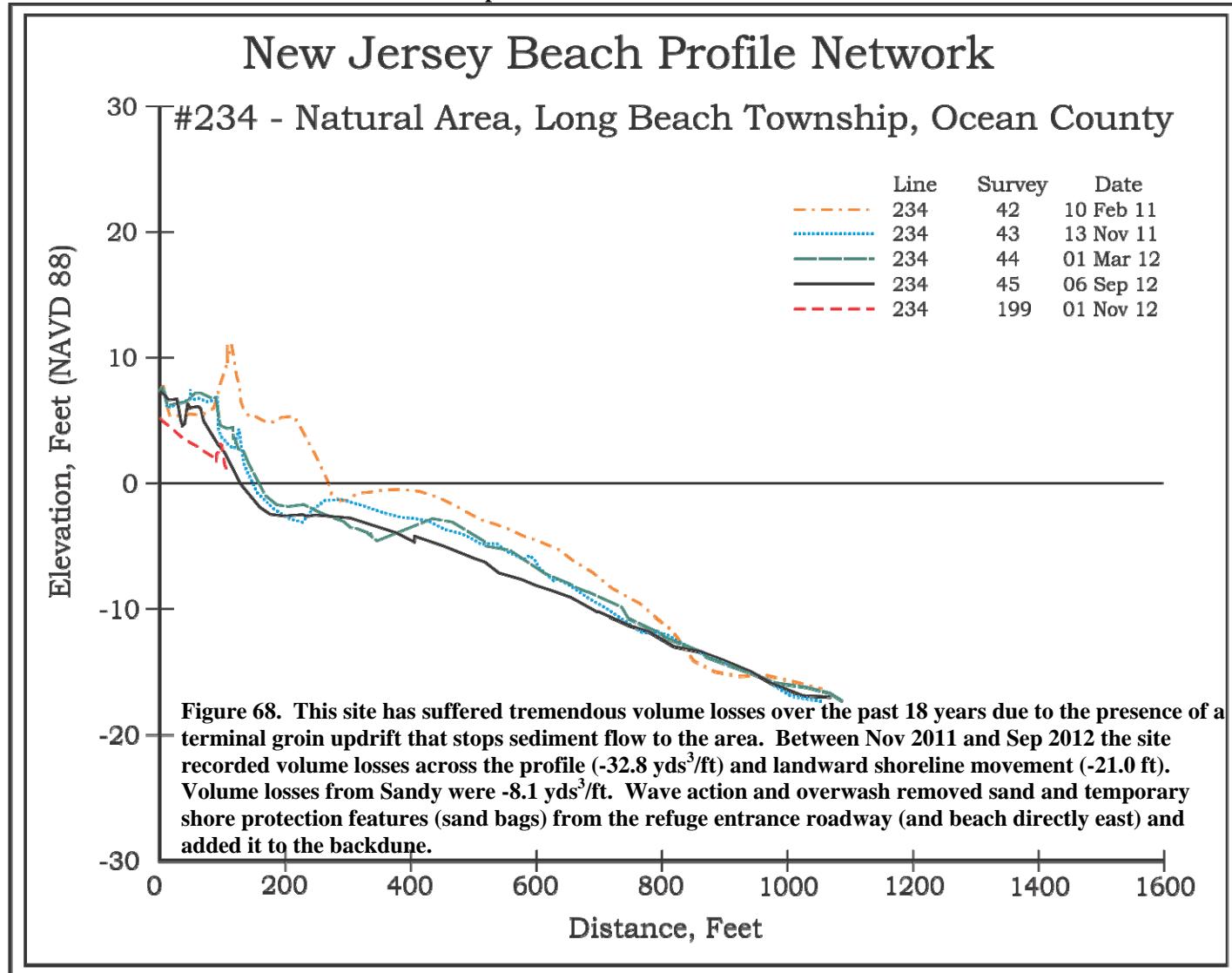
#135 - Webster Ave., Long Beach Township, Ocean County



NJBPN 234 – Forsythe National Wildlife Refuge, Holgate Entrance, Long Beach Township



The photographs above were taken on September 6th, 2012 (left) and November 1st, 2012 (right). Both images show the view looking north at the beach-buggy entrance to the Forsythe Refuge (site 234). Wide-scale overwash occurred that extended to Barnegat Bay at this location due to the effect of Hurricane Sandy. All traces of a dune system in the natural area were flattened and moved landward as an overwash deposit.



Summary & Conclusions

Northern Ocean County Post Sandy Volume Changes				Long Beach Island Post Sandy Volume Changes			
Site	Vol Change cu yds per ft	Dune Failure	Recent Beach Fill	Site	Vol Change cu yds per ft	Dune Failure	Recent Beach Fill
347	-48.673	N	N	234	-7.8	Y	N
148	-43.722	N	N	135	-37.9	Y	N
248	-39.327	Y	N	136	-24.1	Y	N
149	-68.744	Y	N	137	-27.3	Y	N
150	-51.687	Y	N	138	-19.1	N	N
151	-46.139	Y	N	139	-29.5	Y	N
152	-42.014	Y	N	140	-40.4	N	Y
153	-109.595	Y	N	141	-40.3	N	N
154	-19.576	Y	N	241	-36.4	N	Y
155	-45.752	Y	N	142	-48.2	N	Y
156	-62.677	Y	N	143	-33	N	Y
				144	-21.6	Y	N
				145	-28.6	N	N
				245	-5.2	N	N

Figure 69 shows a table of values for the 11 developed shoreline profile site locations in northern Ocean County (left) and the 14 profile sites on Long Beach Island (right). The sand volume lost per foot of shoreline represents loss from the dune and the beach and does not include changes in the offshore region. These surveys were completed as rapidly as possible so no swimmers were brought to these sites. The swimming portion of the survey takes 75% of the time at each site and the crew was trying to cover as many sites as possible each day following Sandy. There are 105 sites to cover statewide. Full surveys completed in the spring of 2013 and later in the fall of 2013 should provide information as to sand volume recovery occurring naturally since Sandy.

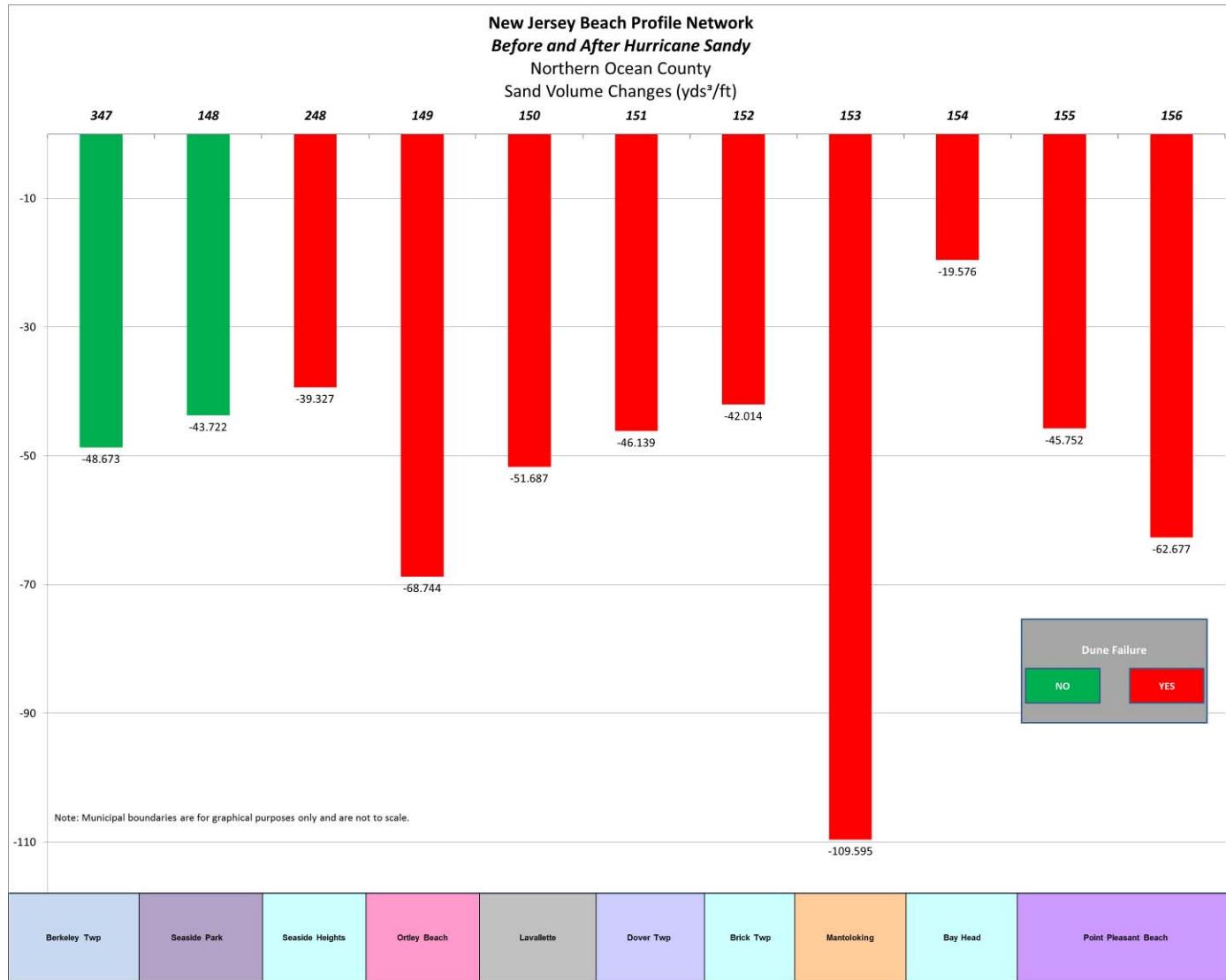


Figure 70. This graphic shows the sand volume loss figures for each of the communities within the developed sections of the northern Ocean County Atlantic shoreline. No Federal shore protection projects have occurred along this portion of the New Jersey shoreline. All sites experienced berm erosion and dune losses. Sites 347 and 148 contained a greater dune volume prior to the storm and though dune losses were recorded, there was no dune failure. The losses measured at Site 153 were enhanced due to the presence of a newly-opened inlet (with depths measured at approximately 18 feet). The dune at Site 154 contained a rock/timber core that was included in the pre-storm dune volume calculation.

Northern Ocean County Post Sandy Volume Changes

MUNICIPALITY	Site	Vol Change cu yds per ft	Average Volume Between Sites	Dune Failure	Recent Beach Fill	REF POINT Distance (FEET)	Vol Change - Cubic Yards Between Profiles (South to North)	Cumulative Volume Change - Cubic Yards (South to North)
Berkely Township	347	-48.673		N	N	0.00	0.00	0
Seaside Park	148	-43.722	-46.20	N	N	4,607.59	-212,859.05	-212,859.05
Seaside Heights	248	-39.327	-41.52	Y	N	9,074.11	-376,798.01	-589,657.06
Ortley Beach	149	-68.744	-54.04	Y	N	7,154.30	-386,586.18	-976,243.25
Lavallette	150	-51.687	-60.22	Y	N	11,087.76	-667,654.81	-1,643,898.06
Dover Twp	151	-46.139	-48.91	Y	N	10,393.85	-508,394.46	-2,152,292.51
Brick Twp	152	-42.014	-44.08	Y	N	5,184.78	-228,527.02	-2,380,819.53
Mantoloking	153	-109.595	-75.80	Y	N	15,628.24	-1,184,691.26	-3,565,510.79
Bay Head	154	-19.576	-64.59	Y	N	10,487.40	-677,333.97	-4,242,844.76
Point Pleasant Beach	155	-45.752	-32.66	Y	N	6,800.90	-222,144.64	-4,464,989.40
Point Pleasant Beach	156	-62.677	-54.21	Y	N	9,971.70	-540,610.46	-5,005,599.86
Total Volume Loss for Northern Ocean County =							-5,005,599.86	

Figure 71. This table provides a summary of all the individual site sand volume losses from the dune and beach to the limit of the post-Sandy survey. The total is derived by adding two adjacent site losses and dividing by two, then multiplying by the distance in feet between the two sites. This is known in the dredging industry as “closed-end averaging” to obtain dredged volume along a channel. It is acknowledged that sand resources reside seaward of the short post-storm surveys, but the need for speed dictated that taking additional time to survey to 15-16 feet of water offshore would not add significantly to the losses seen within the beach/dune system. These longer surveys will be completed in due course however. No estimate was made for the sand loss values south of the Berkeley Township site (347) in the natural areas of Island Beach State Park. A percentage of the sand carried offshore by Sandy will move back toward the beach over time in the absence of future storms. All sand lost from the dunes will require human intervention to replace, groom and re-vegetate in order to have the protection in place quickly. A natural dune system developing from scratch would require 15 to 20 years to re-establish close to what was lost.

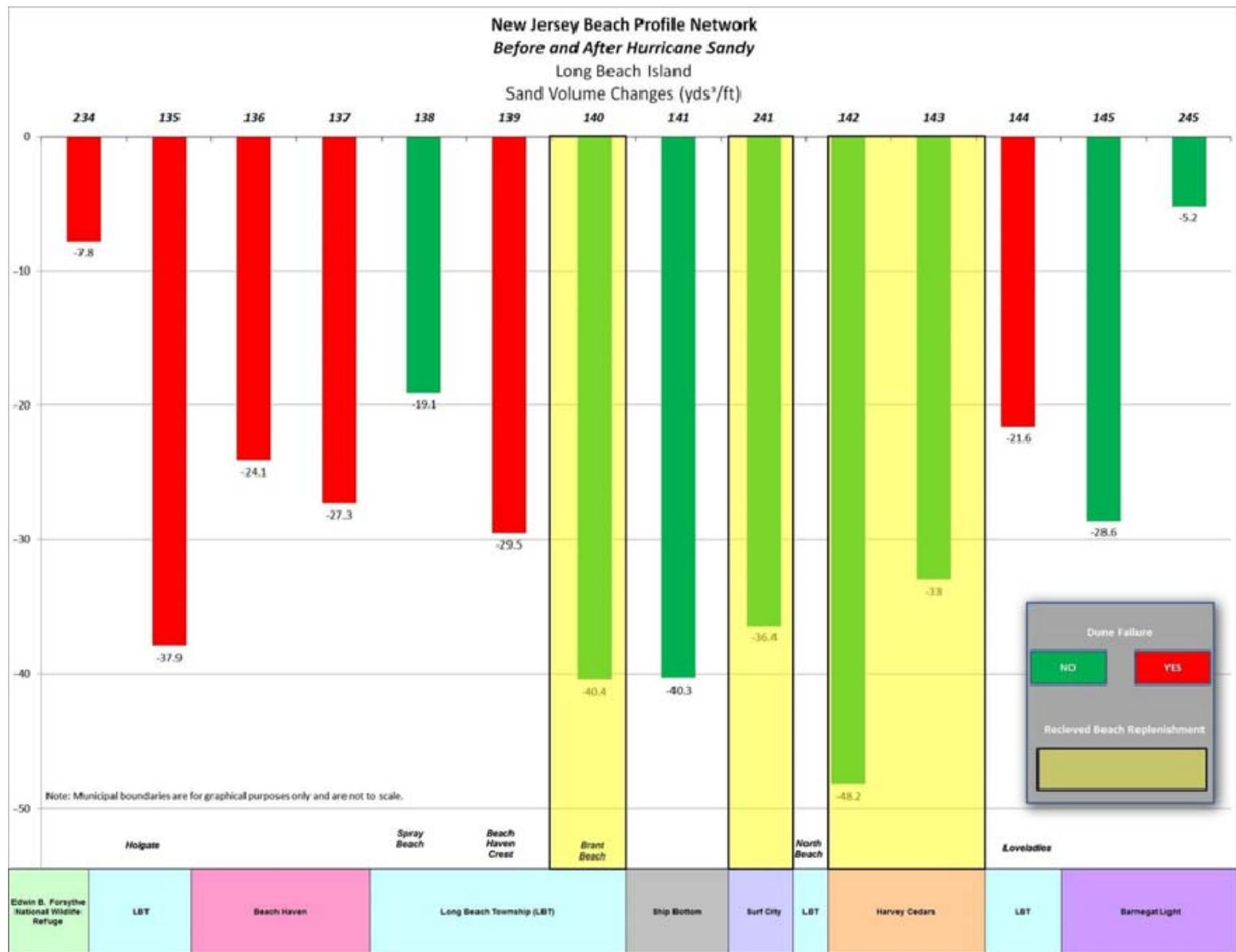


Figure 72. This graphic combines the loss figures with the presence or absence of the Federal Shore Protection Project and the occurrence of dune failure. It became perfectly clear that the ACOE shore protection design was sufficient to preclude structural damage along the extent of the LBI coastal shoreline where it had been completed.

Long Beach Island

MUNICIPALITY	Site #	Vol Change (cu yds/ft)	Average Volume Between Sites	Dune Failure	Recent ACOE Beach Fill	REF POINT Distance (FEET)	Vol Change - Cubic Yards Between Profiles (South to North)
Forsythe Wildlife Refuge	234	-7.80		Y	N	0	0
Holgate - Long Beach Township	135	-37.90	-22.85	Y	N	5,643	-128,941
Beach Haven	136	-24.10	-31.00	Y	N	5,114	-158,543
Beach Haven	137	-27.30	-25.70	Y	N	5,268	-135,393
The Dunes - Long Beach Township	138	-19.10	-23.20	N	N	8,654	-200,780
Beach Haven Crest - Long Beach Township	139	-29.50	-24.30	Y	N	8,559	-207,972
Brant Beach - Long Beach Township	140	-40.40	-34.95	N	Y	10,774	-376,558
Ship Bottom	141	-40.30	-40.35	N	N	6,027	-243,205
Surf City	241	-36.40	-38.35	N	Y	7,522	-288,466
Harvey Cedars	142	-48.20	-42.30	N	Y	8,082	-341,858
Harvey Cedars	143	-33.00	-40.60	N	Y	6,618	-268,691
Loveladies - Long Beach Township	144	-21.60	-27.30	Y	N	7,018	-191,603
Barnegat Light	145	-28.60	-25.10	N	N	8,992	-225,688
Barnegat Light	245	-5.20	-16.90	N	N	5,155	-87,117
Long Beach Island Sand Loss =							-2,854,815

Figure 73 is a summation of all the individual site sand volume losses from the dune and beach to the limit of the post-Sandy survey. The total is derived by adding two adjacent site losses and dividing by two, then multiplying by the distance in feet between the two sites. No estimate was made for the sand loss values south of the Forsythe Refuge site positioned a short distance from the terminal groin on LBI. Likewise there was a small additional sand loss north of site #245 in Barnegat Light Borough to the Barnegat Inlet south jetty, but at 5.2 cubic yards per foot, a 1000 feet distance yields only a 5,000 cy addition to the 2.85 million cubic yard total emerging from this study. Speculation on what percentage of the lost sand lies unrecoverable on LBI and in Barnegat Bay could range up to a million cubic yards that will need to come from offshore or mainland borrow zones/quarries. Perhaps as much as 500,000 cubic yards could be recovered over time as sand carried offshore by Sandy moves back toward the beach. All sand lost from the dunes will require human intervention to replace, groom and re-vegetate in order to have the protection in place quickly.