

STOCKTON UNIVERSITY COASTAL RESEARCH CENTER



The winter beach at 35th Street in Avalon, Cape May Co., NJ. No signs of spring had appeared as of April 24, 2020, but the expanse of dunes and an expanding maritime forest that lies between development and the sea is unique on the Jersey shore.

New Jersey Beach Profile Network 2020 Annual Report on Shoreline Changes in New Jersey's Four Coastal Counties Raritan Bay to Delaware Bay Spring of 2019 Through Fall of 2020

Prepared for:

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The Stockton University Coastal Research Center



New Jersey Beach Profile Network 2020 Annual Report

On

Shoreline Changes In New Jersey In the Four Coastal Counties Raritan Bay to Delaware Bay

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TABLE OF CONTENTS

• Executive Summary	1
• Acknowledgements	3
• Introduction	3
• Storm Recovery and Beach Project Effectiveness	3
• Monmouth County	5
Figures 1a-1d. Monmouth County Station Locations	6
Site Descriptions	10
Site Photographs & Survey Data – Cliffwood Beach to Riverside Drive (Figs 2 – 104)	27
Summary & Conclusions	129
Figure 105a & b. Sand Volume Gains in the Sandy Hook National Seashore	131
• Ocean County	132
Figure 106. Ocean County Station Locations	133
2020 Beach Fills in Ocean County	134
Site Descriptions	134
2020 Storm Activity	136
Site Photographs & Survey Data – Water Street to Beach Haven (Figs 107 - 134)	137
Summary & Conclusions	165
• Atlantic County	166
Figure 135. Atlantic County Station Locations	167
Atlantic County Shore Protection Summary	168
Figure 136 Typical USACE Beach Design Template for Absecon Island	169
Figure 137 Typical USACE Beach Design Template for Brigantine Island	170
Site Descriptions	170
Figure 138 March 28, 2019 Brigantine Aerial Photograph	171
Site Photographs & Survey Data – Brigantine Natural Area to Longport (Figs 139 – 148)	176
Summary & Conclusions	186
• Cape May County	188
Figure 149. Cape May County Station Locations	189
Cape May County & Delaware Bay Location Descriptions	190
Site Photographs & Survey Data – Gardens Road to Reeds Beach (Figs 150 – 180)	195
Summary and Conclusions	226

APPENDIX & BIBLIOGRAPHY

• Monmouth County Sand Volume & Shoreline Change Values (Tables 1 & 2)	228
• Ocean County Sand Volume & Shoreline Change Values (Tables 3 & 4)	230
• Atlantic County Sand Volume & Shoreline Change Values (Tables 5 & 6)	232
• Cape May County Sand Volume & Shoreline Change Values (Tables 7 & 8)	233
• Typical New Jersey Beach Profile Terminology	235
• Glossary of Coastal Terms	236
• Bibliography	238



EXECUTIVE SUMMARY

The digital monitoring of the New Jersey oceanfront shoreline commenced 35 years ago in the fall of 1986. The New Jersey Department of Environmental Protection asked The Stockton University Coastal Research Center (CRC) to establish topographic cross section transects along the NJ oceanfront and parts of the Raritan and Delaware Bay shorelines to provide information about changes occurring in the dunes, on the beach and nearby offshore seafloor along the Jersey shore. Work began as an annual oceanfront and Raritan and Delaware Bay shoreline survey in the fall between 1986 and 1993, then switched to a spring and a fall survey at each site in 1994. This allowed the CRC to summarize winter storm damage each spring and review beach accretion following the summer season. The 2020 report is separated into four coastal county segments arranged from north to south.

The US Army Corps of Engineers (USACE) has established coastal shore protection projects along 100% of the 97 miles of New Jersey's developed oceanfront shoreline with the NY District responsible for Raritan Bay efforts and the oceanfront from Sandy Hook National Seashore, south to Manasquan Inlet. The Philadelphia District has jurisdiction from Manasquan Inlet south to Cape May Point and into Delaware Bay. Currently, the only segment where construction of the selected shore protection effort has yet to be undertaken encompasses North Wildwood to Lower Township (The Wildwoods). This project continues to evolve as limitations on sand supplies, real estate ownership and methodology for the project are worked out among the stakeholders.

In 1994 additional survey sites were added to gain a better perspective on changes around the 11 NJ tidal inlets with a station located close to both sides of each inlet's beachfront. A site was added in 2016 on Sandy Hook closer to the northern end of the spit tip. In 2017 following discussions with the Division of Coastal Engineering (DCE) and the NY Corps of Engineers District, 66 sites were introduced between the 34 already located along the Monmouth County oceanfront to better follow changes occurring within the Monmouth County shore protection project shoreline. These were selected from existing NY District survey sites between the present NJBPN survey locations. These sites are distributed among the original 34 oceanfront locations. Including the three Raritan Bay sites, the number of NJBPN sites for Monmouth County is 102 (Figure 1a-d). The first survey of these new locations took place in the fall of 2017. These new sites have been surveyed in the spring and fall each year starting in 2018. Today the CRC surveys a total of 171 sites twice each year with the results summarized in these annual reports to the DCE.

2020 Shoreline Management:

Eight years after Hurricane Sandy the USACE and NJ DCE have shifted focus onto more routine project maintenance with periodic sand placement in areas of continued losses. Areas like the northern ends of barrier islands (Absecon Island in Atlantic City), Bay Head in Ocean County, and various spots along the Monmouth County shoreline have seen recent maintenance work.

In 2017, work commenced on the Manasquan Inlet to Barnegat Inlet project for the developed portion of Northern Ocean County. Multiple dredges moved sand from the offshore borrow sites and placed the material on the beach to build the design beach/dune cross section. The project runs from the northern boundary of the Island Beach State Park in the south and tapers off to no added material in the northernmost third of Point

Pleasant Beach Borough located just south of Manasquan Inlet. There have been up to four surveys since this project was complete with indications of variable beach stability becoming apparent.

All NJBPN survey data were analyzed to show changes in shoreline position and sand volume in each coastal county for an 18-month study interval. The seasonal, annual, and 18-month summaries are provided as county-wide averages in the tables below and a complete listing of all changes recorded between spring 2019 and fall 2020 are presented in tables at the end of the report.

Three of the four coastal counties saw sand volume increases with Monmouth and Cape May Counties showing the benefit from beach nourishment work during this study interval. The Ocean County sites remained relatively neutral following the massive sand placement work in Northern Ocean County that wrapped up in 2019. Atlantic County saw modest sand volume losses over the past 18 months.

	Sand Volume Changes at the NJ Oceanfront			
	S 19 – F 19	F 19 – S 20	S 20 – F 20	S 19 – F 20
	Cu. yds./ft.	Cu. yds./ft.	Cu. yds./ft.	Cu. yds./ft.
Monmouth County	2.78	3.52	2.10	7.69
Ocean County	8.05	2.90	-9.00	1.83
Atlantic County	5.13	-10.55	-6.26	-11.13
Cape May County	1.79	15.36	8.44	25.35

The shoreline-change values represent the difference in horizontal distance of the zero-elevation position (0.0 ft. NAVD88) from the reference monument on the two profiles being compared. Advances seaward for the zero-elevation position in the most recent survey data are shown as positive integers and retreat landward is shown as negative. Each number shown in the table below is the average change for all the sites in each county. Beach maintenance work accounts for the positive Monmouth and Cape May County shoreline movements while some shoreline retreat would be expected in Ocean and Atlantic Counties where work was recently completed.

	Shoreline Position Shifts Landward (-) or Seaward (+) at the NJ Oceanfront			
	S 19 – F 19	F 19 – S 20	S 20 – F 20	S 19 – F 20
	Feet	Feet	Feet	Feet
Monmouth County	3.23	-2.68	7.73	8.28
Ocean County	-4.59	7.16	-7.00	-5.13
Atlantic County	-2.83	-9.05	8.08	-3.80
Cape May County	-5.44	20.94	17.46	32.97

ACKNOWLEDGEMENTS

This research was funded by the State of New Jersey Department of Environmental Protection, Division of Construction and Engineering under the New Jersey Shore Protection Fund (N.J.S.A. 13:19-16.1). This is the final report under the third year of the 3-year contract #4298-19.

INTRODUCTION:

The New Jersey Beach Profile Network (NJBPN) research effort provides site-specific information that can be expanded into a regional assessment of NJ coastal zone changes. The surveys are designed to document seasonal and storm-related damage assessments or show beneficial sand volume accumulations along the four-county New Jersey shoreline. The originally established sites have been visited annually in the fall since 1986. Semi-annual visits, each spring and fall, began in 1994 following the passage of NJ Public Law 93. The program was enhanced to take surveys every spring following the winter northeasters and, in the fall, following summer beach accretion. During the first decade of work, new sites were established in the gaps of coverage and at all oceanfront shorelines adjacent to tidal inlets. The information collected consists of photographs of the beach/dune system at each site, digital elevation points necessary to generate a topographic profile of the dune, beach and seafloor to a minimum depth of 15-18 feet, and field notes on significant geomorphic changes. Also, construction activity is noted and necessary information regarding quantity and duration of such activity is gathered. The field data are used to generate graphical cross section plots, which can be used for comparison across the width of the active coastal zone. The direct comparison of any two cross sections at each site can be used to calculate sand volume and shoreline position changes at the site during the time interval between the two surveys.

The major innovation in recent years has been the CRC, NJDEP DCE, and the USACE-New York District coordinated efforts to add 65 new profile sites to Monmouth County that were distributed along the oceanfront coastline south from the Sandy Hook National Seashore. There are now seven surveys in the record at these new sites to begin building trends of change across all 102 oceanfront and Raritan Bay Monmouth County locations.

Serious storm activity over this study interval has been remarkably low with periods of northeast and easterly winds of 10 to 25 MPH as the majority of all episodes of wave erosion seen. Hurricane activity has also been relatively absent along the mid-Atlantic shoreline over the past several years. Tropical Storm Isaias passed through New Jersey on August 4, 2020 causing some wind damage and mild to moderate beach erosion. Atlantic storms have moved northeast away from New Jersey with limited impact. The last major northeast event was January 23, 2016. A northeast storm March 1 and 2, 2021 did have a spring 2021 impact in places.

The tables of beach volume and shoreline change data are found after the county site descriptions for Cape May County in the appendix. A summary of each county's coastal zone activities follows the county profile site location diagram at the start of each county discussion. Conclusions based on the study data for this time interval appear at the end of each county section.

STORM RECOVERY AND BEACH PROJECT EFFECTIVENESS:

It is now 9 years since Hurricane Sandy and while natural sand recovery has long been completed, the bulk of the recovery has been due to the diligent efforts by the NY and Philadelphia US Army Corps Districts in implementing their emergency relief funds to restore the shore protection projects to design specifications. The massive effort by the NJ DCE and the two Army Corps Districts were critical in instituting a significant recovery in the level of beachfront storm protection for NJ coastal communities. It is a testimony to the efforts of local leaders, the NJDEP DCE staff and leadership, the federal planners and engineers, and the interest by local citizens that New Jersey is the only US state with 100% of its developed oceanfront shoreline under federal jurisdiction with completed oceanfront shore protection projects and one final authorized project about

ready to be built. In addition, work has been completed or under construction along the NJ Raritan Bay at three sites (Port Monmouth, Keansburg, and Union Beach). The Philadelphia District completed projects in Avalon in 2019 and Ocean and Atlantic Cities in 2020 and is working along the Delaware Bay shoreline in NJ with several in the design stages for Fortescue, Money Island, and Villas. Project betterments were executed in Holgate, Long Beach Island to retain the shore protection benefits by reconstructing the terminal groin at the south limit of development.

The most recent renourishment cycle, in Sea Bright, Monmouth Beach and Long Branch, was completed in November 2020 with the placement of 2.8M cubic yards of material. The contract was funded with FY19 and FY20 appropriations, as well as non-Federal contributions from NJDEP, Monmouth County and the three municipalities for a total of \$55.1M. The District received \$24M in federal funds for FY21 for renourishment in Section II (Asbury Park to Manasquan). Contract award is scheduled for September 2021 (Jason Shea, Project Manager).



New Jersey Beach Profile Network

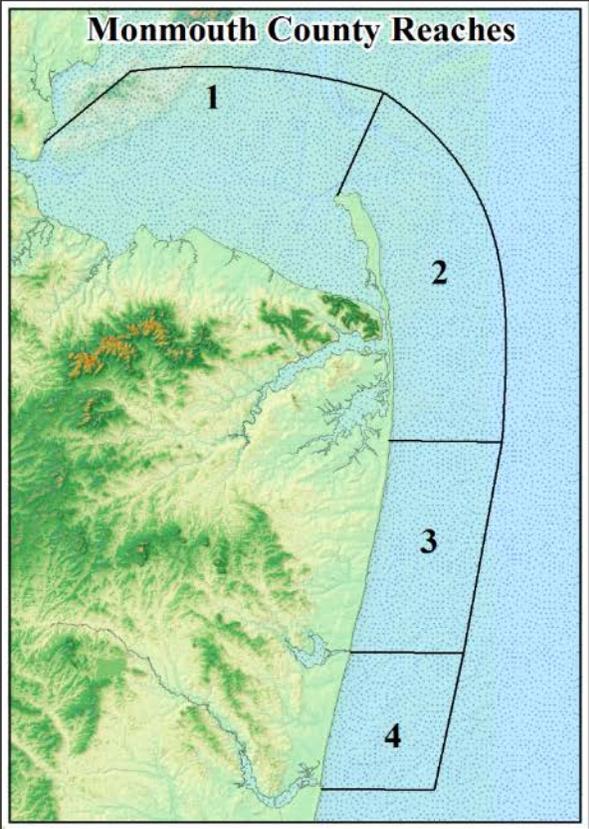
Monmouth County

Raritan Bay and Sandy Hook
to Manasquan Inlet

NJBPN Profile #'s
187 - 256

New Jersey Beach Profile Network

Monmouth County Site Locations - Overview and Reach 1



The 102 NJBPN shoreline monitoring sites in Monmouth County extend from three sites along the eastern beaches of the Raritan Bay, to the oceanfront shoreline of Sandy Hook, then south to Manasquan Inlet. Profile sites are located in: Cliffwood Beach in Aberdeen Township, the Borough of Union Beach, Port Monmouth in Middletown Township, Gateway National Seashore, the Borough of Sea Bright, the Borough of Monmouth Beach, the City of Long Branch, the Borough of Deal, the Borough of Allenhurst, the City of Asbury Park, Ocean Grove in Neptune Township, the Borough of Bradley Beach, the Borough of Avon-by-the-Sea, the Borough of Belmar, the Borough of Spring Lake, the Borough of Sea Girt, and the Borough of Manasquan. Monmouth County has the greatest number of beach profile sites due to the complexity of its shoreline. A combination of man-made structures, the natural variety of beach widths and distinct erosional and/or accretional areas made careful site selection a necessity. In the fall of 2017, monitoring efforts were expanded to more fully document current conditions and seasonal changes. This expansion involved adding 65 new monitoring sites throughout the county. Locations of new sites were selected to match those previously occupied by the Army Corps of Engineers.

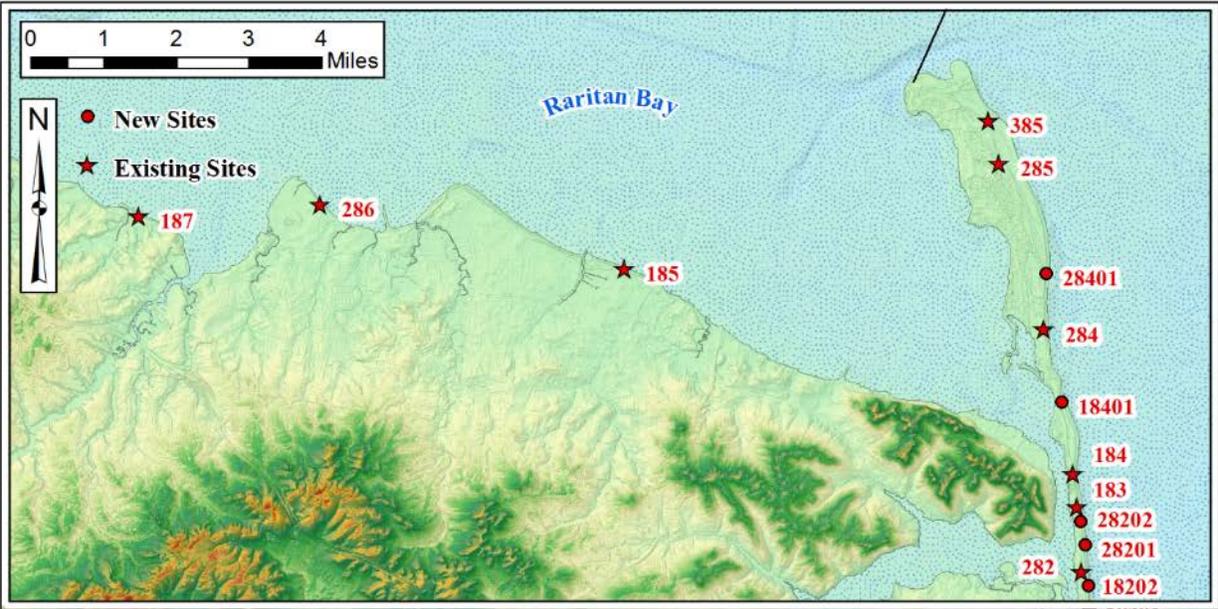


Figure 1a. Location Map for the four Monmouth County coastal reaches where the original and new survey sites are positioned along the Raritan Bay and oceanfront shorelines. The new sites have 5 digit ID numbers with the first three digits representing the original site immediately to the south, and the second two indicating the number of the site added. Site #286 was relocated in 2009 to the middle of a public bathing beach to document changes at a non-structural shoreline.

New Jersey Beach Profile Network Monmouth County Site Locations - Reach 2

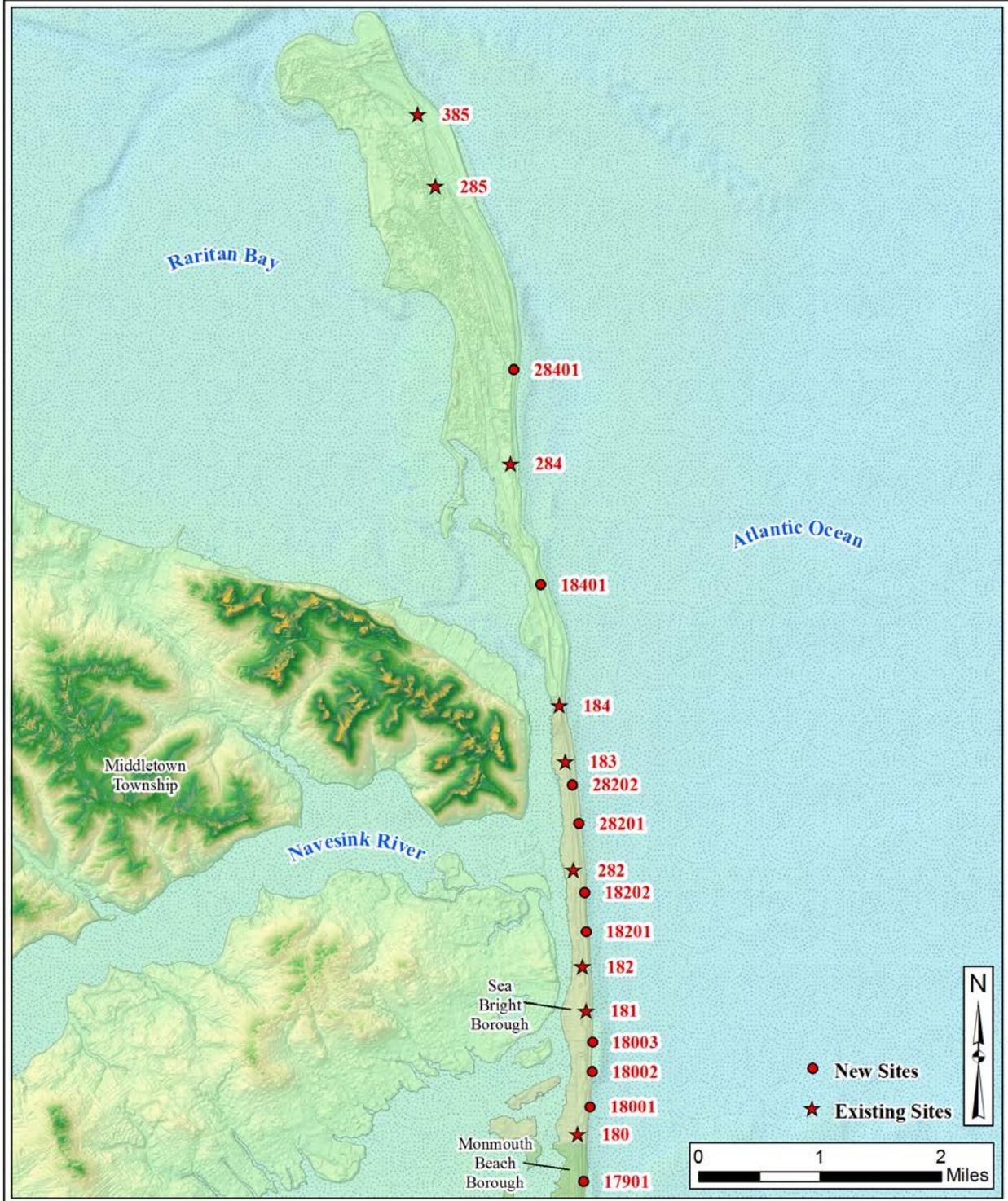


Figure 1b. Reach 2 showing Sandy Hook and Sea Bright survey site locations. The USACE NY District sites added in the fall of 2017 have 5 digits as location numbers. Site #385 was added spring 2017 to extend the Sandy Hook oceanfront beach coverage closer to the tip of the spit to gain better information on sand volumes moving north from the federal project.

New Jersey Beach Profile Network Monmouth County Site Locations - Reach 3

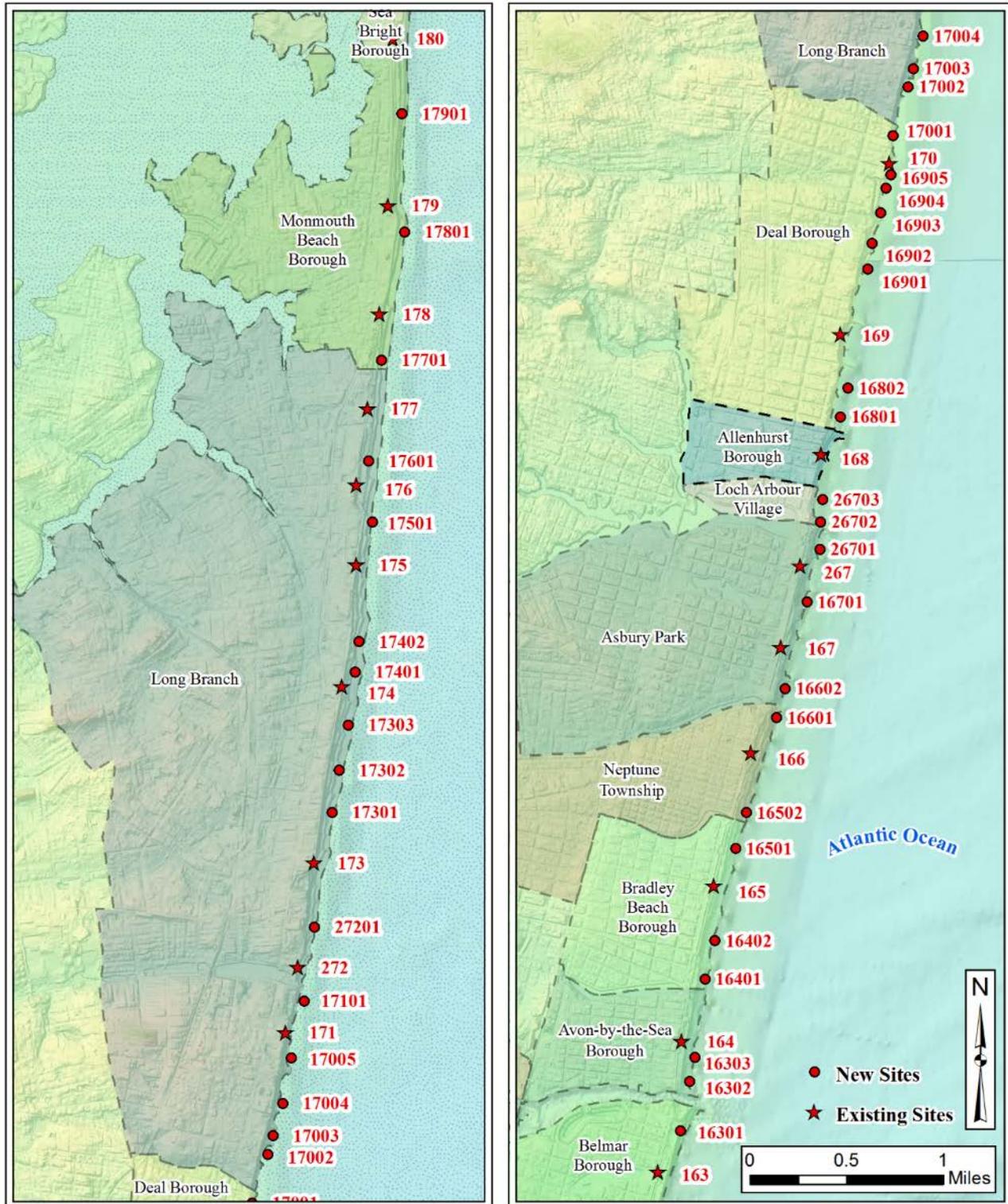


Figure 1c. Reach Three extends from Monmouth Beach south to Belmar Borough along the Monmouth County shoreline. A new location just north of Lake Takanassee was added (#272) in 2010 as Phase III of the federal beach project went to construction to better document the transition between the Phase I and Phase III projects.

New Jersey Beach Profile Network Monmouth County Site Locations- Reach 4

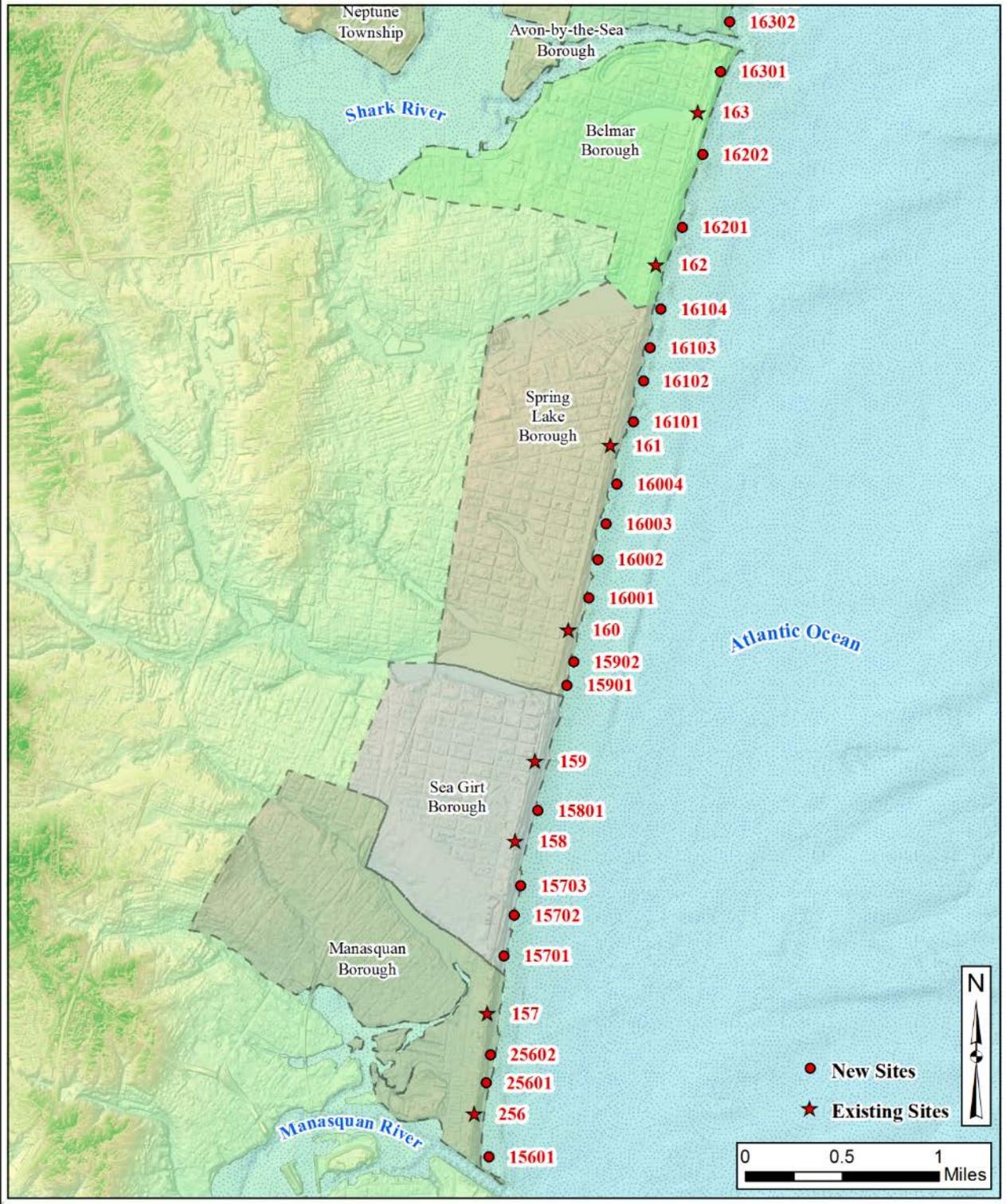


Figure 1d. The fourth reach extends to the Manasquan Inlet, the southern limit of the Monmouth County oceanfront and the NY Corps District project jurisdiction.

Individual Site Descriptions:

Phase III of the Monmouth County shore protection project was completed starting in Loch Arbor/Allenhurst into Long Branch through the Elberon section (3.5 miles) leading to Lake Takanassee and a linking-up Phase II with Phase I project beaches extending north from West End Avenue (4.45 million cu. yds., \$38 million dollars). Work started in 2015 and was completed with groin modifications plus storm water system changes by 2018, all funded under PL 113-2 (Disaster Relief Appropriations Act of January 2013). The NY District has been provided with data from all 102 sites along the Monmouth County oceanfront to aid in evaluating beach conditions emerging from this, the largest shore protection effort ever undertaken by the Corps of Engineers and in terms of sand volume, the largest in the world (USACE NY District Fact Sheet, Sandy Hook to Barnegat Inlet, NJ, Jason A. Shea, project manager).

The beaches along Raritan Bay were badly eroded following Hurricane Sandy, but some recovery was documented since that time. The NY District undertook multiple efforts in restoration, spending \$36.9 million placing 875,000 cu. yds. of new sand along the Keansburg Raritan Bay shoreline in 2014. The 2014 Port Monmouth work involved 3,000 feet of shoreline and about a half-million cubic yards of new sand plus a western groin to hold in the sand and a new, longer fishing pier at the Spy House Museum location. Phase II of the Port Monmouth work includes an extensive flood wall nearing completion, road closure structures, tide gates and pump stations along with road elevation raising of Port Monmouth Road to be done by 2022.

In Union Beach, work in the design phases was reevaluated following Hurricane Sandy via the Limited Re-evaluation Report (HSLRR) that was conducted with non-federal partners, NJDEP and Borough of Union Beach, NJ and published in June 2017. This project includes terminal groins, levees, floodwalls, tide gates, pump stations, and a dune and beach program. The Project Partnership Agreement was executed in January 2018 with design plans for Phase I to include sand placement, terminal groins, dune crossovers, and outfall extensions. All these efforts are 100% federally funded under Public Law 113-2 (Disaster Relief Appropriations Act of 2013).

Cliffwood Park, Aberdeen; #187

This site is in a small county park that was established shortly before surveying commenced in 1986. The shoreline faces north-northeast into Raritan Bay and is subject to a significant wave fetch across the bay. A series of beach retreat episodes occurred between March 2019 and June 2020 followed by stability between June and September 2020. The beachface slope to the bay floor surface has lost material as a thin wedge that fades toward the toe of the dune. Offshore, no significant change in bayfloor elevation has been observed over 35 years of surveys.

Union Beach; #286

The Union Beach site was moved to the middle of the municipal bathing beach on Raritan Bay to provide more meaningful data on bay beach changes. This site appears to have remained in chronic equilibrium over the past 18 months with very little change in the beachface or dune and no change offshore. The normal range in wave periods generated on Raritan Bay is between 1 and 3 seconds which means the waves have little impact on the bottom in water over 4 feet deep.

Bay Shore Waterfront Park, Port Monmouth; #185

The easternmost site along the Monmouth County Raritan Bay shoreline is positioned west of Highlands and Atlantic Highlands at a Monmouth County Park site dedicated to an historic building dating to the revolution. The New York District Corps of Engineers concluded pumping approximately a half-million cubic yards of sand onto 3,000 feet of the Port Monmouth shoreline adding a 150 yds³/ft. sand volume addition to the beach in

2014. This project includes a new, longer fishing pier and a rock groin on the west end to retain the bulge in the sand shoreline now present. The 142.11 yds³/ft. sand volume reported as a result of the spring 2014 to fall 2014 survey reflects this project. The past 18 months of surveys show next to no minor fluctuations at the beachface, no change in the dunes and no changes offshore. Since completion in 2015, the sand loss amounts to 24.52 yds³/ft. in five years (17.3%) accompanied by a shoreline retreat of 25.4 feet. This represents a 2% loss percentage improvement since 2018 with no net loss attributable to the past year's conditions.

North Beach, Sandy Hook National Seashore; #385

This site was added to NJBPN in 2016 to gain information on the sand volumes accumulating along the National Seashore oceanfront to the northernmost vehicular access location. This added 3,500 feet of beach to that previously analyzed between the park entrance (#184) and Gunnison Beach (#285). The tip of the Sandy Hook spit extends for an additional 4,000 feet of curving shoreline into Raritan Bay, but profile maintenance and access would be difficult. Sand volume was added to the outer 500 feet of dry beach starting in February 2019, continuing through June 2020. Little added change occurred between June and December 2020.

Gunnison Beach, Sandy Hook National Seashore; #285

Gunnison Beach, originally the northernmost site on Sandy Hook National Seashore lost beach width between February 2019 and November 2019, then stabilized between November 2019 and December 2020. The wind produces minor variations on the 1,500-foot wide dry beach between each successive survey.

Area F Road, Sandy Hook National Seashore; #28401

This site is the northernmost of the newly added 64 profiles to the original series of 37 NJBPN locations in Monmouth County. The new sites were established in 2017 for the NY District Corps of Engineers to provide greater shoreline coverage density throughout the Monmouth County project. This new profile site was positioned between Gunnison Beach and Parking lot E in the Sandy Hook National Seashore. The wide dune has an extended slope seaward to the beach. The offshore slope includes small bars in various positions relative to the shoreline. This line was moved 70.2 feet south of the initial given coordinates for the start point to avoid a concrete obstacle. The ruins are likely related to WW I or WW II military defense installations. The site gained sand between fall 2019 and spring 2020 and continued to add sand at the beachface as of December 2020. There were similar shoreline advances seaward between all four surveys.

Parking Lot E, Sandy Hook National Seashore; #284

This public bathing beach was selected because it was located in the middle of Sandy Hook and represented both a public use area and an easy access point to conduct surveys. The maximum beach and berm width were seen as of the November 2019 survey. Loss prevailed over the next 12 months reaching a point about 28 feet landward of the February 2019 position. Sand was deposited immediately offshore however.

Parking Lot C, Sandy Hook National Seashore; #18401

A second new site on the Sandy Hook National Seashore oceanfront. There is a 22-foot elevation dune located 225 feet landward of the berm crest on the beach. Retreat in the beachface occurred between surveys 58 and 59 generating the most landward shoreline location. Sand returned to the beach adding material following the June 2020 and December 2020 surveys. Little change was seen offshore.

Highlands Beach, Sandy Hook National Seashore; #184

This was initially the northern coastal site in 1986, but data supported the need to add sites on Sandy Hook since it was clear that losses south of #184 were being deposited along the National Seashore beaches. The beach was at a maximum width with the February 2019 survey, then retreated following the next two surveys ending with the March 2020 survey. Sand likely derived from maintenance work to the south by the NY District Corps produced a beachface addition and a shoreline advance as of the January 2021 survey. Offshore, bar migration was most pronounced in the November 2019 survey.

Via Ripa, Sea Bright; #183

This northern Sea Bright location lies just south of the bridge to Atlantic Highlands across the entrance into the Shrewsbury and Navesink Estuaries. A large sand volume was added to the beachface between February 2019 and December 2019 followed by retreat of greater magnitude by February 2020. Partial recovery occurred by January 2021 partially due to offshore bar migration and perhaps littoral transport north from recent USACOE maintenance work.

300 Ocean Avenue, Sea Bright; #28202

Positioned along the Sea Bright seawall, this site is similar to #183 above with a wide beach, but no dune, a steep berm and a large offshore bar that moved onto the beach by the February 2020 survey. The bar reformed well seaward as of the January 2021 survey. The beachface accreted sand successively up to the February 2020 survey then stabilized following the addition of the offshore bar sand supply.

436 Ocean Avenue, Sea Bright; #28201

This new Sea Bright seawall site includes a dune seaward of the wall and a wide beach and an average offshore bar system that shifted both landward by March 2020 and added to the beach before reforming seaward as of January 2021. Little change was noted on the beach above the zero-elevation position.

Shrewsbury Way, Sea Bright; #282

This site accumulated sand to the point where the shoreline was further seaward than prior to Hurricane Sandy. The site was relatively stable both on the beach and offshore until the January 2021 survey which saw 65 feet of shoreline retreat and a lower elevation offshore. The worst seasonal northeast storm event did not occur until Feb.1, 2021.

678 Ocean Avenue, Sea Bright; #18202

This new site includes a small dune at the base of the seawall, but a 250-foot wide dry beach seaward of the dune. The April 2019 survey revealed the widest beach and highest elevation offshore followed by modest losses between April 2019 and February 2020. Then the January 2021 survey saw additional beachface retreat without deposition offshore.

801 Ocean Avenue, Sea Bright; #18201

There is no seawall at this new profile site located between two beach clubs. There is a wide beach rising about 2 feet higher in the mid-section than at the berm crest that is 540 feet wide to the water's edge. The initial and final survey in this series seem to have arrived at essentially the same general configuration following retreat between April 2019 and January 2021. A tiny ridge appeared at the 100-foot distance on the 2021 survey.

Sea Bright Public Beach, Sea Bright; #182

The next location south was obtained by NJ State purchase 36 years ago and converted into a public bathing area with some off-street parking. There is a modest dune at the toe of the rocks which increased in size over the study interval. The beachface advanced seaward between April 2019 and June 2020. The position stabilized over the next interval and by January 2021 there was a larger offshore bar system developed somewhat at the expense of sand formerly located at the base of the beachface close to the shoreline.

Sea Bright Municipal Beach; #181

The peninsula widens here to include commercial businesses on both sides of Ocean Avenue plus parking for the beach. Following Hurricane Sandy, a new hard structure was installed at the seaward edge of the parking lot. The beach width decreased somewhat from the maximum position that developed by June 2020 but the gain in material offshore balanced any loss seen around the zero-elevation area.

1201 Ocean Avenue, Sea Bright; #18003

This new profile location includes a dune ridge seaward of the seawall and as of the March 2020 survey a horizontal dry beach seaward of the dune that improved in elevation to 10.0 feet by January 2021 due to USACOE efforts. A large deposit also appears offshore as of January 2021 likely derived from littoral movement of material from the south.

15 Tradewinds Lane, Sea Bright; #18002

This new profile site has a slowly developing dune seaward of the sea wall. The beach sand supply increased dramatically as of March 2020 due to USACOE efforts in sand pumping but change by January 2021 produced a massive shoreline retreat of over 100 feet as the beach deposit was shifted substantially offshore. The total magnitude of these two parts of the change occurring at the site is unknown due to the distance offshore where the two surveys close is beyond the distances from the shoreline achieved by the CRC swimmers.

1485 Ocean Avenue, Sea Bright; #18001

Positioned at the base of the seawall, this new profile site had a narrow beach until June of 2020 when USACOE efforts generated a wider dry beach at elevation 10.0 feet with a very steep beach face. Later erosion took a big toll on the beach material, but sand deposition offshore offset the volume loss somewhat.

Sunset Court, Sea Bright; #180

This location was initially the first site north of Cottage Road. It has maintained a configuration like that seen after the majority of the original sand volume was placed in 1999. The repeated deposition of maintenance material at Cottage Road has moved north through this location. A small dune has developed seaward of the rock wall with a dry beach that has been enhanced as of June 2020 with new material. The January 2021 berm was the widest and highest seen in several years with a distant offshore bar containing additional sand volume well above that present that far distant from the sea wall previously (2019).

122 Ocean Avenue, Monmouth Beach; #17901

This NY USACE site is located just north of Cottage Road and contains no dune at the seawall, but a relatively decent width beach slopes into the sea without an offshore bar system. The April and December 2019 beach configurations were ones where the sand supply was located on the beach above the zero-elevation position. Sand supplies added during the recent maintenance effort augmented the sand volume offshore by June 2020 followed with a wider berm showing on the January 2021 survey.

Cottage Road, Monmouth Beach; #179

The Cottage Road location was once again augmented with additional sand fill. It has been the “Hot Spot” erosion area in an otherwise very successful Federal beach restoration project. The massive stone groin that was privately built decades ago still acts to restrict sand movement north from the beach fronting a 19th Century private beach club. The groin obviously serves its intended purpose, but to the detriment of the Federal beach project’s durability just north of the groin. The Cottage Road site commenced losing sand as soon as it was completed. Losses were replaced in 1997, 1999, 2001, and a modest sand volume was added in 2010 from Shrewsbury River dredging. Just prior to Sandy the construction of a 2012 restoration had started here and was moving northward. The post-storm survey in late March 2013 showed even more loss at the low tide line. By October 2013, restoration had occurred where the berm was regenerated at elevation 10.0 feet and extended 500 feet from the seawall at that elevation. Losses resumed cutting the beach berm back into the seaward toe of the small dune with a beach slope relatively continuous from that toe into the offshore region. Fill arrived by June 2020 and further advance in berm width was completed by January 2021 including a decent wedge of sand added offshore.

65 Ocean Avenue, Monmouth Beach; #17801

This new profile location includes a 14-foot elevation dune that lies at the landward edge. The beach width was enhanced during 2020 with the June survey showing the most sand on the beach extending into the offshore region. By January 2021 a large offshore bar had developed at the expense of berm retreat approaching 55 feet.

Monmouth Beach Club, Monmouth Beach; #178

The Valentine Street site is located on the premises of the venerable Monmouth Beach Club with the survey starting point in the landward segment of the timber deck overlooking the seawall. Destroyed by Sandy, this site has been rebuilt and the sand replaced to the initial federal project specifications. A small dune has developed at the site with a wider berm in place as of January 2021. The June cross section had the most sand on the beach with a 60-foot retreat in the zero-elevation location taking some material by January 2021. A deep trough developed between the beachface and a small offshore bar as well.

9 Ocean Avenue, Monmouth Beach; #17701

Positioned half way between #178 and #177, this new profile site includes a seawall with a sand ridge immediately seaward of it, followed by a 270-foot wide dry beach. The beach slope is steep and ends at a very small offshore bar system. The berm position at the zero-elevation location was constant across the 18 months of surveys, but a trough did develop offshore by January 2021 that acted to reduce the total sand volume present.

Ocean Avenue Long Branch; #177

This site is part of the Seven-Presidents Park system belonging to Monmouth County. Restored by the USACOE following hurricane Sandy, the site lost beach width over the 2018-19 winter. Subsequently the beach remained relatively constant in width with variations in offshore elevation and bar components making up the majority of sand volume changes.

300 Ocean Avenue, North Long Branch; #17601

This new profile location includes an artificial slope up to the dune crest as a straight line drawn between the reference mark 400 feet landward of the crest and the top of the dune. The beach is about 200 feet wide but

slopes steeply into terrace offshore where minor bars appear and vary seasonally. Change was not extensive at this site over the past 18 months.

Seven Presidents Park, Long Branch; #176

This site was converted into open parkland space 50 years ago with the purchase of all commercial and private buildings near the waterfront. The area has 25-foot dunes with several prominent gaps to allow public easy access to the beach. The wide beach was retained with a dramatic shift from a steep beachface into a bar system to a more gentle, uniform slope that extended the zero-elevation position 40 feet beyond other surveys in this series into the offshore.

Ocean Terrace, Long Branch; #17501

Starting at a bulkhead, this new profile site shows a beach with a high seaward berm and a steep slope into the water. The latest cross section from October 2020 is clear evidence of USACOE efforts in beach maintenance as the shoreline moved 150 feet seaward in the interval between the February and October 2020 surveys.

Broadway Avenue, Long Branch; #175

Sand from the beach accumulated at the base of the steel bulkhead protecting the sedimentary bluff in Long Branch at this site but was removed from the area near the profile line to allow the cabanas to sit lower and not block the view from the promenade. It does not appear as if sand was added to this location because changes were within relatively modest ranges both on the beach and offshore.

45 Ocean Avenue, Long Branch; #17402

The bluff at this new profile location lies protected behind a decades old vertical steel sheet pile wall. The beach is 180 feet wide with a milder slope into the ocean. The beach changes were minimal but the appearance of an offshore bar as of January 2021 was noted since it has been uncommonly seen at this site.

North Morris Avenue, Long Branch; #17401

At this new profile site, the old steel sheet pile wall has a rock revetment protecting it. The beach is about 250 feet wide with a significant berm developed high up on the beachface slope by June 2020. Berm retreat moved the zero-position landward almost 50 feet by January 2021 as an offshore bar system appeared with sand transferred well offshore.

Morris Avenue, Long Branch; #174

This site is positioned along the old Long Branch beachfront along the former Ocean Avenue now reduced to a pedestrian walk. The boardwalk was rebuilt at the bluff's edge after Sandy. Very modest change occurred on the beach during this survey series, with sand shifting seaward as a small relief offshore bar developed with a trough at the beachface toe and sand added further seaward.

276 Ocean Avenue, Long Branch; #17303

This new profile starts at the top of the bluff and crosses the rock revetment that protects Ocean Avenue in Long Branch. This site saw minor changes in beachface position and few changes offshore either. The upper dry beach remained unchanged.

378 Ocean Avenue, Long Branch; #17302

This new profile location was established along the uplands bluff and crosses the rock revetment. This site has a similar beach width to site #17303 to the north. The beachface slope shifted seaward by January 2020, then eroded landward by 65 feet by June 2020 and shifted seaward 20 feet as of January 2021. The upper dry beach was unchanged.

Wooley Court, Long Branch; #17301

This is the third new site between Morris Avenue and West End Avenue, which starts on the top of the sedimentary bluff, crosses the rock revetment to the beach. Here the two January surveys lie almost superimposed except that January 2021 has a significant offshore bar present. The two “summer” surveys show an advance seaward as of April 2019 and a retreat landward from the winter pair as of June 2020.

West End Avenue, Long Branch; #173

Located near the southern end of Phase I zone within the NY District Corps of Engineers Monmouth County beach restoration project, this site has a rock revetment protecting the base of the bluff, with the boardwalk positioned at the edge of the bluff some 15 feet above the revetment. This work suffered 47% loss rates into the fall of 2015, that was followed by restoration work in 2016 and 2017 as the third phase of the Monmouth County project was completed through Deal and Elberon into Long Branch. Since the final segment of this Monmouth County shore protection project was completed, the West End site appears to be more consistent in beach volume stability. Positions seen in 2019 into early 2020 are both landward of the 2020 and early 2021 surveys where shoreline advance seaward occurred. The final survey in January 2021 presents an offshore bar roughly in the same place and elevation as was seen in January 2020.

717 Ocean Avenue, Long Branch; #27201

This new profile site is positioned just south of the end of the rock revetment protecting the old Ocean Avenue in Long Branch. There is a bulkhead at the property line and a 200-foot wide beach seaward of the bulkhead. No dune exists at the site. The sand supply was improved as of January 2021 as a result of maintenance work further south along the Phase III reach. Sand moved north along the shoreline adding to this site.

Lake Takanassee, 805 Ocean Avenue, Long Branch; #272

This profile location was established a few years ago to replace original site #172 abandoned years ago. Lake Takanassee is the northernmost “estuary lake” along the Monmouth County shoreline and, like the others, has a fresh water drainage system constricted at the shoreline by a bay-mouth barrier. It was necessary to relocate the profile to the south, further from the condominium’s parking lot retaining bulkhead. Significant sand appeared on the berm as of January 2021, again likely due to maintenance elsewhere to the south. The offshore bar was part of the sand increase as well.

Plaza Court, Long Branch; #17101

Located south of Lake Takanassee, this new site was completed under Phase III of the NY District USACE beach nourishment project in 2016. The three cross sections ending with the June 2020 survey show relatively constant shoreline retreat over time, followed with a 135-foot shoreline advancement as of January 2021 indicating direct sand placement at this location as a result of Corps beach maintenance.

Pullman Avenue, Elberon; #171

The initial Phase III sand placement was 271.99 yds³/ft., with a 418-foot shoreline advance. Losses were substantial by May 2017 (-100.86 yds³/ft., and -189 feet of shoreline retreat). Loss continued during the summer of 2017 (-40.66 yds³/ft., and -57 feet of additional retreat). The net change since May 2016 was a loss of 137.40 yds³/ft. and a shoreline retreat of 173 feet (41.4% of the placement shoreline advance). Beach retreat rates have consumed the remainder of the initial USACOE deposit (-57; -46; and -48 feet among three surveys totaling 150.5 feet of retreat). Sand volume losses were almost as consistent totaling -98.02 yds³/ft. As of May 2018, the site retains just 13.4% of the sand initially placed here in 2016. The profile series continued with minimal change during 2019, but further beach retreat seen as of June 2020. Restoration arrived during 2020 with the berm rebuilt as of January 2021 with an offshore bar generated offshore. The sand volume increase includes both the beach berm and the offshore bar with a small subtraction because of the trough landward of the bar.

981 Ocean Avenue, Long Branch; #17005

This new profile is situated along the high bluff on private property and starts at the toe of the dune at the bluff. The beach slopes seaward starting at elevation 10.0 descending to the zero-elevation position about 150 feet from the reference point. As of January 2021, some sand had added to the beachface and a generous offshore bar had developed.

1115 Ocean Avenue, Long Branch; #17004

This is the second of the five new profile locations moving south from Pullman Avenue. The dune covers the bluff edge and extends about 80 feet seaward from the starting point. Stability seems to dominate the surveys on the beach while offshore large variations appear in the bar trough between a nearly flat terrace present in April 2019 and the deep trough present in January 2021.

Ocean Court, Long Branch; #17003

This new profile starts at the toe of either bluff sediments or a small dune and extends at elevation 10.0 feet, 200 feet seaward to the berm crest. Minimal change occurred on the beach or berm including the beachface slope into the ocean. Offshore minor bar variations were present.

Garfield Road, Long Branch; #17002

This new profile site has a vertical bulkhead as its starting point and sand was placed to the 10.0-foot beach elevation. The berm crest retreated somewhat from the April 2019 position, then advanced seaward with added sand by June 2020 to a maximal location for this series. Since June 2020 the berm retreated 60 feet and a deep trough appeared offshore by January 2021.

Jerome Avenue, Deal; #17001

Located just south of the Deal municipal boundary with Long Branch, this new profile starts at a vertical bulkhead and initially extends for 160 feet at elevation 10.0 to the berm crest. Beach changes were modest across the latest 18 months with a significant trough developed immediately offshore as of November 2020.

Roosevelt Avenue, Deal #170;

The Roosevelt Avenue site is located north of the Deal sewage pumping station built in 1906 at the base of the sedimentary bluff. The bluff is protected by a timber bulkhead with a massive rock revetment in front of it. South of this street is a series of private homes built on the bluff with a decent sand beach seaward of the dune-mantled bluff edge. North of Roosevelt Avenue there was essentially no dry beach between closely-spaced groins and the shore parallel revetment. Site #170 had a 30-year history of a wet beach against the rocks. By November 2016 the Phase III deposition amounted to 189.96 yds³/ft. and a 311-foot shoreline advance. The recent history saw the maximum extent of beach width in June 2020 followed by retreat to the 2019 beachface positions as of November 2020. Bar and trough generation occurred as of November 2020 as at this site as well.

South Roosevelt Avenue, Deal; #16905

This new profile site is situated south of the Roosevelt Avenue street end, but north of Poplar Brook, a unique freshwater stream that still flows across the beach into the sea from headwaters to the west of the Borough of Deal in Monmouth County. This stream channel apparently never achieved an “estuary lake” status at the coastline but has been flowing across the beach for decades. This stream has been put into an underground culvert extending from Ocean Avenue into the sea, so no longer flows at the surface directly into the ocean. Beach restoration provided over 100 feet of dry beach with a stable slope into the ocean that advanced slightly over the April 2019 position. Minimal bar formation has occurred at this location.

71 Ocean Avenue, Deal; #16904

Starting at a vertical bulkhead, this new profile location was enhanced with a 200-foot wide berm with a slope into the ocean that seldom supported an offshore bar. The November 2020 survey found a miniscule ridge of sand offshore, but little other changes.

Ocean Lane, Deal; #16903

This new profile starts at a rock revetment and reaches the beach at elevation 10.0, which extends seaward for 280 feet to the berm crest. Very little change occurred either on the beach or the beachface slope. Minimal variations were seen in the offshore terrace including the absence of bar formation at this location.

Brighton Avenue, Deal; #16902

This new profile location is situated directly in front of a major beach club in Deal and has a new dune between the property development and the open beach. This dune is narrow with a summit elevation of 20 ft. (NAVD88). The beach seaward is about 200 feet wider at elevation 10.5 descending steeply to a lower slope gradient terrace offshore. Variations occurred in the elevation seen on this terrace with January 2021 having the lowest elevation complete with a very minimal offshore bar as a distinctly new feature.

Wallace Road, Deal; #16901

Positioned at a tall bulkhead and rock revetment that reaches the bluff crest at a 30-foot elevation, this new profile location includes a beach that is 150 feet wide at elevation 8.0 to 10.0. The beach slopes to the ocean at similar gradients to others in the area but has a wide low-gradient terrace offshore. The terrace elevation decreased starting in June 2020 and continuing into January 2021 when compared to the elevation during 2019. Beach changes were minimal.

Darlington Avenue, Deal; #169

The Darlington Avenue site is about a mile north into Deal from Allenhurst and was picked because there was a pocket beach centered at Darlington Avenue extending several blocks in either direction. The sediment bluff once exposed 25 years ago was armored by individual property owners over time with timber bulkhead “seawalls”. Individual owners were required to repair the extensive damage to their bluff protection once again concealing the geologically older sedimentary deposits from inspection. This site did gain sand as the federal project got underway with 241.39 yds³/ft. added during the spring to fall 2015 interval. The net change was a sand volume gain of 231.44 yds³/ft. accompanied by a 350-foot shoreline advance. The April 2019 survey appears to have been the most extensive beach berm position with general modest retreat occurring through January 2021. The offshore terrace also decreased in elevation between June 2020 and January 2021.

Monmouth Drive, Deal; #16802

This new profile site has a 100-foot wide beach at elevation 10.0 that gradually slopes downward to the zero-elevation position and transitions into an offshore terrace with a gentler slope. The January 2021 cross section saw the most erosional scour into the terrace with only the most trivial deposition further seaward as a bar.

Neptune Avenue, Deal; #16801

From the bluff elevation, this new profile descends to the beach at the 10.0-foot elevation. Beach widths varied largely due to the steepness of the beachface slope (steep in June 2020, gentle in January 2021 and January 2020). No offshore bar system was present this past 18 months.

Corlies Avenue, Allenhurst; #168

The site #168 at Allenhurst sits on top of an old concrete wall that retains the bluff sediments. There is a drop vertically to the sand beach. There is a wooden walk elevated above the road just landward of the concrete wall. The boardwalk is 20 feet above sea level, behind the vertical concrete wall. The site gained 89.54 yds³/ft. as the USACE project got underway in 2015. Completed earliest in the Phase III project, this site now has a 200-foot wide beach. The beach changes were modest but the beachface location along with the offshore elevation present in April 2019 diminished by 2 feet across 350 feet of transect distance

Euclid Avenue, Loch Arbor; #26703

This new profile site is located at a public beach at the north limit of this community’s two block shoreline width. There is no dune present. Change in the beachface position is a bit unusual in that the winter seasonal surveys found a wider beach berm than seen in the two spring surveys. One would think that winter events would take any summer accretion by mid-January.

Edgemont Avenue, Loch Arbor; #26702

This new profile site is situated directly at Deal Lake, the boundary between Loch Arbor and Asbury Park. The Deal Lake flume is the boundary as Loch Arbor has half its two-block shoreline as a public beach and half in private ownership. There has been a long history of storm waves washing through the private beach club into Deal Lake. The road across the “estuary lake” bay mouth barrier was still closed months after Sandy. Deal Lake is the largest of the now-closed stream estuaries along the Monmouth County shoreline. It was mapped as open to tidal flow continuously between 1867 up to as late as 1880 but mapped as closed by 1889. The site has a small dune and a 120-foot wide beach at elevation between 10 and 6.0 feet. Beach changes were seen in the

berm slope steepness especially between the June 2020 and January 2021 surveys. April 2019 and June 2020 cross sections extended across a wide, fairly flat terrace. This terrace was transformed twice (February 2020 and again as of January 2021) into an extraordinarily deep trough with a depth about 8 feet greater than the elevation seen on the bar seaward.

This terrace is positioned less than 100 feet north of the large rock groin supporting the Deal Lake flume structure and with the larger than normal distance seaward, the groin generates a wave-generated scour hole immediately to its northeast. The survey transect passes along the northeast edge of the feature, so minor changes in the size or extent of the scour will produce huge “gains” or “losses” at the site of the scour. The feature can be seen in Google Earth air photographs. The sand volume represented by the “cut” shown offshore between June 2020 and January 2021 amounts to XXX yds³/ft. just for this scour hole volume.

1740 Ocean Avenue, Asbury Park; #26701

Positioned on the Asbury Park side of Deal Lake at the north end of the boardwalk, this new profile site has a tiny dune seaward of the boardwalk and a 240-foot wide beach at elevation 10.0 feet. In 2021 a narrow boardwalk had been extended past this site as seen on the profile. Beach changes were minimal with a modest trough scoured into the offshore terrace.

Seventh Avenue, Asbury Park; #267

The Federal project beach in Asbury Park developed a dune by January 2021 that may have been manmade. The USACOE provided an additional 92.68 yds³/ft. generating a 115-foot shoreline advance. The beach did retreat between June 2020 and January 2021 accompanied by a scour deepening of the terrace offshore that generated a modest offshore bar near the end of the survey extent.

Sunset Avenue, Asbury Park; #16701

This new profile location starts at the boardwalk and the beach extends 165 feet seaward at a 10.0-foot elevation descending into the ocean at a uniform slope seaward to an offshore bar. A flat terrace at -3.0 feet elevation was present during the May 2019 survey, developed into a scour trough by January 2020, filled in by June 2020 and reverted to a deeper scour trough by January 2021. The final end point elevation of all four surveys was remarkably similar.

Third Avenue, Asbury Park; #167

At site #167 on Third Avenue, there is a 200-foot wide beach at elevation 10.0 leading to a steep slope into the water. The final survey in January 2021 revealed a deep scour at the base of the beachface that generated the negative sand volume for the site. The Jan. 2021 “dune” was a manmade ridge.

Asbury Avenue, Asbury Park; #16602

Located at the southern limit of Asbury Park, this new profile site also starts at the boardwalk with the beach extending 270 feet seaward at a 10.0-foot elevation. Beach retreat appeared as of January 2021 returning the beachface slope to exactly where it was in May 2019. The final survey of this series also found a deeper nearshore elevation similar to others in the area.

Spray Avenue, Ocean Grove; #16601

There is a minor dune present seaward of the boardwalk sloping down to the elevation 10.0-foot beach. The beachface slope ends at -2.0-foot elevations in the water. A low-gradient terrace remained relatively constant between May 2019 and June 2020, then eroded downward below earlier survey elevations by December 2020.

Ocean Grove, Ocean Pathway; #166

At Ocean Pathway the dune remained as did the large, open, but roofed seating area seaward of the boardwalk. The beach changed very little but offshore the terrace eroded lower in elevation between June and December 2020.

Broadway, Ocean Grove; #16502

This new site has a boardwalk, a dune and a 175-foot wide dry beach seaward of the dune at a 10-foot elevation. The most pronounced berm was seen on December 2020 as a result of summer and fall accumulation. Offshore there were few changes in terrace elevation or bar formation.

Cliff Avenue, Bradley Beach; #16501

At this new profile location, there is a promenade on the bluff edge followed by a dune on the beach. Today, the beach at elevation 10 continues about 140 feet seaward of the dune before descending into the water at elevation -4.0. The terrace eroded lower in elevation by December 2020 with sand transferred further offshore than the previous three surveys.

McCabe Avenue, Bradley Beach; #165

This site originally was surveyed with a timber boardwalk seaward of the promenade. The December 2020 survey found a sand ridge added just seaward of the dune as added storm protection. The beach berm retreated landward following a maximal extent documented in June 2020. The loss in elevation was continued offshore across most of the terrace surface.

4th Avenue, Bradley Beach; #16402

This new profile site is situated at the Bradley Beach bluff promenade and dune complex. The beach eroded back between June and December 2020 with continued loss seen offshore to the 660-foot distance.

2nd Avenue, Bradley Beach; #16401

The new profile at 2nd Avenue begins at the boardwalk that lies landward of the dune by approximately 100 feet. The beach is 150 feet wide at elevation 10.0 feet. The berm crest remained nearly constant over the 18 months with fluctuations seen in the nearshore region. The December 2020 profile has no bar system present and a uniform slope seaward from the berm crest to the distal end of the survey.

Sylvania Avenue, Avon-by-the-Sea; #164

The beach extends 220 feet from the boardwalk at a 10-foot elevation before sloping into the water. Seasonal variations occurred in the beachface slope to the water, but little net change happen in the zero-elevation position. Sand moved landward for the December 2020 survey making the beach to offshore transition the most gentle slope of the series.

Garfield Avenue, Avon-By-The-Sea; #16303

This new profile site includes a tiny dune seaward of the boardwalk that became a variation in the slope to the beach elevation from the boardwalk by Dec. 2020. Erosion impacted both the berm and offshore reducing the elevation both places between May and December 2020.

Washington, Avenue, Avon-By-The-Sea; #16302

Located just north of Shark River Inlet, this new profile site has a 160-foot wide beach without a dune seaward of the boardwalk. The beach slope and offshore gradient were quite gentle as of December 2020. Sand filled in the offshore trough near the base of the beachface at the expense of a reduced elevation further offshore in comparison to the survey done May 2020.

2nd Avenue, Belmar; #16301

Positioned 3 blocks closer to Shark River Inlet on the Belmar side from site #163, this new location has the wide beach retained by the inlet jetty (420 feet wide). The steeply sloping beachface was retained during the entire 18 months of study with very minor retreats documented from December 2019 into May 2020 followed by accretion back to the April 2019 position. No change offshore.

5th Avenue, Belmar; #163

Belmar has an original survey site at 5th Avenue near Shark River Inlet. Since the 5th Ave. beach is extra wide due to the south jetty of Shark River Inlet impounding material, the USACE does not add significant sand to this site. The berm crest varied within a 50-foot range at the crest and nearly that amount at the zero-elevation position. Offshore a migrating bar seen in the May 2020 profile redistributed the sand volume in the bar between the beachface and further offshore by December 2020.

8th Avenue, Belmar; #16202

At this new profile site, the boardwalk is just seaward of Ocean Avenue and the beach extends 200 feet further seaward at the 10.0-foot elevation. Sand was added to the berm crest between April 2019, continuing through the December 2019 survey to the May 2020 survey. The berm then eroded back to the April 2019 position. Modest changes occurred offshore with the May to December 2020 changes appearing to be mostly related to storm activity similar to those seen elsewhere.

14th Avenue, Belmar; #16201

At this new profile location, the boardwalk appears to have a tiny dune at its seaward base which developed 60 feet seaward of the boardwalk by Dec. 2019. Since this “Dune” vanished in the May 2020 survey only to reappear in the December 2020 profile, it is assumed to be the result of added storm protection bulldozed into position. Here the offshore shifts in sand volume locations were equivalent to those mentioned for the 8th Ave. site above, but more pronounced in total sand volume moved.

18th Avenue, Belmar; #162

No sand ridge was generated by the City at this location during this survey series. The berm was cut back to the April 2019 position by December 2020 and the sand volume offshore decreased slightly when compared to the May 2020 survey.

North Boulevard, Belmar; #16104

This new profile site is south of the municipal boardwalk seaward of Lake Como, another of the Monmouth County “estuary lakes”. While, historically, not known to have been open to the sea, there is no reason to

believe that it never was. Following Hurricane Sandy, the Lake Como ocean discharge pipeline was replaced with a much larger diameter structure. The beach retreated modestly between December 2019 and May 2020, then remained relatively constant.

Remsen Avenue, Spring Lake; #16103

The new profile at the Spring Lake boardwalk lies seaward of the dune system with a 170-foot wide beach at elevation 10.0 feet. This site gained some sand on the beachface slope by December 2020 likely at the expense of the offshore region. The beach and offshore were relatively stable during the past 18 months.

Lorraine Avenue, Spring Lake; #16102

At the next new site south, the dune exists landward of the boardwalk with a small ramp of sand from the beach going under the walk. Here the beachface slope retreated from prior positions by December 2020 and the offshore region became lower in average elevation particularly compared to the May 2020 survey.

Tuttle Avenue, Spring Lake; #16101

This fourth new profile site in Spring Lake maintains a 200-foot wide dry beach near 10.0 feet elevation with some sand added to the lower beachface slope by December 2020. Little change occurred offshore.

Brighton Avenue, Spring Lake; #161

The dunes are far higher here than further north, but still exist landward of the boardwalk installation. The wind characteristically forces sand under the structure to the point of filling in under the decking. During the past several storms this has resulted in wave forces lifting the decking off the concrete supports wrecking the entire Spring Lake walkway. This site did not see much beach change above the zero-elevation position but minor loss in elevation offshore by December 2020.

Madison Avenue, Spring Lake; #16004

This new profile site includes a dune, then the boardwalk, with sand ramped up under the structure by December 2020. The beach descends from elevation 12.0 to about 9.0 at the berm crest with a slope down to the offshore region where a wide, very low gradient terrace exists seaward. Little net change was seen.

Morris Avenue, Spring Lake; #16003

This new profile location includes a dune, then the boardwalk but no flat dry beach. Here the slope to the water begins at the boardwalk and descends to about -3.0 feet in the nearby offshore region. Modest fluctuations in the offshore bar position and elevation marked the changes seen offshore.

Mercer Avenue, Spring Lake; #16002

This new profile location closely resembles #16003 with sand accumulation at the boardwalk and a consistent beachface slope from the boardwalk edge into the ocean. Offshore bar migration appears to have shifted sand volume toward the shoreline between April 2019 and May 2020 after which the volume lost by December 2020 moved elsewhere or gradually replaced sand lost from the beachface.

Essex Avenue, Spring Lake; #16001

This fourth new site between the two original NJBPN locations in Spring Lake more closely resembles the northern site #16004 with 150 feet of beach seaward of the boardwalk. Between May and December 2020 the

boardwalk area accumulated enough wind transported sand so that the landward edge of the boardwalk deck was level with the dune further landward and substantial sand volume was deposited on the dry beach seaward of the boardwalk. Neither the beachface or the offshore region changed much during this 18-month study period.

Salem Avenue, Spring Lake; #160

The Salem Avenue dune is a bit smaller in elevation, but still a significant feature landward of the boardwalk. Here less sand was deposited at or under the boardwalk but did add to the dry beach elevation and the beachface slope by December 2020. Offshore variations were not dramatic with the most pronounced bar present in December 2020.

Union Avenue, Spring Lake; #15902

At this new profile location, the dune is quite a bit higher than the boardwalk with a 140-foot wide, 10-foot elevation dry beach. The beachface slope did not materially change in the 18-month study interval, but the offshore bar moved landward almost to the beachface toe between December 2019 and December 2020.

Brown Avenue, Spring Lake; #15901

At this new profile site, there is a boardwalk seaward of a dune that is approximately equal to the elevation of the boardwalk. The beach width is about 130 feet at elevation 10 feet. This is the southernmost site in Spring Lake close to the Wreck Point estuary lake. The berm retreated back to the April 2019 position after advancing seaward in December 2019, holding steady up to the May 2020 survey then retreating again by December 2020. There also was a decline in offshore sand volume between May and December 2020.

New York Avenue, Sea Girt; #159;

Sea Girt is divided into two parts, each with an original profile site. The New York Avenue site #159, represents northern Sea Girt where a shore-parallel Ocean Avenue allows vehicles to park at the boardwalk with easy public access to the beach. By the April 2013 a new dune had been placed on the beach using sand recovered from inland with a wider base, but about the same height (17.5 feet). Neither the beach or the dune saw significant sand added during the study period, but stability was in place. Offshore the elevation gradually decreased between April 2019 and the final survey completed December 7, 2020.

Crescent Park, Sea Girt; #15801

Crescent Park is an enclave of expensive single-family homes located starting south of Philadelphia Avenue and extending to Trenton Avenue. At this new profile location, there is a old, pre-project dune deposited on top of the sedimentary bluff seaward of the homes, followed by a boardwalk with the post-federal project dune established seaward of the boardwalk. Incremental sand was added to the dry beach with a stable beachface slope. Between April 2019 and January 2020, the offshore region lost sand volume some of which was deposited further seaward on the profile. A bar formed further seaward and slowly migrated landward by May 2020, then retreated in crest position by December 2020.

Trenton Avenue, Sea Girt; #158

The southern Sea Girt site at Trenton Avenue typifies the southern extent where the coastal bluff has been exposed to view after storms with single family homes and a wide, high dune landward of the boardwalk deposited on the bluff. Sand was deposited on the dry federal beach surface with some beachface sand moved over the crest between May and December 2020. Offshore bar migration was the rule with progressive

landward movement between April 2019 and May 2020 but retreat in the bar crest by December 2020. It is likely that the May bar material moved onto the beachface but then was eroded back a bit since.

Seaside Place, Sea Girt; #15703

This new site starts at the street end and goes directly to the landward base of the bulkhead defending the street. Seaward lies a dune and the beach with a steep beachface. Few changes occurred onshore while sand loss was seen between March 2019 and December 2020 in the offshore region.

National Guard Training Center, North, Sea Girt; #15702

This new profile site is one of two within the oceanfront segment long devoted to NJ State Police and National Guard training. The beach is off limits to the public; the very impressive dune is also part of the shooting range back stop for bullets. There is a 100-foot wide beach at 10.0-foot elevation transitioning into a beachface slope where some sand was added during the study period. Offshore bar migration generated a small ridge by May 2020 that persisted up to the December 2020 survey.

National Guard Training Center, South, Sea Girt; #15701

This new profile location is situated at the south end of the NGTC beach segment with a tall dune, a small foredune leading into a 240-foot wide beach at 10.0-foot elevation. The beachface slope changed very little with offshore sand deposition highly variable but with small elevation changes as the bar crest positions shifted toward or away from the shoreline.

Riddle Way, Manasquan; #157;

Manasquan is located at the southern limit of the NY District's Monmouth County beach restoration project and positioned just north of the Manasquan Inlet. Manasquan has only recently allowed a meagre dune to form just seaward of their paved promenade seaward of the beachfront homes. Reliance on pushed up sand ridges each winter has been recorded on multiple surveys (April and November 2019). Natural beachface changes occurred within narrow limits this past 18 months with minimal offshore bar creation on the sub-tidal terrace.

Main Street, Manasquan; #25602

This new profile extends across the beach from the asphalt promenade. A very small dune lies seaward of the promenade as well as a 270-foot wide sloping beach with a fairly consistent gradient all the way into 5 feet of water at the beachface toe. No offshore bar formation was noted over the past 18 months and the terrace has a very low gradient.

Brielle Road, Manasquan; #25601

Positioned closer to Manasquan Inlet, this new site also consists of a wide beach extending from the asphalt promenade with a tiny dune at the walkway across the 150-foot wide dry beach with a sand ridge pushed up on the 2019 surveys. A well-defined offshore bar was present as of Nov. 2019 indicating sand transport landward seasonally. This bar moved close to the beachface toe by May 2020 and likely added the sand volume seen present at the base of the beachface on the November 2020 survey.

Pompano Avenue, Manasquan; #256

At the Pompano Avenue site (#256) a small dune is present just seaward of the paved promenade with the same beach slope seaward as noted previously. Sand ridges were present in 2019, but not repeated on the 2020 surveys. The beachface slope remained in the 2020 location between that present as of April 2019 and the

deposition seen as of November 2019. Offshore sand moved landward onto the terrace between May and November 2020 raising its elevation.

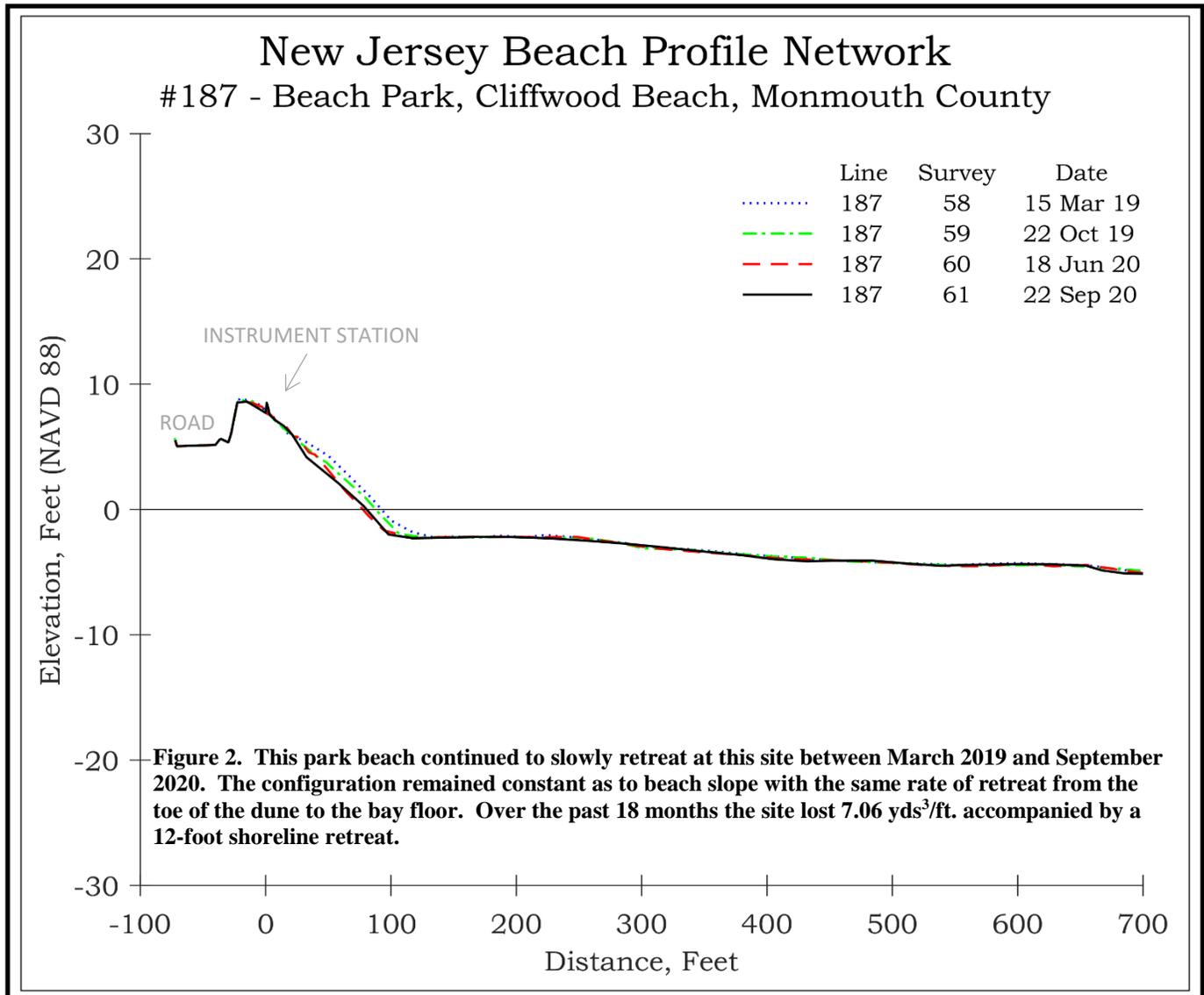
Riverside Drive, Manasquan; #15601

The southernmost new profile site in Monmouth County is positioned just north of the north jetty to Manasquan Inlet. The minimal dune at the promenade is followed by a wide beach (250 feet) and a relatively uniform slope seaward to an offshore terrace system. The beachface advanced seaward between April and November 2019, then retreated incrementally by May then November 2020 to a position midway between the two 2019 locations. There is an offshore terrace present with a gentle gradient and very limited bar development perhaps related to the proximity of the tidal flow in Manasquan Inlet.

NJBPN 187 – Beach Park, Cliffwood Beach



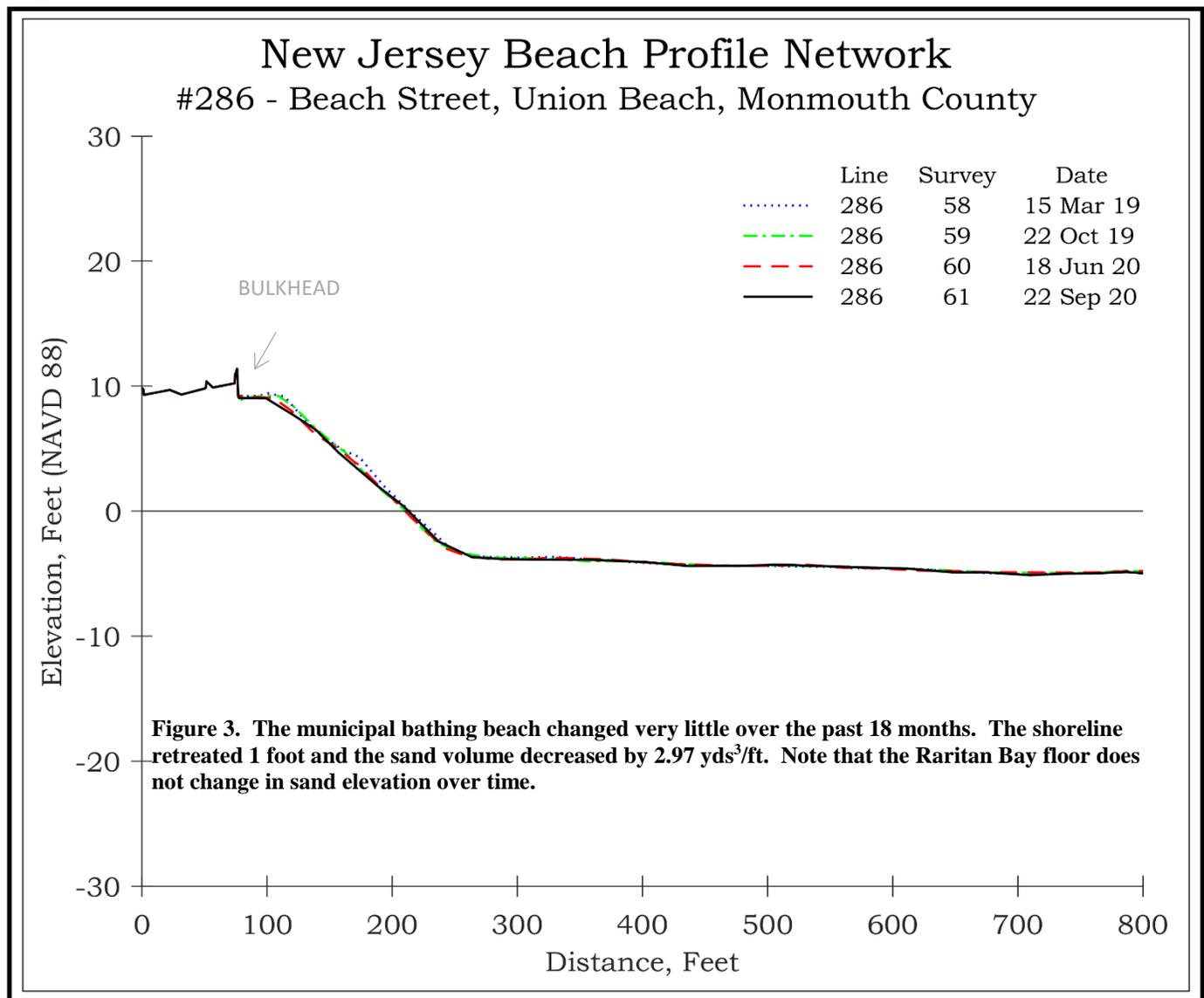
This is the westernmost NJBPN site located on Raritan Bay. The photograph on the left shows the shoreline on October 11, 2019 at a particularly low tide revealing the fine sand composing the Raritan Bay floor. The right picture was taken September 22, 2020 and shows a higher tide stage, but a very similar beach and dune profile.



NJBPN 286 – Beach Street, Union Beach



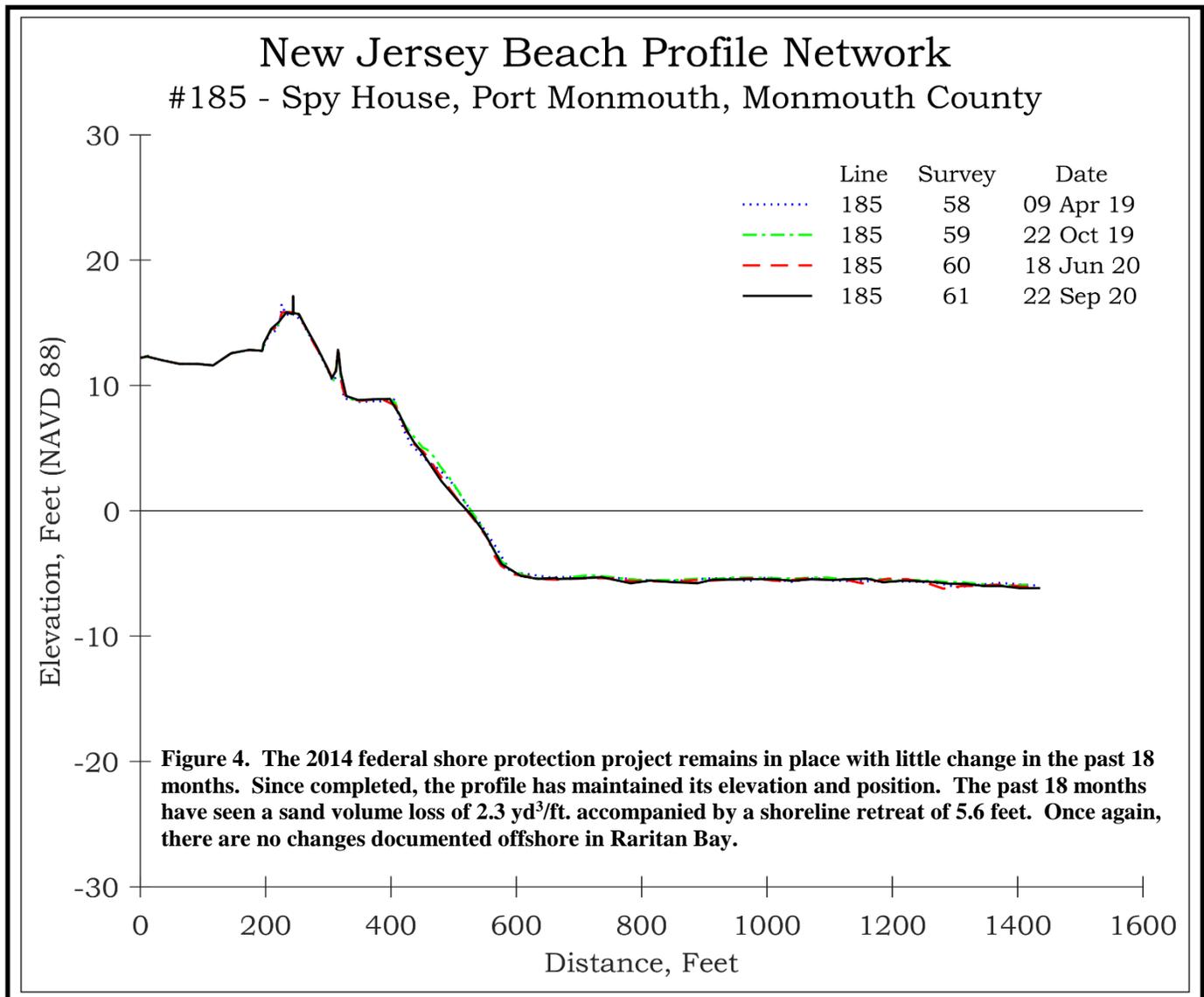
This site was moved to the public bathing beach in 2009. The photograph on the left shows the shoreline on October 24, 2019. The photo on the left shows the beach width and berm on October 24, 2019 with a beach slope created by the bay wave action. The photo on the right shows the shore line on September 22, 2020. The shoreline has seen very minimal change during these two photos.



NJBPN 185 – Bay Shore Waterfront Park, Port Monmouth



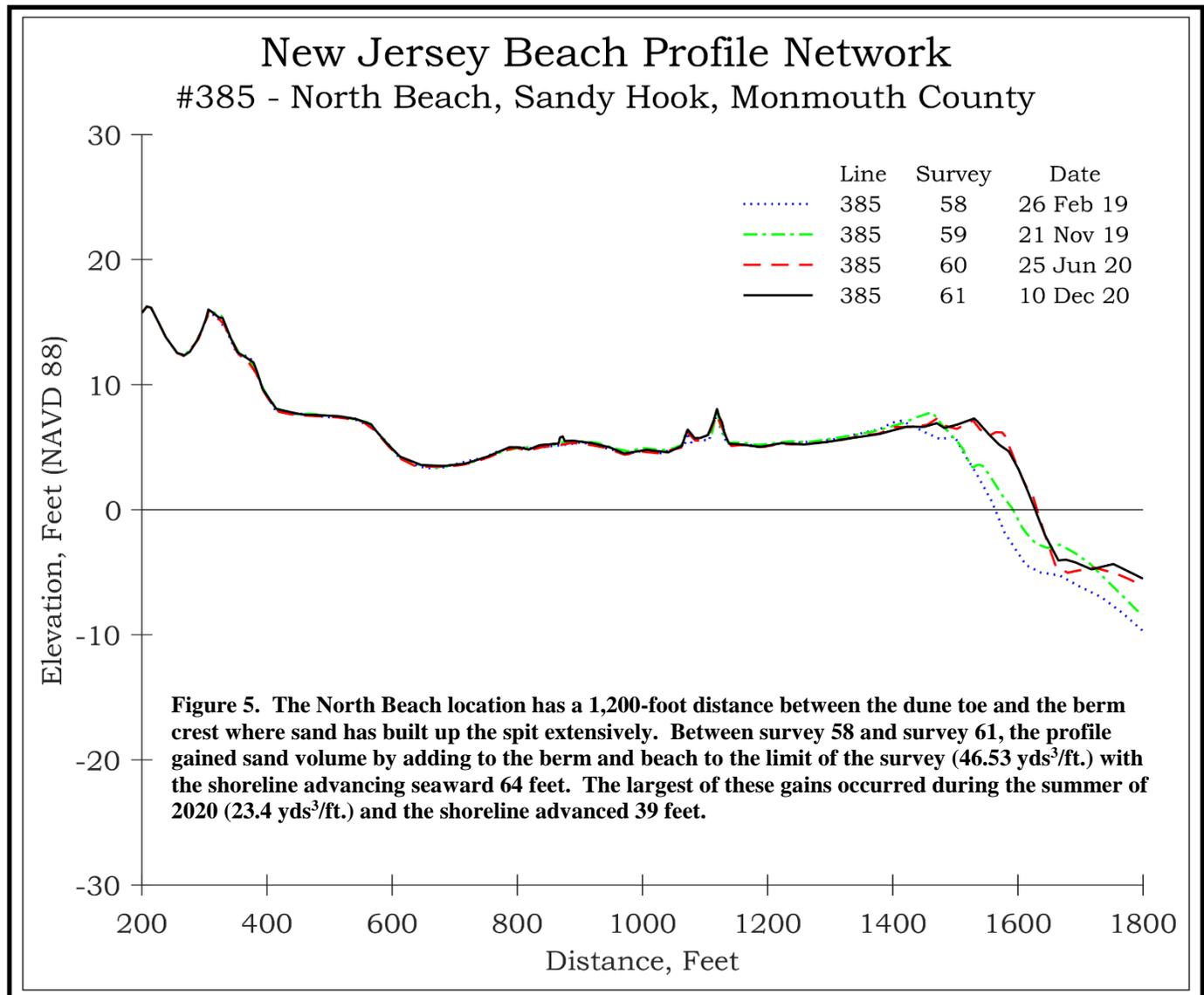
This site was greatly enhanced during 2014 by the NY USACE. The left picture was taken October 22, 2019 showing dune grass progressing out onto the upper dry beach beyond the fence. The right photo was taken September 22, 2020 showing the continued growth of dune grass outward onto the dry beach.



NJBPN 385 - North Beach, Sandy Hook National Seashore



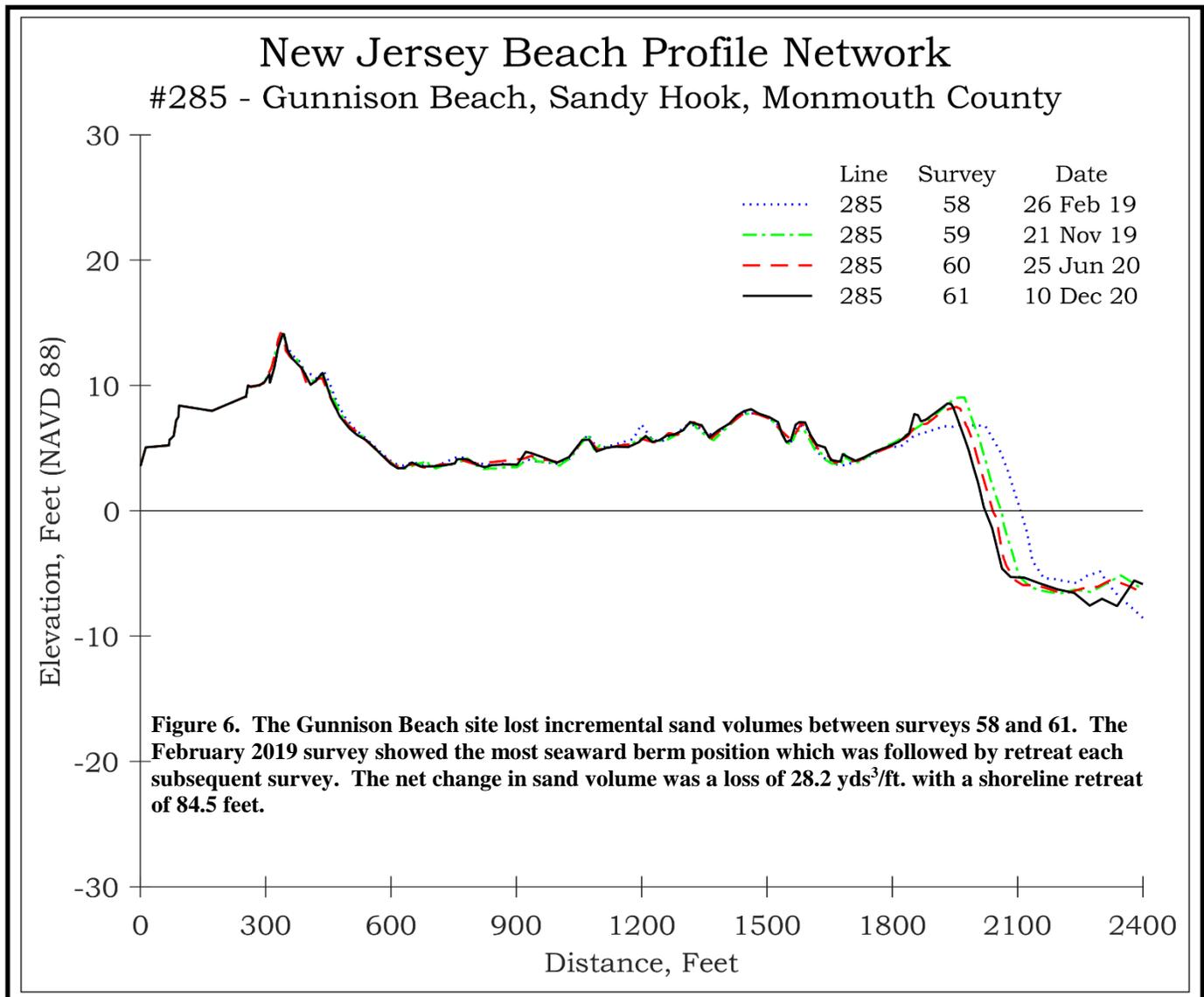
This Sandy Hook location was established in December 2016. The view on the left, taken November 22, 2019, shows the extensive expanse of dry sand making up the northern end of the Sandy Hook spit. The photo on the right, taken December 10, 2020, shows the continued growth of dune grass as well as the sheer mass of the northern end of Sandy Hook.



NJBPN 285 – Gunnison Beach, Sandy Hook National Seashore



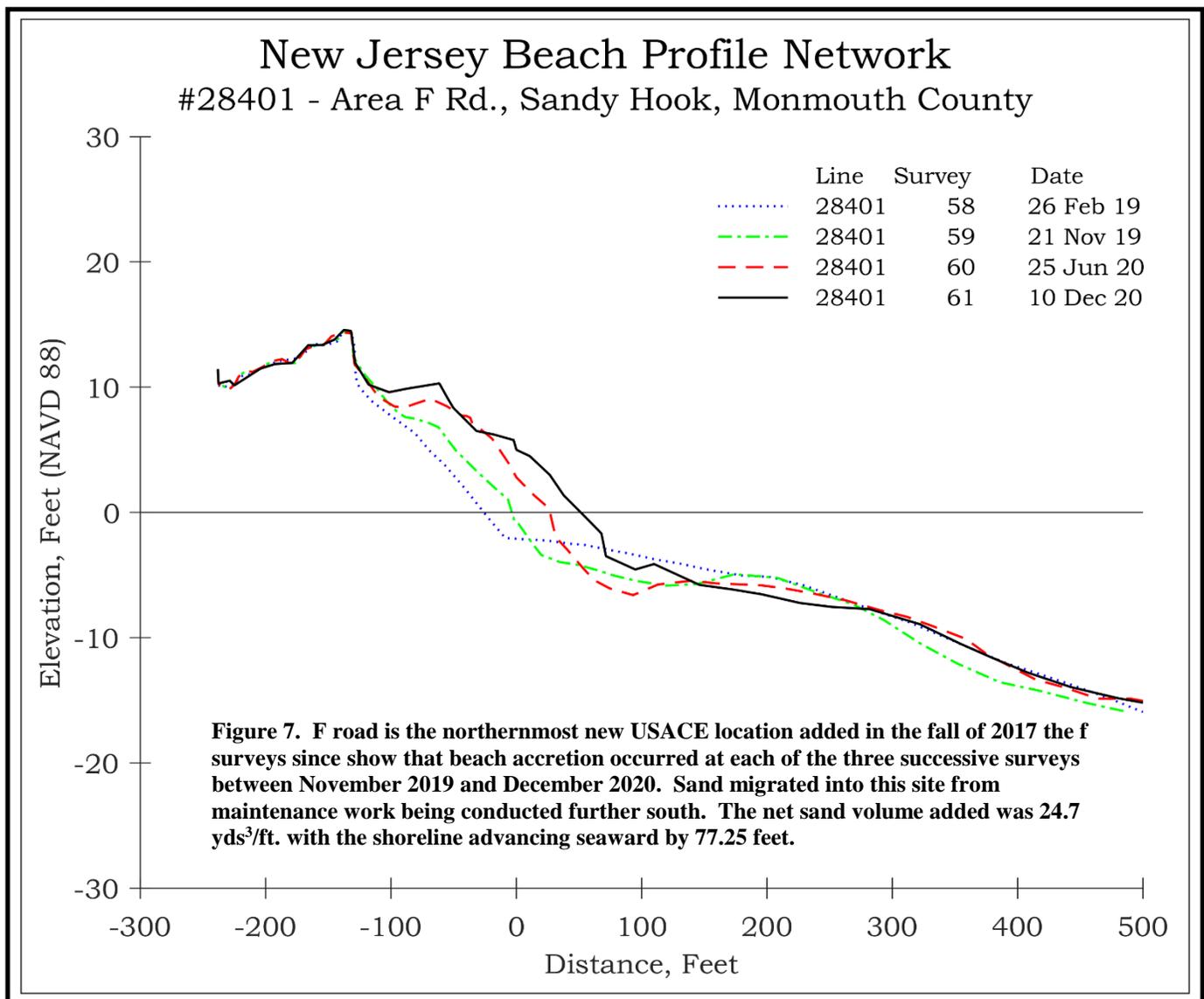
The photograph on the left shows On November 22, 2019 the berm presented a common ridge with alternating patches of dark minerals separated by the swash. The expanse of beach to the right is enormous. The photo on the right, taken December 10, 2020, shows the gradual transition between the dry beach and the beachface slope.



NJBPN 28401 - Area F Road, Sandy Hook National Sea Shore



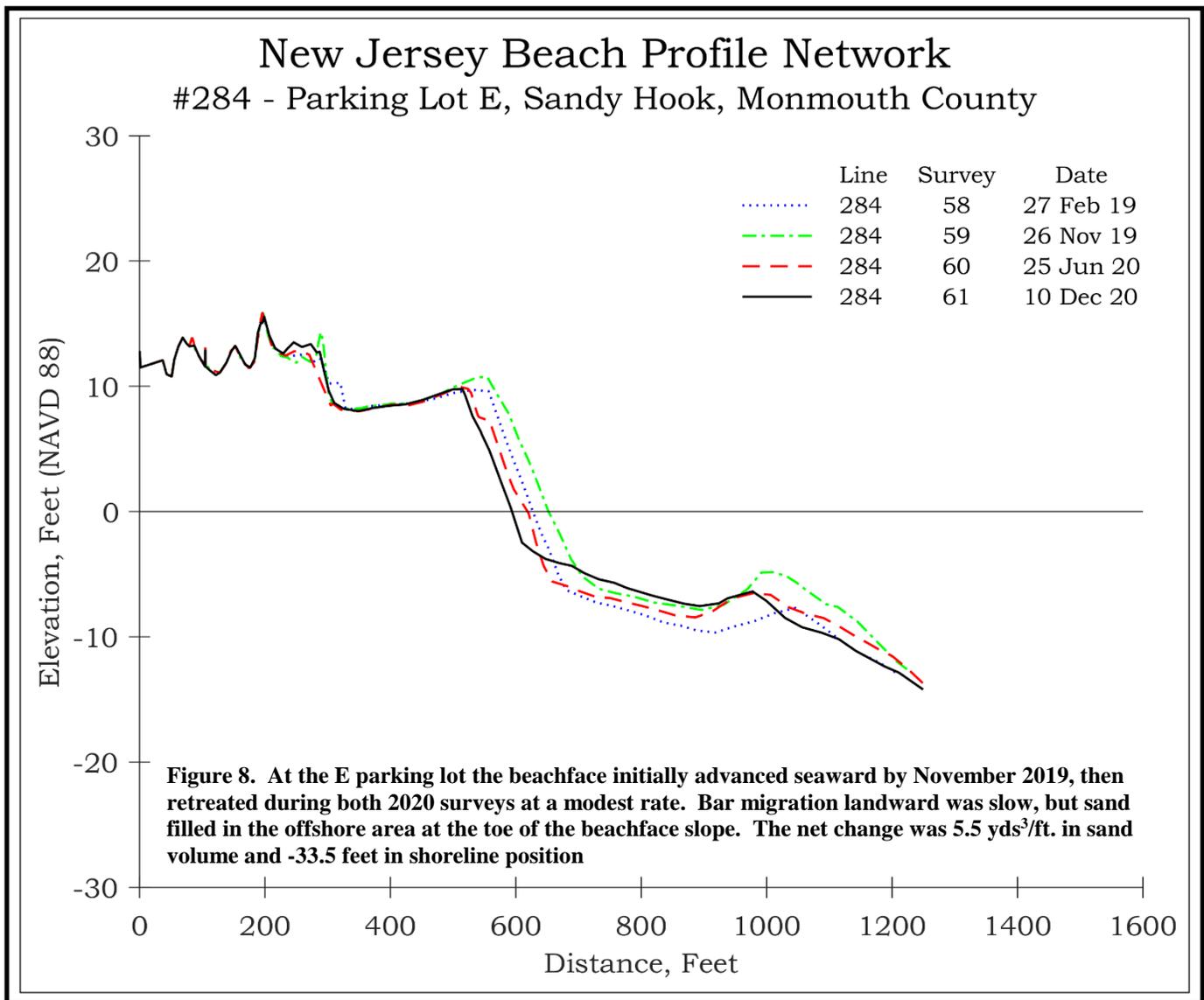
The left view from November 22, 2019 is to the south along the dune crest shows vegetation on the dunes near the beach. The right-side photograph was taken December 10, 2020 with the beach wider by 55 feet with 33.5 yds³/ft. more sand in place.



NJBPN 284 – Parking Lot E, Sandy Hook National Seashore



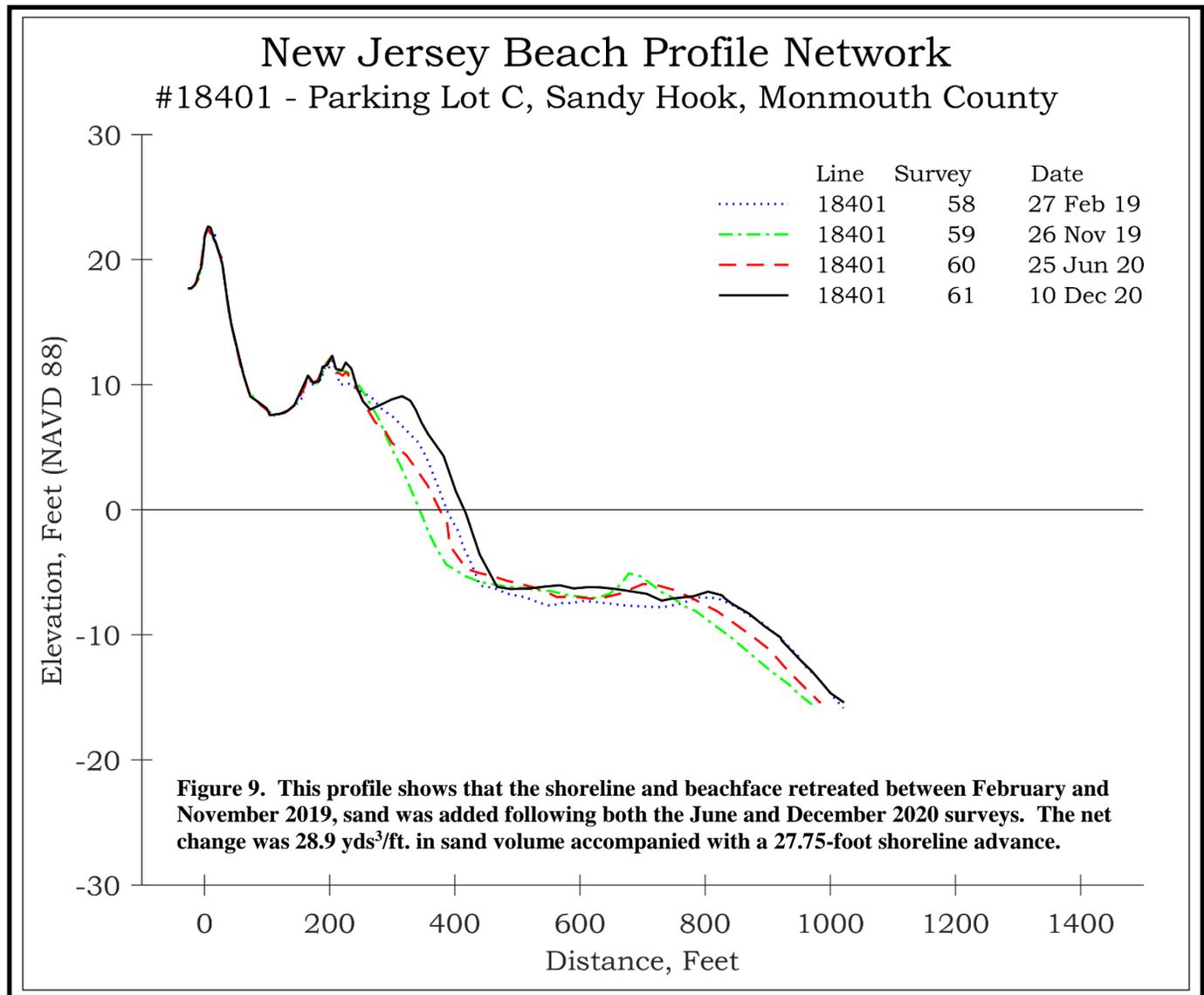
On the left is a beach picture from November 26, 2019 looking south along the dune toe. A similar perspective on December 10, 2020 shows the dune toe and a wide dry beach seaward of the dunes.



NJBPN 18401 - Parking Lot C, Sandy Hook National Sea Shore



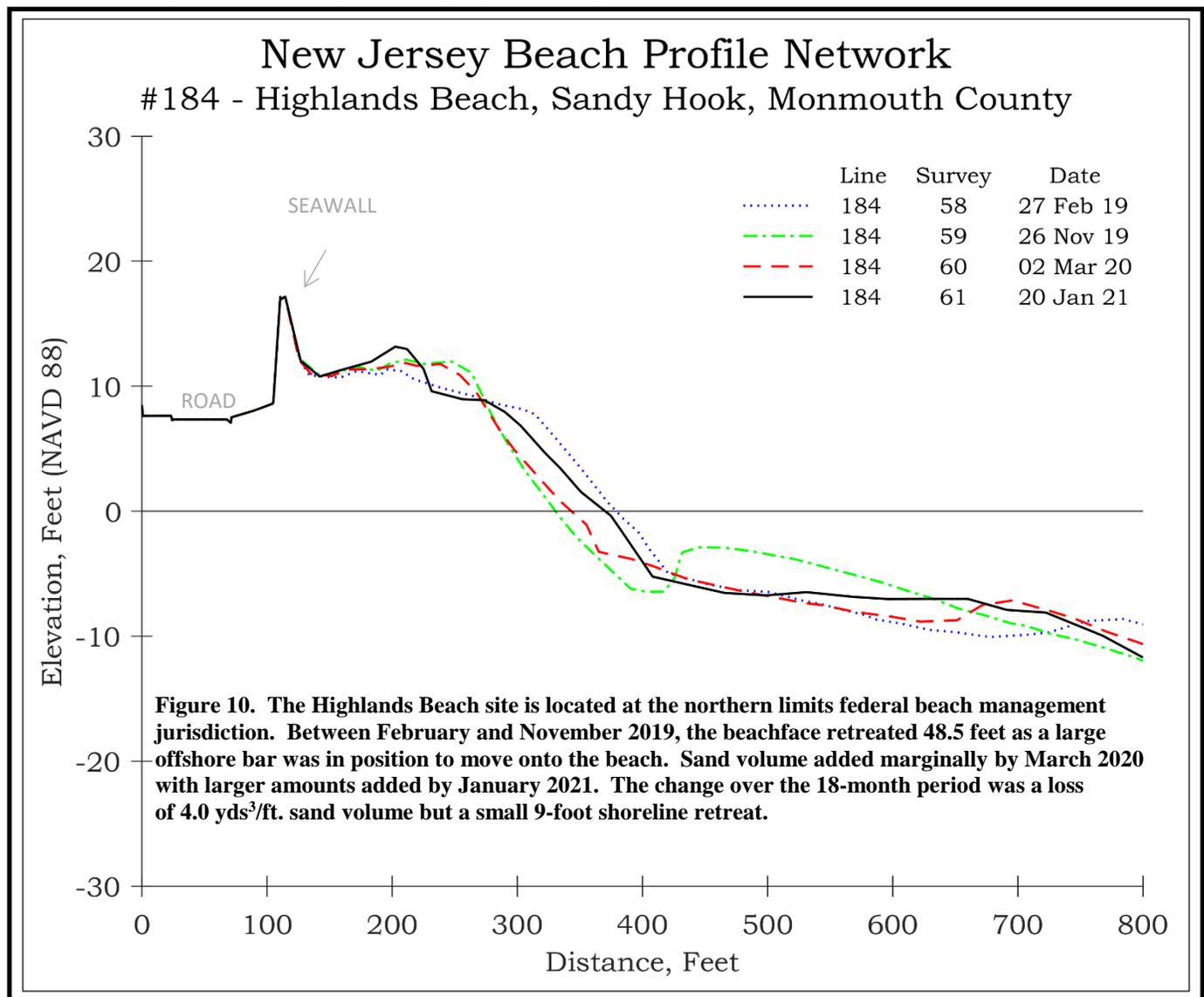
This photo taken of a USACE site on November 26, 2019, shows a wide area of dune growth. A similar view from a photo taken on December 10, 2020, on the right shows that the beach has developed additional sand moved into the dunes as the berm advanced seaward.



NJBPN 184 – Highlands Beach, Sandy Hook National Seashore



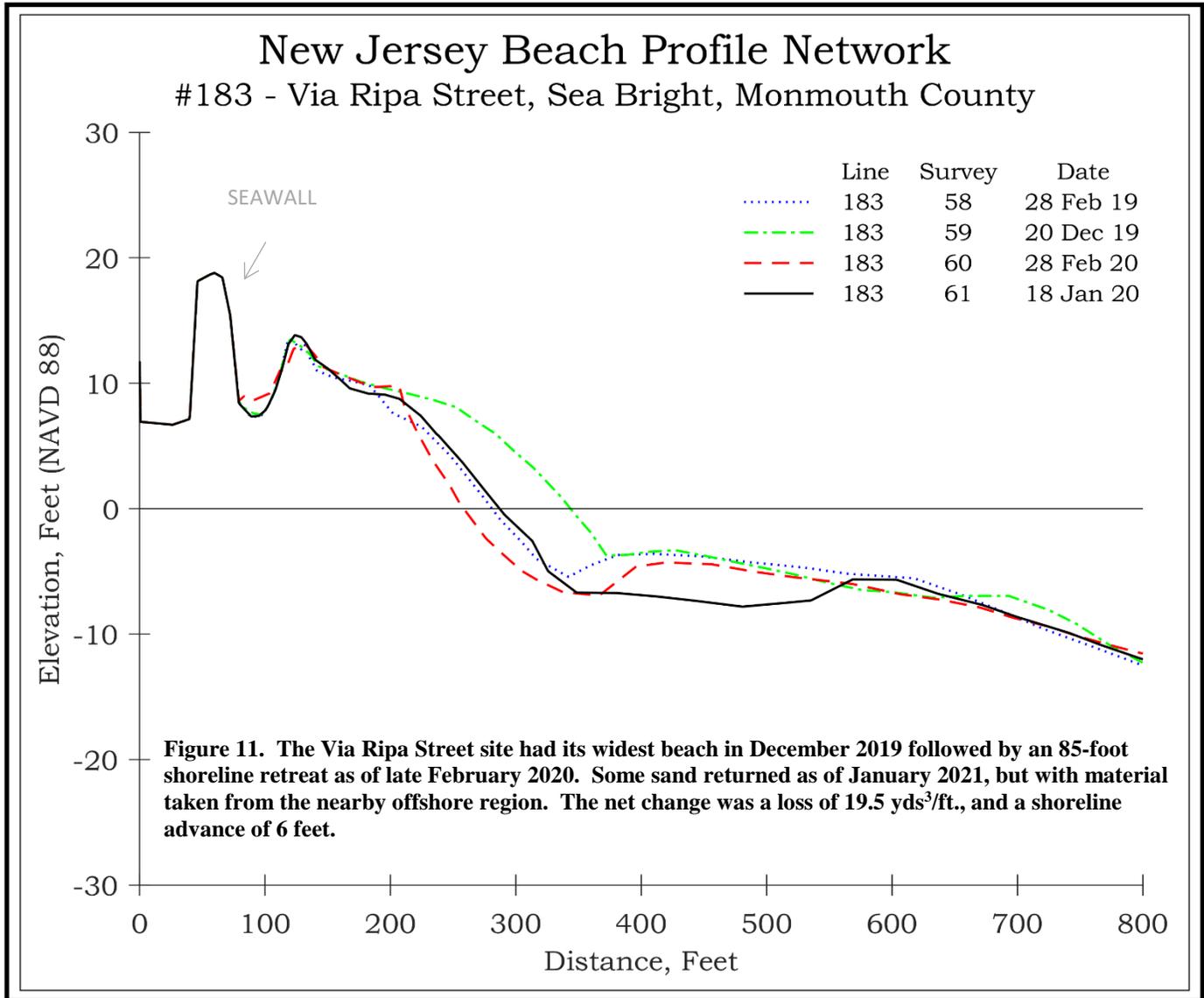
This southern Sandy Hook site is located near the entrance to the park. The left view, taken Nov. 26, 2019, faces south from the rock seawall showing the dune system and the beach and offshore bar system. The photo on the right, taken January 21, 2021, shows a very similar landscape, with slightly less dune grass.



NJBPN 183 – Via Ripa Street, Sea Bright



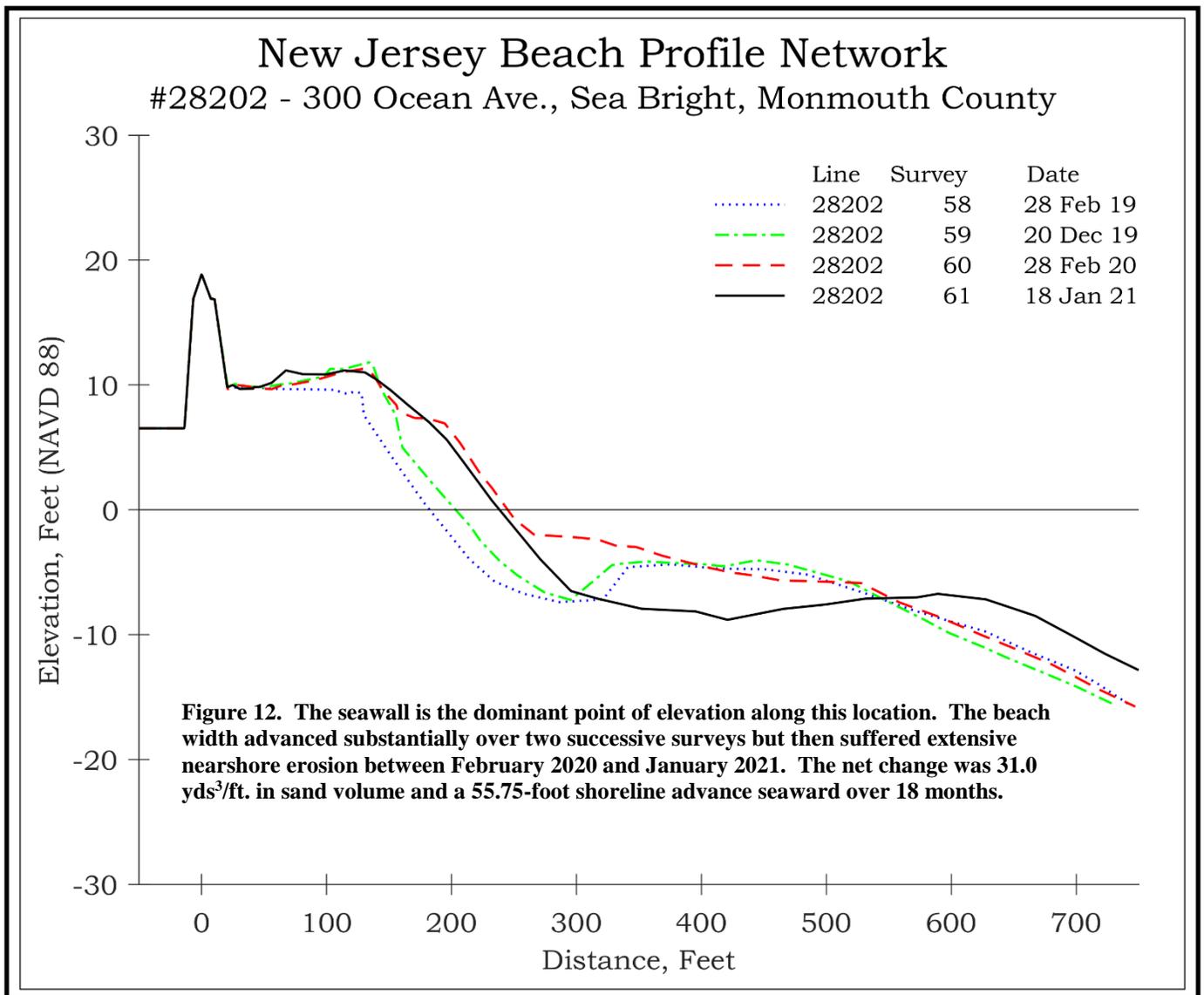
This site is near the northern limit of the initial Federal shore protection project. The left photo shows the seawall and the line of dunes looking south on Dec. 20, 2019. The right photo (Jan. 18, 2021) shows an almost identical looking landscape.



NJBPN 28202 - 300 Ocean Avenue, Sea Bright



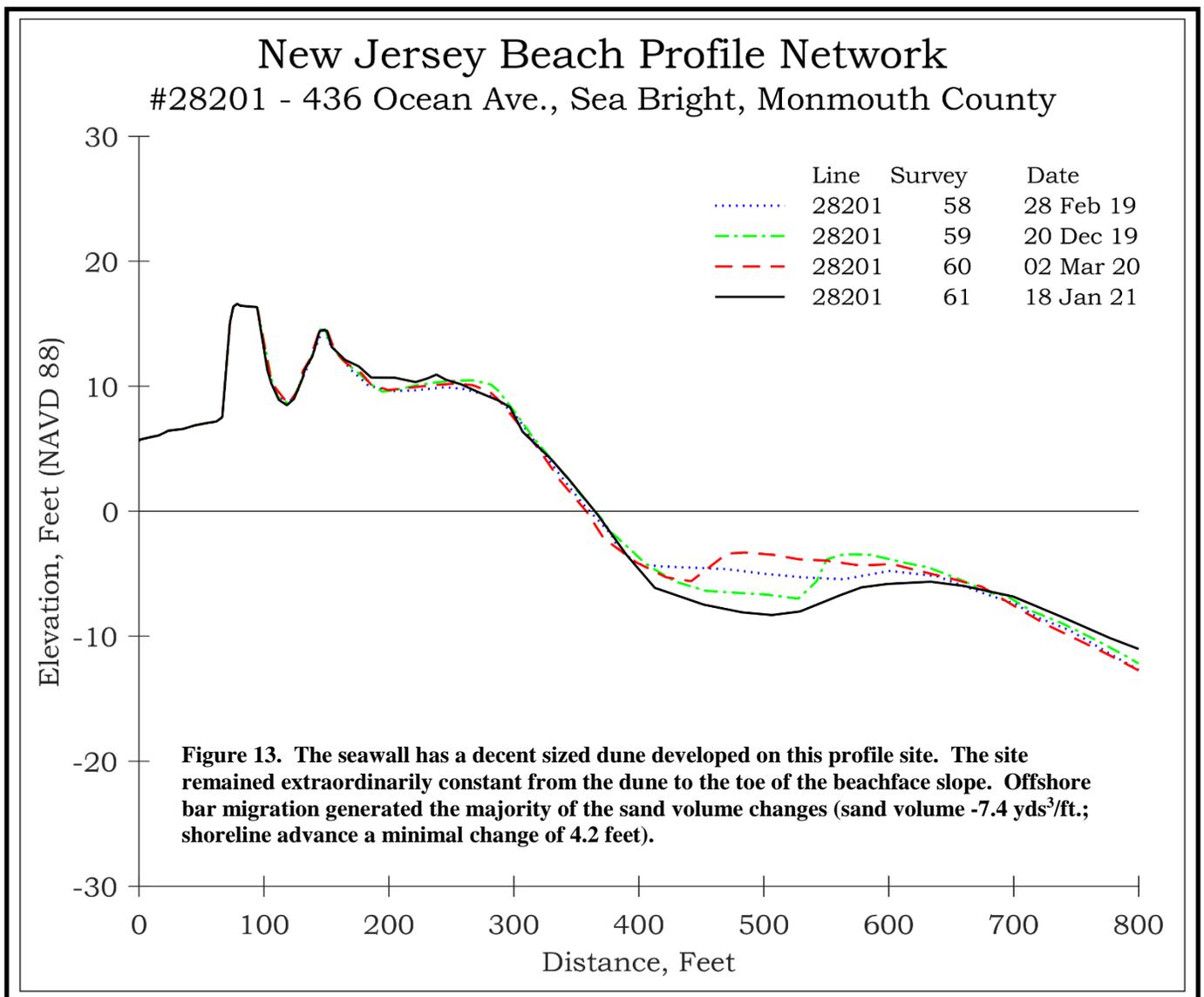
This new site has beach grass established along the toe of the rock seawall, but no extensive dune exists yet (Dec. 20, 2019). The right-hand photograph was taken Jan. 18, 2021 at the seaward edge of the dune grass, where much of the dune grass seems to be covered by the sand deposited by wind since early spring 2020.



NJBPN 28201 - 436 Ocean Avenue, Sea Bright

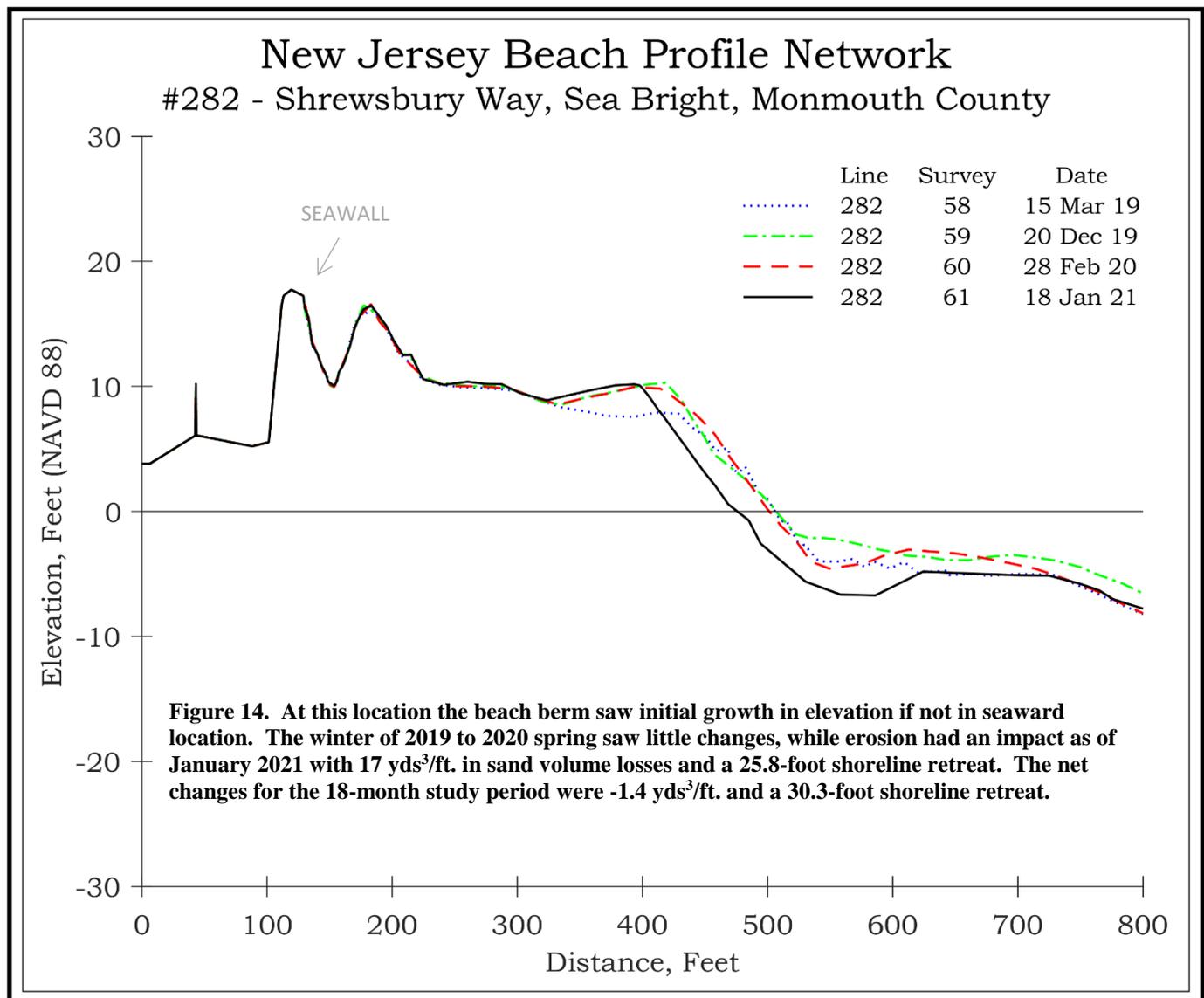


A short distance south, this location has a substantial dune developed seaward of the seawall with a wider beach and dune grass extending onto the sand flats near the dune (Dec. 20, 2019). By January 18, 2021 (on right) the grass coverage remained constant with minimal change to the beach.





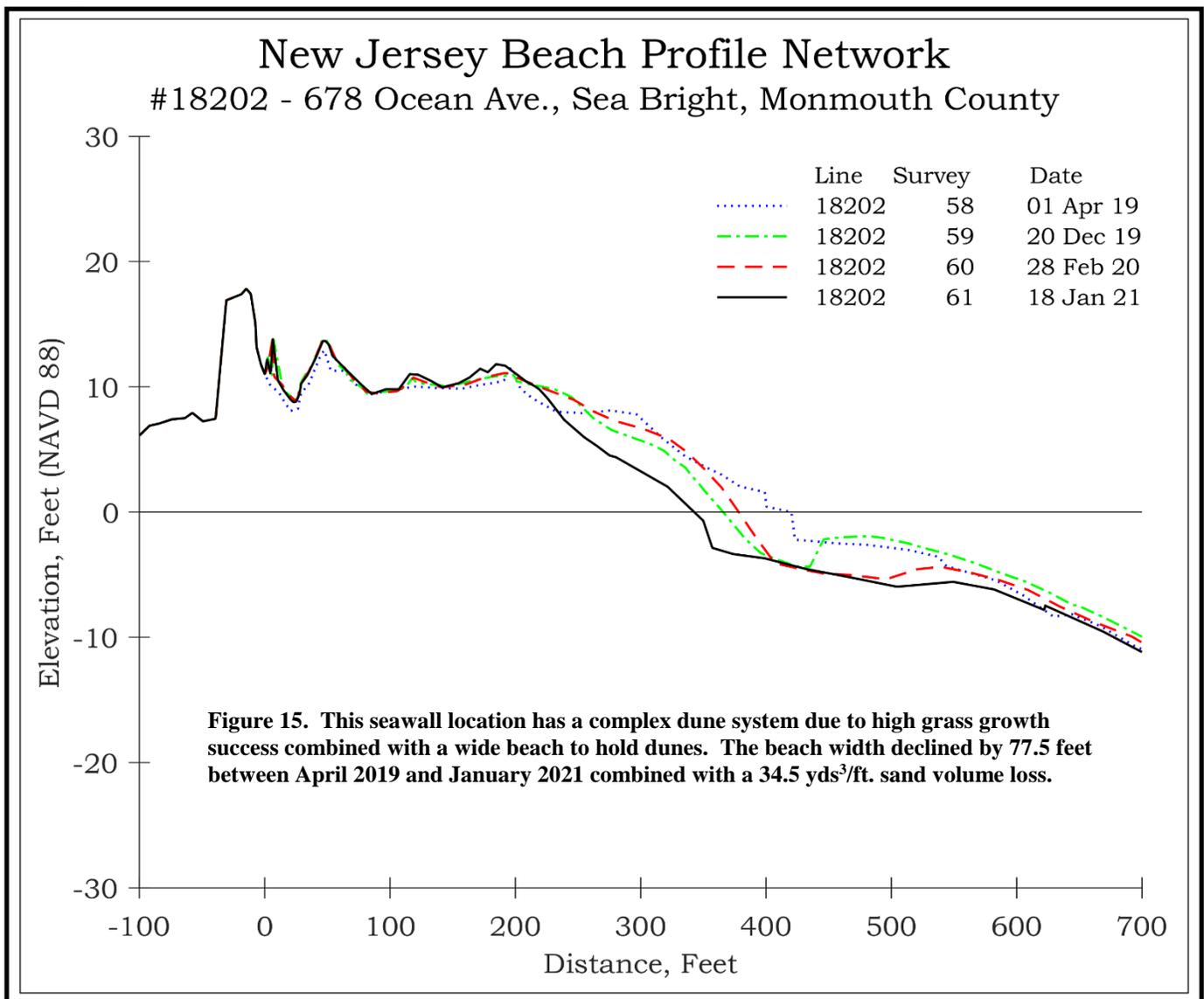
The left view shows the federal project from the crest of the dune on Dec 20, 2019 (view to north). The right photo, also from the dune crest looking north, shows the dune and beach seaward of the rock seawall on Jan. 18, 2021.



NJBPN 18202 - 678 Ocean Avenue, Sea Bright



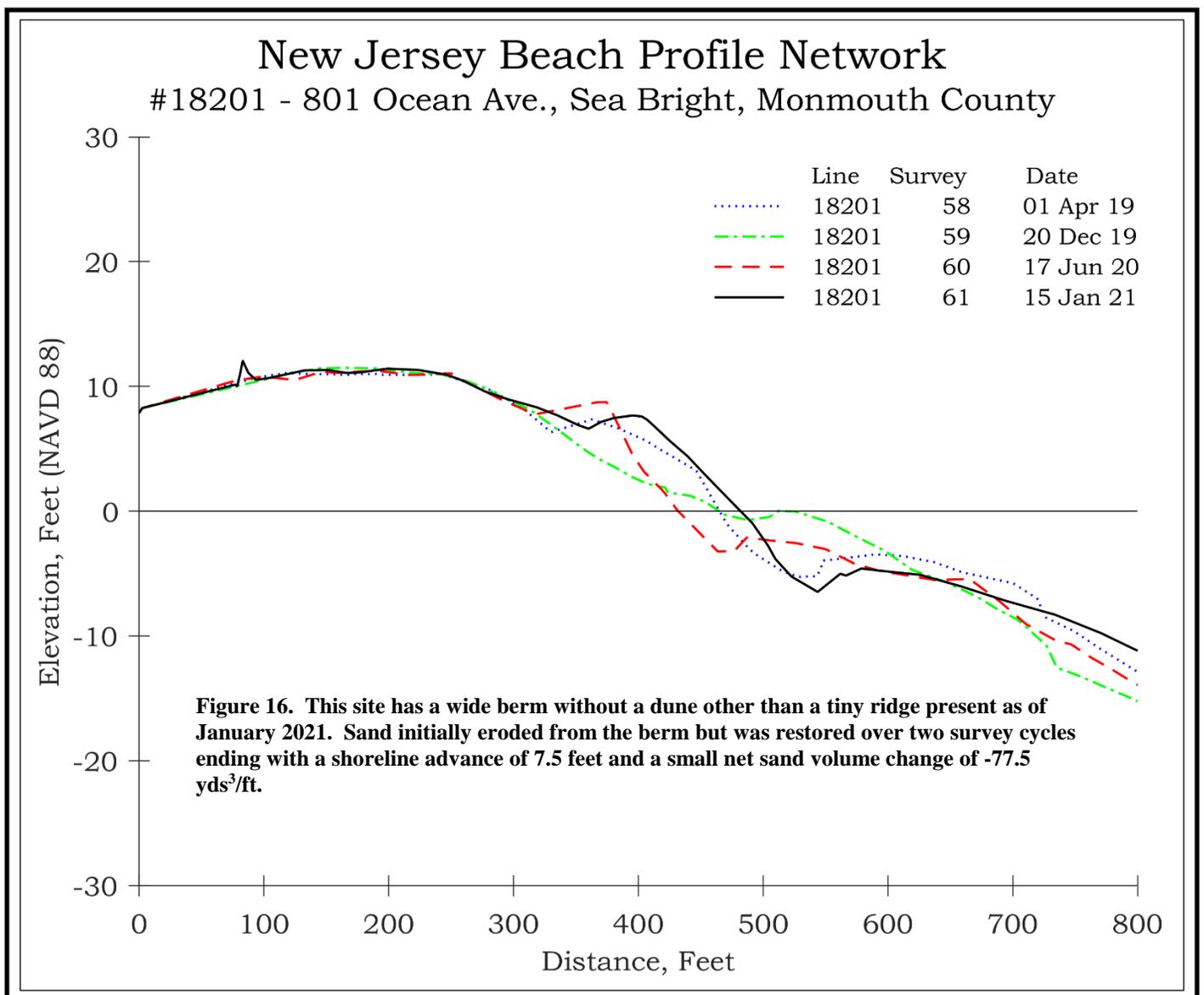
The photo on the left, taken December 20, 2019, shows the extent of grass propagation seaward is evident as a foredune development. There was no attempt along Sea Bright to build a dune system except place a line of fence seaward of the seawall. The photo on the right, taken January 18, 2021, depicts a similar landscape, with some wind deposited sand covering the dune grass.



NJBPN 18201 - 801 Ocean Avenue, Sea Bright



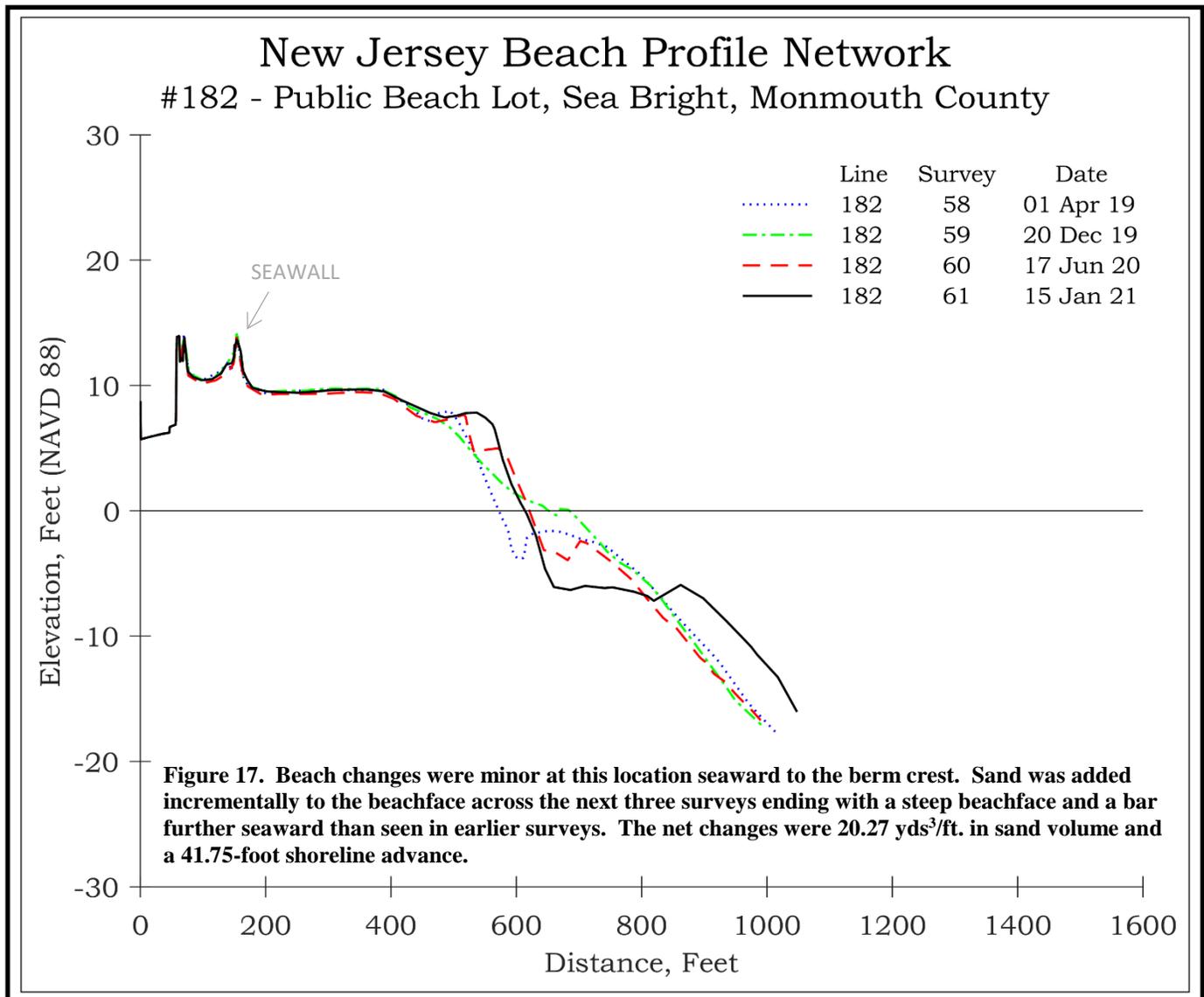
Positioned between two beach clubs, this line starts at the parking lot, ramps up to the dry beach without any dune present. The beach extends 500 feet seaward of the parking lot where the beachface drops into the water (Dec 20, 2019). By January 15, 2021 minor beach retreat was reversed by gain on the berm as sand move onto the beach from offshore.



NJBPN 182 – Public Beach, Sea Bright



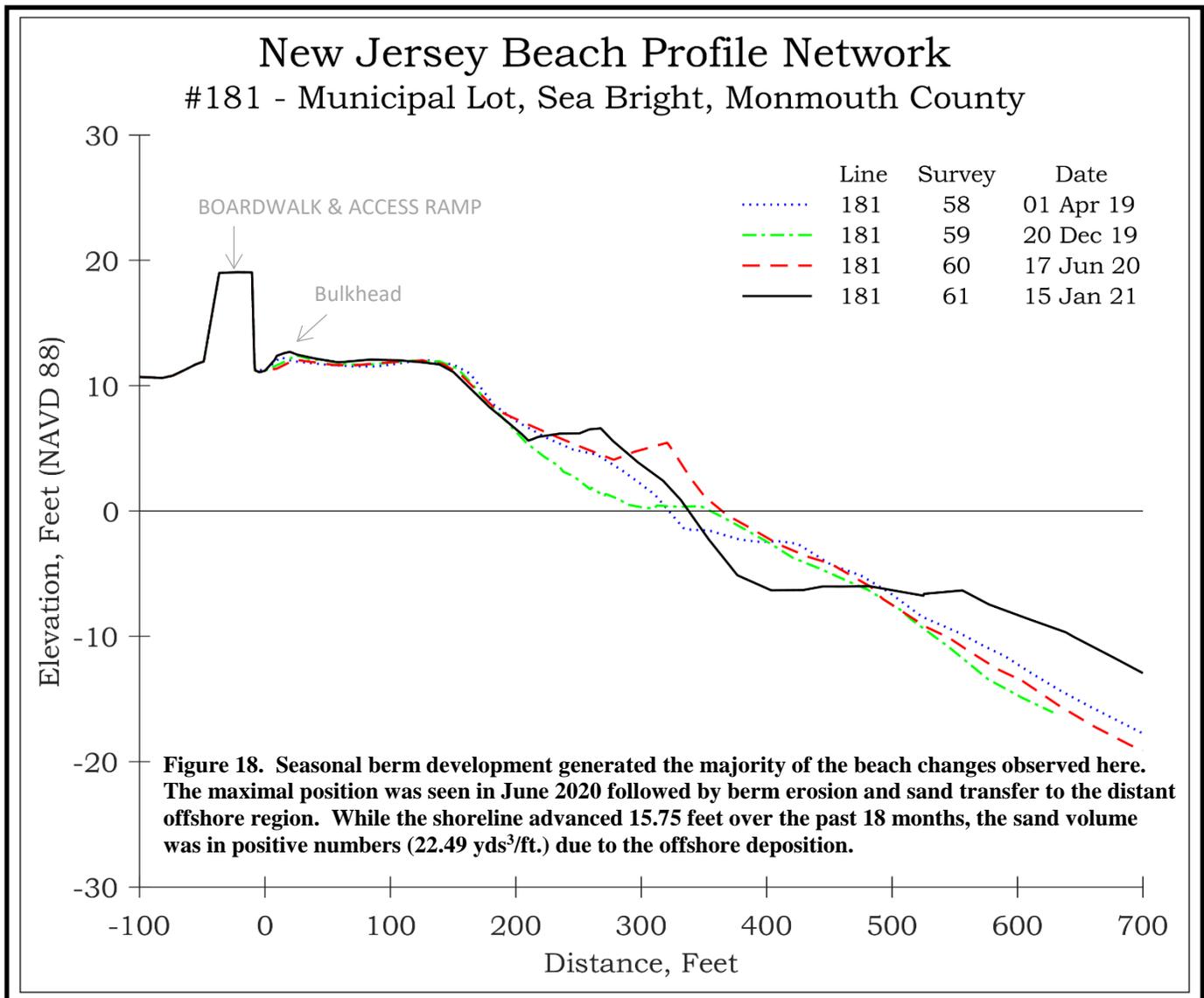
The photo on the left, taken December 20, 2019, shows the expanse of dry beach seaward of the beach club. The photo on the right, taken January 15, 2021, shows the same beach at a higher tide, along with a steeper berm slope due to accumulation of sand.



NJBPN 181 – Municipal Beach, Sea Bright



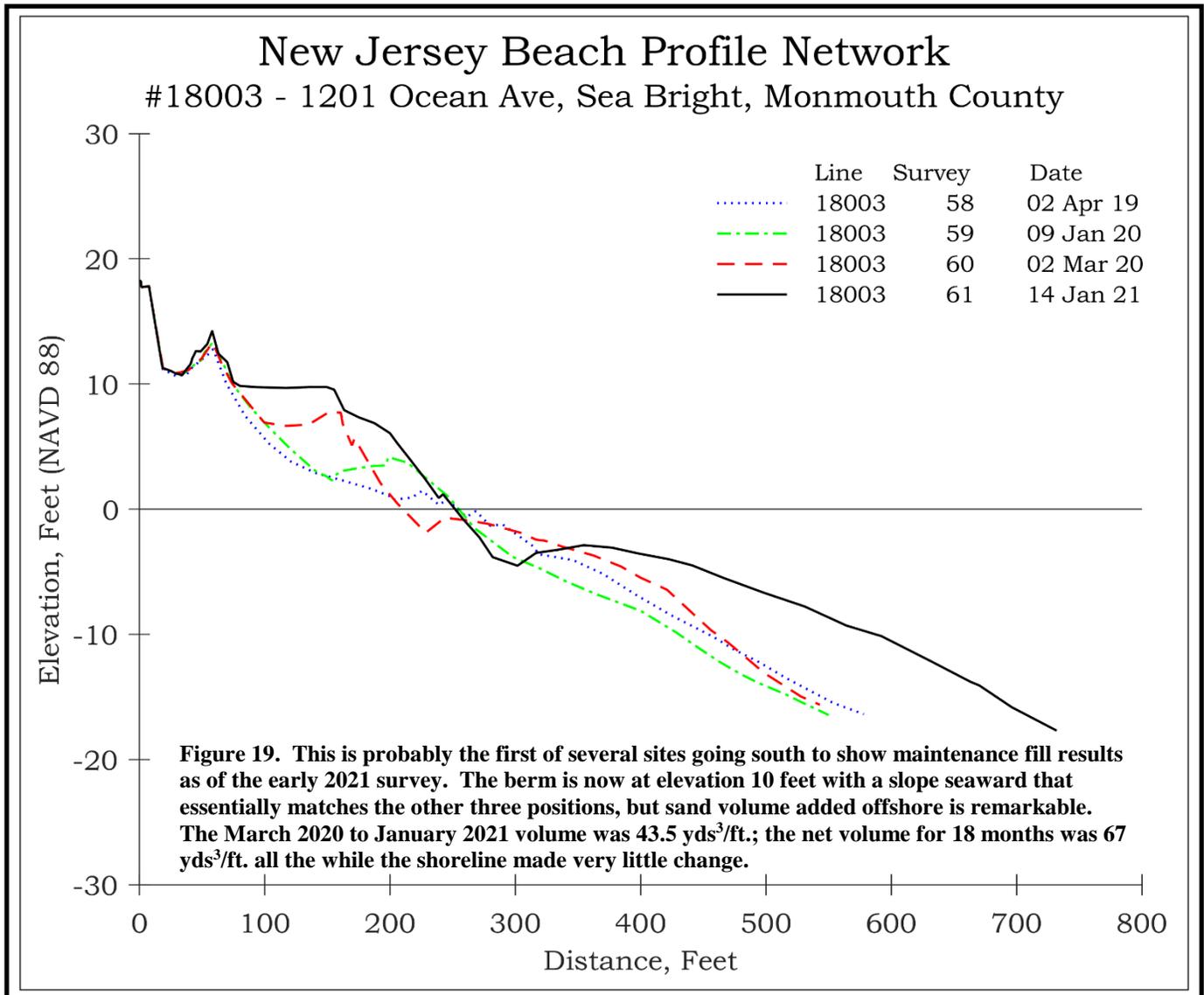
The December 22, 2019 view on the left seems to indicate that retreat slowed considerably based on the exposure of the distant rock groin. The view on the right, taken January 15, 2021, seems to be following the same trend as the groin is even less visible.



NJBPN 18003 - 1201 Ocean Avenue, Sea Bright



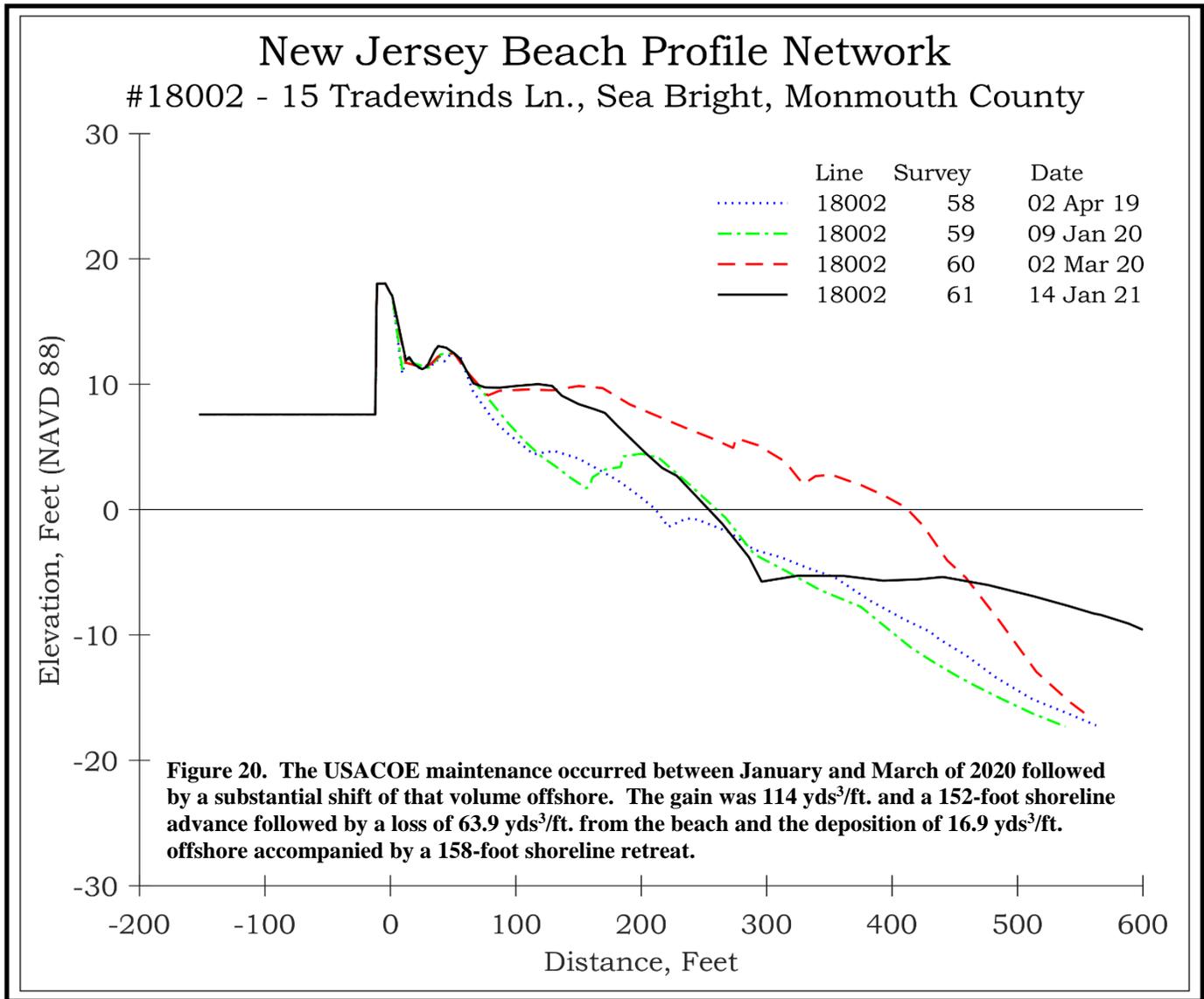
This site starts at the concrete and rock seawall with a small dune present on the landward beach's first 70 feet of width (Jan. 30, 2020 on left). The photo on the right, although from another view, shows minor change in the dune but a wider dry beach (Jan. 14, 2021).



NJBPN 18002 - 15 Tradewinds Ln., Sea Bright



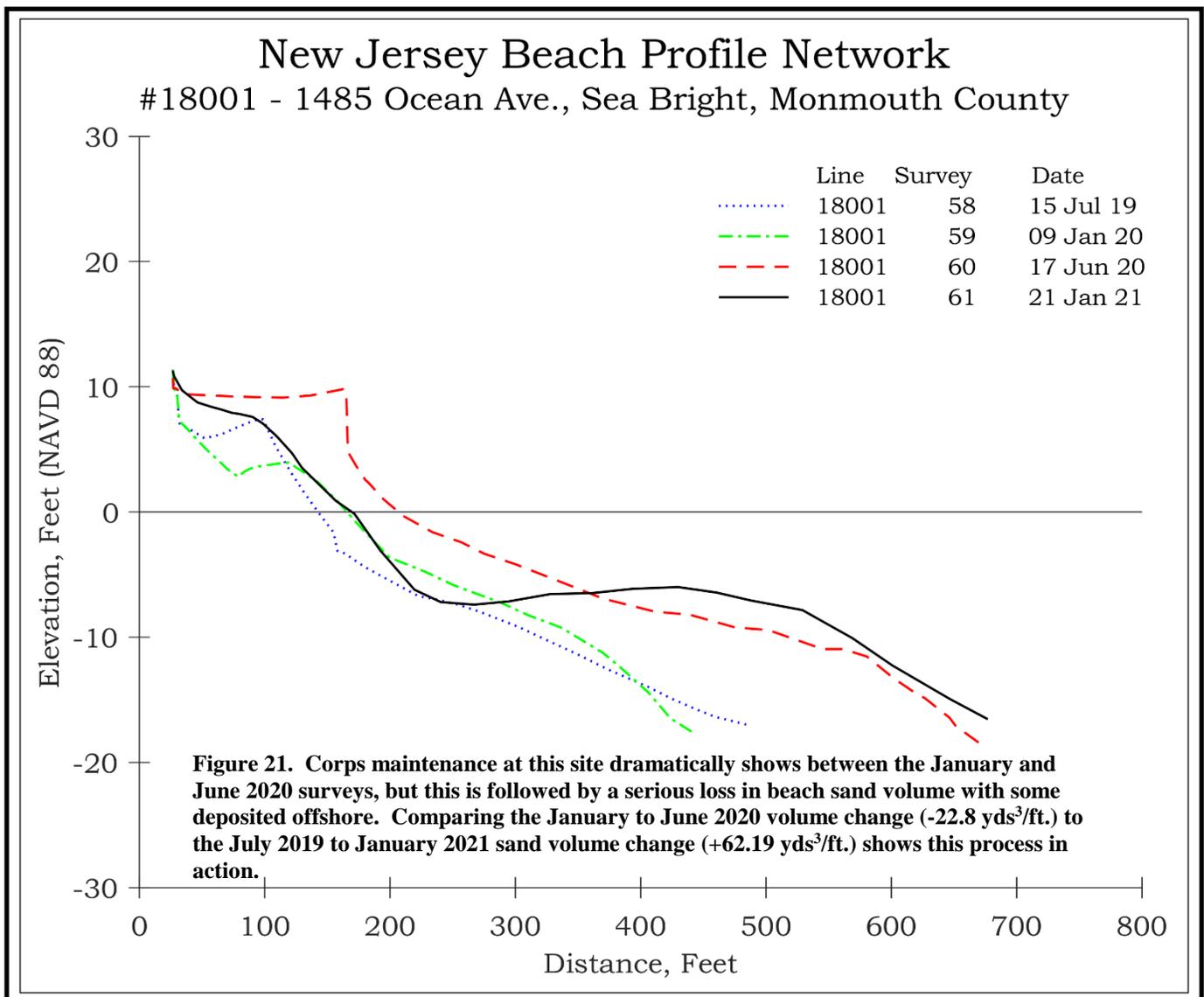
The dune at this location has developed along the single row of fencing. By Jan 2020 some dune vegetation loss is evident, but sand has blown over the dune toward the rock wall. The right photo, taken Jan 14, 2021, shows dune vegetation growth has occurred.



NJBPN 18001 - 1485 Ocean Avenue, Sea Bright



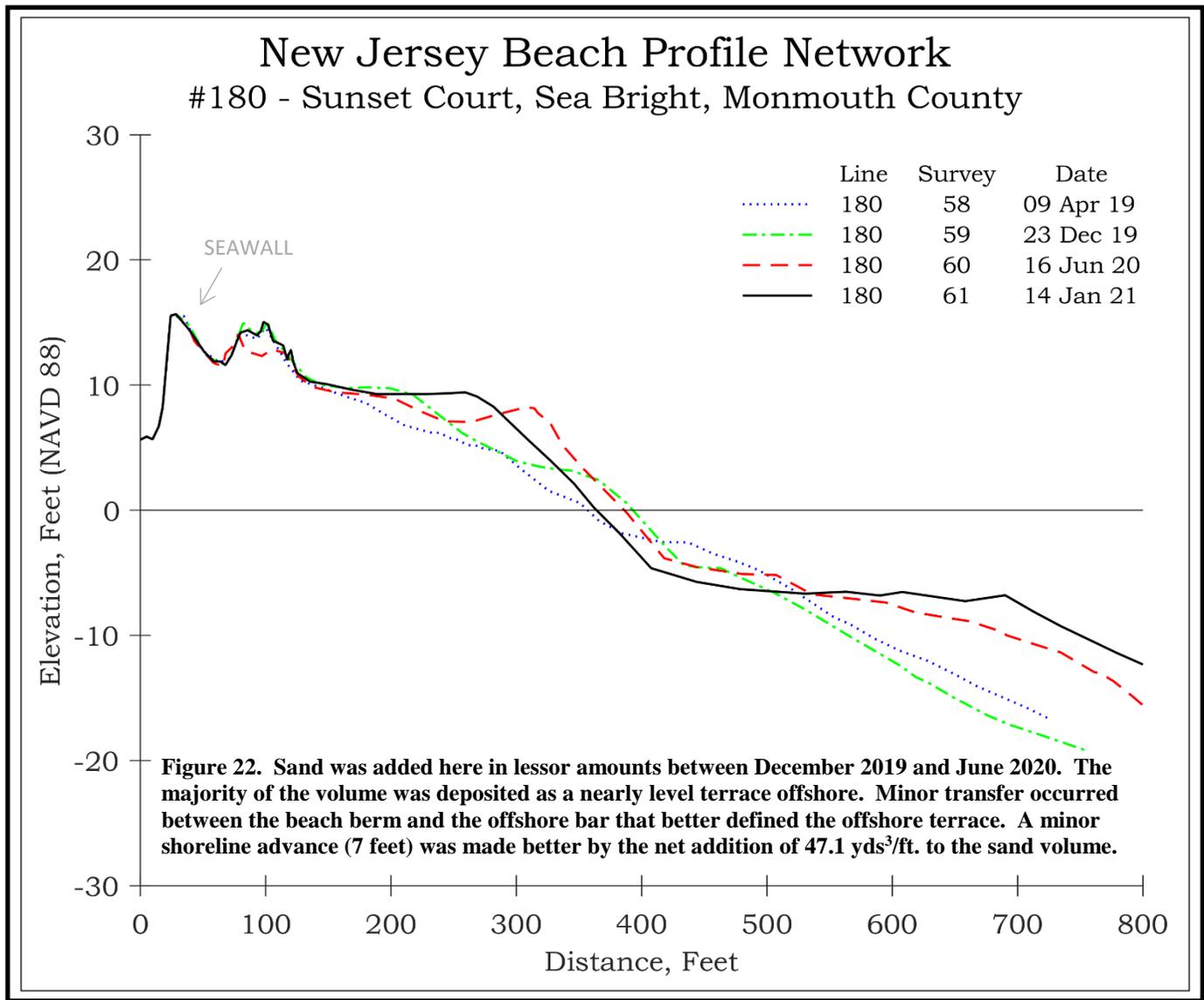
This site starts at a bulkhead and rocks considerably seaward of Ocean Avenue because the structures have been built seaward of the highway. There are no dunes, and a narrow beach that is losing sand (left view Jan. 30, 2020). As of Jan. 14, 2021, the beach shows that waves regularly reach the rocks while a new ridge of sand has just built onto the shoreline at the low tide line.



NJBPN 180 – Sunset Court, Sea Bright



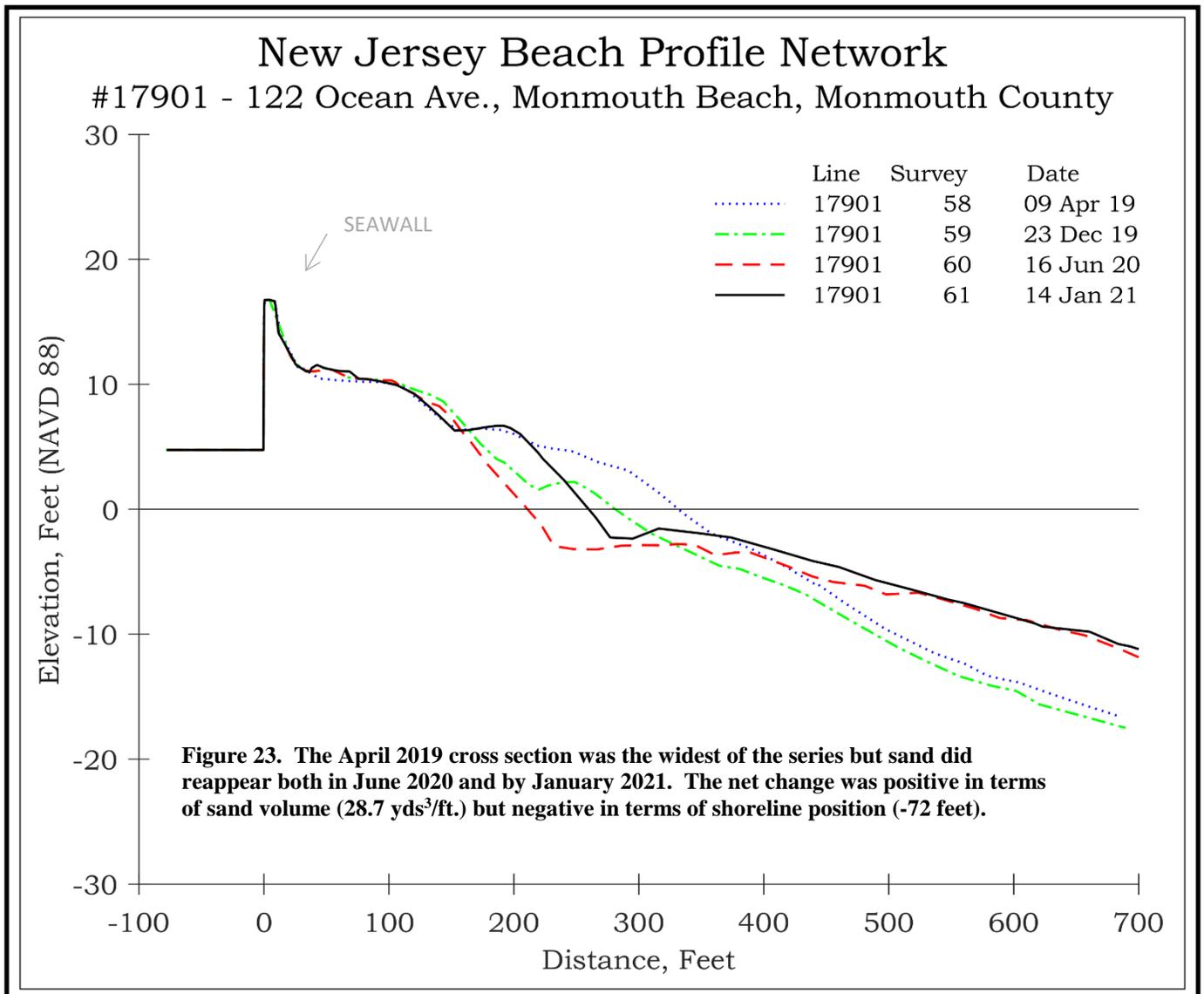
The view on the left taken Dec. 22, 2019 shows the sand build-up on the dune at the seaward slope (on left). By January 14, 2021, the fence area filled in with new grass and growth was extensive on the dune.



NJBPN 17901 - 122 Ocean Avenue, Monmouth Beach



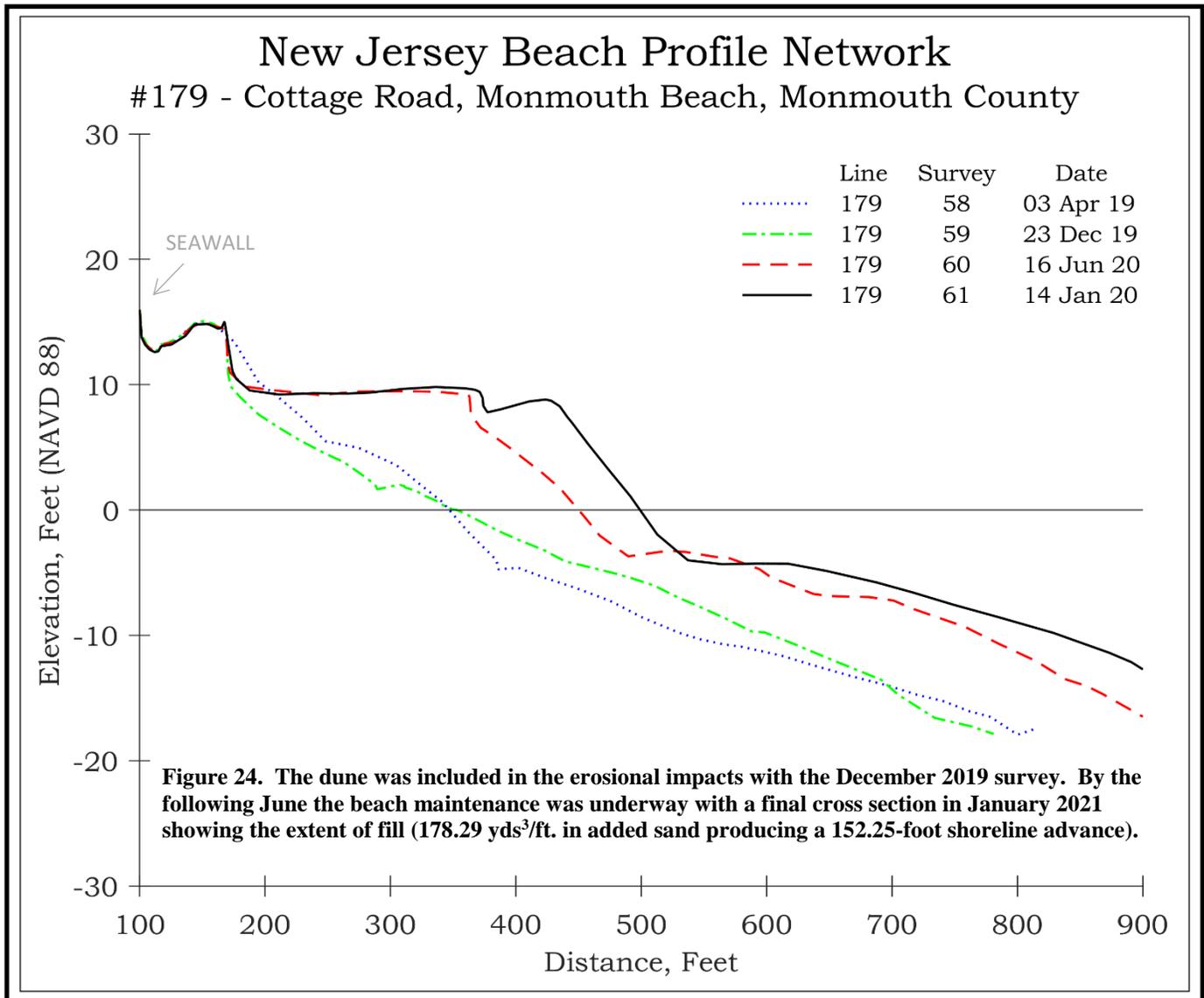
The left view from December 23, 2019 shows sand blown up into the seaward face of the seawall filling in among the rocks, but no dune is present. The right-side view was taken Jan. 14, 2021 and shows extensive grass growth with dune mounds appearing on the beach.



NJBPN 179 – Cottage Road, Monmouth Beach



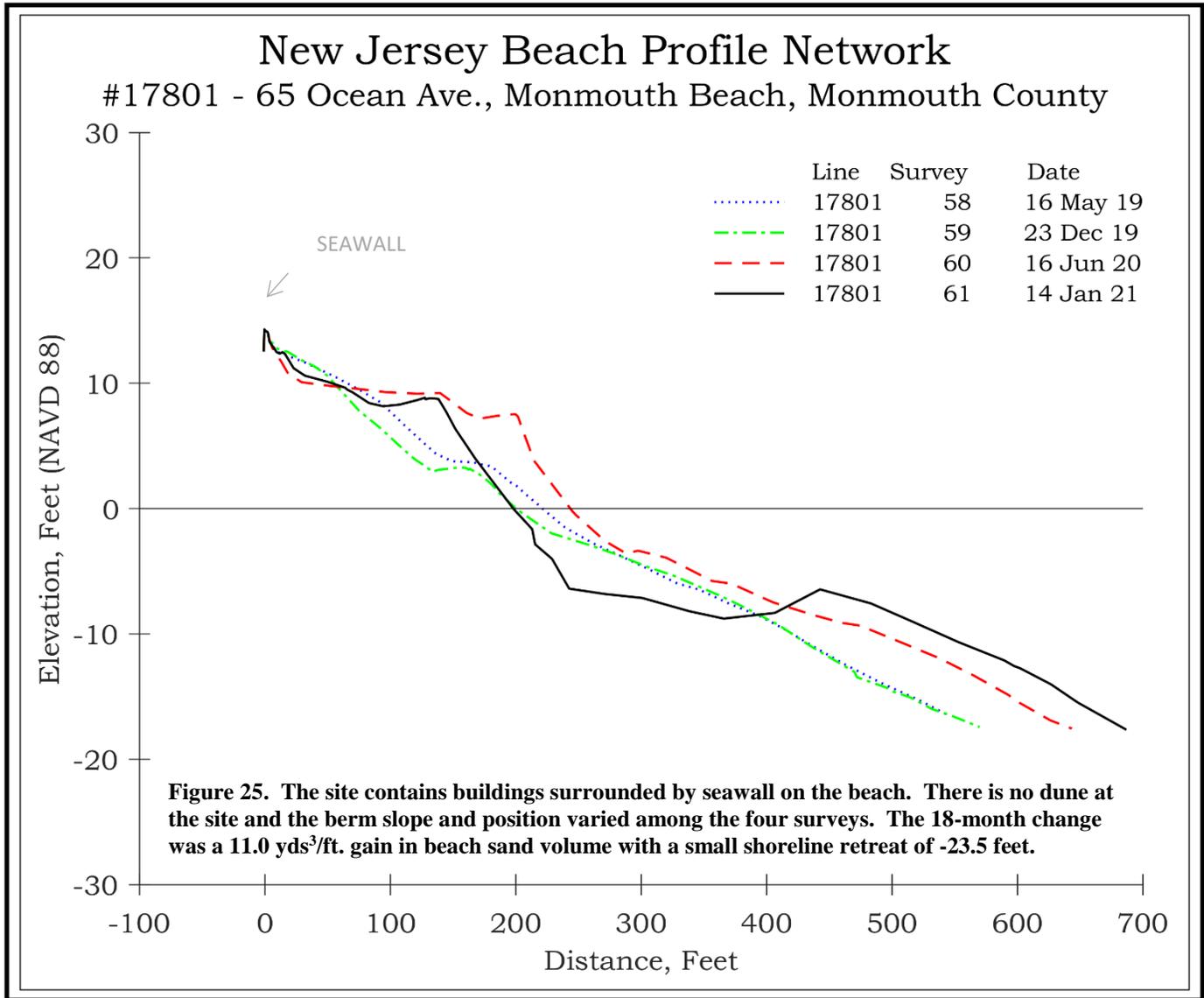
This site has been where the worst erosion occurs in Monmouth County. The left photograph December 23, 2019 shows the existing beach has narrowed the point where the dune becomes in jeopardy. The right-side view illustrates the same scarp cut into the dunes but with the newly maintained beach extending seaward as of January 14, 2021. Wind effects have added a layer of sand into the grass.



NJBPN 17801 - 65 Ocean Avenue, Monmouth Beach

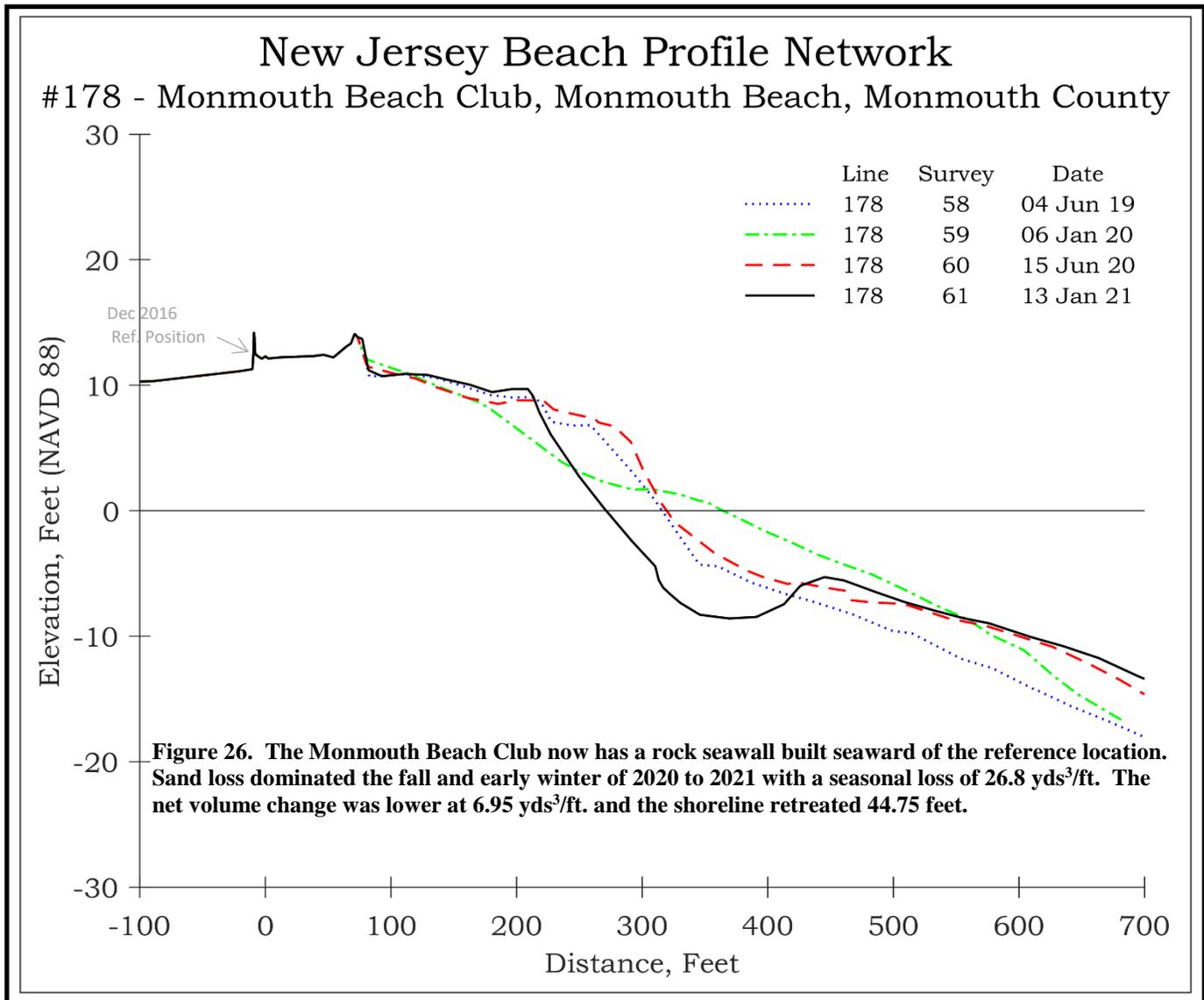


This site is south of the groin at Cottage Road and the beach has a lower gradient beachface (left December 23, 2019). The right view (January 14, 2021) shows where the beach fencing has been reestablished and wind deposition has partially buried the rocks.





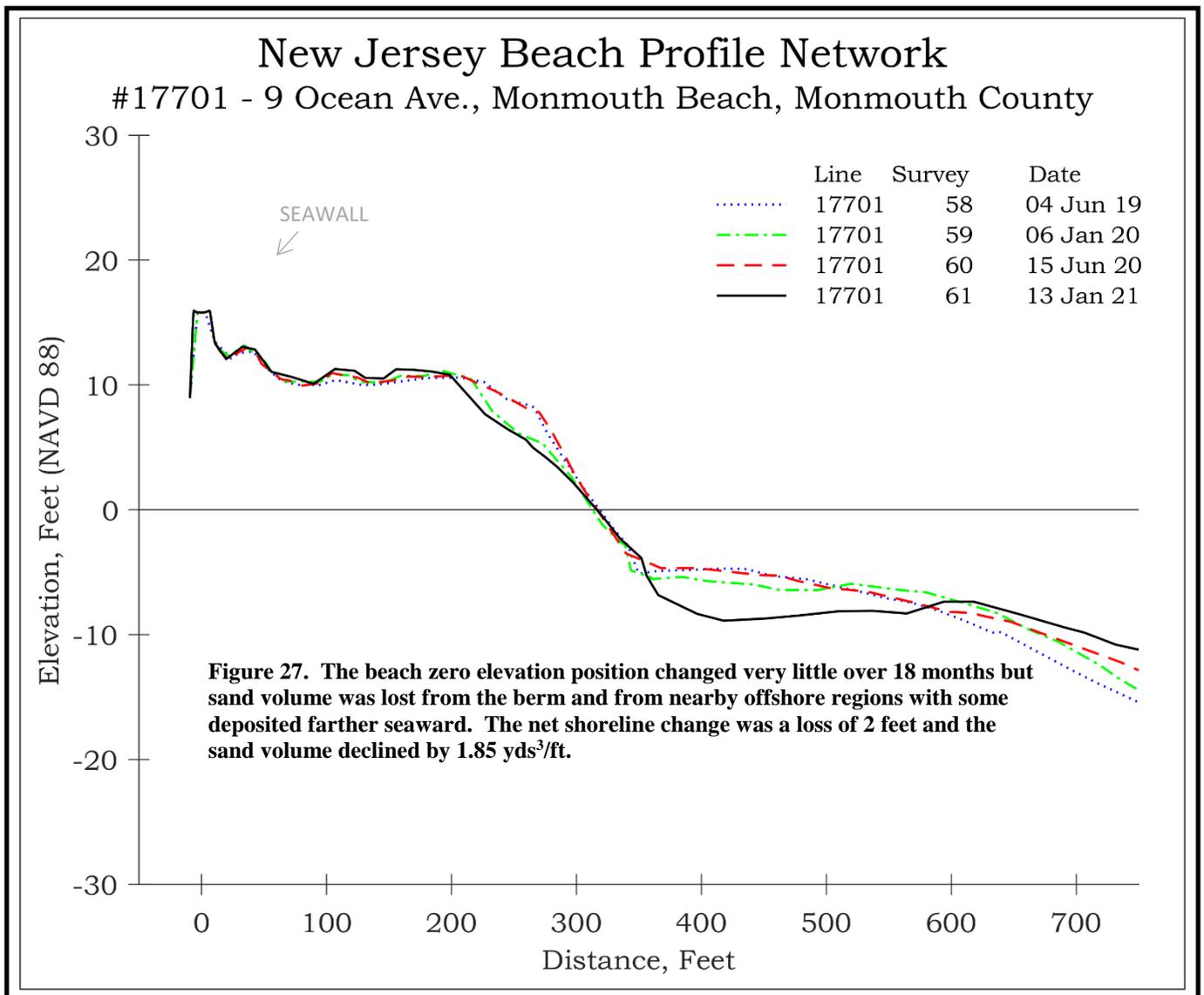
As of January 6, 2020, the rock wall was complete, and the sand pipeline was in place on the beach. The right photo, taken January 13, 2021, shows the beach with the offset in the shoreline produced by the groin at the property line.



NJBPN 17701 - 9 Ocean Avenue, Monmouth Beach



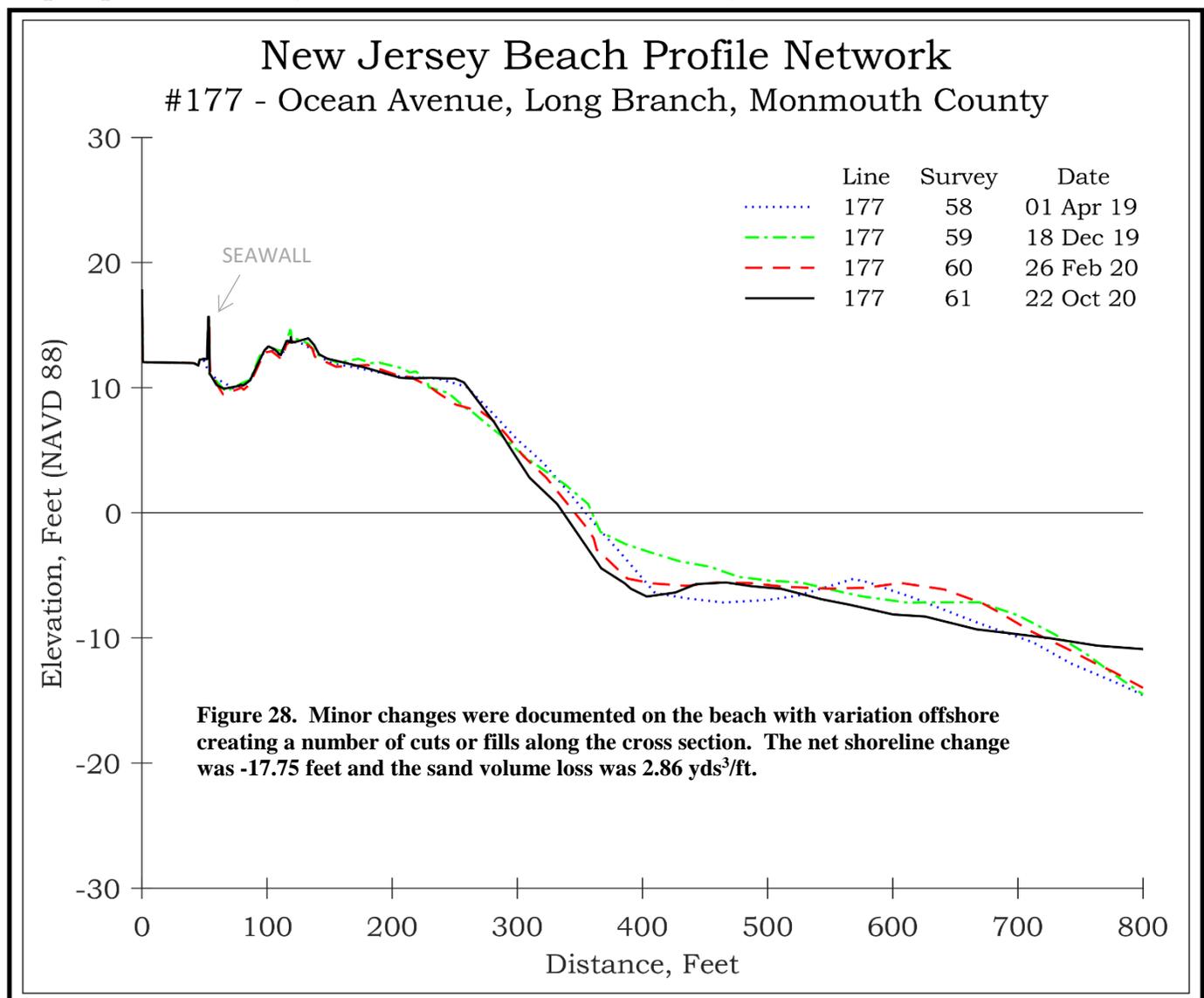
This location has the seawall as the ultimate backstop for this beach. As of January 6, 2020, some added vegetation is evident with the construction to the north completed. The right-side photo, taken January 13, 2021, shows the extent of how far seaward the dune grass growth extends.



NJBPN 177 – 404 Ocean Avenue, Long Branch



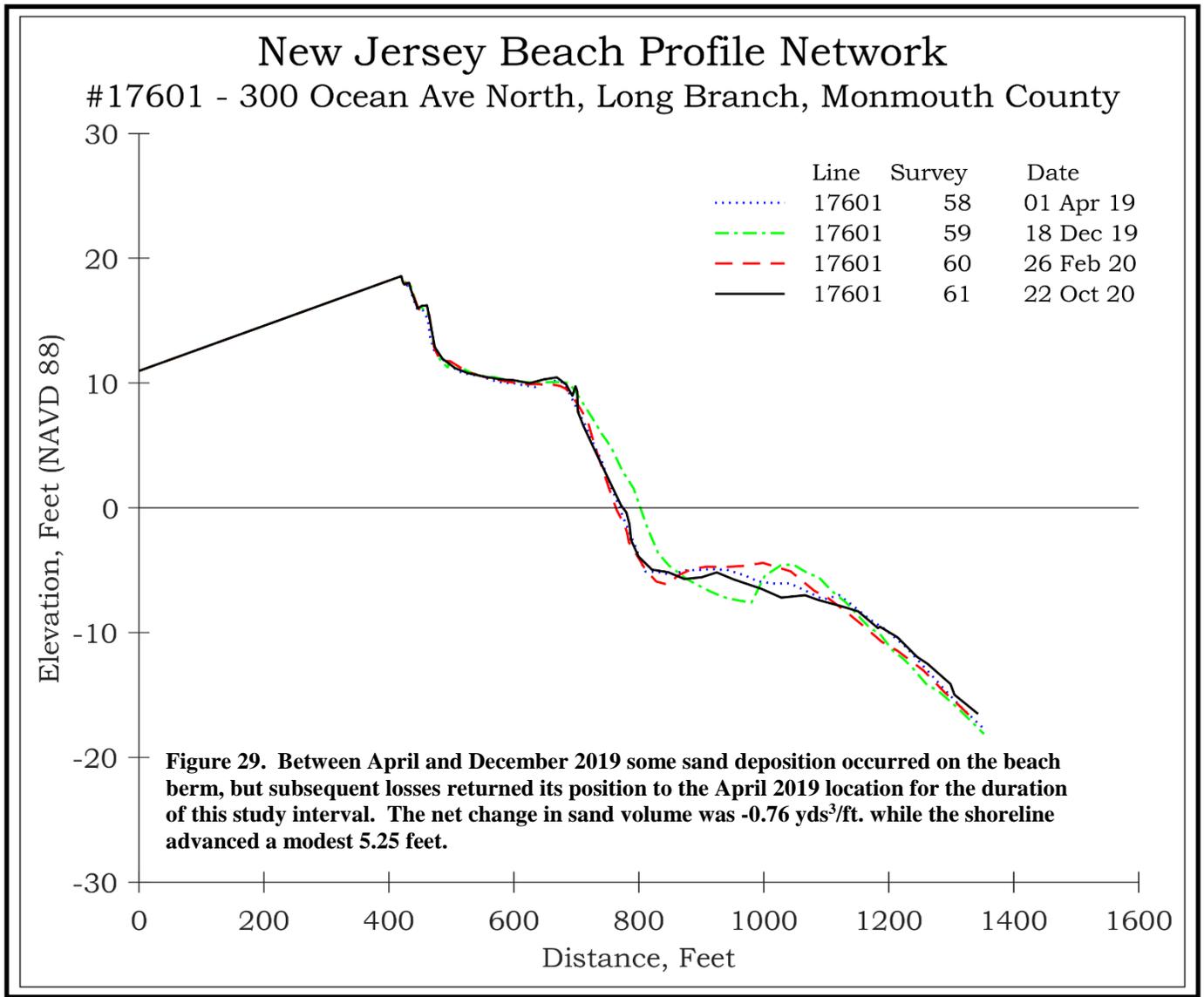
The left photo was taken December 18, 2019 looking north along the dune toe. The right view along the foredune crest shows lush grass growth in the dunes, but much of the beach is obscured (Oct. 22, 2020).



NJBPN 17601 – 300 Ocean Avenue North, Long Branch

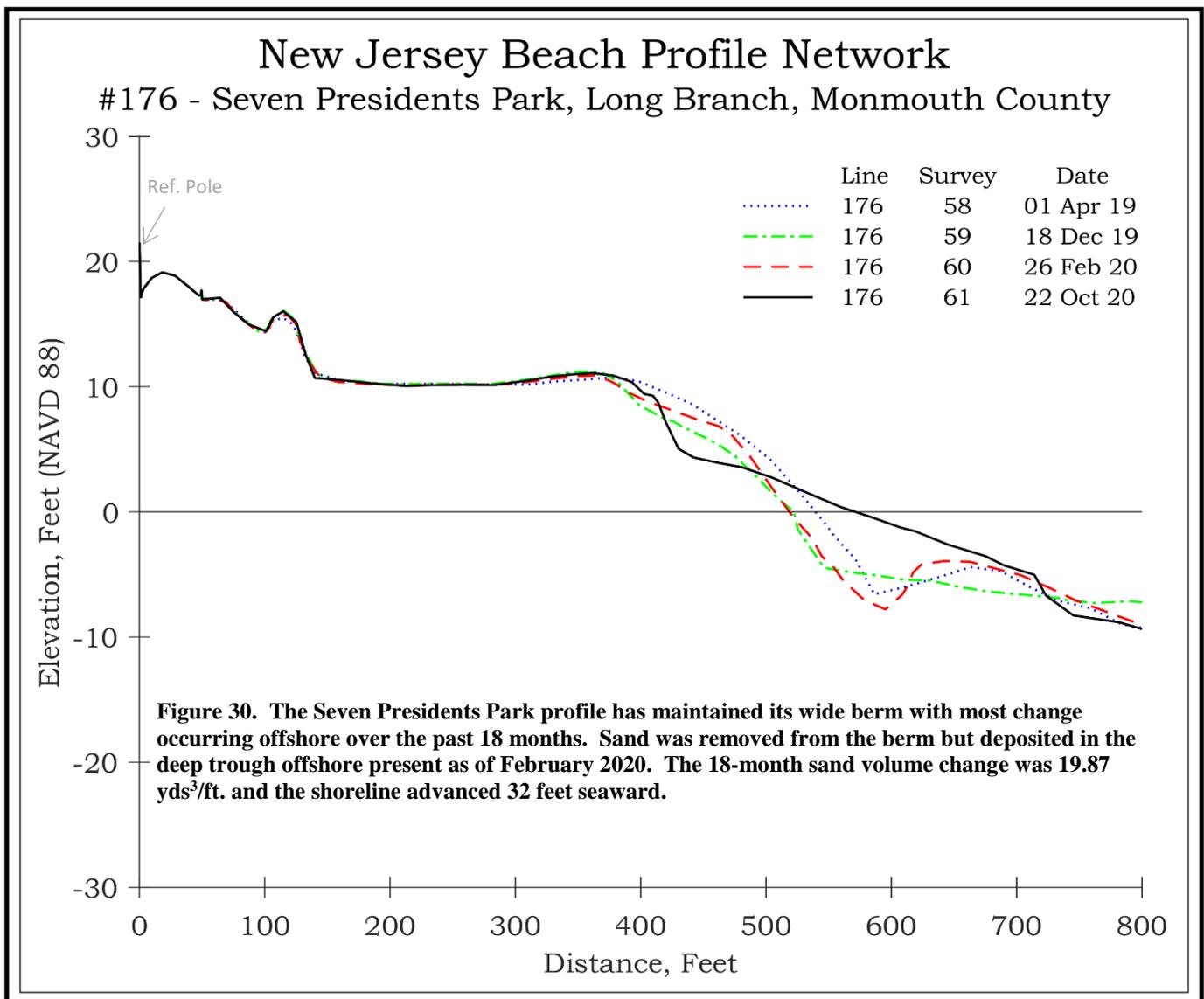


The left view was taken Dec. 18, 2019 and shows the access pathway and the dunes with a wide beach. As of October 20, 2021, the grass had improved further, and fencing had been rearranged once again.



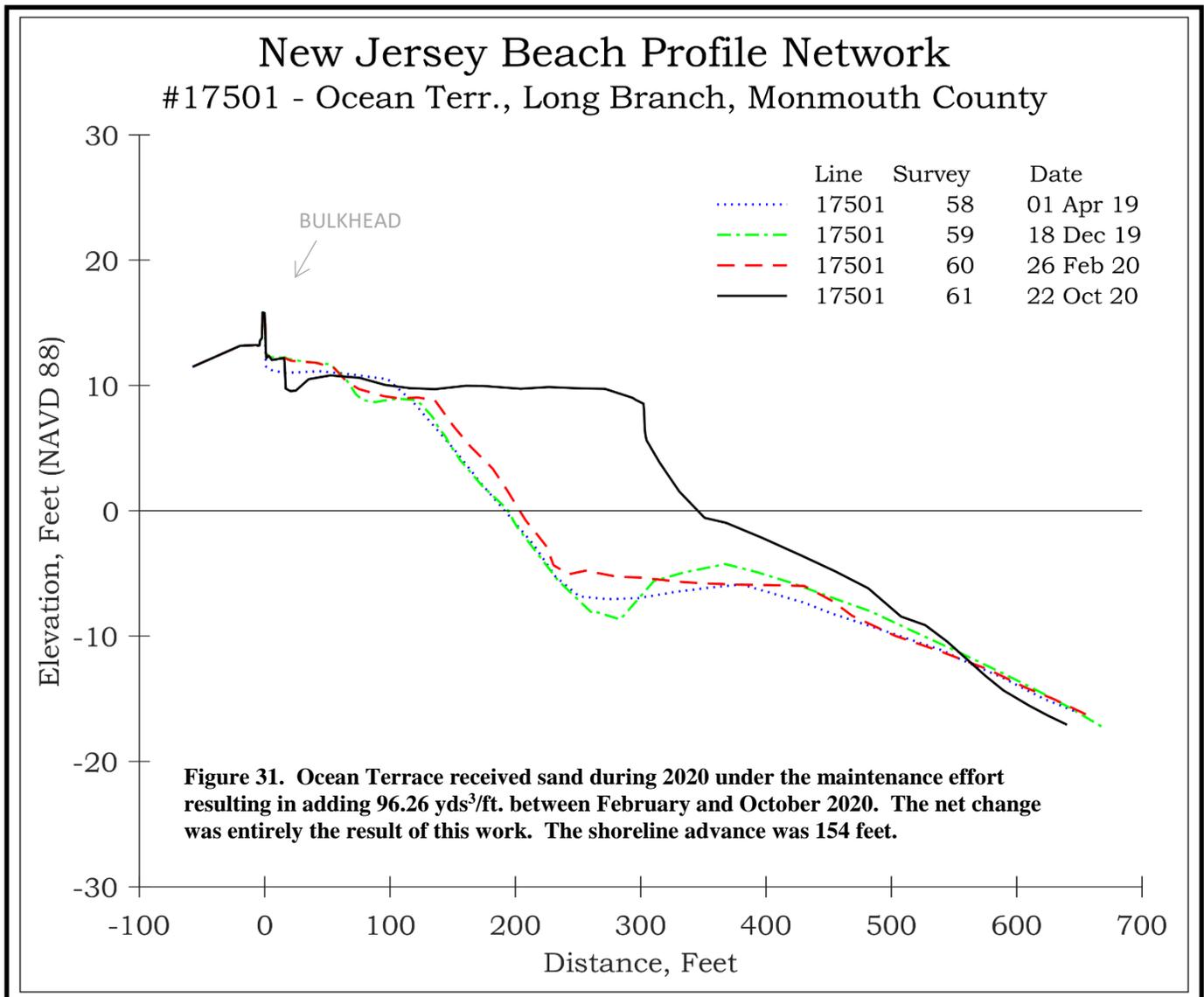


This December 18, 2019 (left) photo shows the groin rocks were exposed with a south to north offset in the beach width. The same perspective on October 22, 2020 has the same offset with more rock showing near low tide.





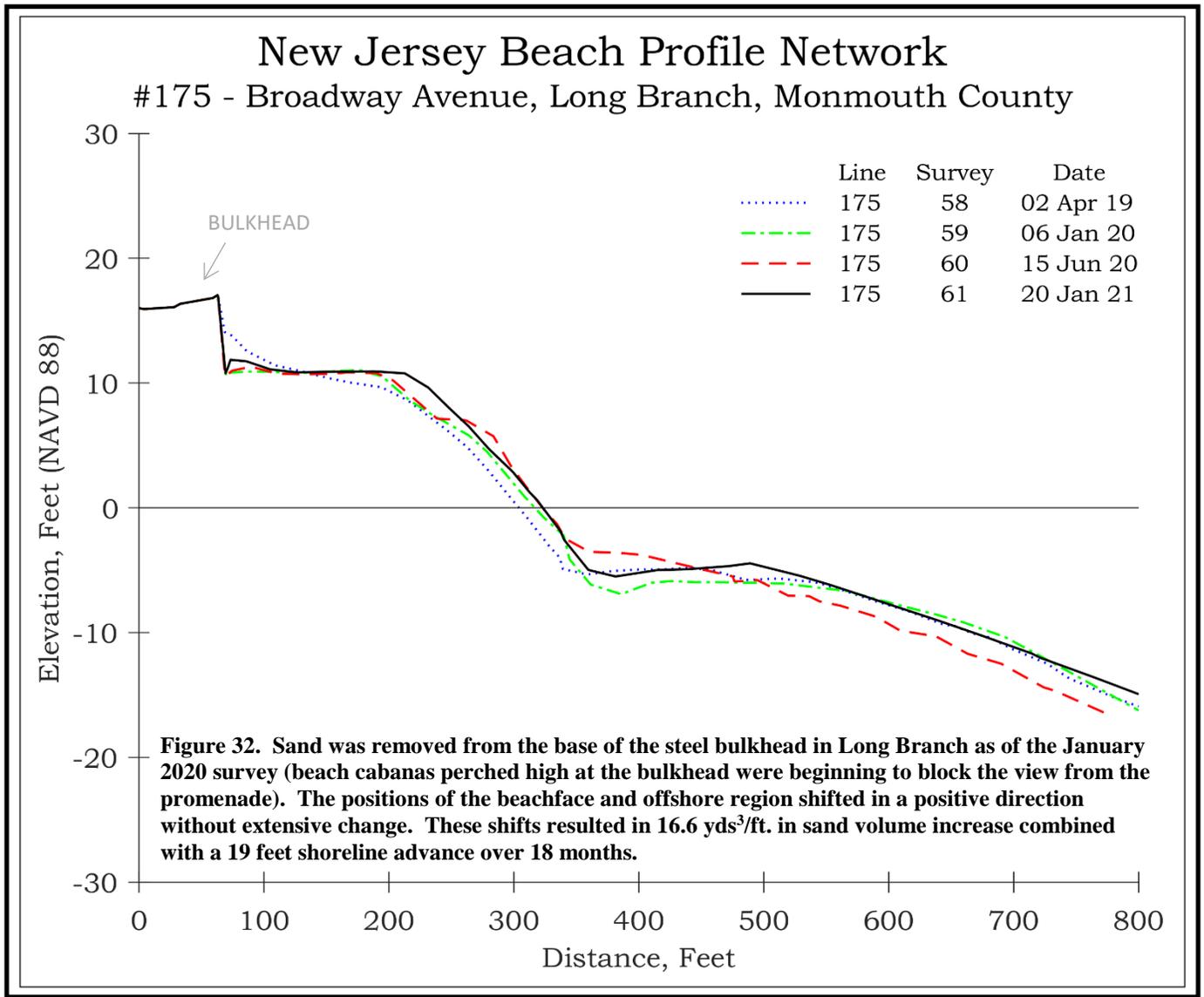
This location is at the very northern end of the old steel sheet pile wall at the Long Branch uplands bluff edge. There is no dune established here, but sand is ramped up against the wall (left view December 18, 2019). On the right is an October 22, 2020 view in essentially the same location on the profile showing the greatly increased width of the dry beach.



NJBPN 175 – Broadway Avenue, Long Branch



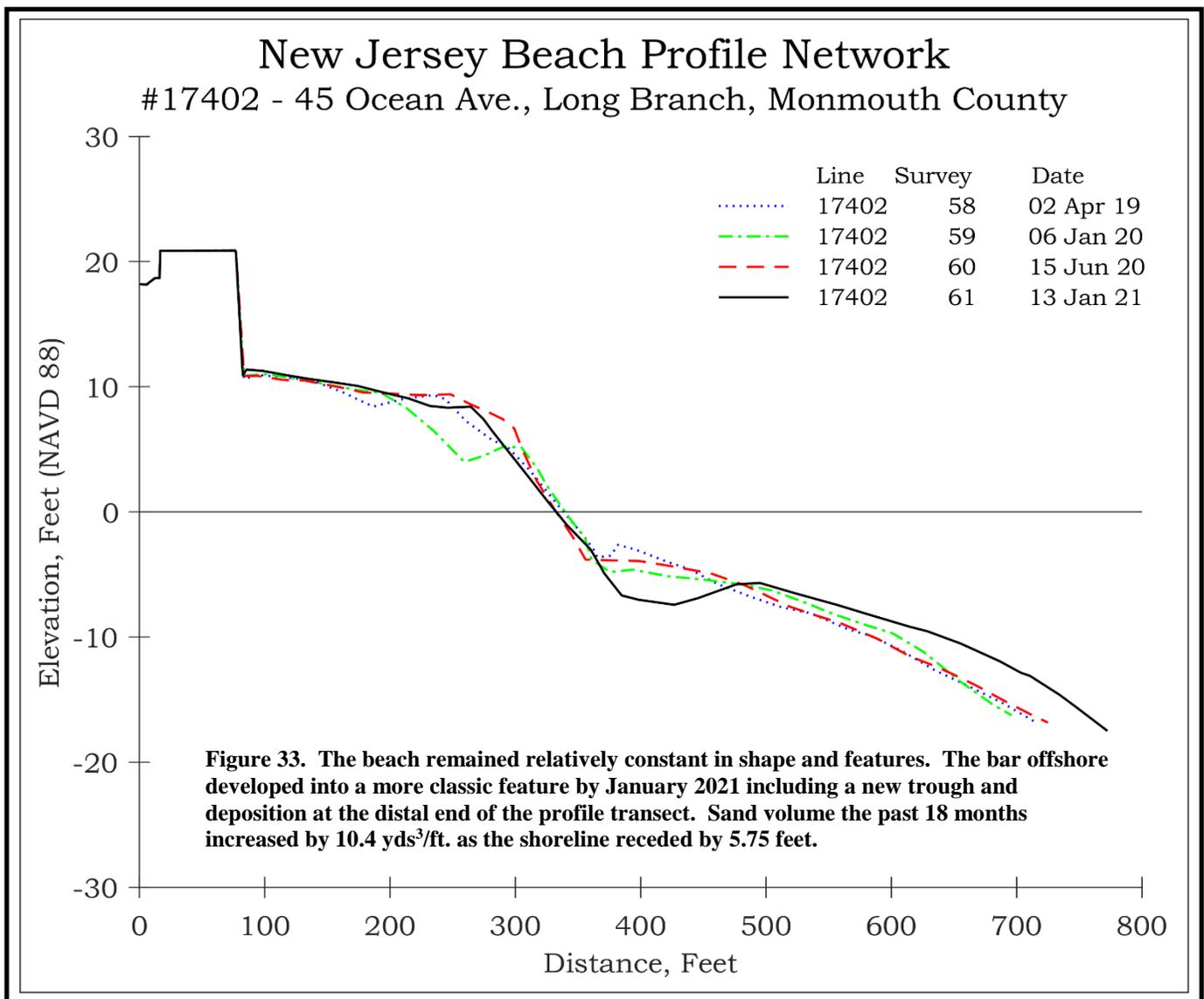
The left photograph taken January 6, 2020 shows the berm in a robust condition. As of January 20, 2021, the beach was essentially the same with limited groin rocks exposed.



NJBPN 17402 – 45 Ocean Avenue, Long Branch



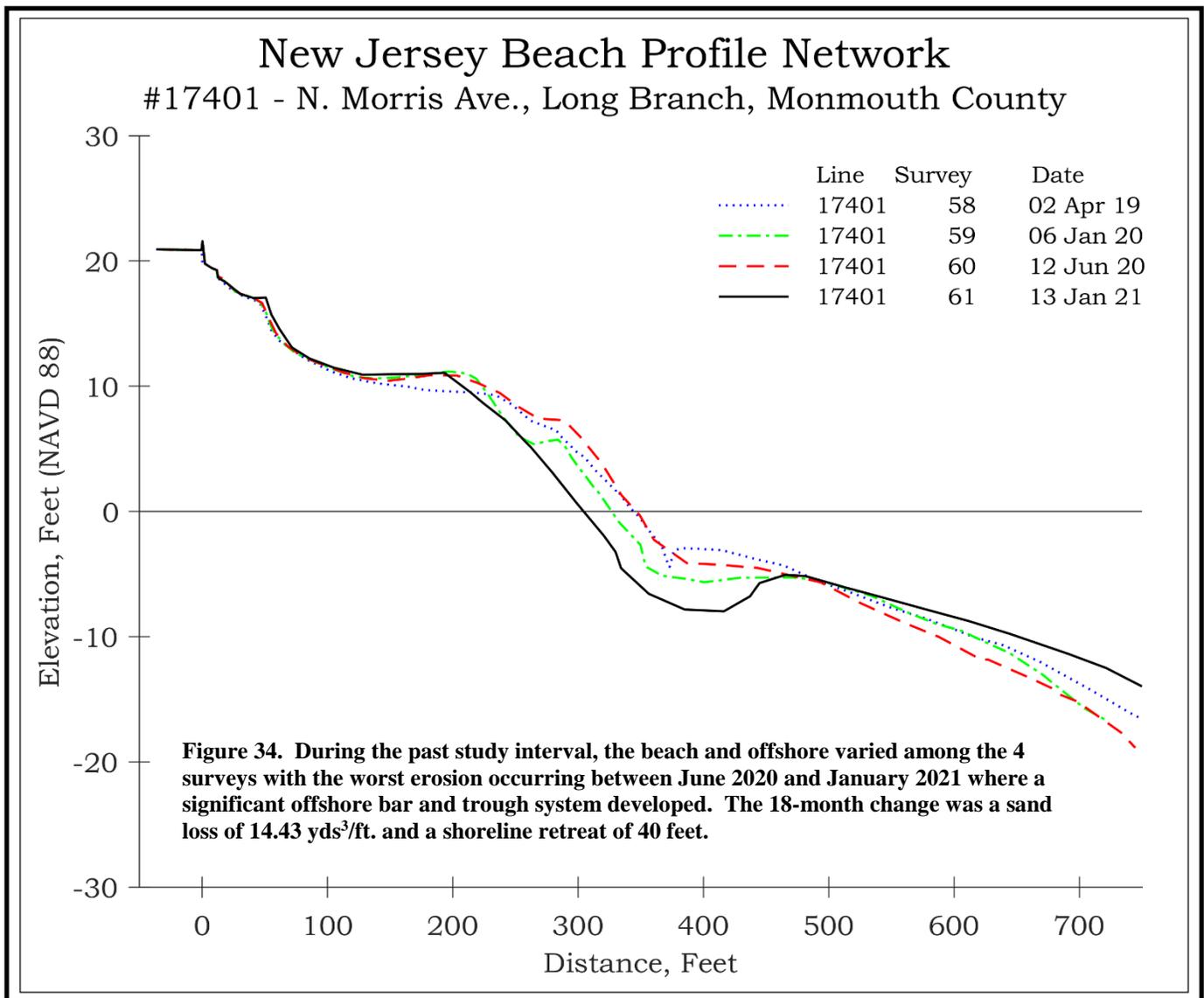
The beach narrows to 150 feet without any bar system present by January 6, 2020 on left). The beach remained relatively the same as of Jan. 13, 2021 if the distant groin rock exposure is compared (on right).



NJBPN 17401 – North Morris Avenue, Long Branch



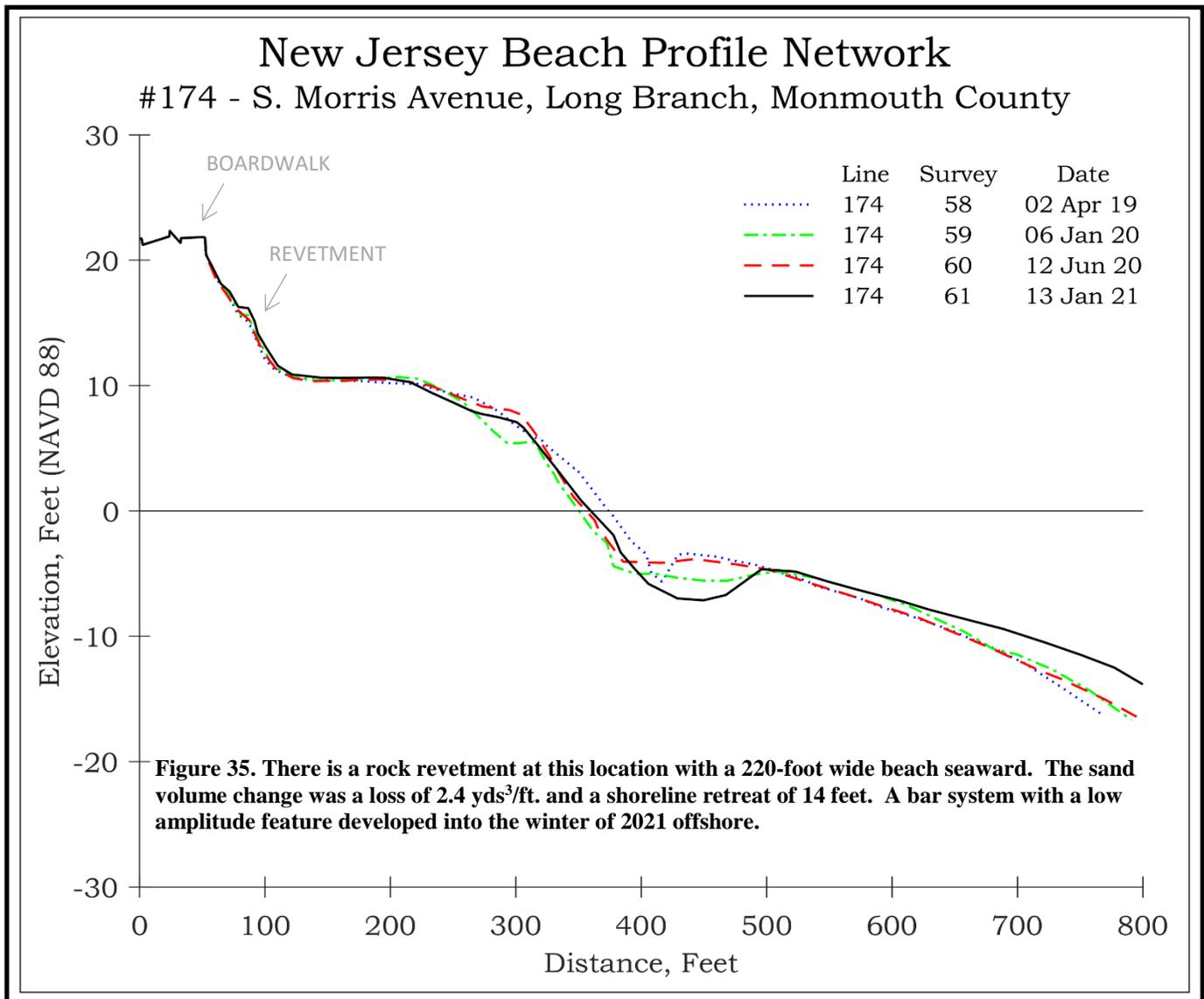
The left view is from Jan. 6, 2020 and shows the sand ramped up against the rock revetment protecting the beach bluff. The right view from Jan. 13, 2021 shows that grass did develop between rocks in that wind deposited sand.



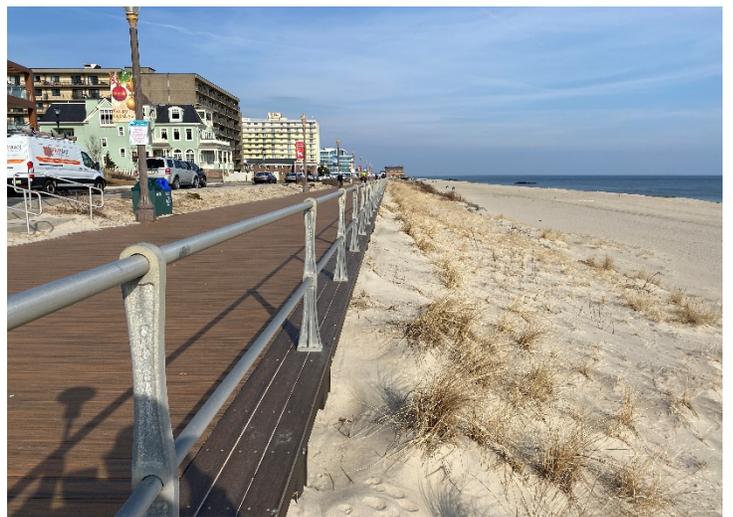
NJBPN 174 – Morris Avenue, Long Branch



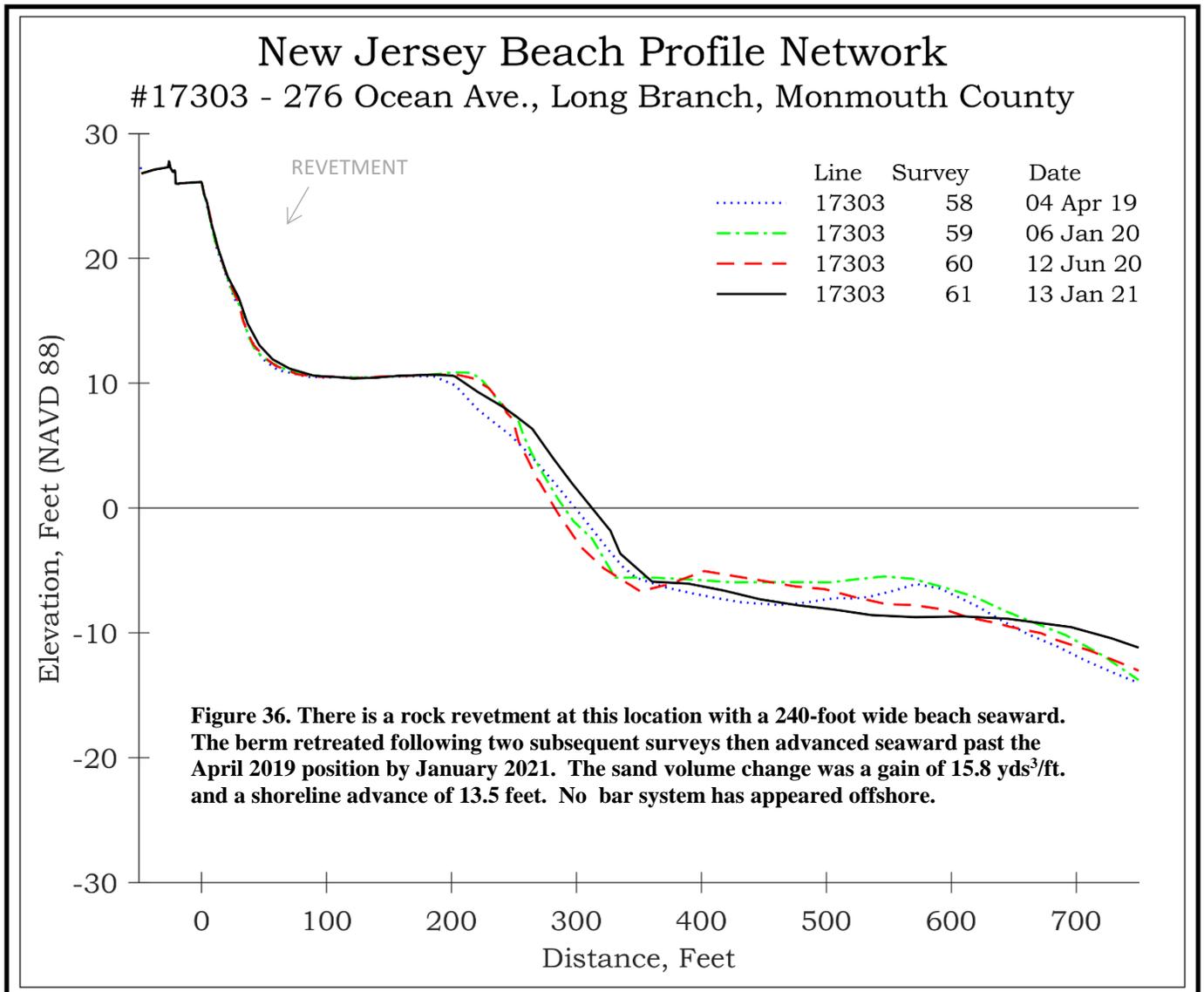
The left-side view, taken January 6, 2020 shows some grass growth above the rock toe on the beach as wind deposition placed sand up the bluff face. As of Jan. 13, 2021, the grass progressed, but does not appear to be extending onto the dry beach surface (right).



NJBPN 17303 – 276 Ocean Avenue, Long Branch



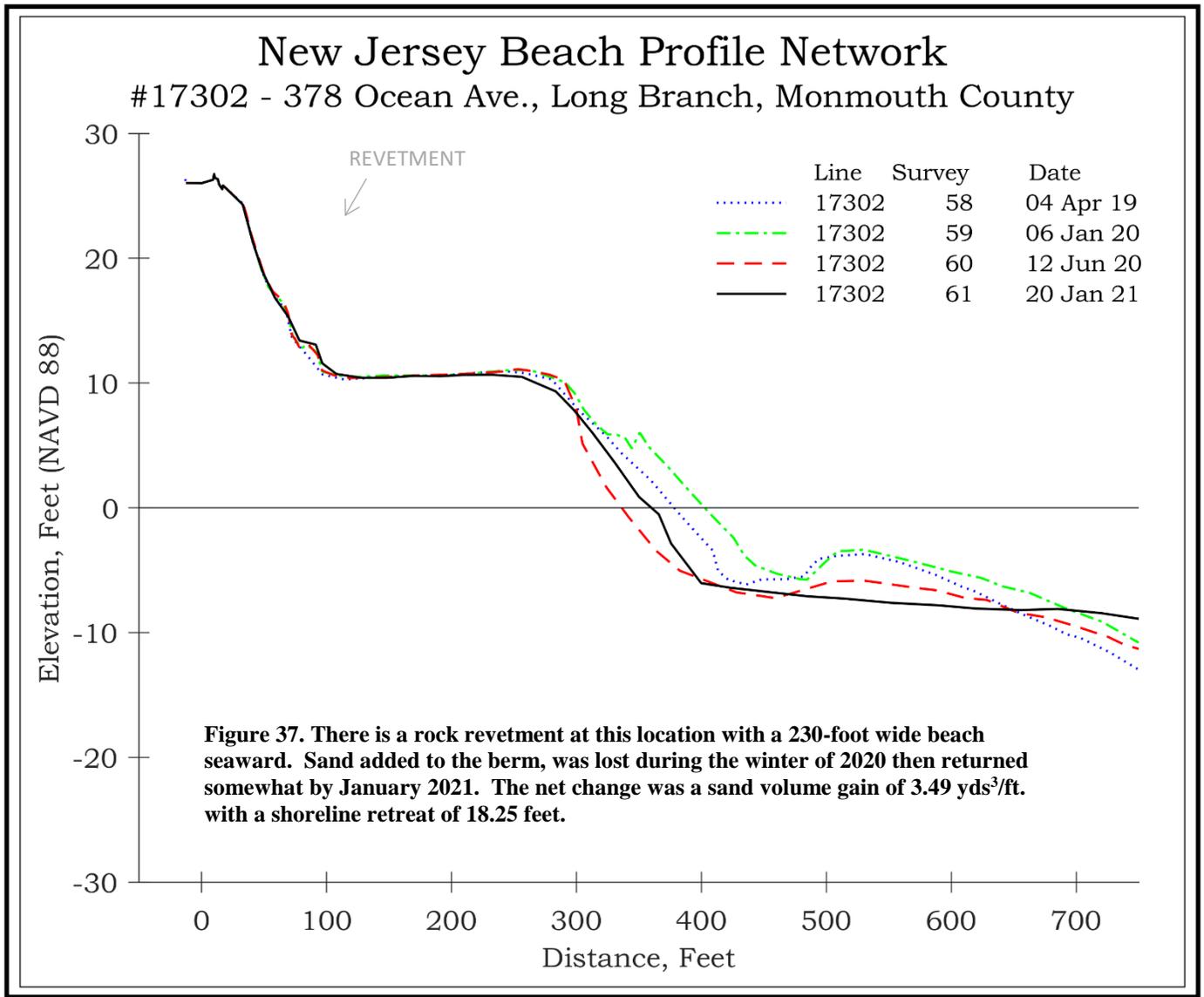
South of Morris Avenue the rock revetment continues with a 240-foot wide beach and no dune system (Jan. 6, 2020). On the right on Jan. 13, 2021, a similar view shows much of the dune grass coated by wind-transported sand.



NJBPN 17302 – 378 Ocean Avenue, Long Branch



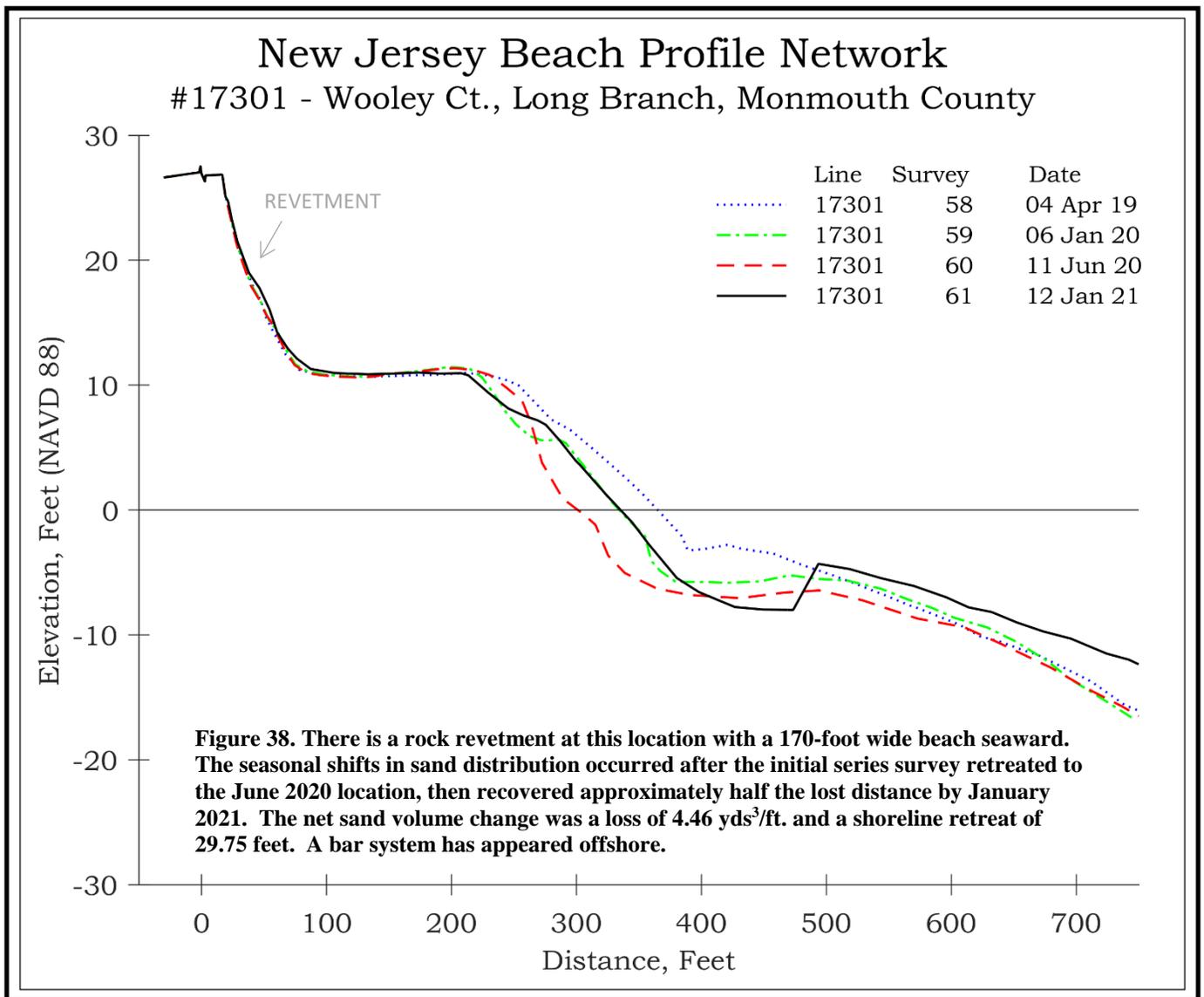
The bluff revetment is the first element in the survey with a 230-foot wide beach to the berm (Jan. 6, 2020 on left). No dune exists at the foot of the revetment, but the beach width remained relatively constant (January 20, 2021 on right).



NJBPN 17301 – Wooley Court, Long Branch



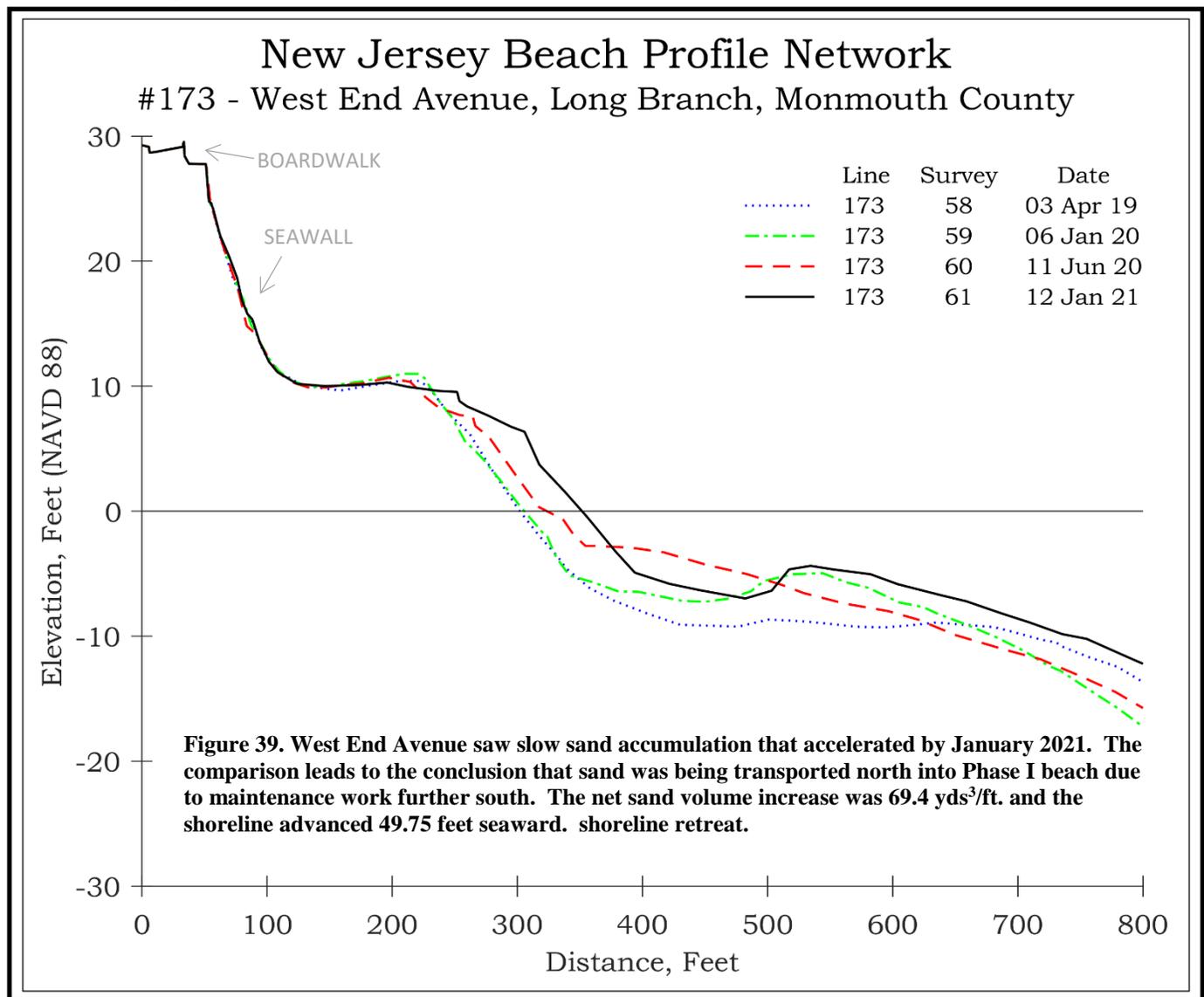
The rock revetment on the left was photographed Jan. 6, 2020. On the right by Jan. 12, 2021, more grass is present among the rocks, exposed at the toe, but covered up-slope. The beach width remained constant.



NJBPN 173 – West End Avenue, Long Branch



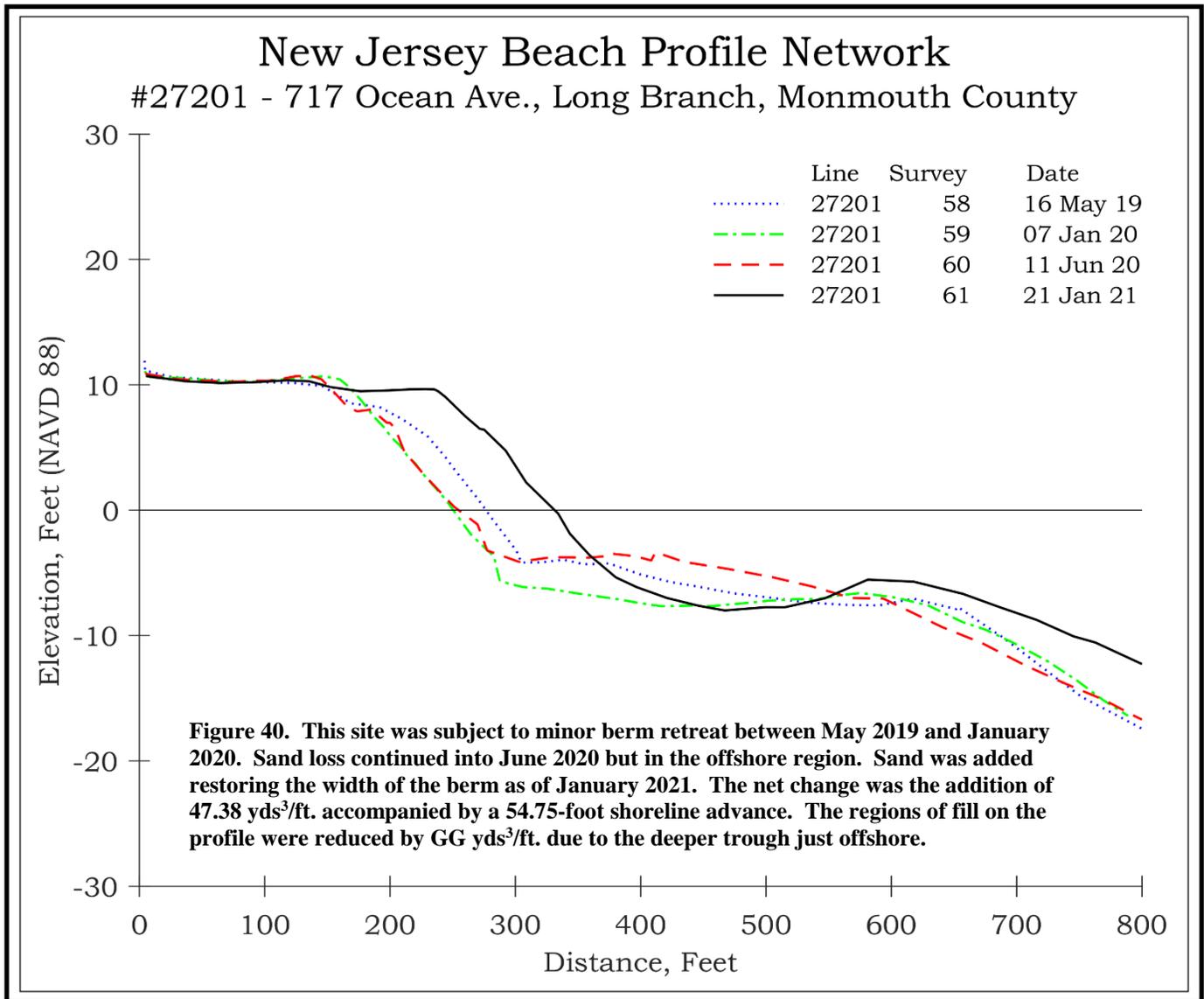
This site was the southern location within Phase I of the federal project. On the left, the rock wall was partially buried in wind-transported sand (Jan 16, 2020). The right-hand view on Jan. 12, 2021 shows the rock toe of the revetment further buried in wind-deposited sand.



NJBPN 27201 – 717 Ocean Avenue, Long Branch



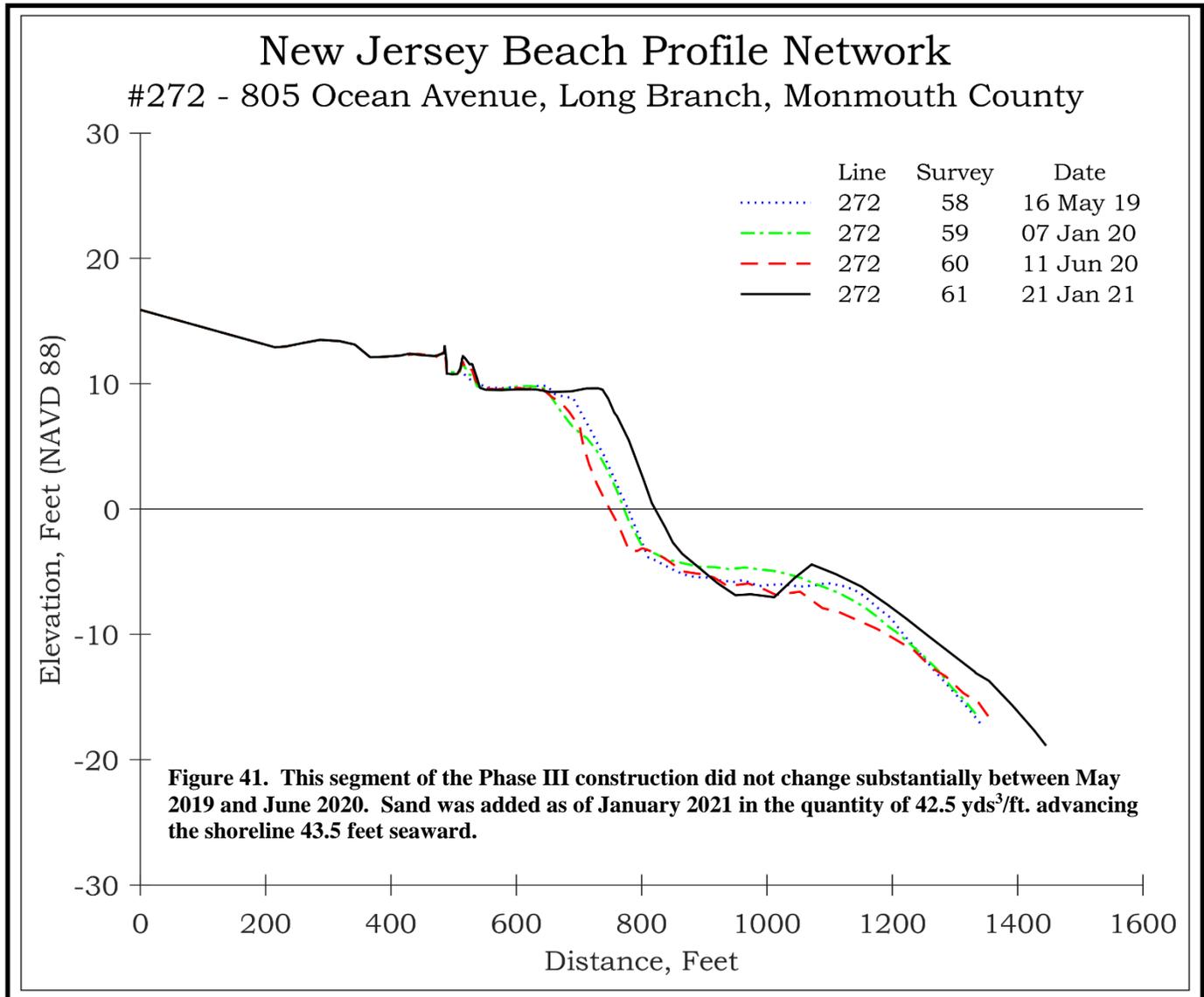
Located in the northern limit for the Phase III USACE beach restoration project, this location was photographed on Jan. 7, 2020 showing the rocks protecting the structures with the dry beach seaward of the rocks. The January 21, 2021 view on the right, shows a very similar view approximately a year later with a wider dry beach.



NJBPN 272 – 805 Ocean Ave, Long Branch



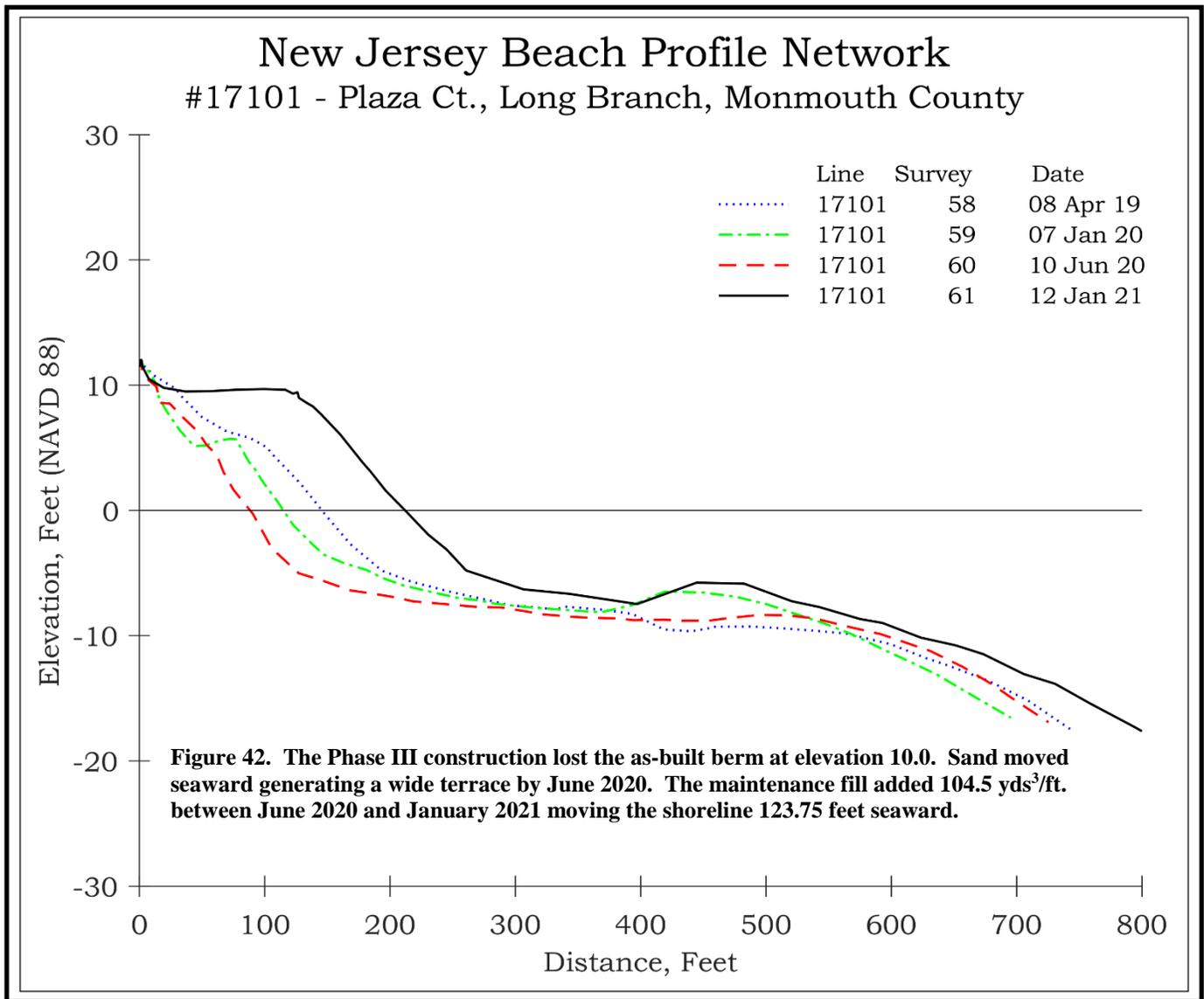
This site, established in 2010, is located on the northeastern edge of Lake Takanassee. The view to the left, taken January 7, 2020, shows retreat at the berm with rocks showing on the south groin. As of January 21, 2021, the rocks cannot be seen in the photo on the right because of sand additions most likely by direct placement.



NJBPN 17101 – Plaza Court, Long Branch



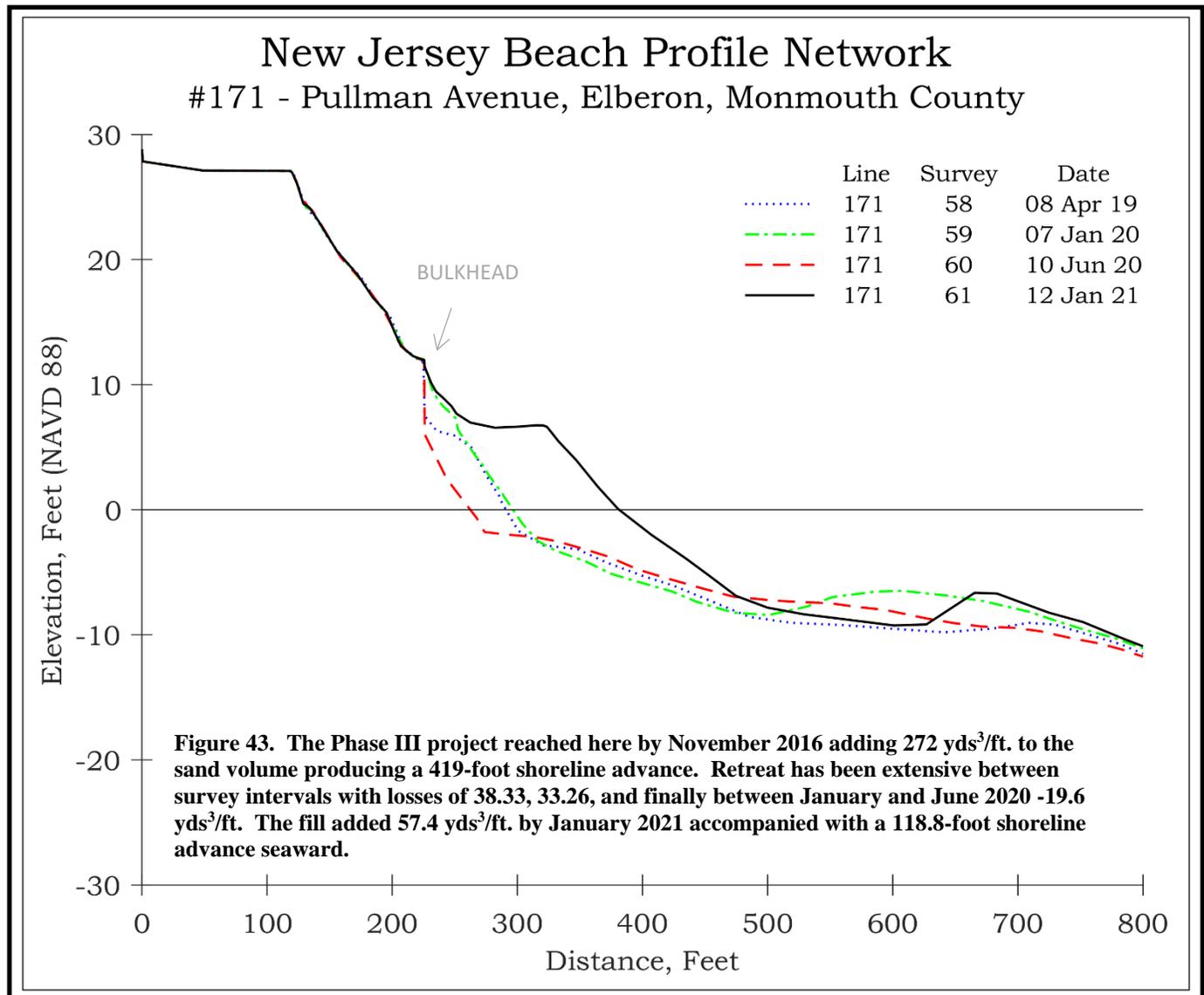
This site is located south of Lake Takanassee positioned south of the lake's freshwater exit flume structure. The left picture from Jan. 7, 2020, erosion has taken a serious toll on the beach width with a scarp present and much more of the groin visible. The right photo displays the beach following a recent nourishment (January 12, 2021) but the scarp is still visible.



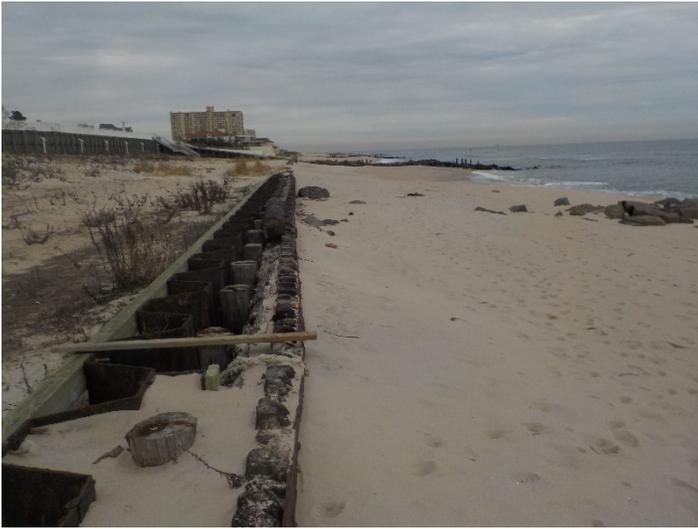
NJBPN 171 – Pullman Avenue, Elberon



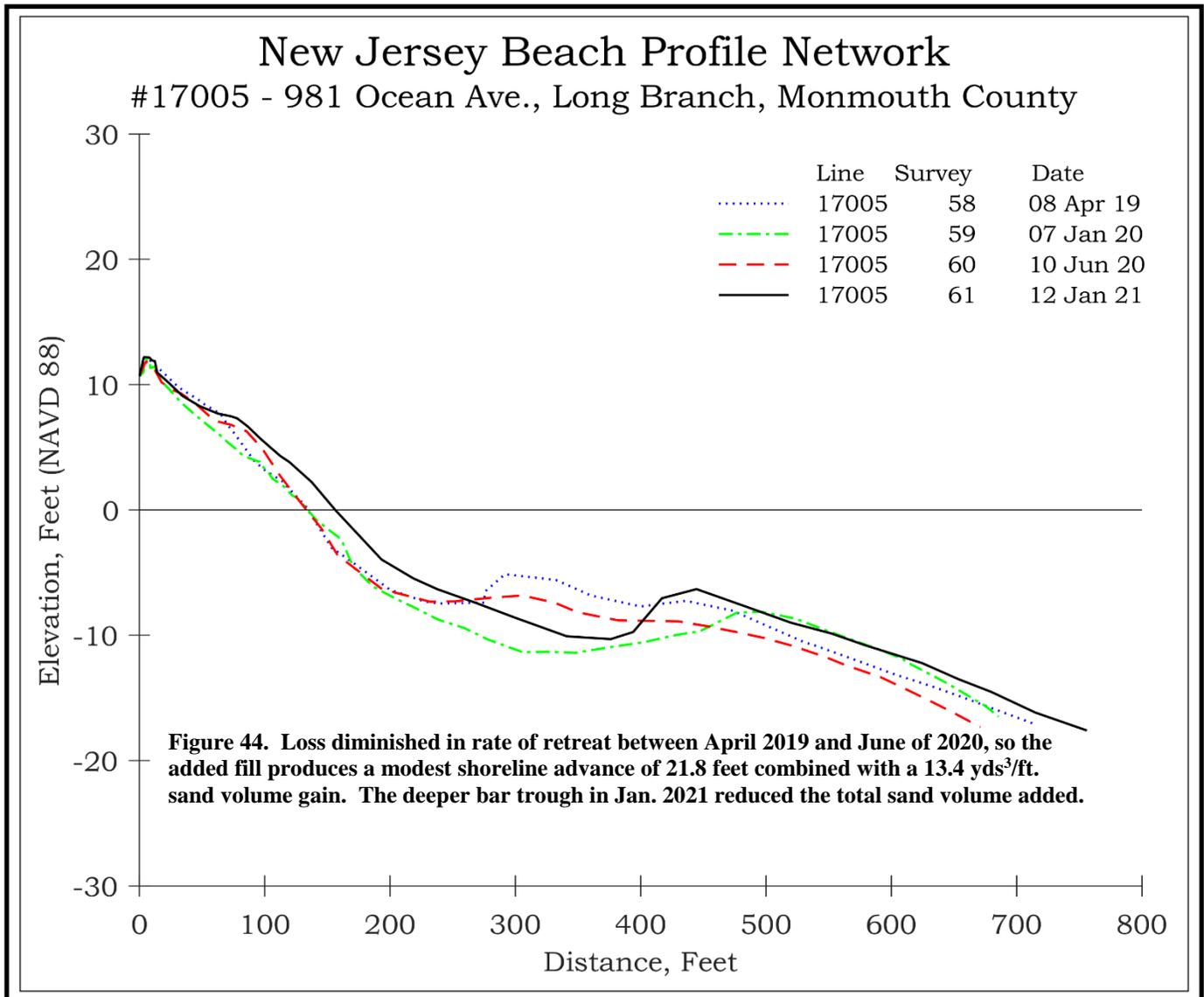
This site is located on the highest point along the bluff shoreline. By January 7, 2020 erosion had fully exposed the rock groin and pushed the beach berm nearly to the main shore-parallel bulkhead. The right view taken January 12, 2021 shows a much less exposed groin following maintenance nourishment.



NJBPN 17005 – 981 Ocean Avenue, Long Branch



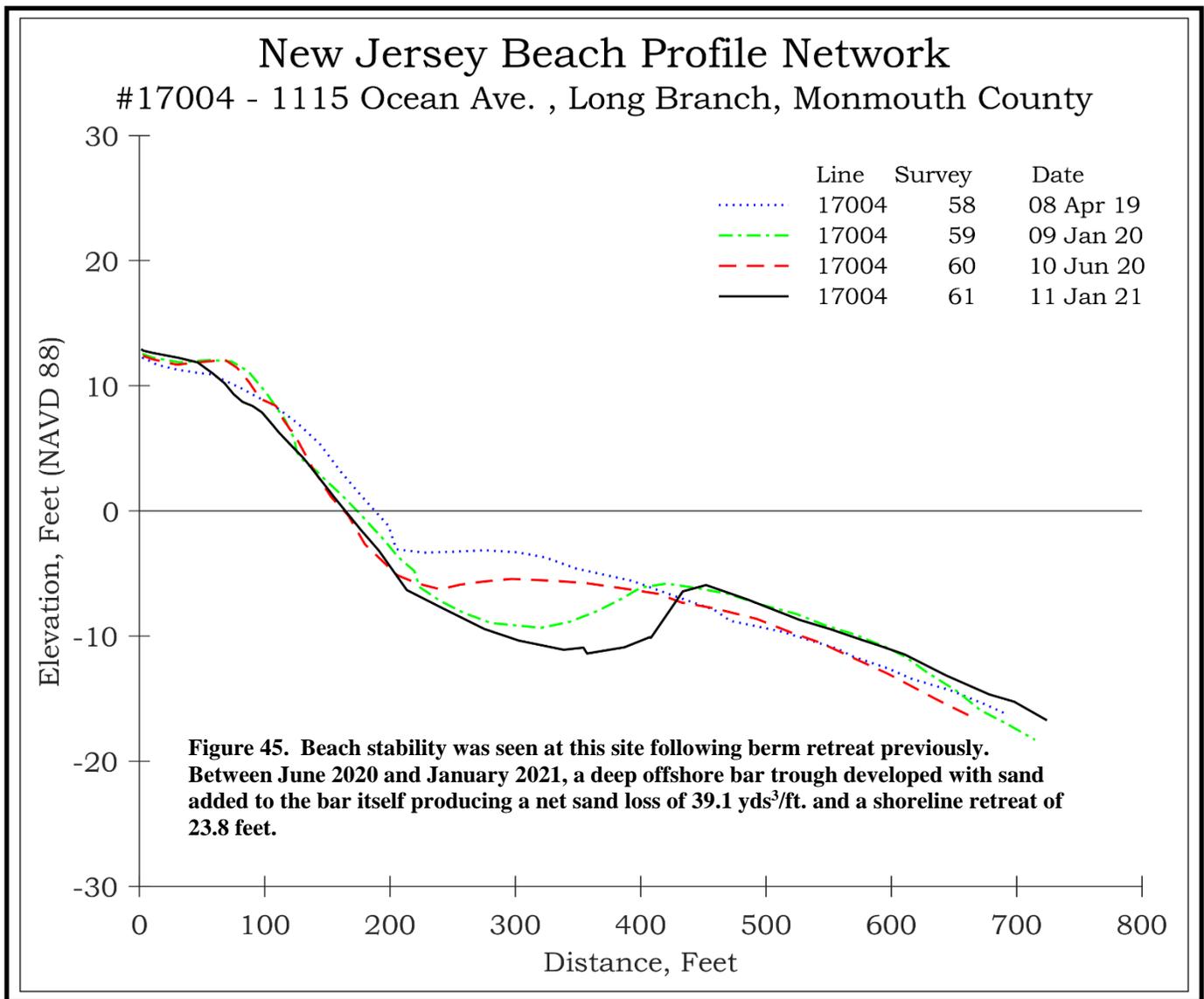
Located in the Elberon groin field, this location was completed during 2016 and suffered retreat, producing exposed rocks by Jan. 7, 2020. The beach was lower in elevation with the old timber bulkhead clearly visible on upper beach. The right photo, taken January 12, 2021 exhibits the beach where the groin is much less exposed, as well as sand recovering the bulkhead.



NJBPN 17004 – 1115 Ocean Avenue, Long Branch



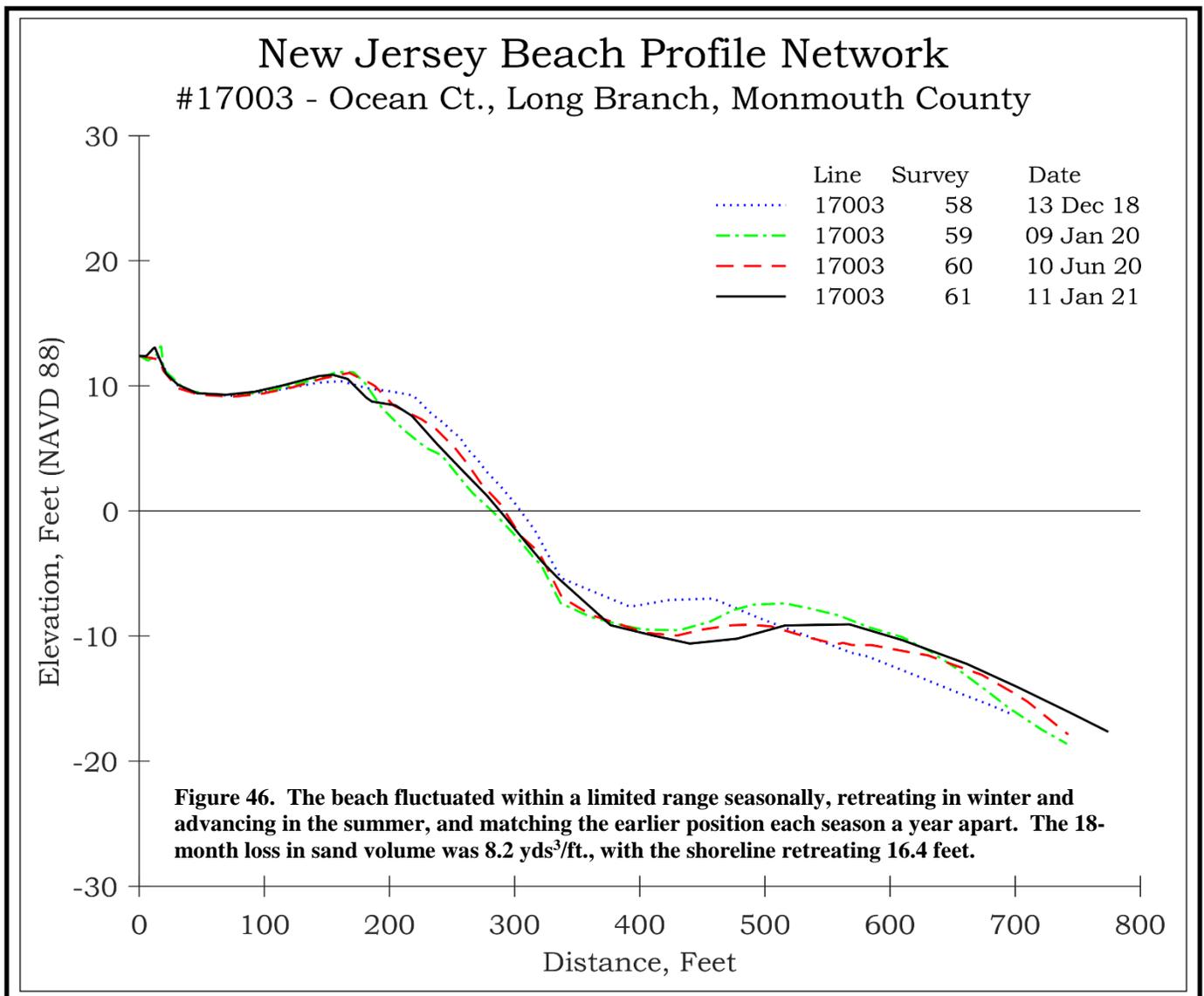
This location is also within the Elberon groin field. The left view was on Jan. 9, 2020 and shows some rock exposure in the distance to the south. As of Jan. 11, 2021 the same perspective on the right shows a new 'fence' has been established, and sand has blown onto the concrete patio.



NJBPN 17003 – Ocean Court, Long Branch



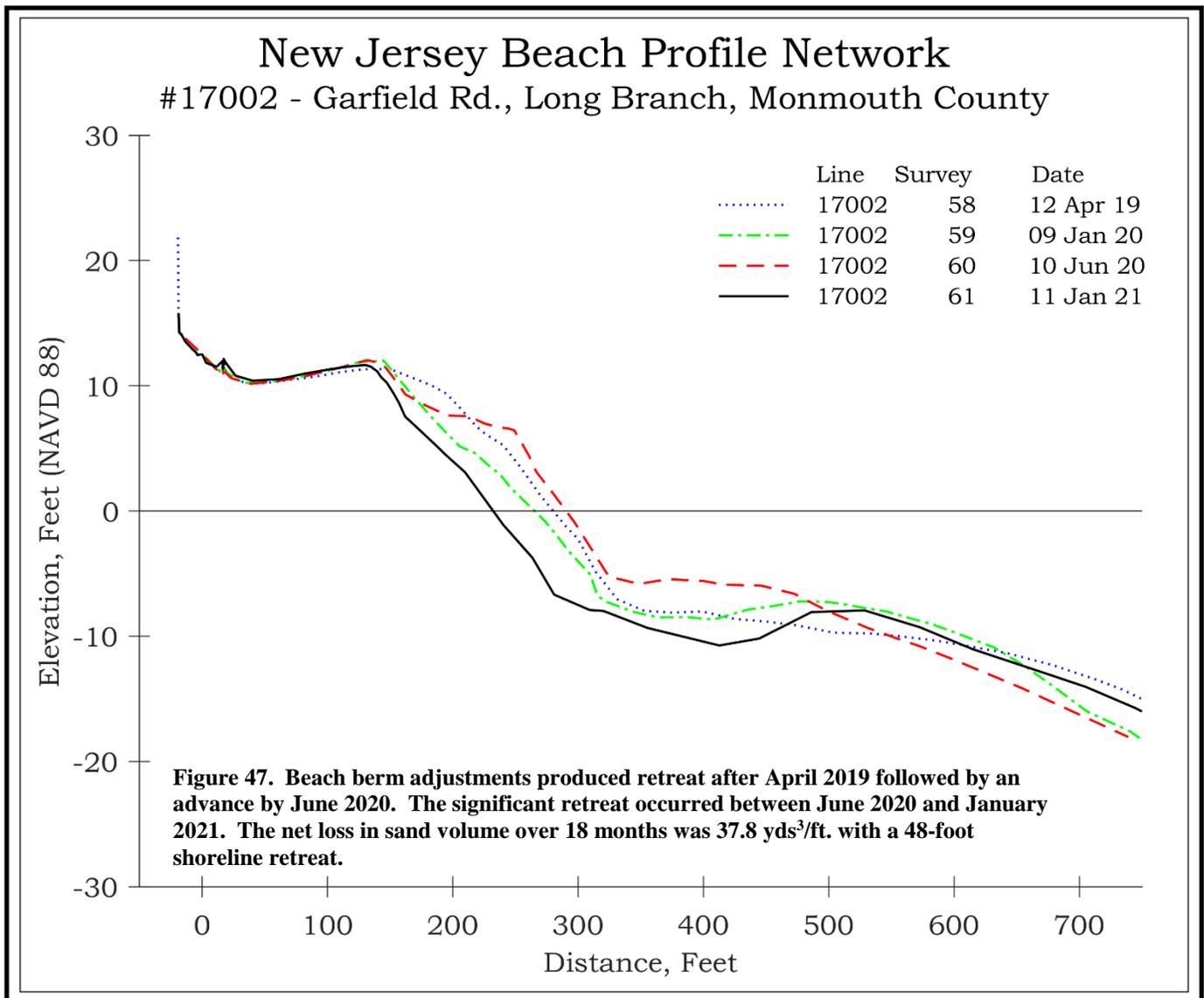
The left view was taken Jan. 9, 2020 and shows a wide beach with little dune development. The right view shows a similar beach configuration as of Jan. 11, 2021 with few changes, aside from the dune grass being covered with wind transported sand.



NJBPN 17002 – Garfield Road, Long Branch

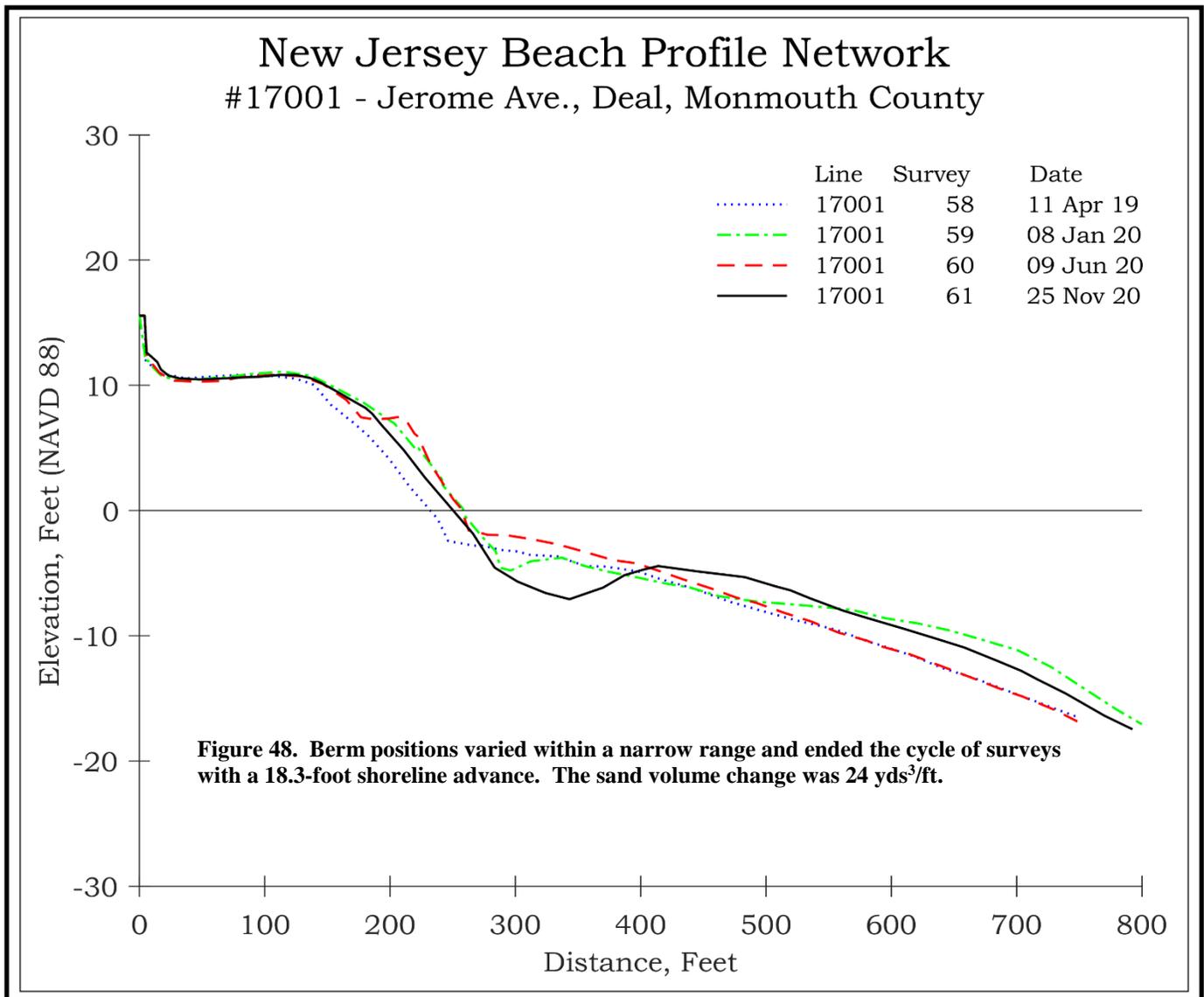


The left view on Jan. 9, 2020 shows a beach with some rock groin exposure, while the right view on Jan. 11, 2021 shows the retreat in the berm crest at the rock groin with the seaward beachface slope starting sooner at the groin.





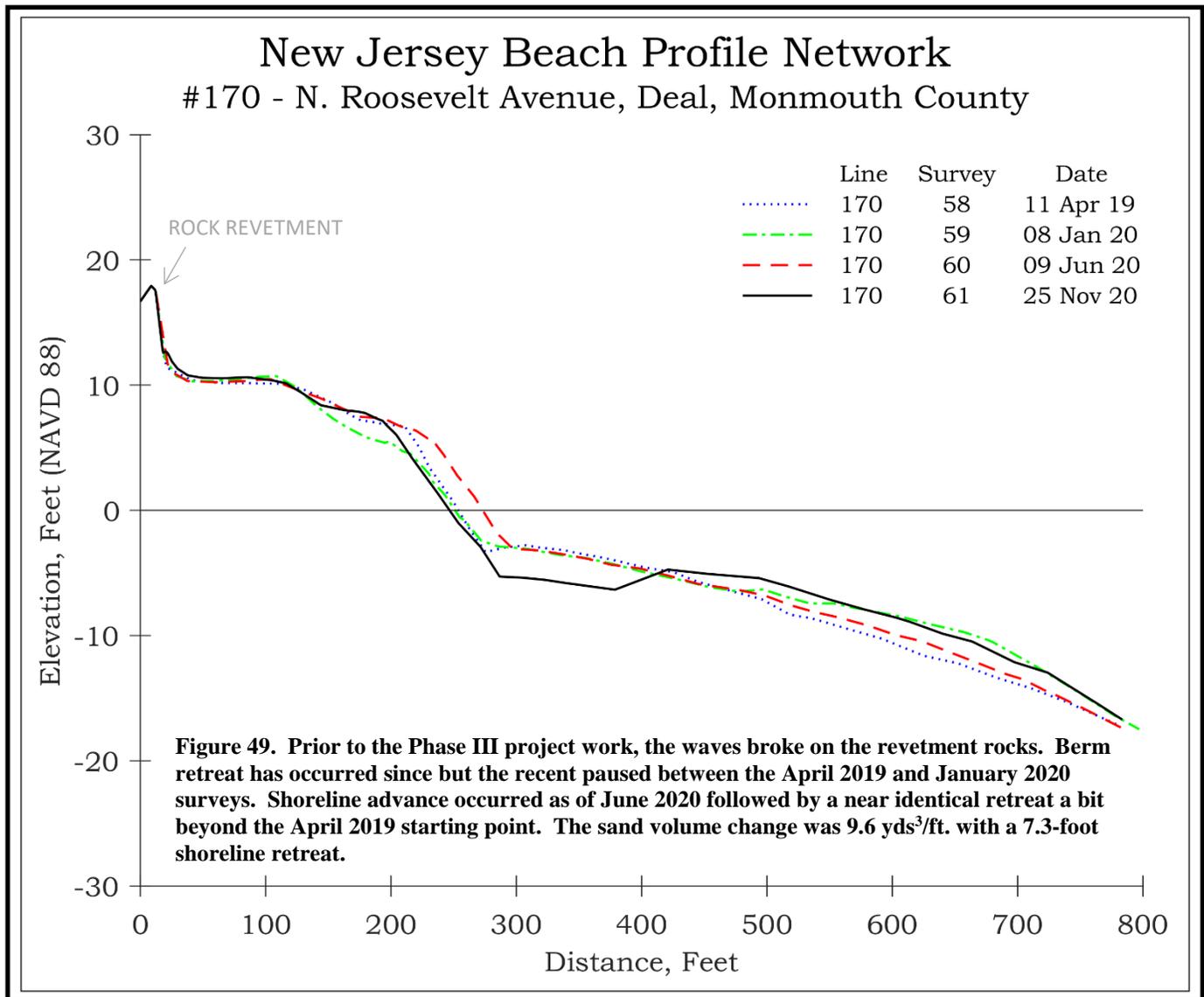
The left view on Dec. 12, 2018 shows the beach to the rock wall. The right-hand view on Jan 8, 2020 shows no sand deposited as incipient dunes but with a fairly stable beach width.



NJBPN 170 – Roosevelt Avenue, Deal

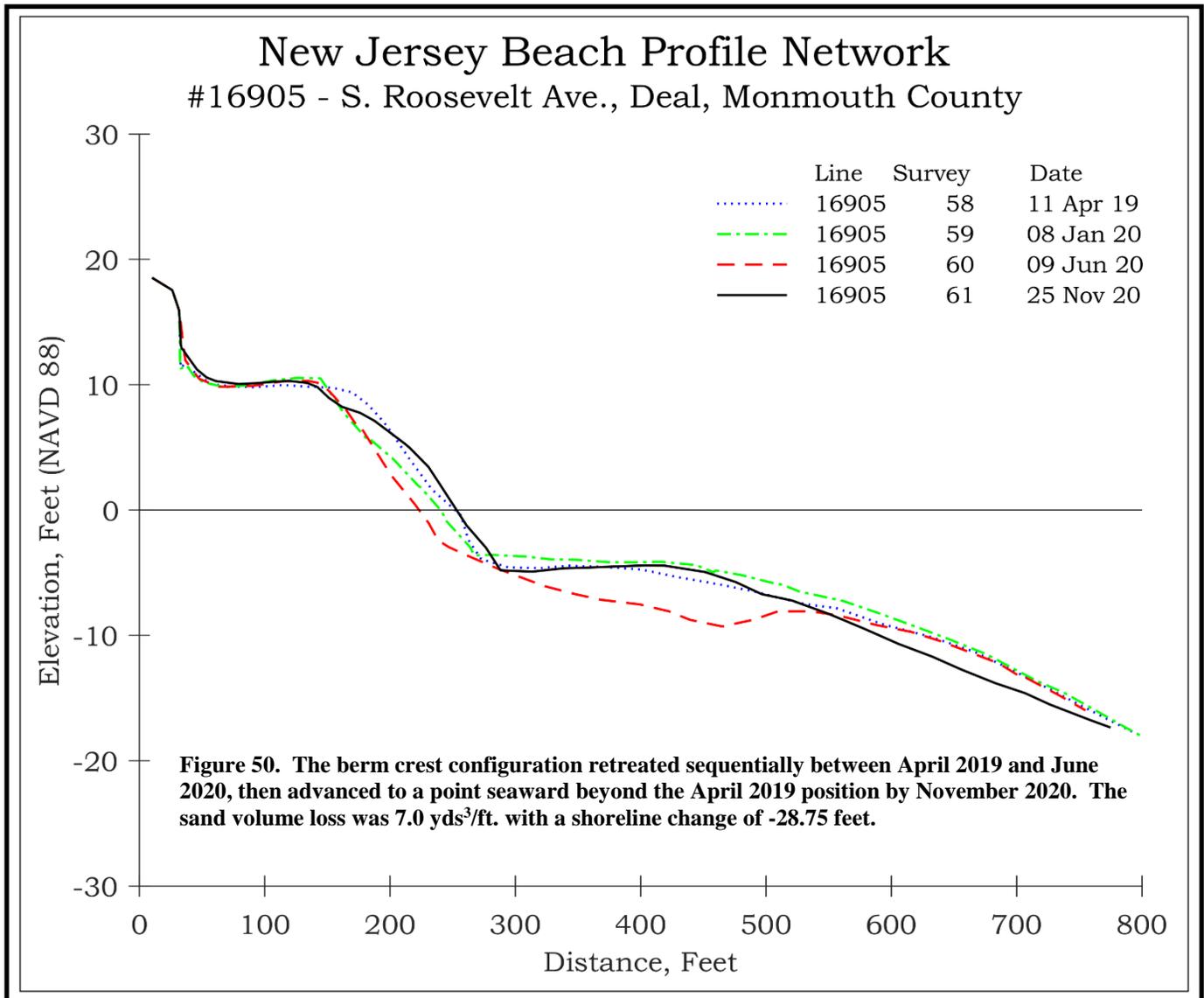


By December 11, 2017 the project was complete. As of Jan. 8, 2020 (left), the situation had changed very little at the rock revetment but with modest retreat of the beachface position. The view on the right, taken November 25, 2020, shows a similar view with slightly more sand deposited against the revetment due to wind.





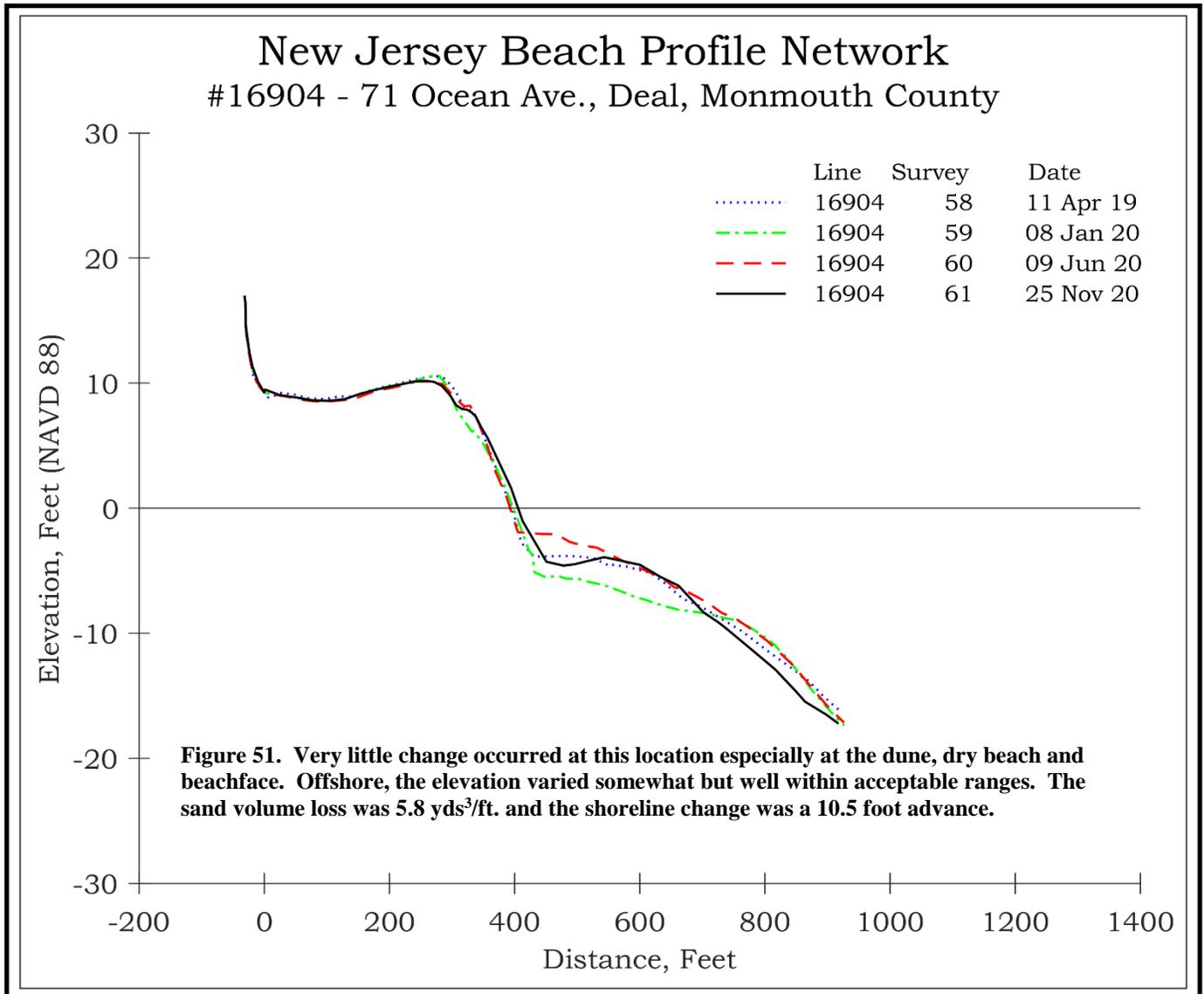
This new site is just south of Roosevelt Avenue in Deal. As of Jan. 8, 2020, the beach width was practically the same with some sand deposited at the toe of the rock by the wind. The November 25, 2020 photo to the right, shows an almost identical view of this site.



NJBPN 16904 – 71 Ocean Avenue, Deal

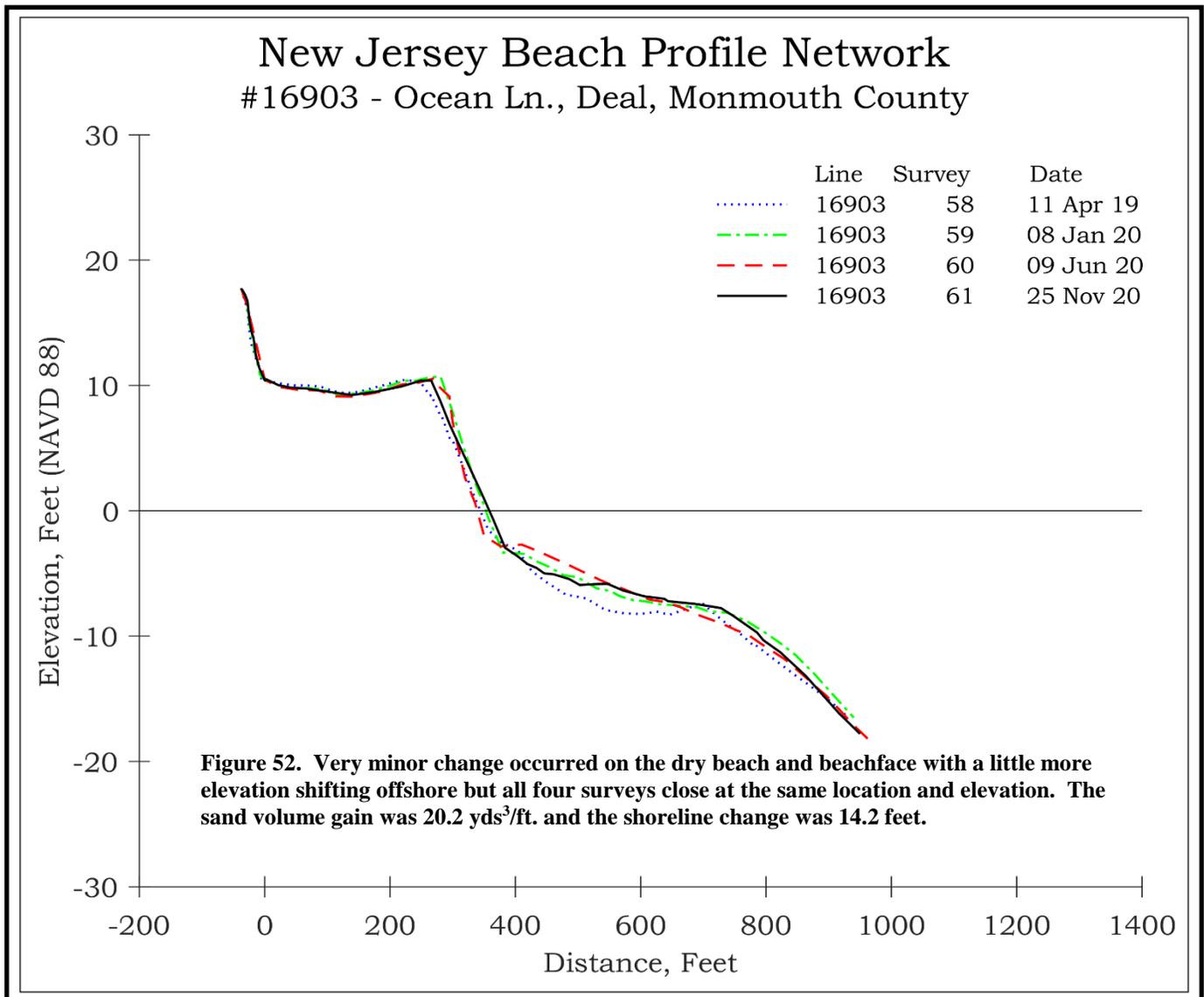


Located south of Poplar Brook, as of Jan. 8, 2020 some beachface retreat has occurred (left view) with a beach still far wider than pre-project. The right side photo (November 25, 2020), shows a fairly similar view with a similar berm.





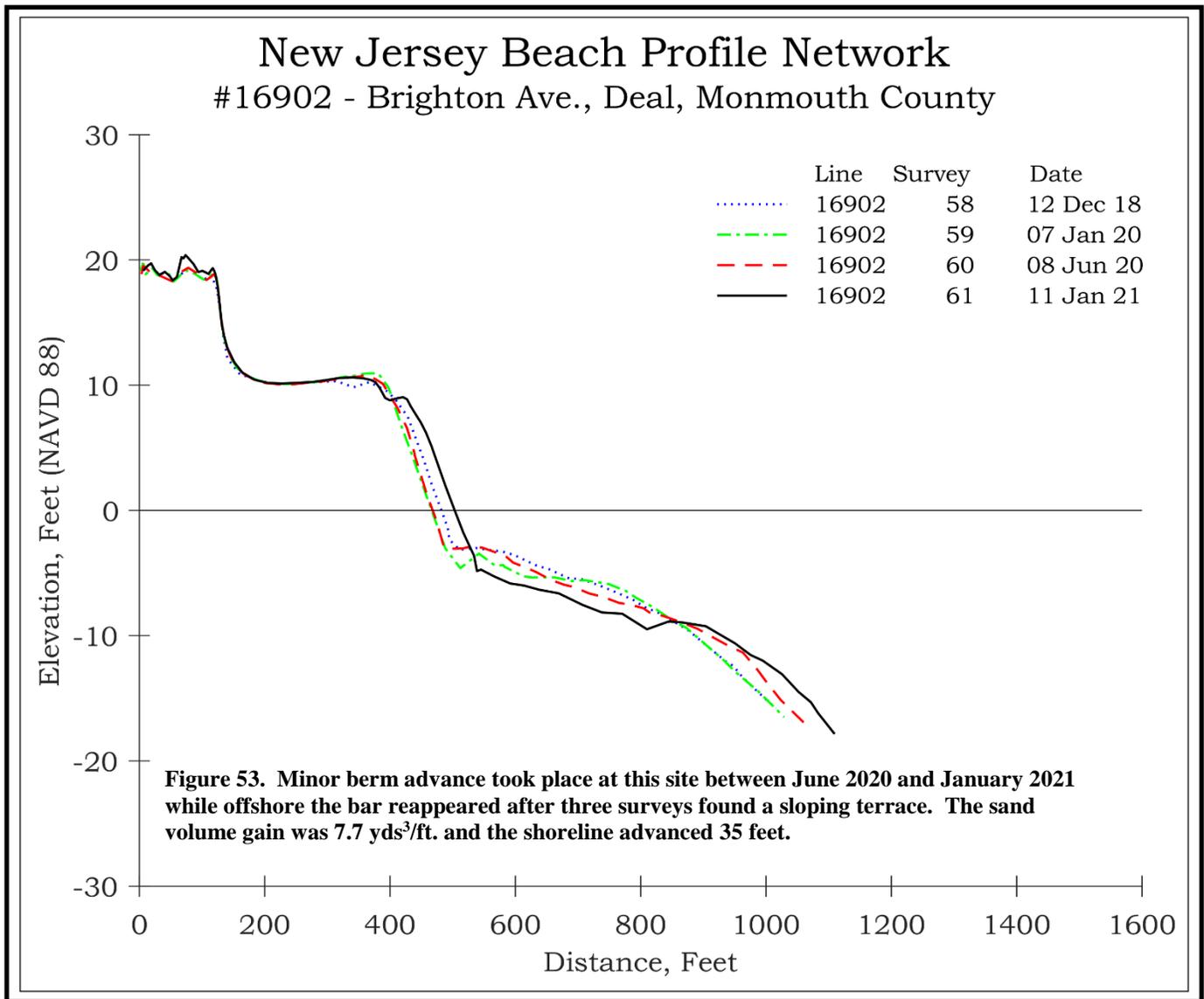
This site is in proximity to Phillips Avenue bathing pavillion, severely damaged by Hurricane Sandy. The left side shows the beach as of Jan. 8, 2020 with wind deposited sand adding to the dune toe. The right photo, taken November 25, 2020 shows a very similar dune and beach configuration.



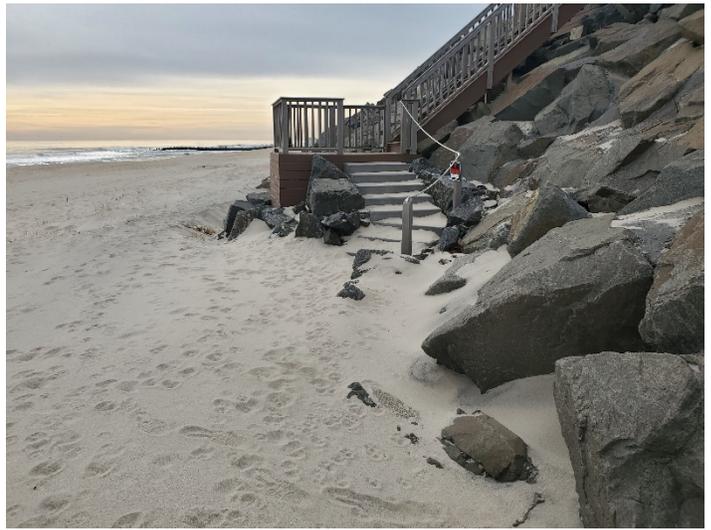
NJBPN 16902 – Brighton Avenue, Deal



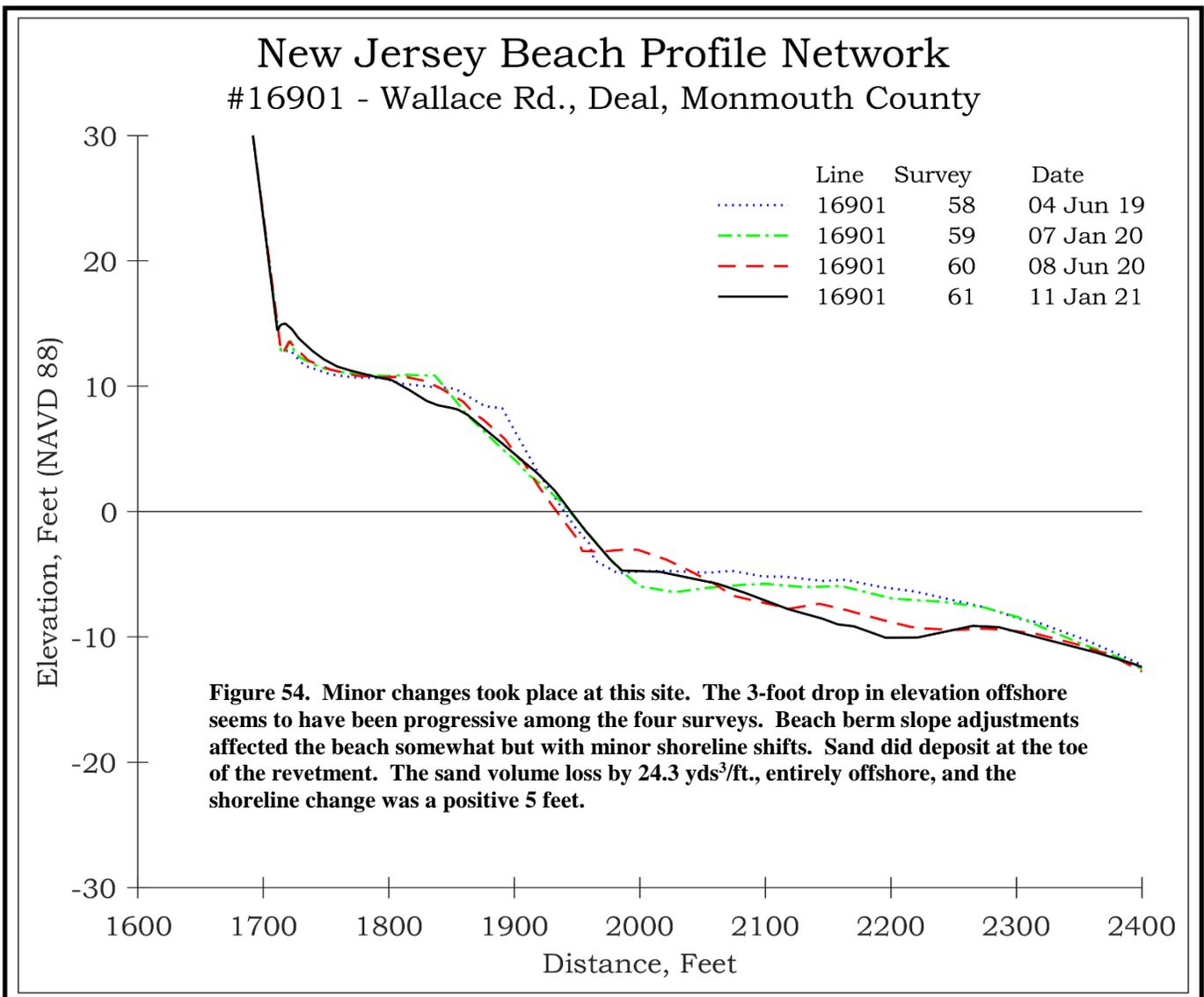
The Deal Casino bathing complex is the site of this cross section. The left view photo, taken January 7, 2020, shows the new sand ridge was not present as sand deposited on the small dune growing at the fence line on the beach. The right hand photo, taken January 11, 2021, shows some growth of the dune along the fence line, as well as dune grass growth.



NJBPN 16901 – Wallace Road, Deal



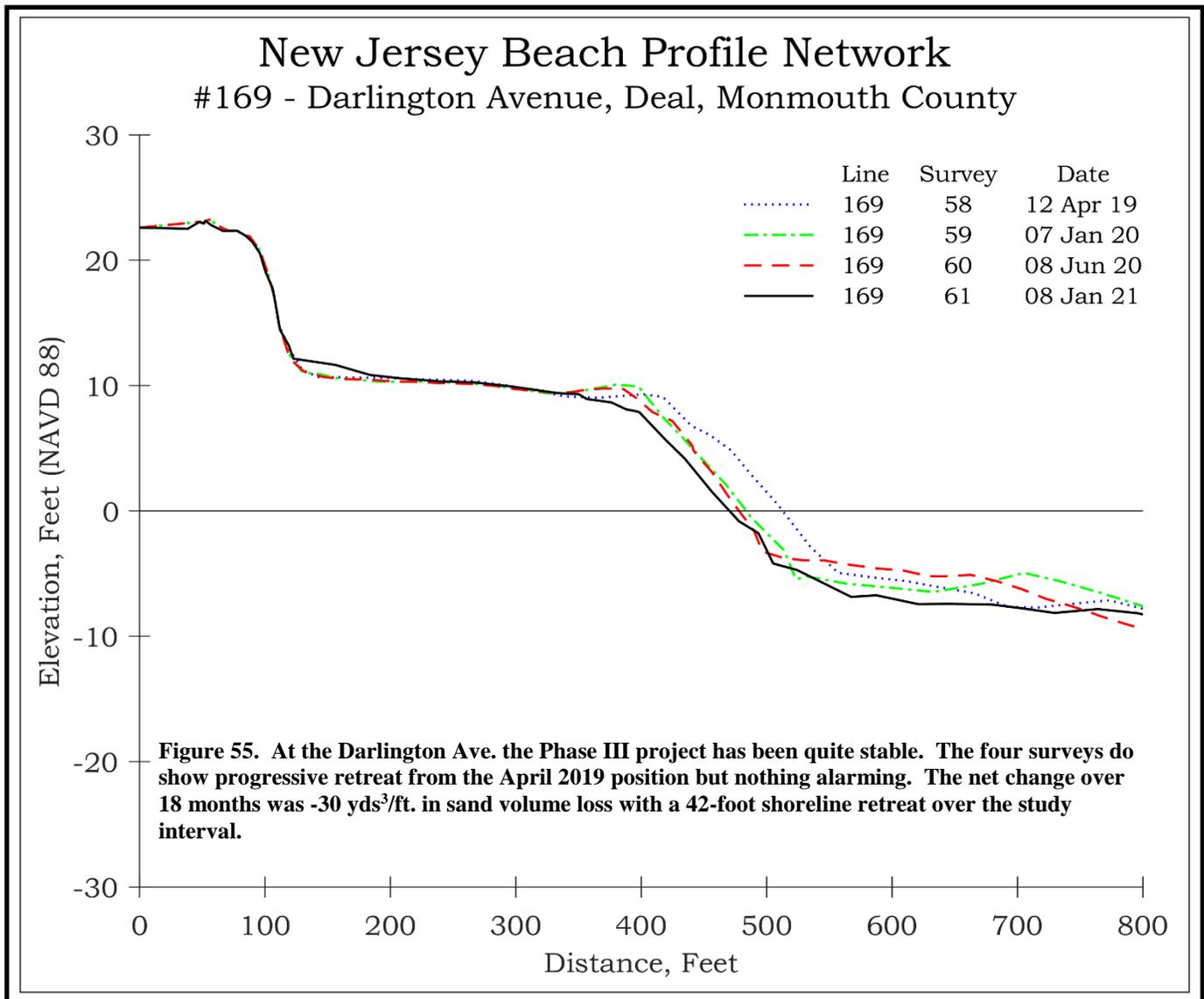
This site is located on the boundary between the bathing complex and private homes which extend south of the location. The Jan. 7, 2020 view was shot at the toe of the rock revetment built post-Sandy at the site with some wind deposition generating an incipient dune (left view). The 4-foot high fence has been buried. The right hand side photo shows additional sand deposition at the rocks with fewer steps exposed.



NJBPN 169 – Darlington Avenue, Deal



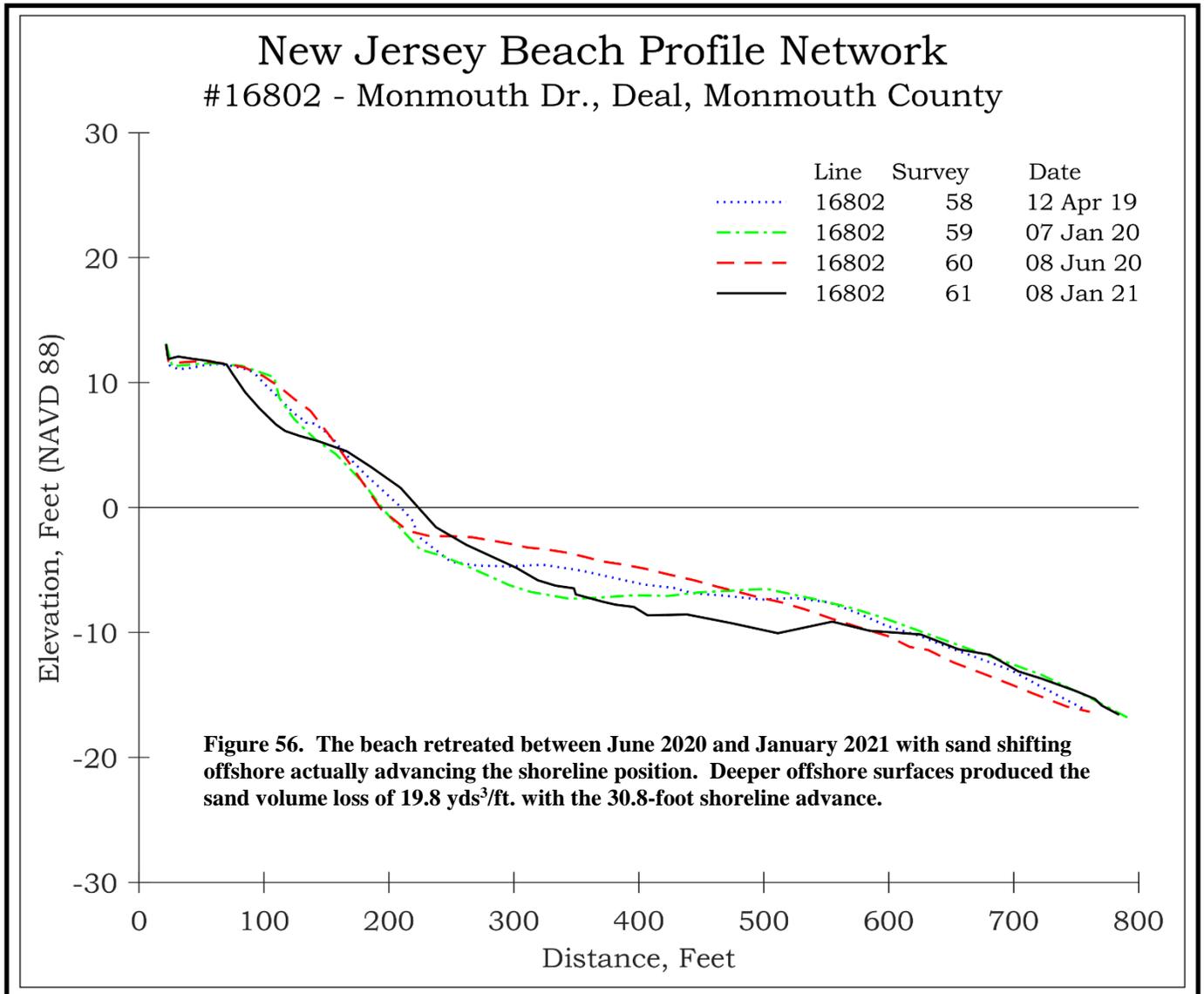
The Darlington site has maintained the as-built width quite well. Completed early during Phase III, there is a wide beach with a berm extending 340 feet beyond the bluff. The January 7, 2020 view shows the beach width quite well (left side) and the Jan. 8, 2021 view on the right shows the berm and beachface at the outer part of the dry sand beach.



NJBPN 16802 – Monmouth Drive, Deal



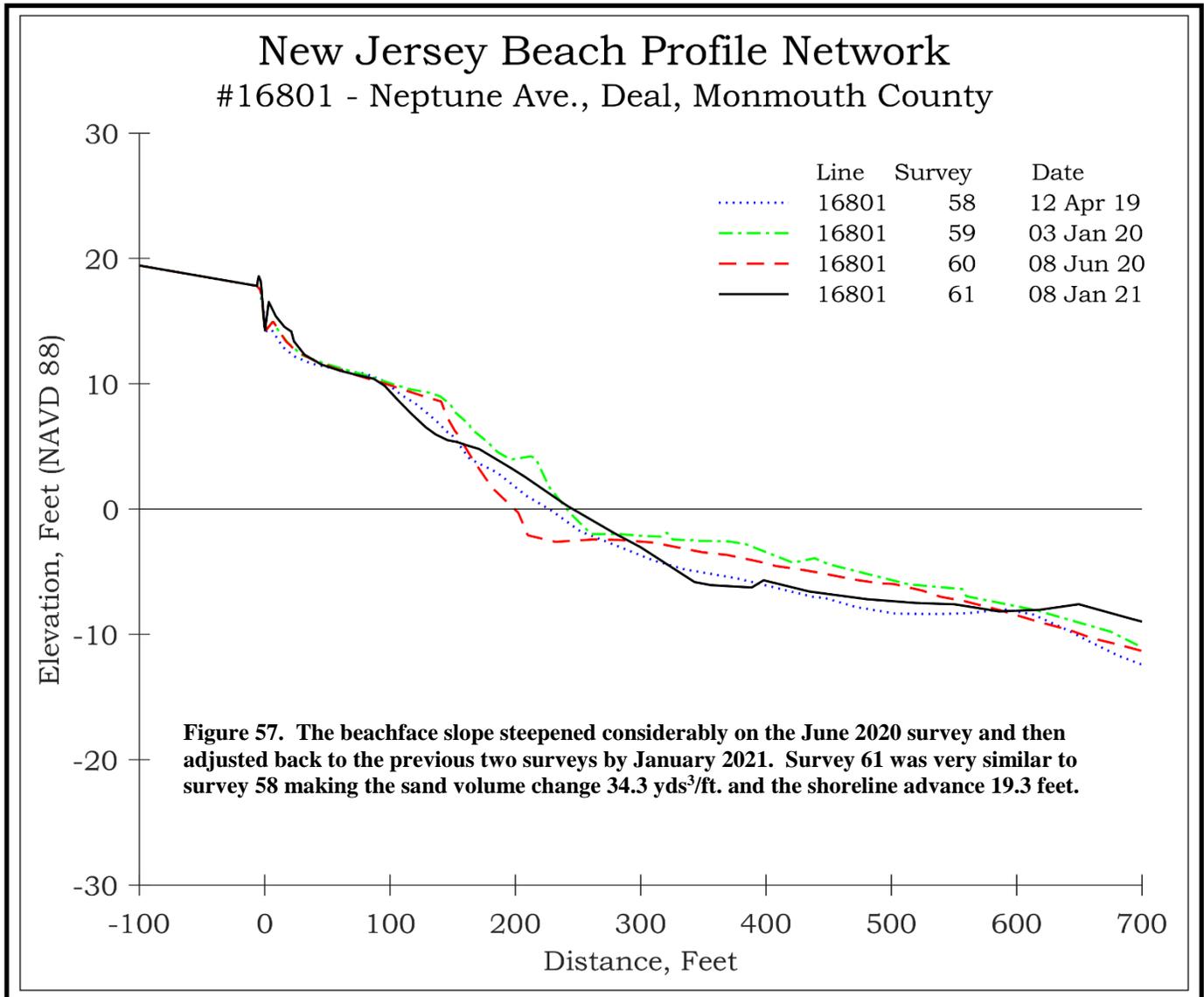
This site fronts a private home at the bluff. As of Jan. 7, 2020, the beach developed a scarp near the rock revetment with sand deposited as a repair berm seaward of the scarp on the left side view. The January 8, 2021 view presents a very similar perspective with the rock revetment having increased exposure.



NJBPN 16801 – Neptune Avenue, Deal

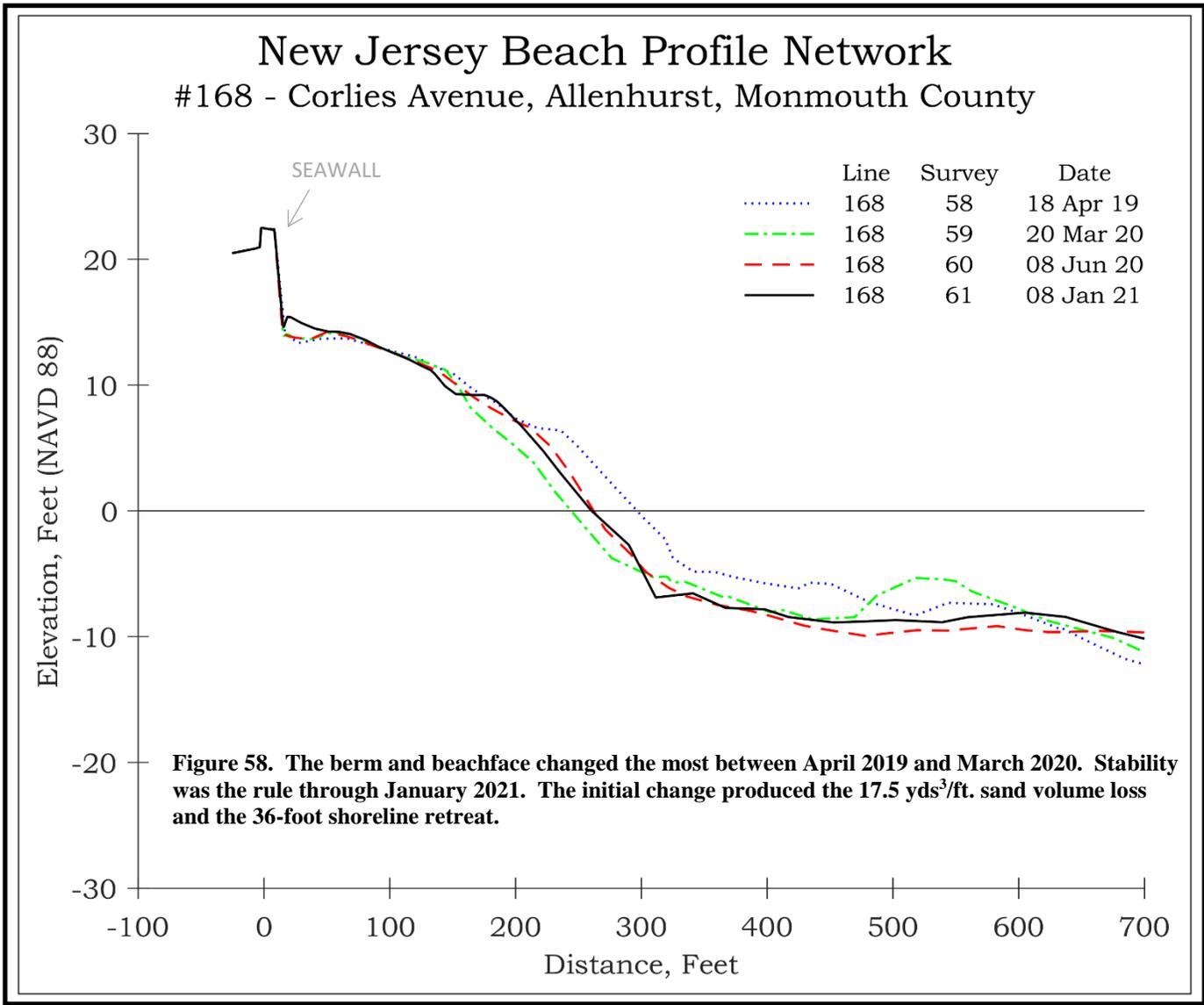


This is the southernmost site in Deal with the bluff protected by armor stone. This beach sits just north of a massive rock structure designed to hold sand in Allenhurst built decades ago. The left view was taken Jan. 3, 2020 and the right taken Jan. 8, 2021.





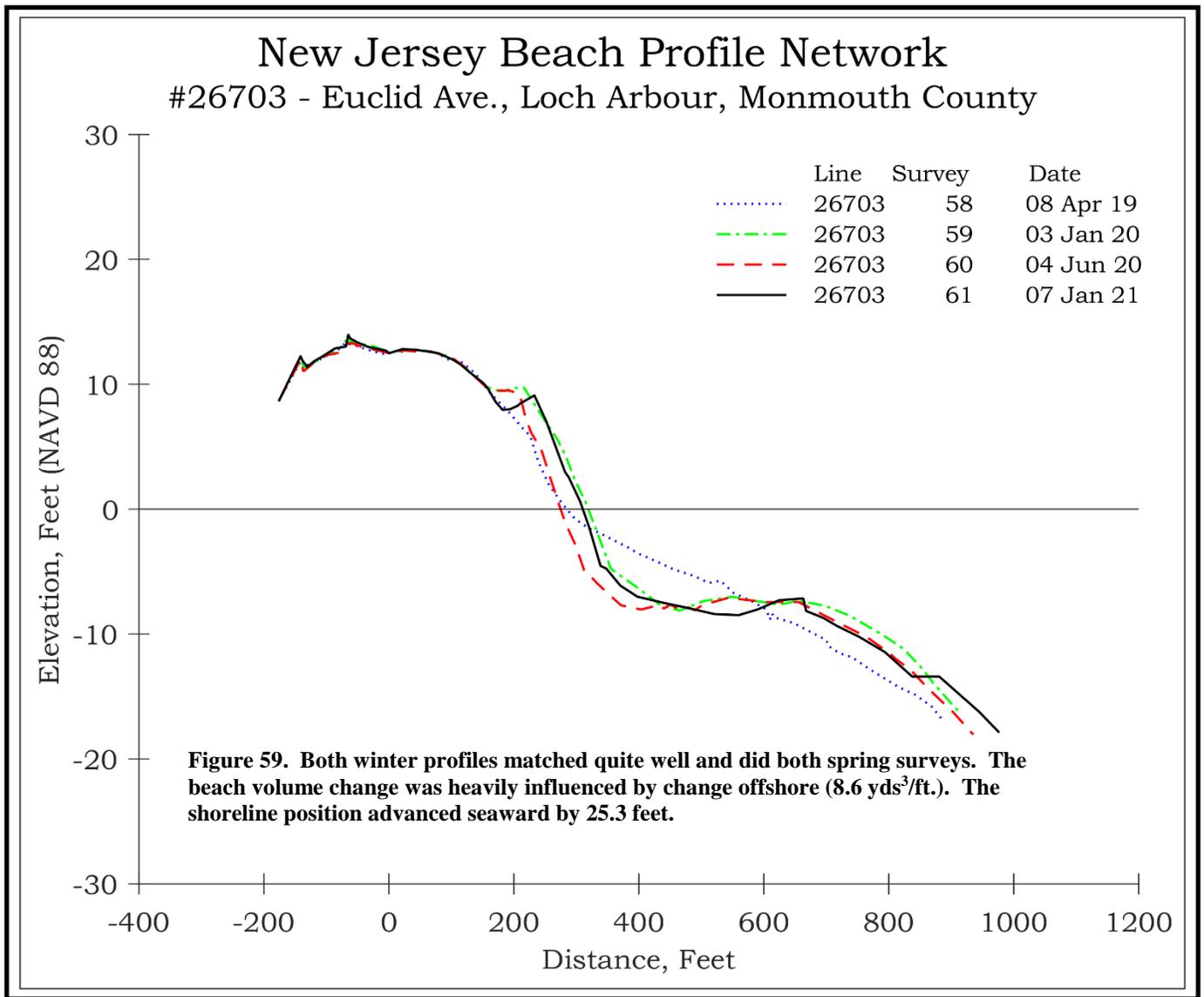
This site in Allenhurst was the starting point for Phase III USACE work in 2015. The left side view (Jan. 30, 2020) to the south includes Loch Arbor and, in the distance, Asbury Park. The right-side photo presents a similar view and tide, revealing more of the pilings at the swash that were previously nearly buried (January 8, 2021).



NJBPN 26703 – Euclid Avenue, Loch Arbor



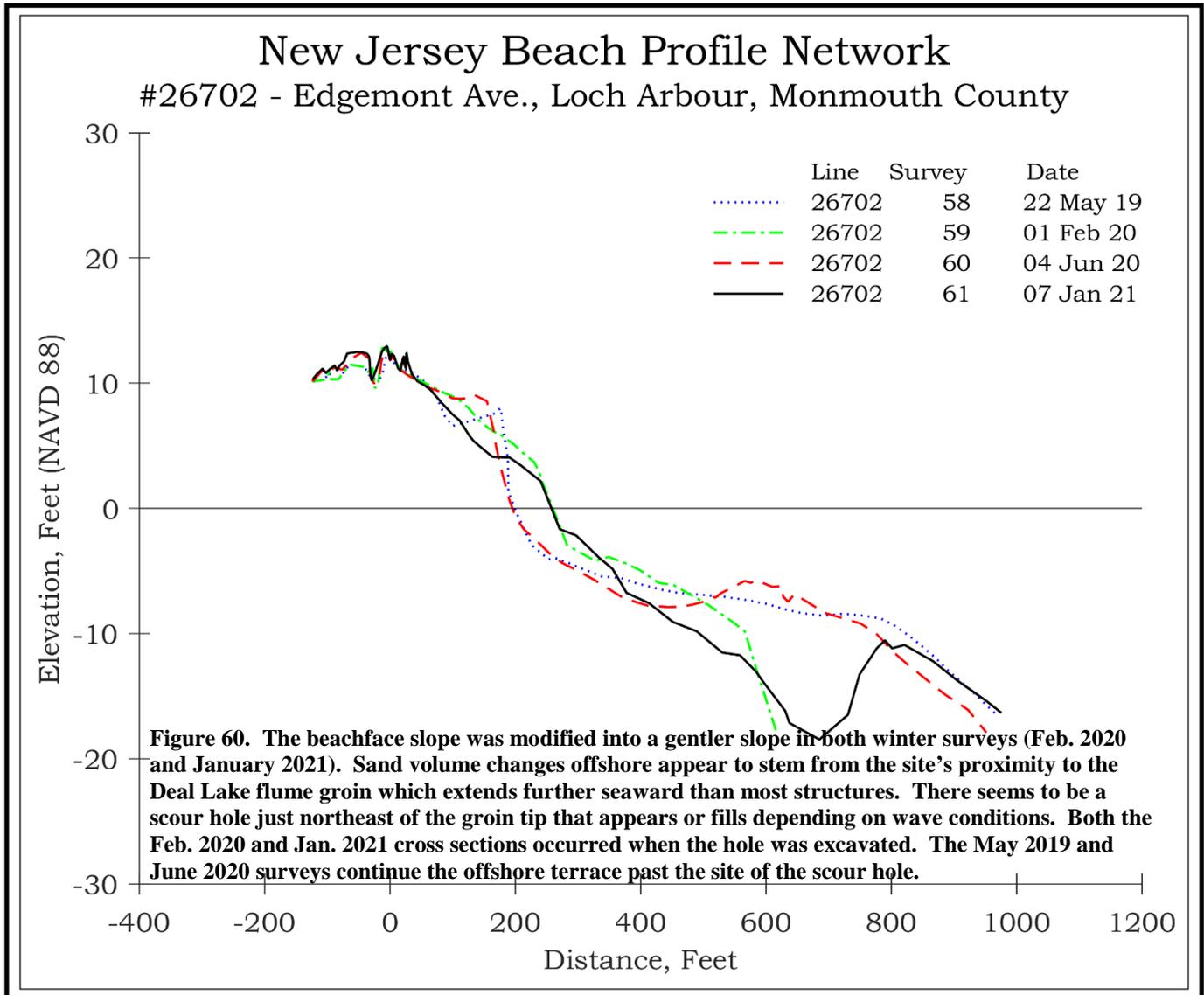
This site is located on the public half of the Loch Arbor shoreline. The Jan. 30, 2020 view on the left shows the beach width in comparison with the Jan. 7, 2021 view on the right taken approximately in the same location on the transect.



NJBPN 26702 – Edgemont Avenue, Loch Arbor



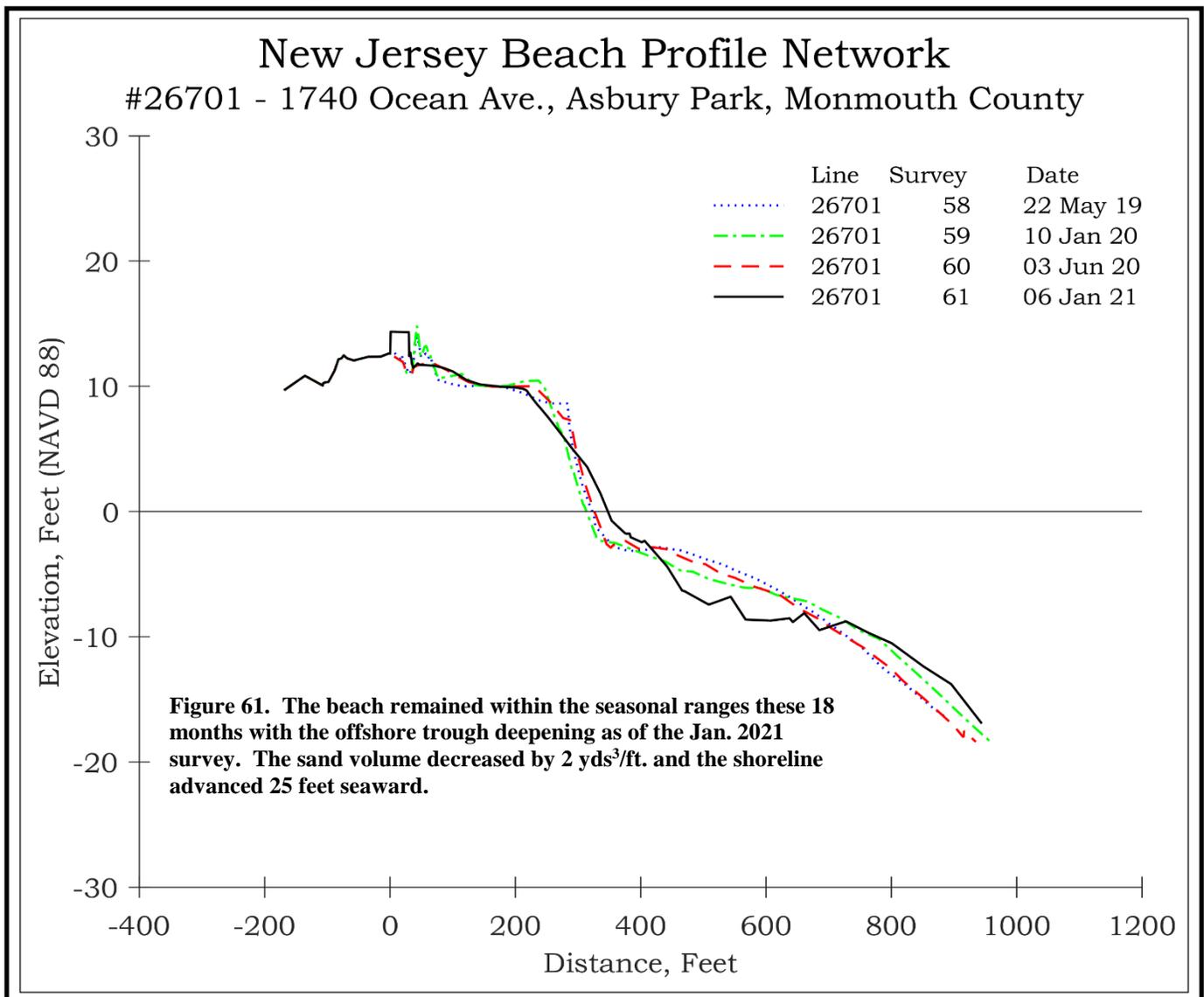
This site is located on the private half of the Loch Arbor shoreline, adjacent to the Deal Lake exit flume. The Jan. 30, 2020 view on the left shows the natural beach slope. The right-side photo presents a similar view of the beach at a lower tide, along with some of the fence configuration (January 7, 2021). The 18-month comparison gives a skewed view of sand loss due to the presence of the scour hole offshore in 2021 (sand loss of 62.7 yds³/ft., but a shoreline advance of 58.8 feet).



NJBPN 26701 – 1740 Ocean Avenue, Asbury Park



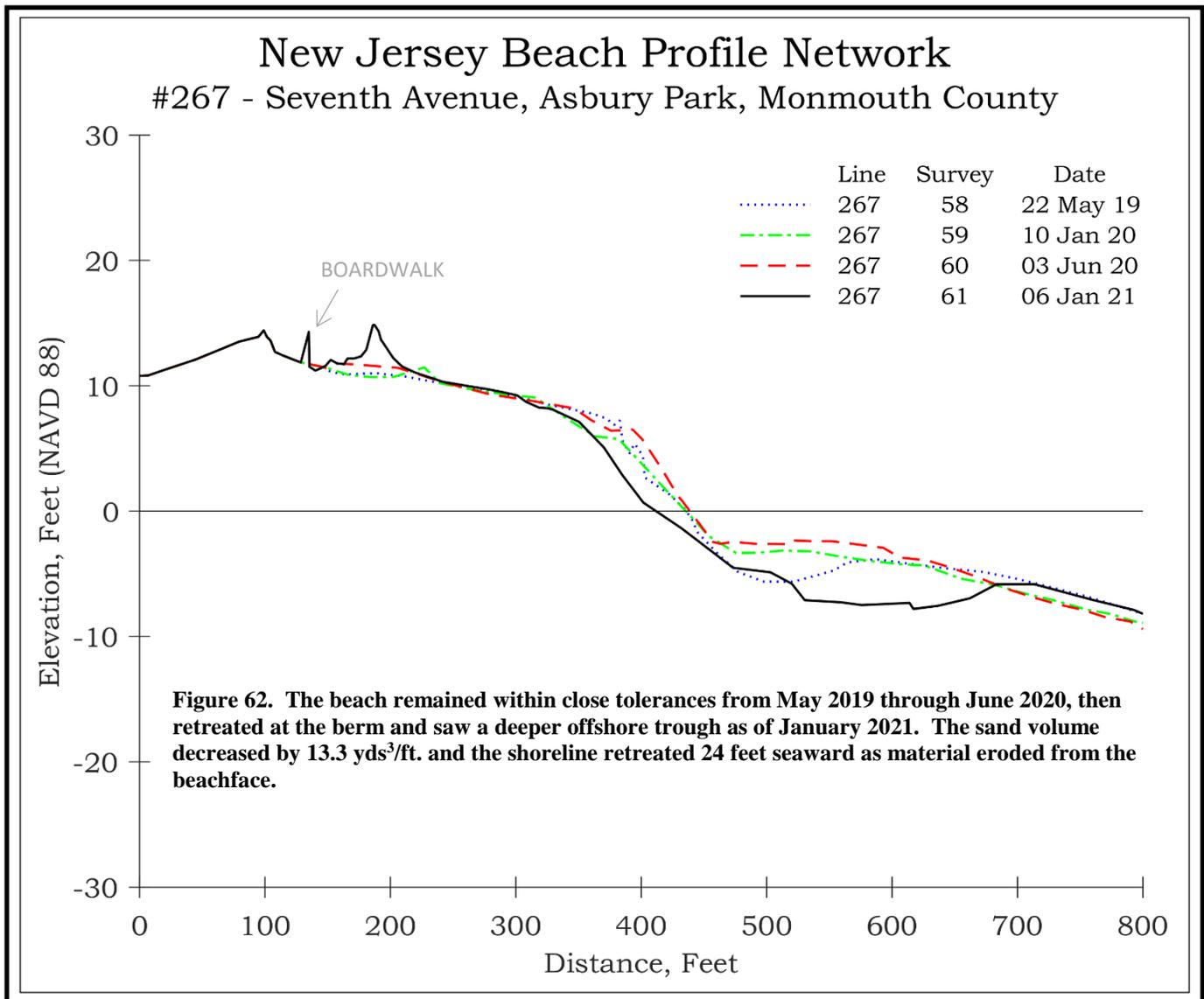
Positioned at the northern limit of the Asbury Park shoreline, this site sits at the boardwalk with a tiny dune seaward of the walk. The Jan. 30, 2020 view (left), shows the rocks were clearly exposed as the beach retreated. The photo on the right, taken January 6, 2021, shows the dry expanse of the beach a bit further up onto the dry beach.



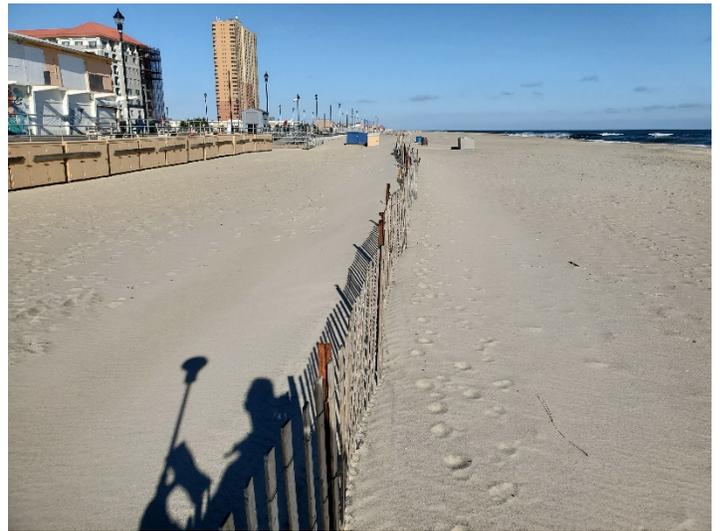
NJBPN 267 – 7th Avenue, Asbury Park



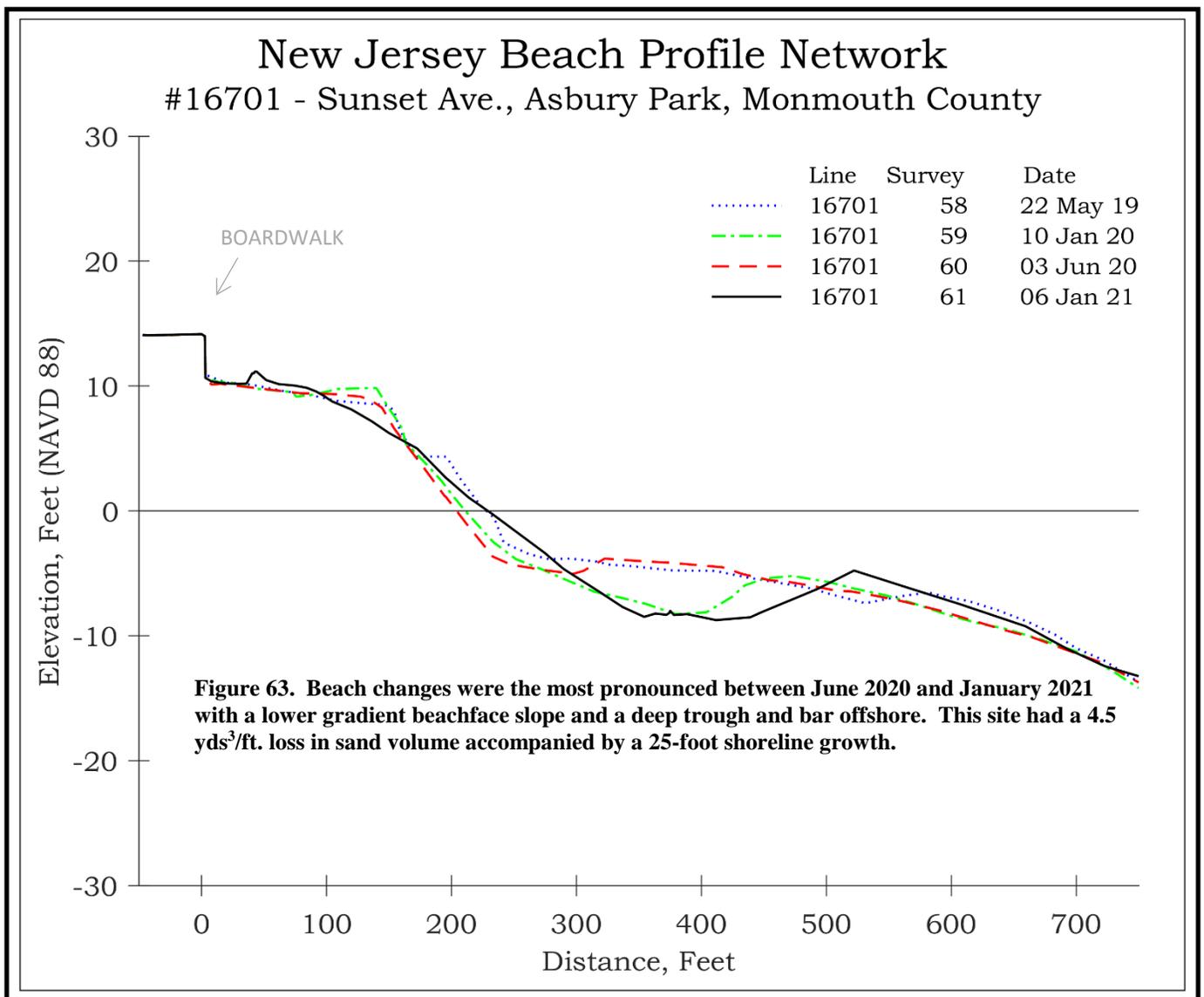
This site is the northernmost location in the Phase II part of the Monmouth County project. The beach face view on Jan. 11, 2020 shows the rock groins with greater exposure indicating shoreline retreat. The January 6, 2021 photo on the right exhibits a less exposed rock groin because the tide was higher with a view across the dry expanse of the beach.



NJBPN 16701 – Sunset Avenue, Asbury Park



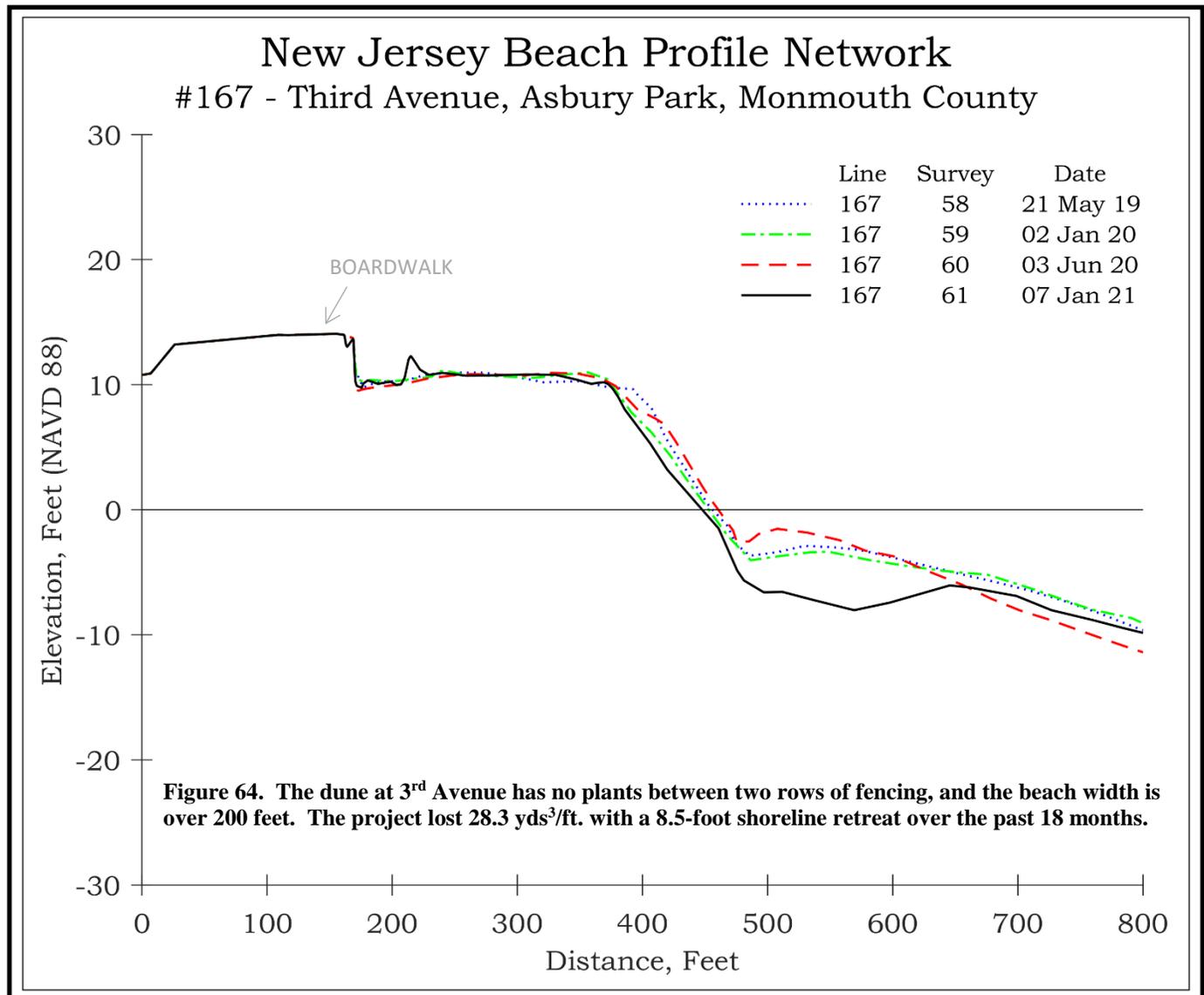
The Jan. 10, 2020 view on the left shows the beach just past the storage boxes and right before the fencing. The Jan. 6, 2021 view on the right shows the storage boxes completed next to the boardwalk with the beach essentially the same.



NJBPN 167 – 3rd Avenue, Asbury Park



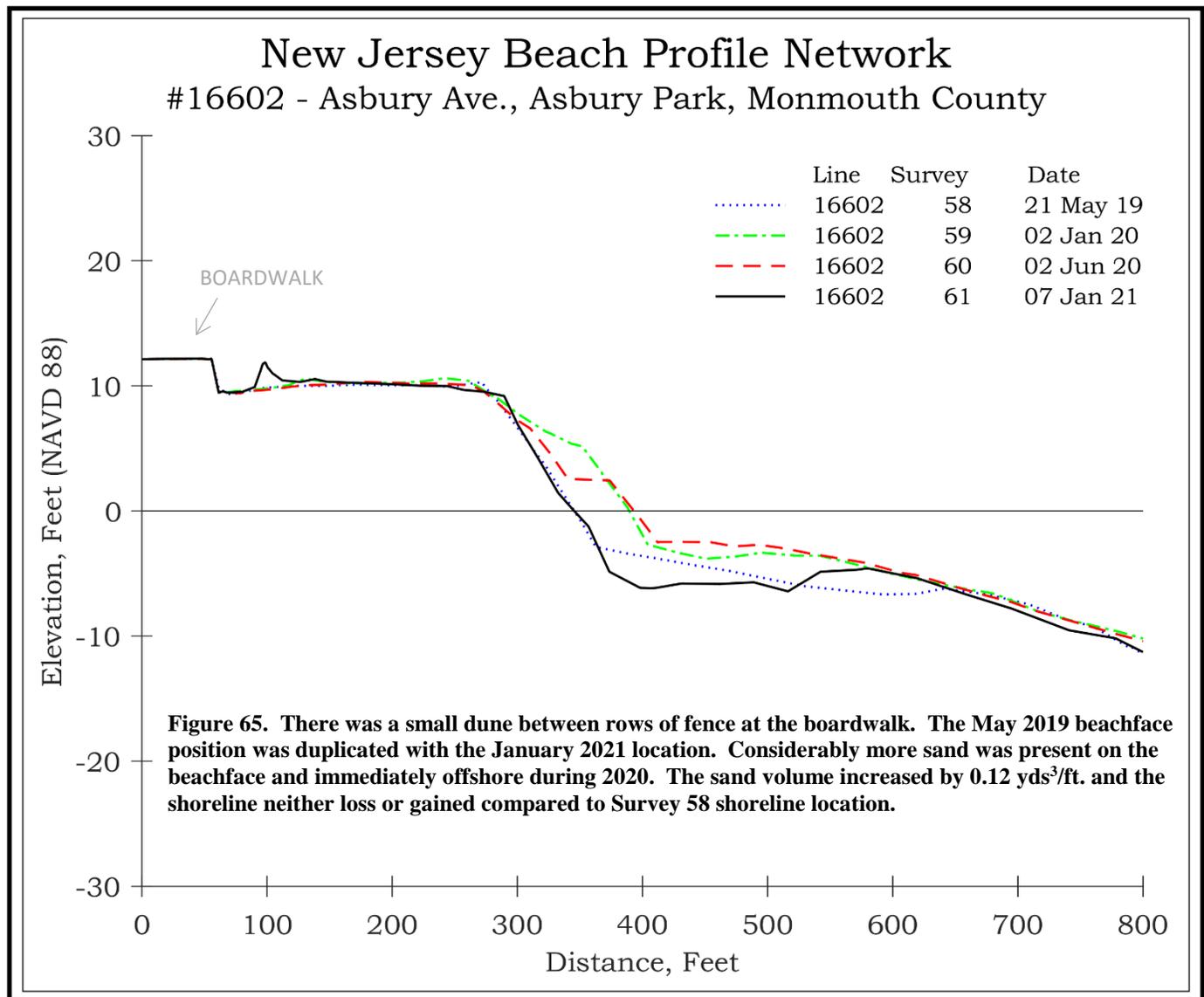
The left view was taken Jan. 11, 2020, showing the berm crest and the exposed groins along with a comparison of the beachface slope position with the Asbury Park convention center building. The right photo presents a very similar view of the beach, revealing slightly more of the Asbury Park boardwalk.



NJBPN 16602 – Asbury Avenue, Asbury Park



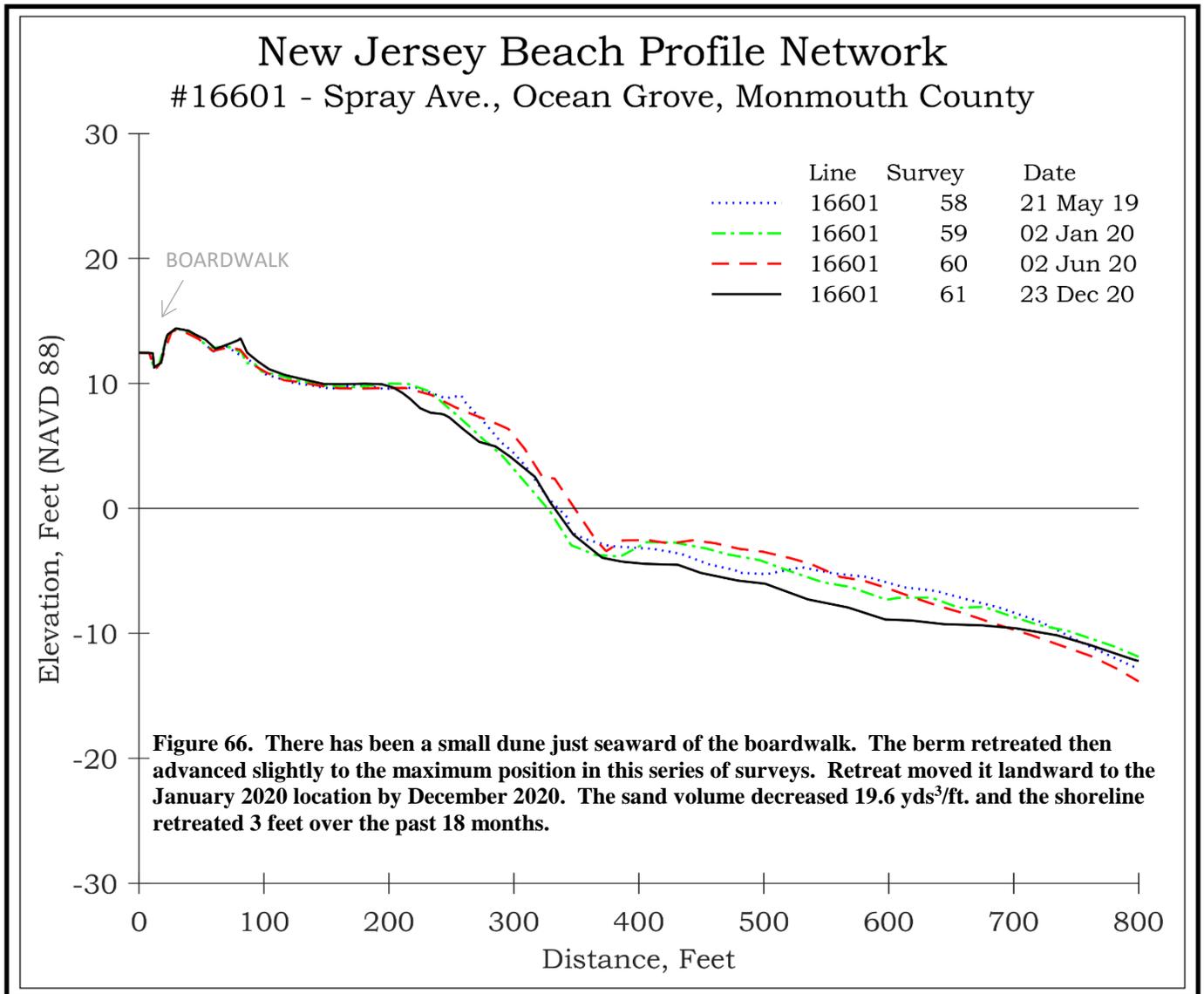
The left view was taken between a double row of sand fence on Jan 2, 2020. The right photo shows where sand has begun to collect between the two rows of fencing (Jan. 7, 2021).



NJBPN 16601 – Spray Avenue, Ocean Grove



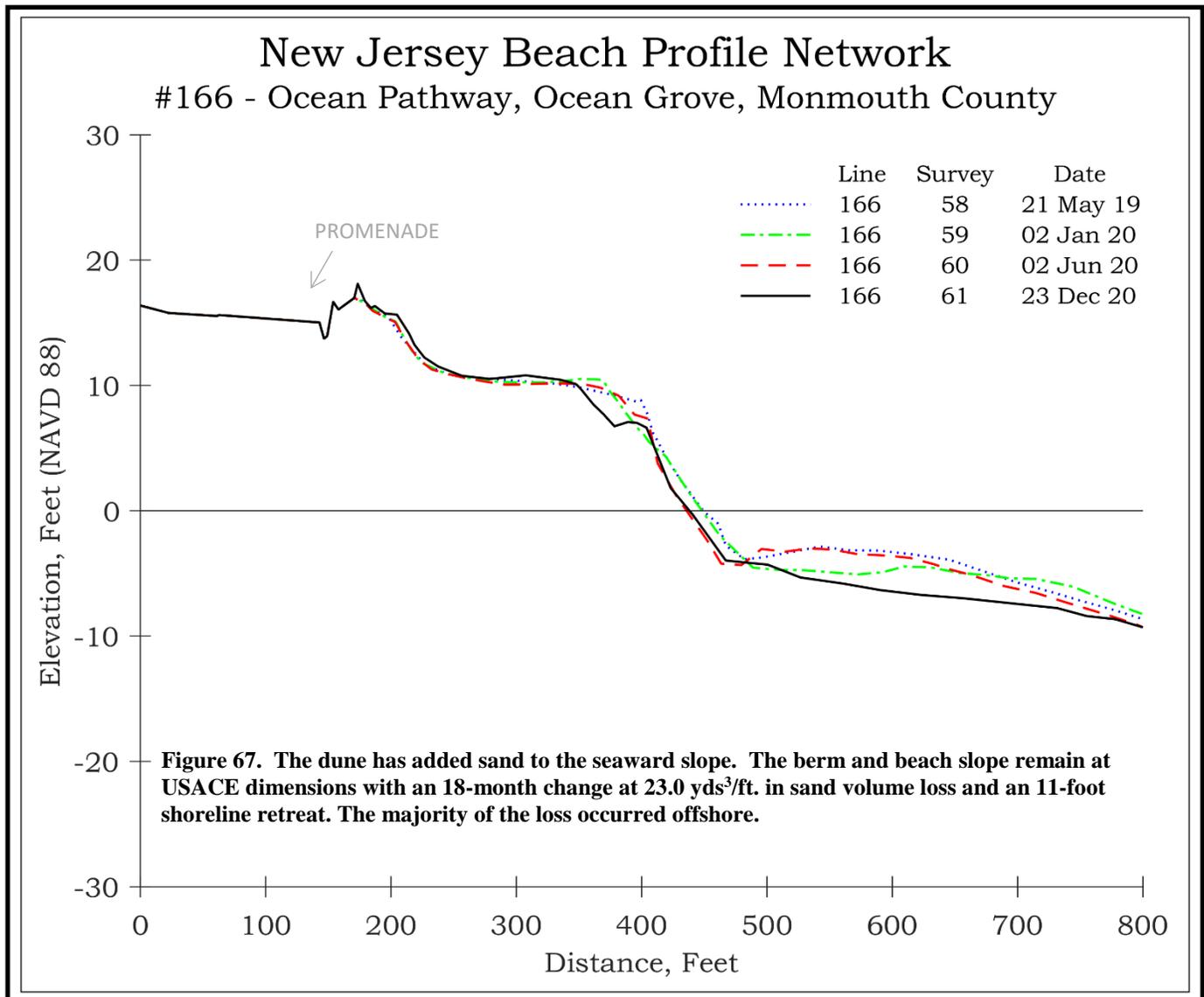
The Jan 2, 2020 view on the left shows the dune toe with grass plants extending onto the foredune slope as conditions continue to improve in the Ocean Grove dunes. The December 23, 2021 view on the right presents the same perspective, showing more dune grass, as well as some buried sand fencing.



NJBPN 166 – Ocean Pathway, Ocean Grove



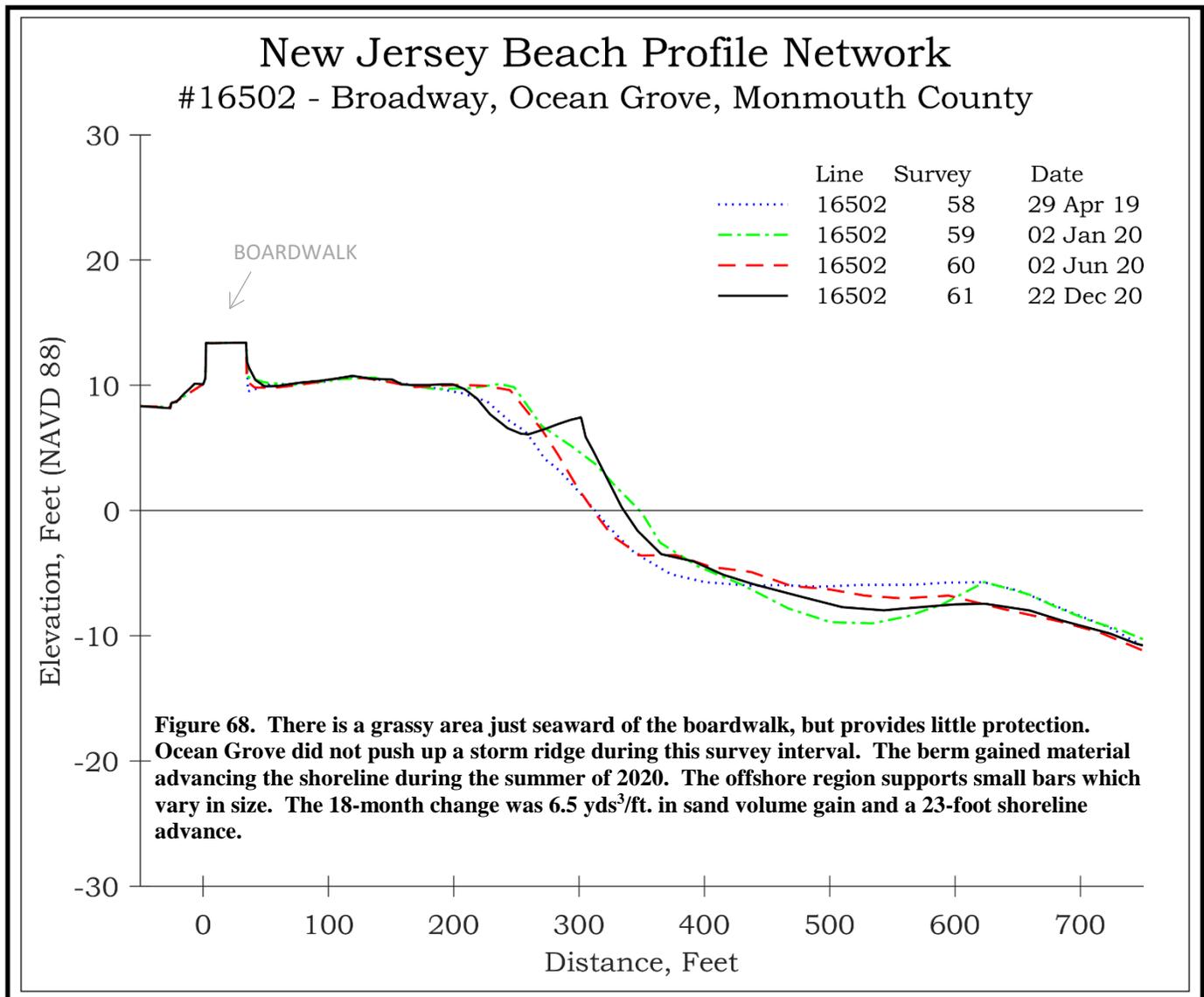
The Jan. 2, 2020 view on the left shows the new service building put on the seaward dune toe and the dry beach width present at the time. The December 23, 2020 view on the right provides a closer view of the access path, just in front of the building pictured on the left.



NJBPN 16502 – Broadway, Ocean Grove



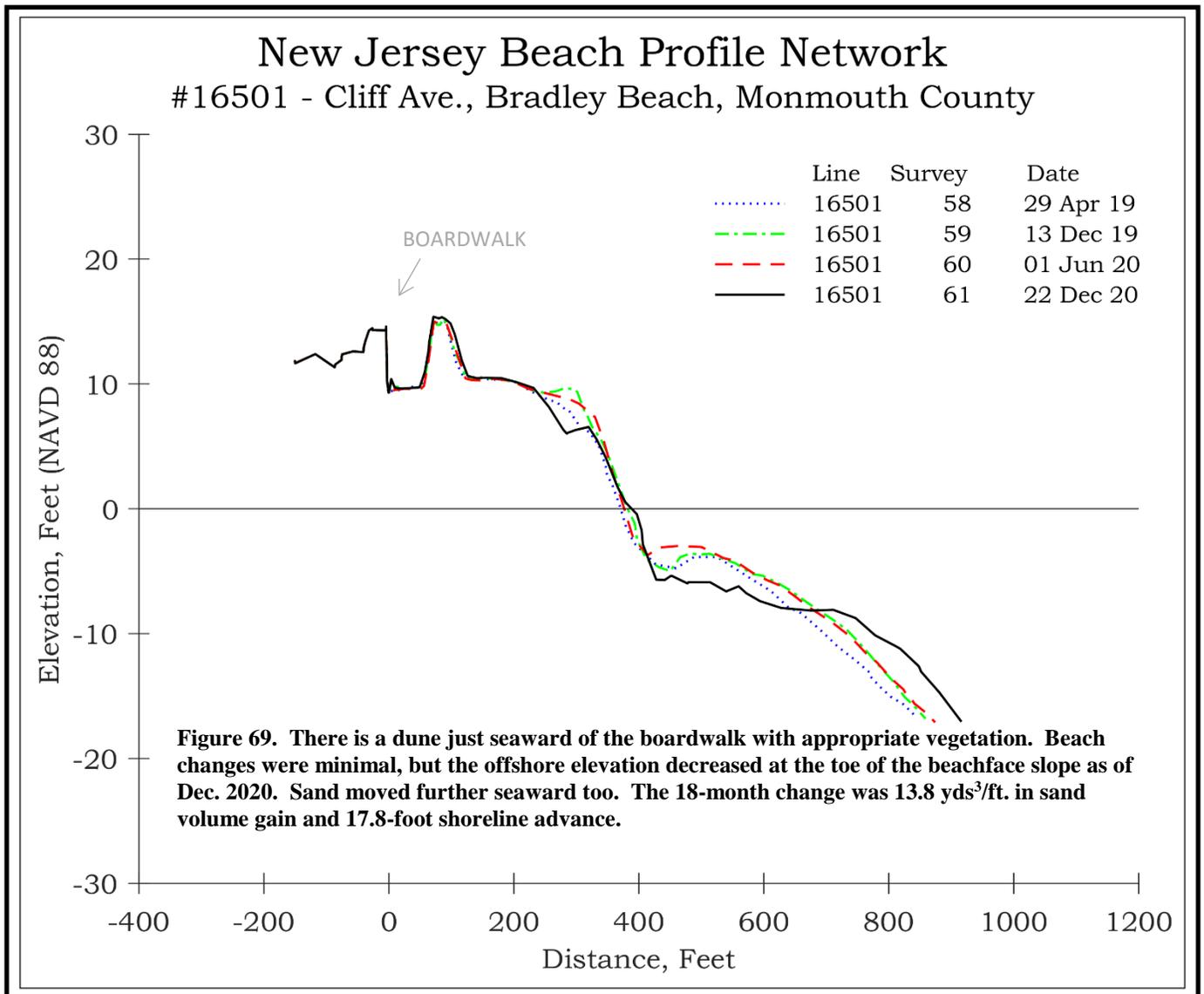
The left view from Jan. 2, 2020 shows the beach width and seaward dune slope without pushed up material. The photo on the right, taken December 23, 2020, provides a look at the berm during a lower tide.



NJBPN 16501 – Cliff Avenue, Bradley Beach



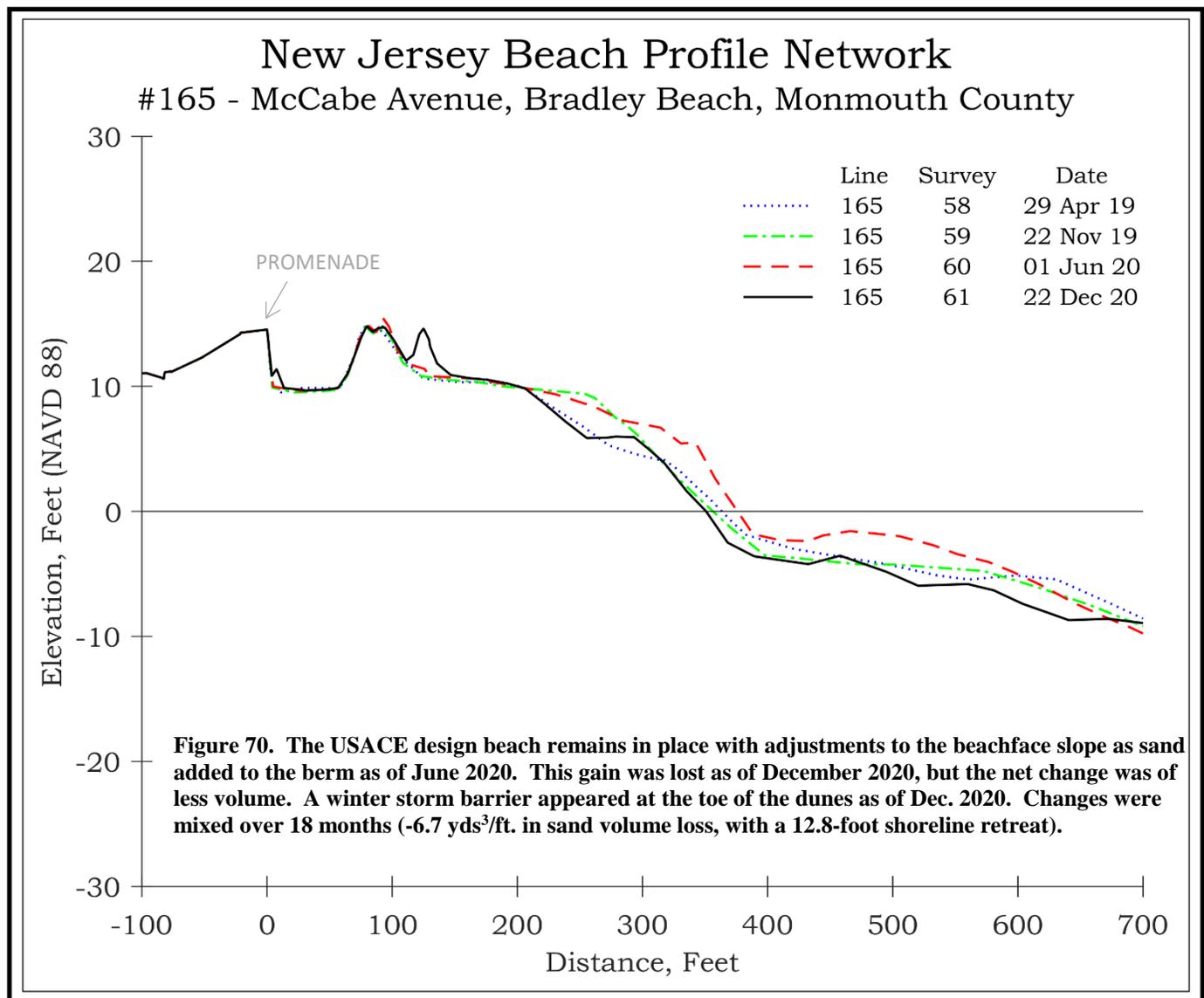
The Dec. 12, 2019 view on the right was taken at the dune crest looking north showing the open space landward of the dunes and the beach width seaward. The December 22, 2020 photo on the right was taken at the same position, showing the dune grass layered by wind-deposited sand.



NJBPN 165 – McCabe Avenue, Bradley Beach



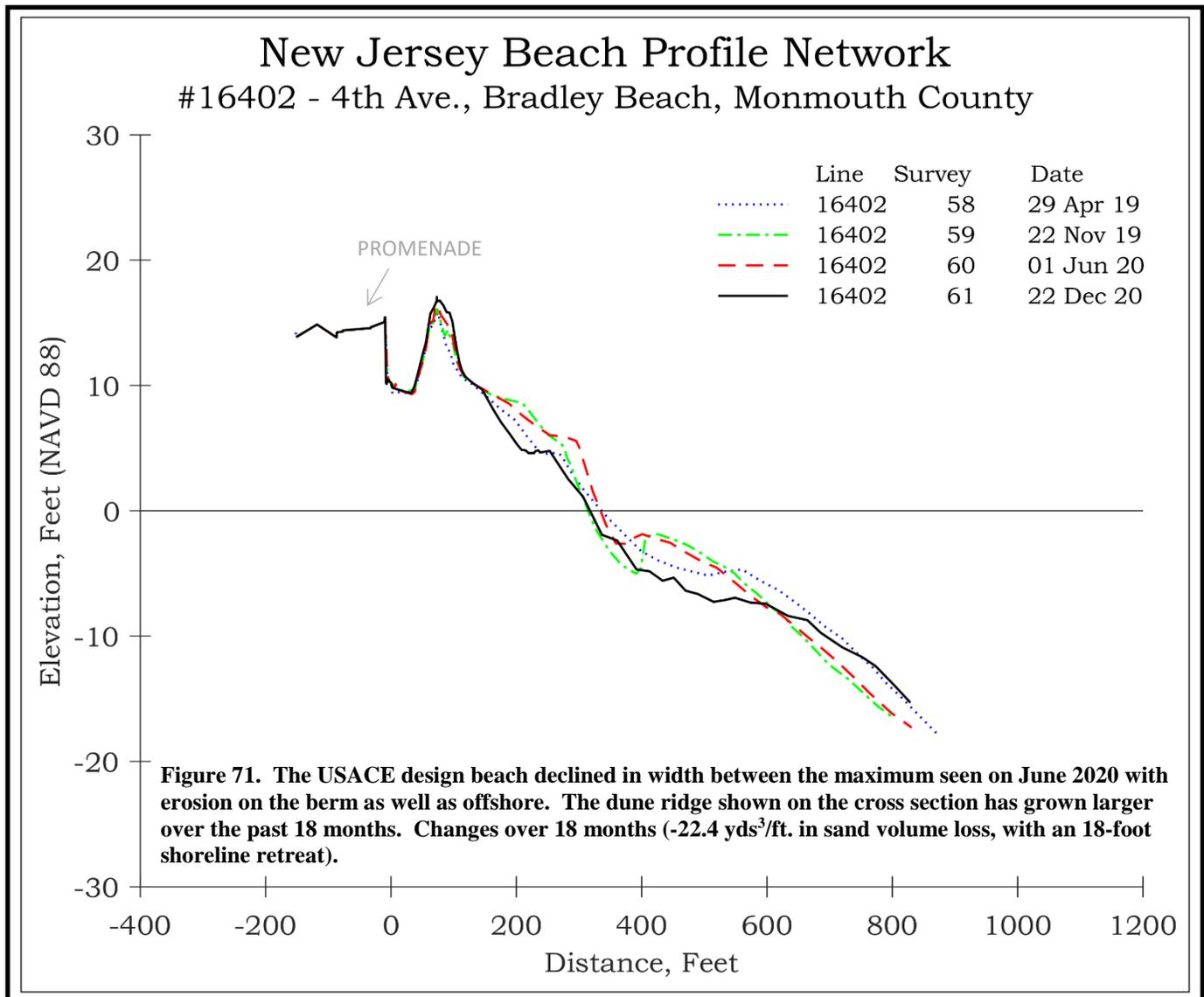
The Nov. 22, 2019 view (left), shows the dunes and the dry beach with conditions appearing to be stable. The right view (December 22, 2020) atop the crest, shows the continued growth of dune grass, as well as the addition of fencing.



NJBPN 16402 – 4th Avenue, Bradley Beach



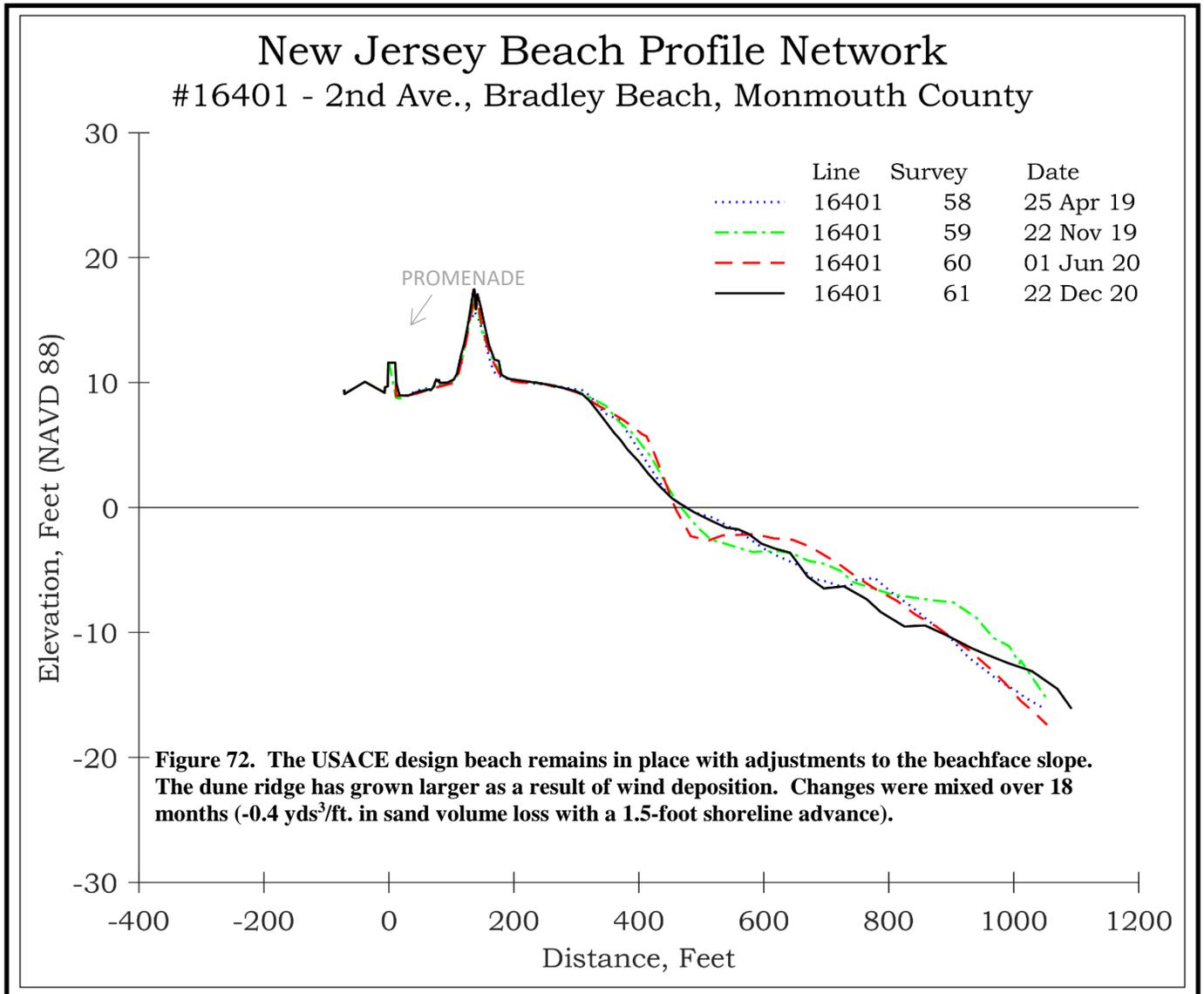
A dune lies seaward of the promenade with a wide space between it and the boardwalk. The Nov. 22, 2019 view on the left was taken from the dune crest showing both the beach and the promenade. The right-hand photo shows the crest in a similar orientation, however, a significant amount of wind deposited sand was added on top of the dune grass.



NJBPN 16401 – 2nd Avenue, Bradley Beach



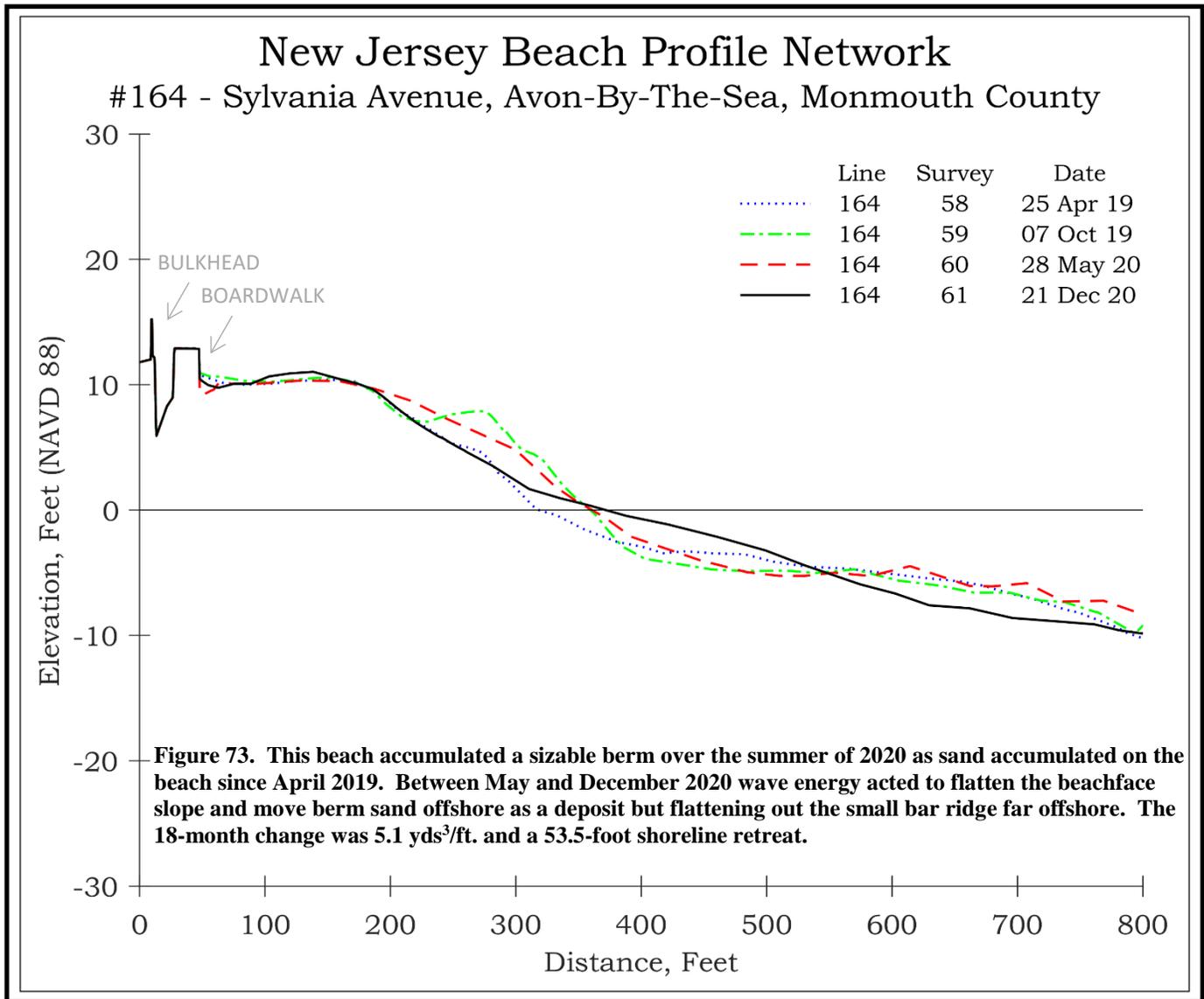
The Nov. 22, 2019 view on the left shows extensive grass growth from the prior year and sand added to the seaward slope as well. The December 22, 2020 view on the right shows the dune grass blanketed by wind deposited sand, causing the ridge to grow.



NJBPN 164 – Sylvania Avenue, Avon-by-the Sea



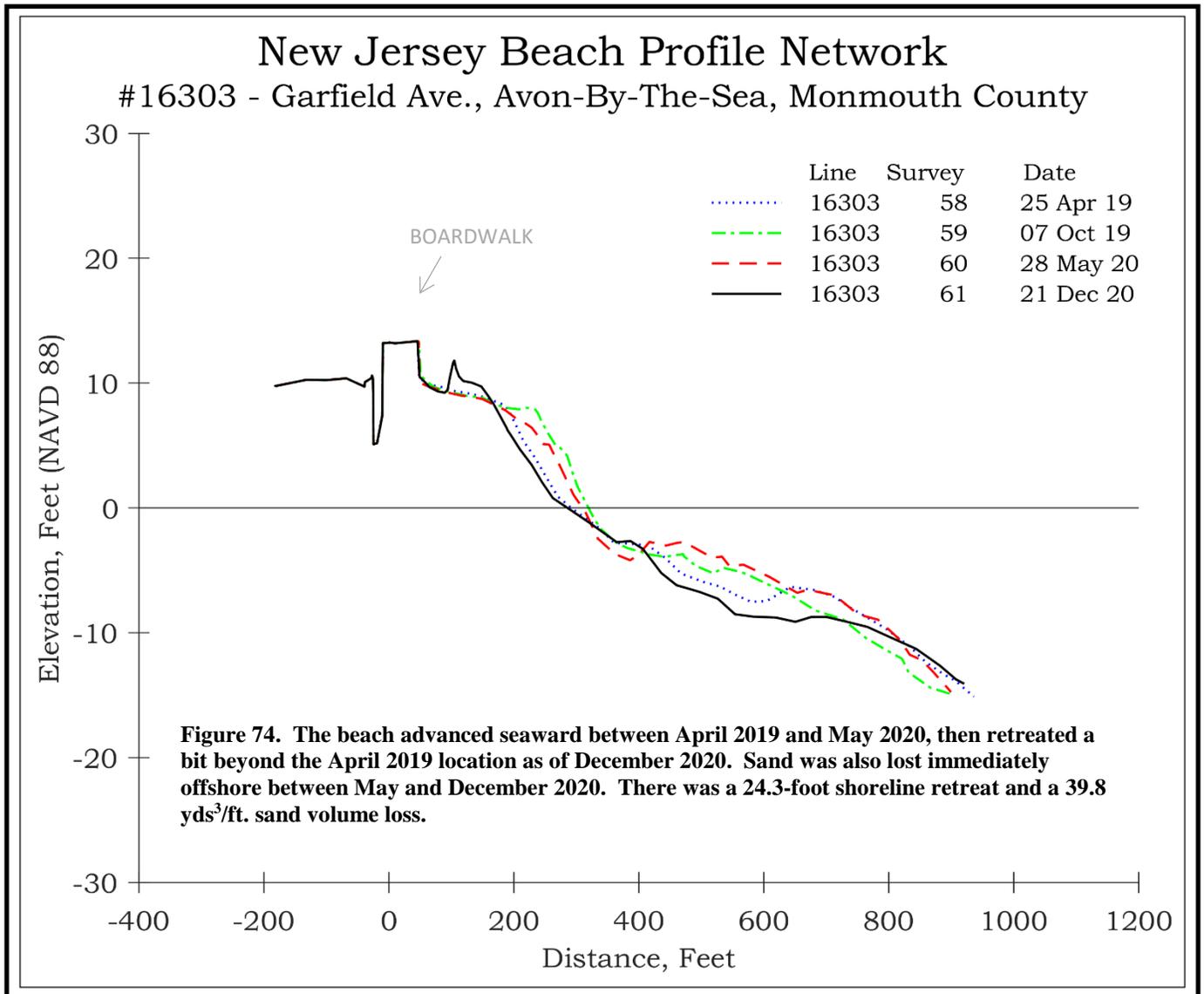
This site is located north of the Shark River Inlet. The left view on October 11, 2019 taken on the berm crest, shows the beach width and configuration around the groins on the beach north of the inlet jetties. The December 21, 2021 photo (right), shows a similar beach profile, with some darker minerals in the sand separated by the swash.



NJBPN 16303 – Garfield Avenue, Avon-by-the Sea



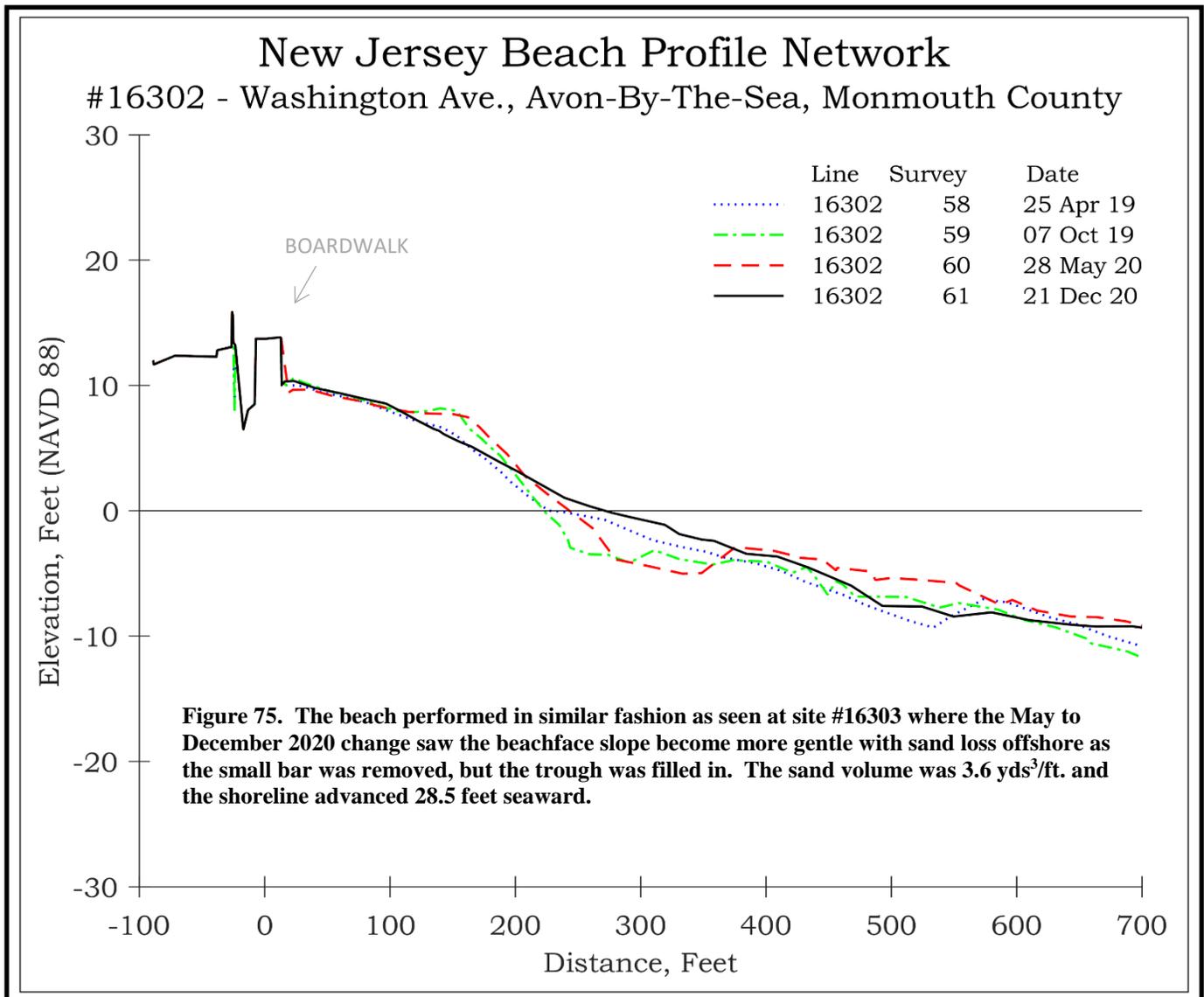
Sand has accumulated at the boardwalk in the absence of any dune system. The beach as of Oct. 10, 2019 is free of the fencing and the dry beach width is substantial (left). The photo on the right, taken December 21, 2020 shows another fence system present, as well as some wind deposition collecting against the boardwalk.



NJBPN 16302 – Washington Avenue, Avon-by-the Sea



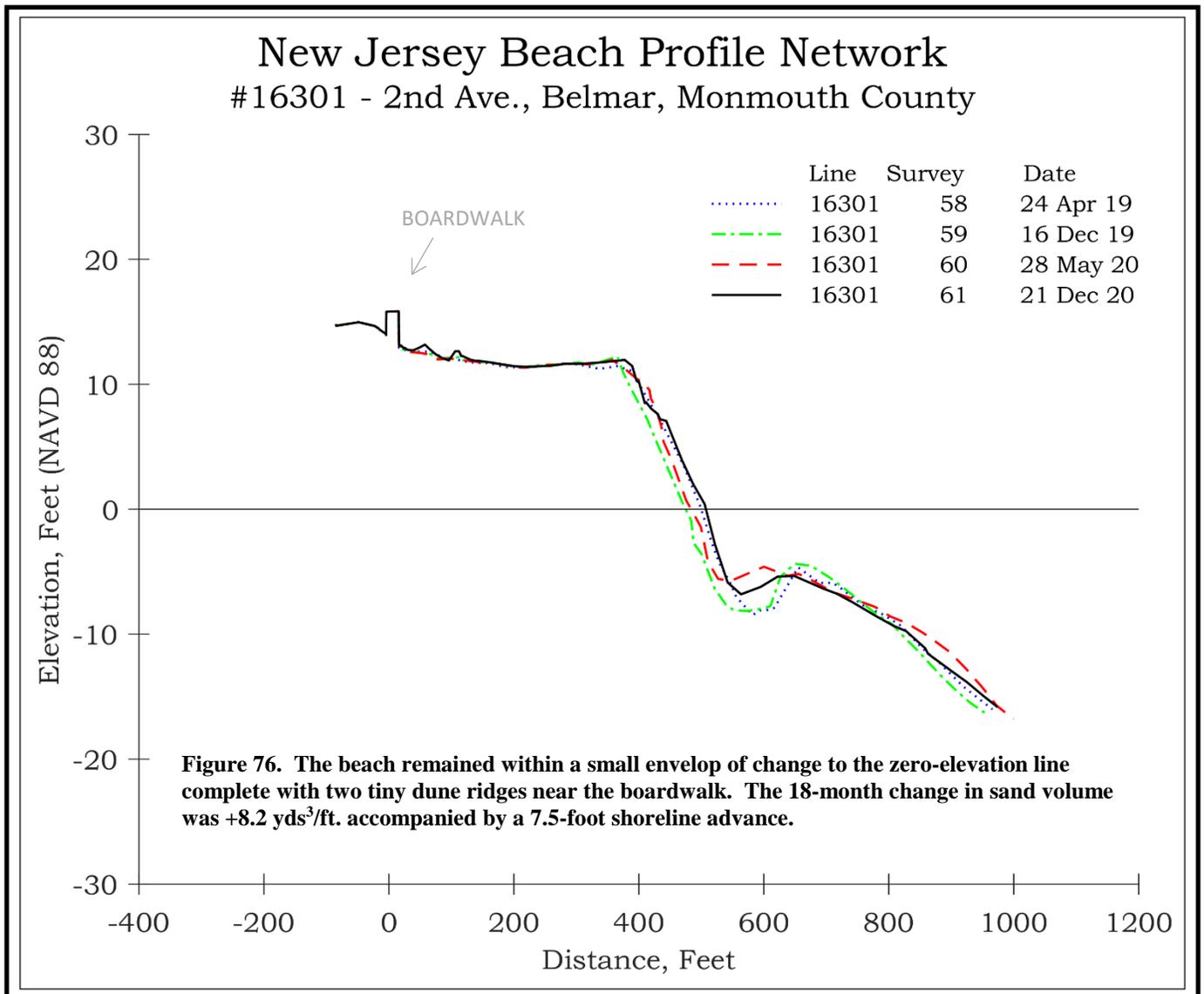
This new site is located approximately 300 ft. north of the Shark River Inlet north jetty. The October 7, 2019 view on the left was taken at the boardwalk looking north along the dry beach with the fencing removed. The right-side photo, taken December 21, 2020 shows the same view of the beach, along with an area where water seems to have collected.



NJBPN 16301 – 2nd Avenue, Belmar



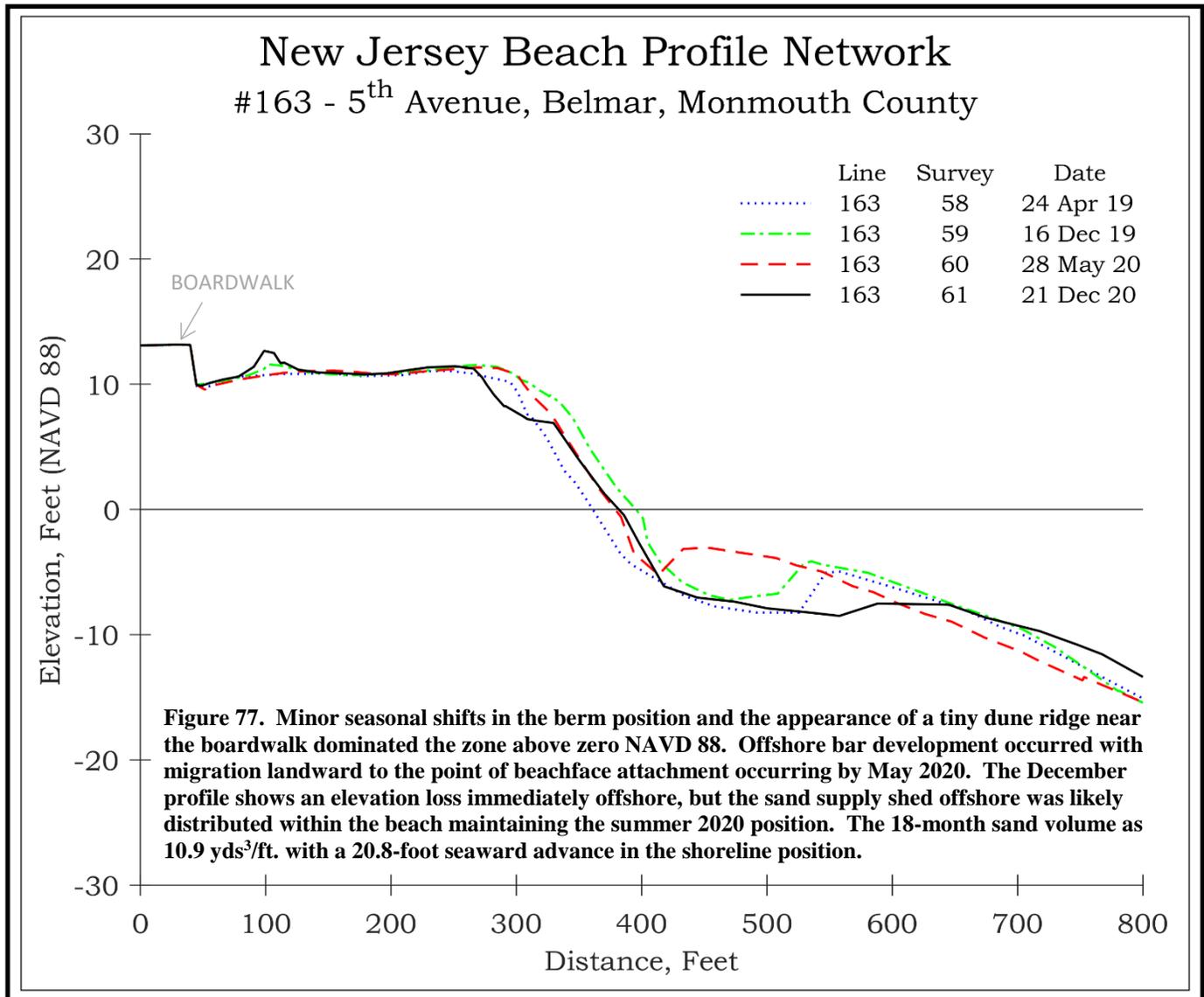
The northernmost site in Belmar includes a 450-ft wide beach with no dune. The Shark River Inlet jetty can be seen behind the pier supports north of this site. The beach width as measured by the pier pilings as of Oct. 7, 2019 is slightly seaward of the same view on the right taken Dec. 21, 2020.



NJBPN 163 – 5th Avenue, Belmar



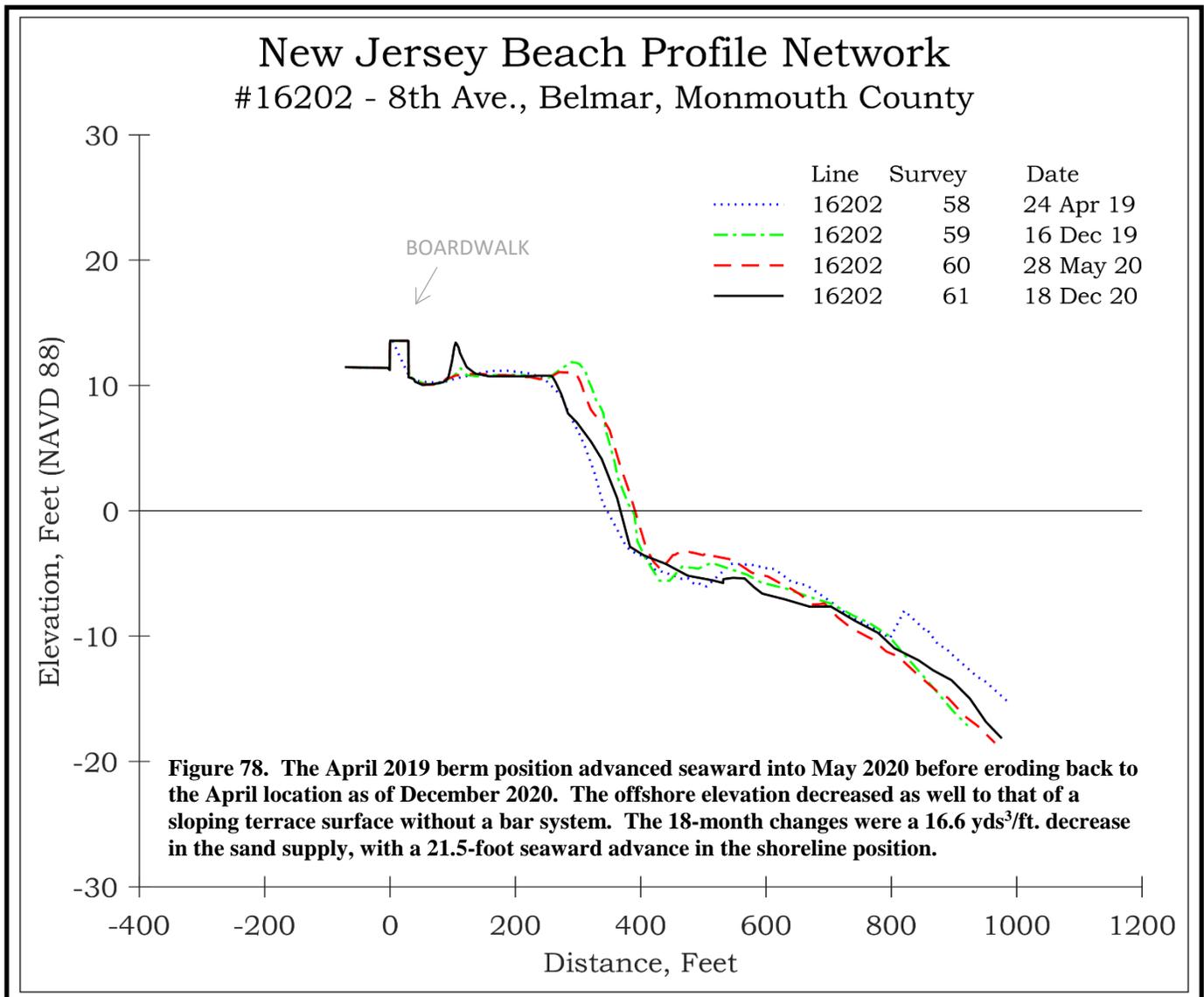
This site never has had a dune but had a wide, dry beach. By October 7, 2019 (left photo) the shoreline was in a similar position as it was the year prior due to sand trapping by the Shark River Inlet jetty. The right photograph, taken December 18, 2020 show the generous if flat expanse of dry beach.



NJBPN 16202 – 8th Avenue, Belmar



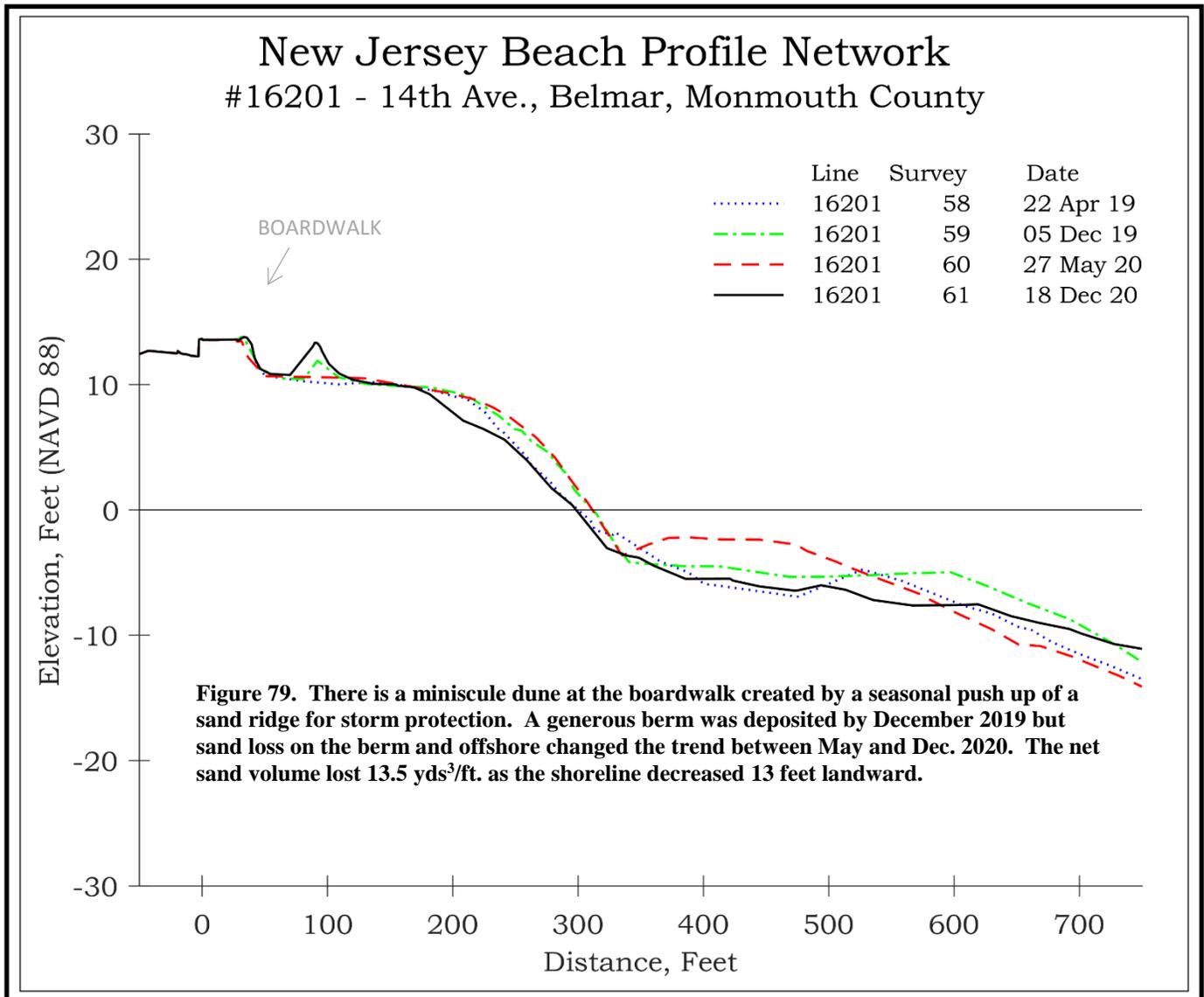
The boardwalk is the backstop for the beach, since there is no dune system. The Dec. 13, 2019 view on the left shows the fencing at the boardwalk put in to lessen wind transport into Ocean Avenue during the winter. The right-side photo shows that same area a year later in a similar condition (December 18, 2020).



NJBPN 16201 – 14th Avenue, Belmar



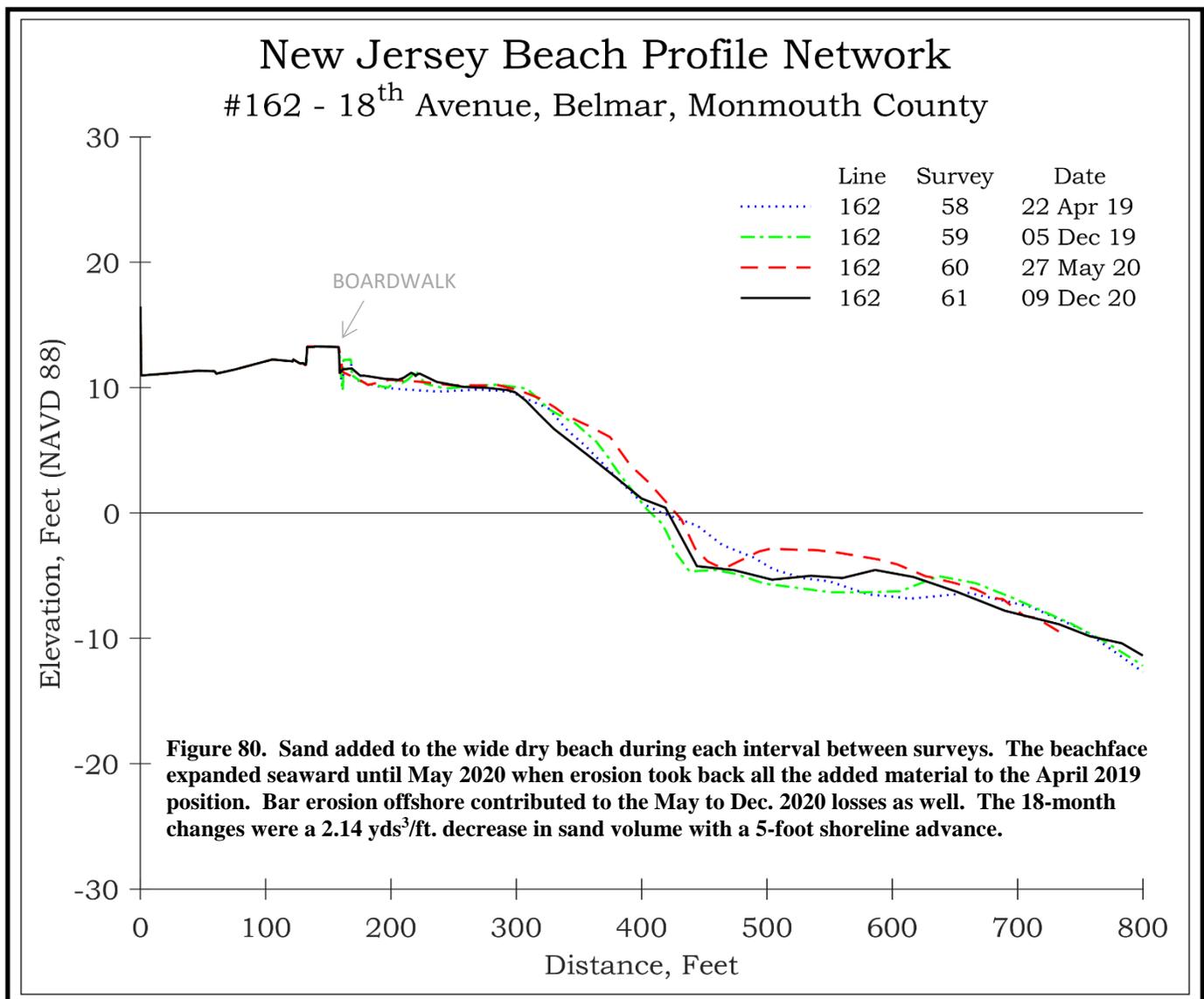
The 14th Avenue site does have a tiny dune feature immediately seaward of the boardwalk. As of Dec. 5, 2019, this ridge was present, removed as of May 2020, and returned once more in a larger size as of Dec. 2020. The beachface slope advanced and then retreated over the four surveys and the loss continued offshore between May and Dec. 2020. The net 18-month change was a gain of 6 yds³/ft. and a small 1.75-foot shoreline decrease.



NJBPN 162 – 18th Avenue, Belmar



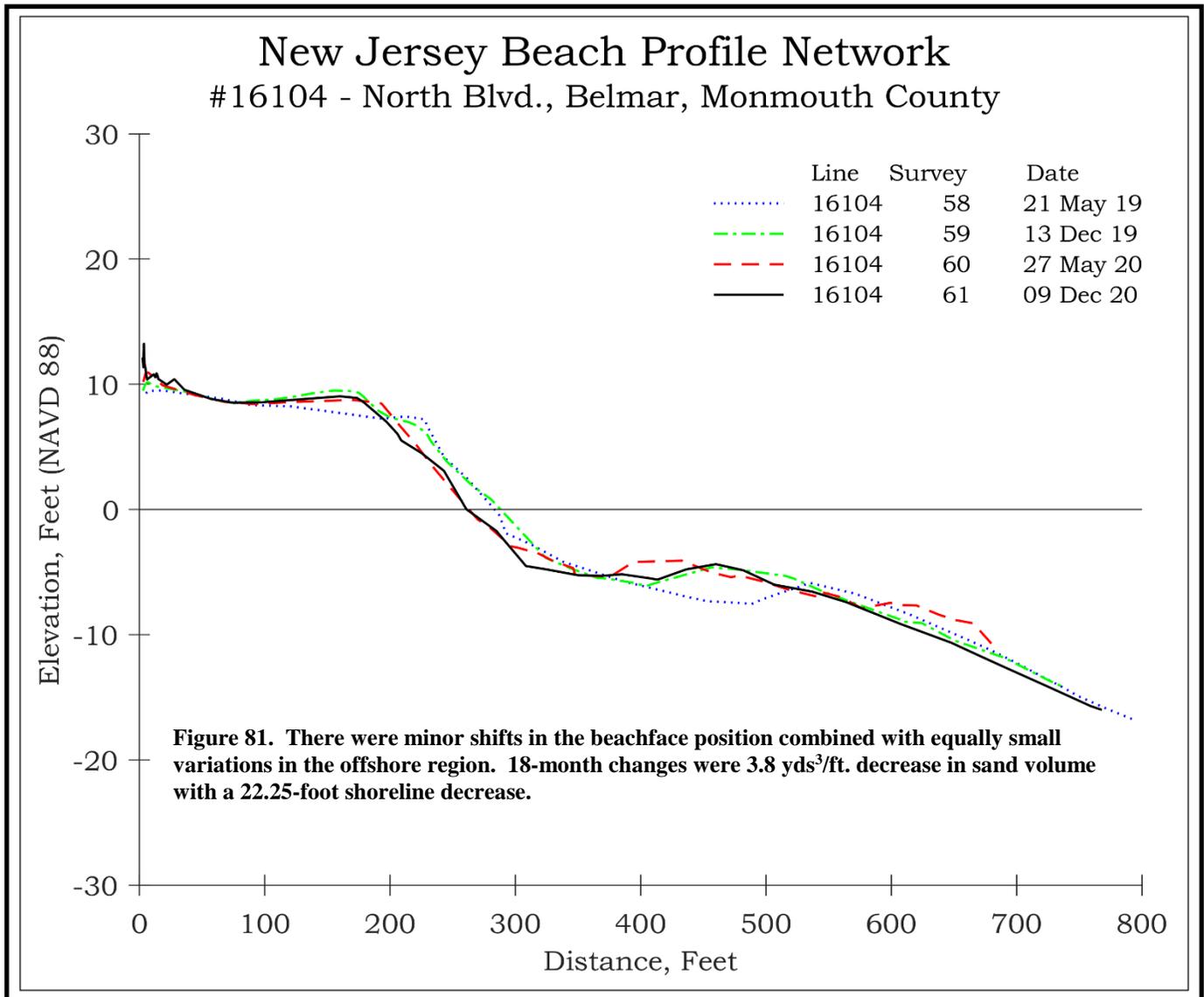
The December 5, 2019 view (left) taken at a sand fence put in place to collect material from blowing into Ocean Avenue shows an uncluttered dry beach seaward. The photo included on the right-hand view taken December 9, 2020 presents an extremely similar photo of the 18th Avenue beach.



NJBPN 16104 – North Boulevard, Belmar



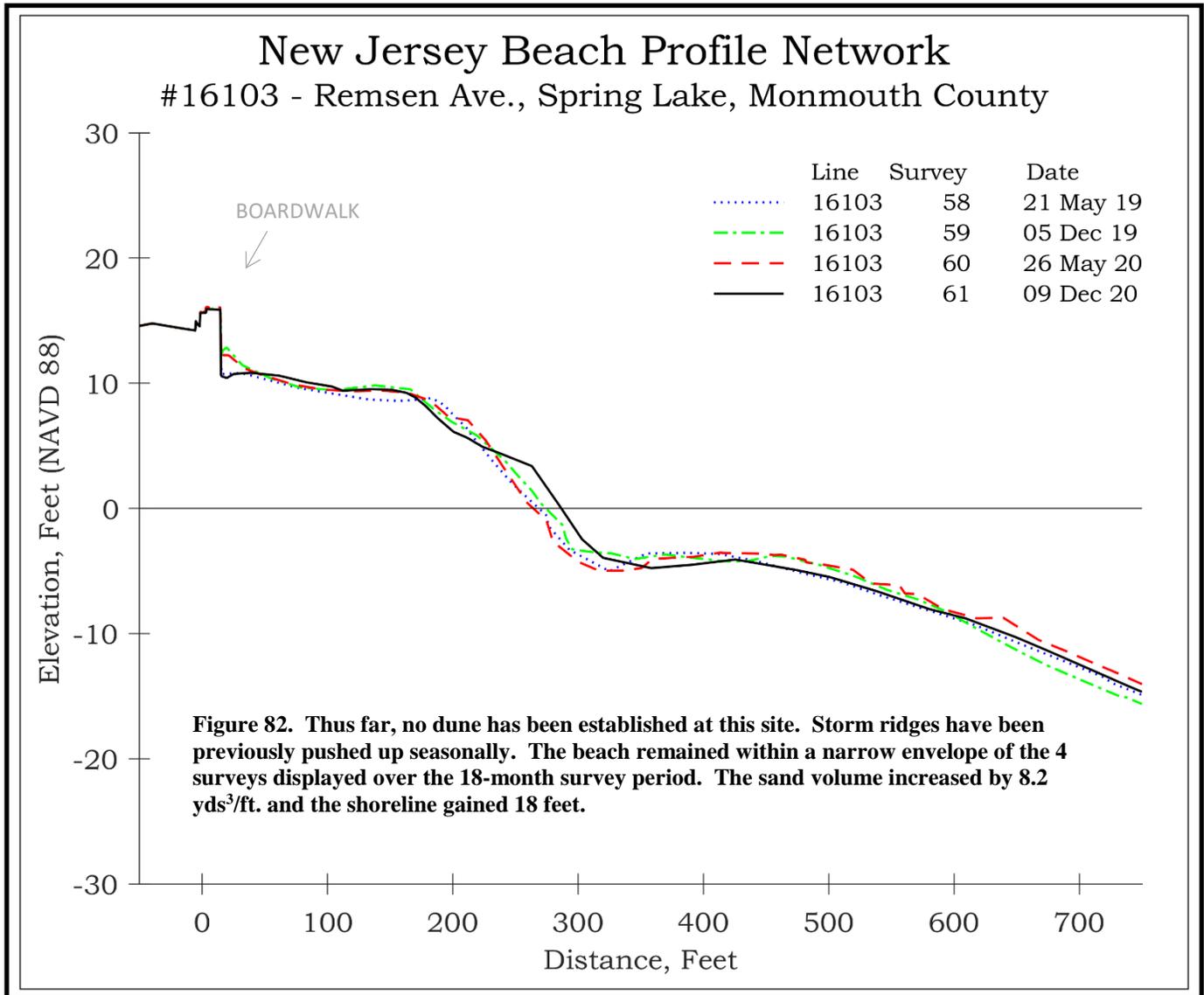
This site is located on the north side of Lake Como, the estuary lake between Belmar and Spring Lake. The Dec. 13, 2019 view on the left shows sand fencing instead of a storm ridge along this beachfront in southernmost Belmar. On December 9, 2020 a similar view to the north shows the wide beach and beachface slope.



NJBPN 16103 – Remsen Avenue, Spring Lake



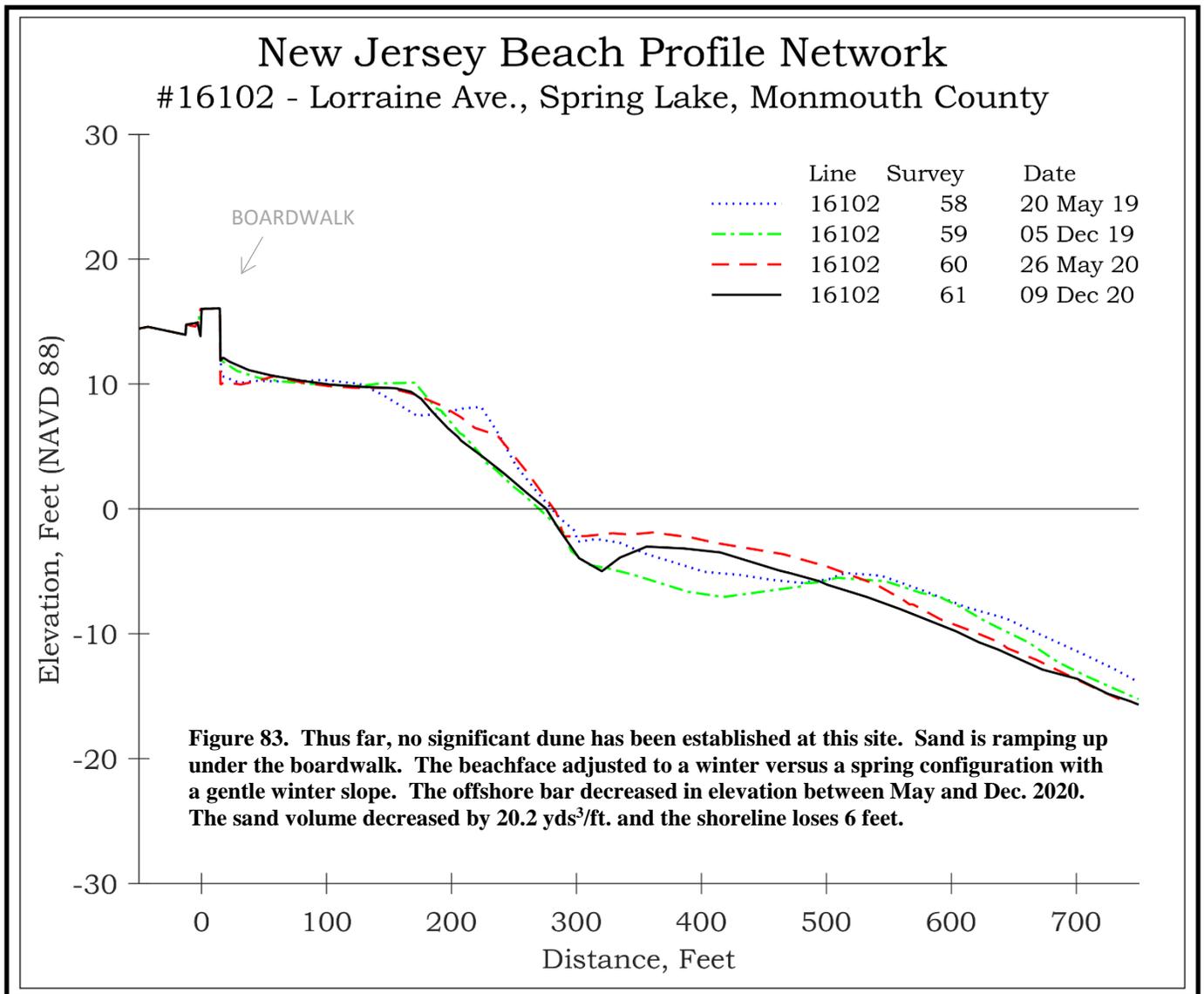
A grass strip separates Ocean Avenue and the boardwalk. On December 3, 2019 (left), sand had ramped up under the boardwalk as wind transport moved it landward. In Spring Lake sand dunes exist landward of the boardwalk between it and Ocean Avenue. The December 9, 2020 view of Remsen Avenue on the right shows a fence configuration to stop sand from blowing landward toward the boardwalk.



NJBPN 16102 – Lorraine Avenue, Spring Lake



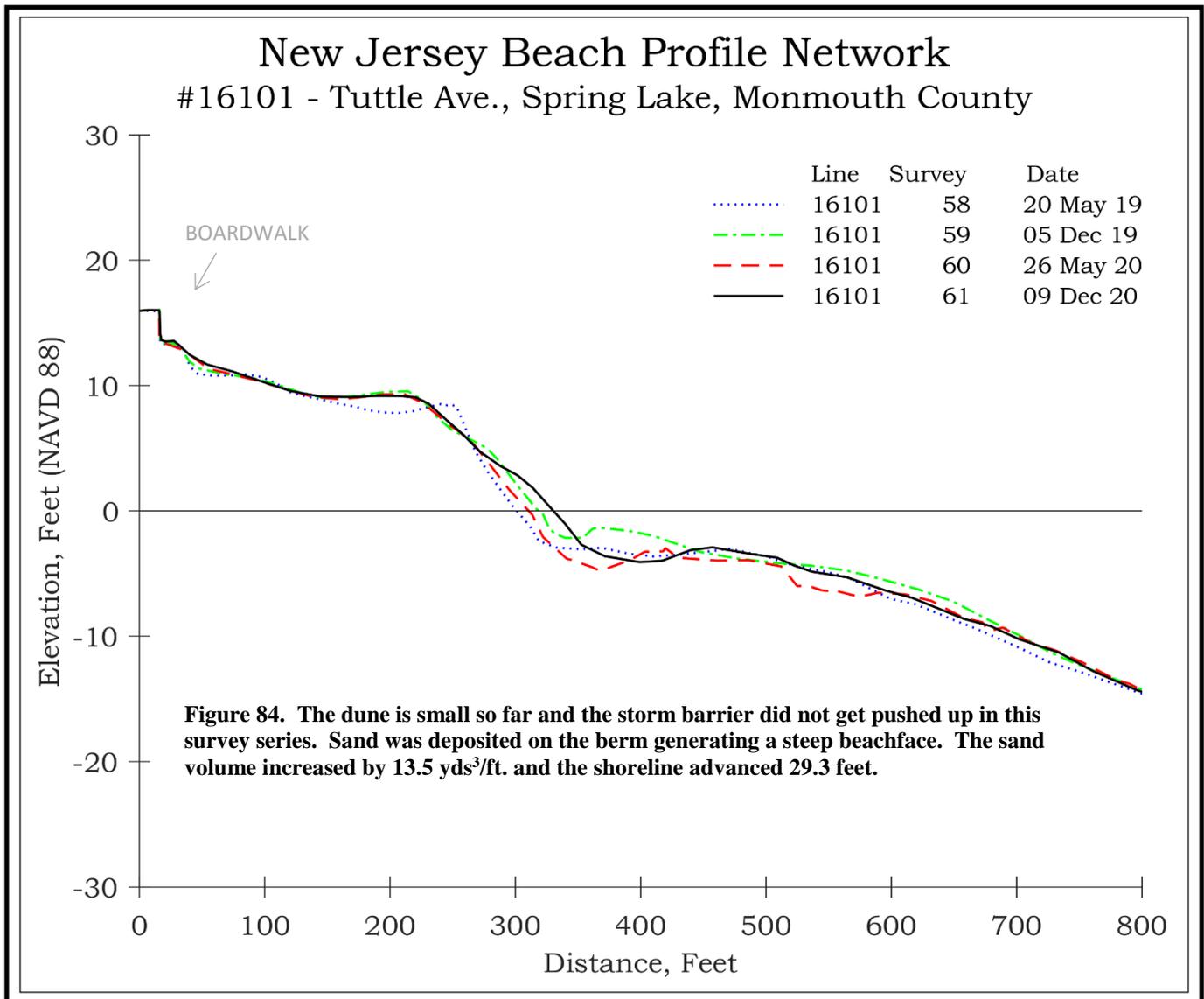
This site follows the same pattern as the site to the north with a boardwalk fronted by a 250-foot wide beach. The grass strip between the boardwalk and Ocean Avenue has no dune. Both the Oct. 2018 and the December 9, 2020 view show the seaward base of the boardwalk, with the wind deposited sand collected against it.



NJBPN 16101 – Tuttle Avenue, Spring Lake



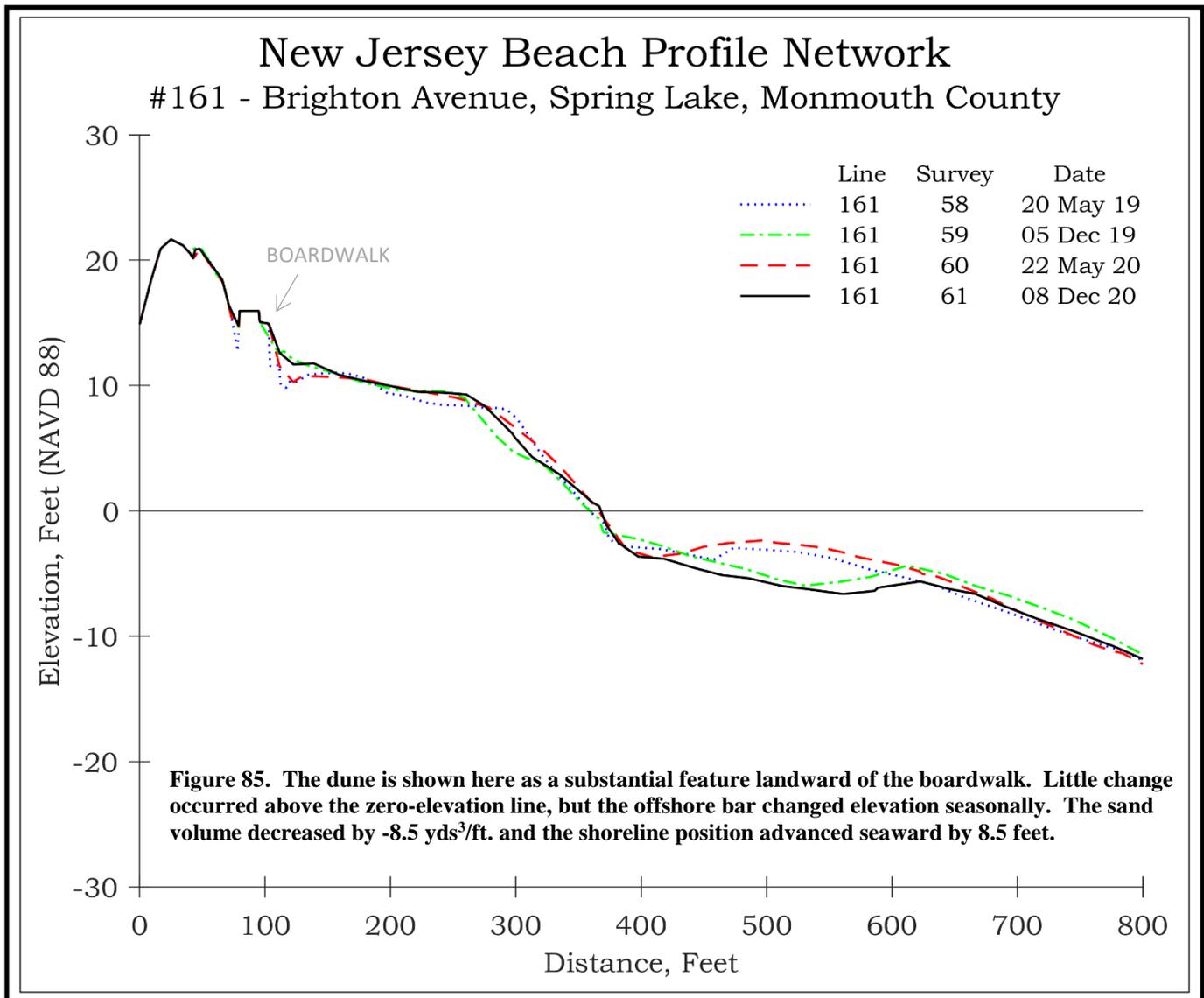
The Dec. 5, 2019 view shows sand accumulating under the boardwalk as the wind deposits the material there with some carried into the vegetated dunes present landward of the boardwalk. The December 9, 2020 view on the right shows a continued trend of wind deposited sand, to the point where it has filled the gap underneath the boardwalk.



NJBPN 161 – Brighton Avenue, Spring Lake



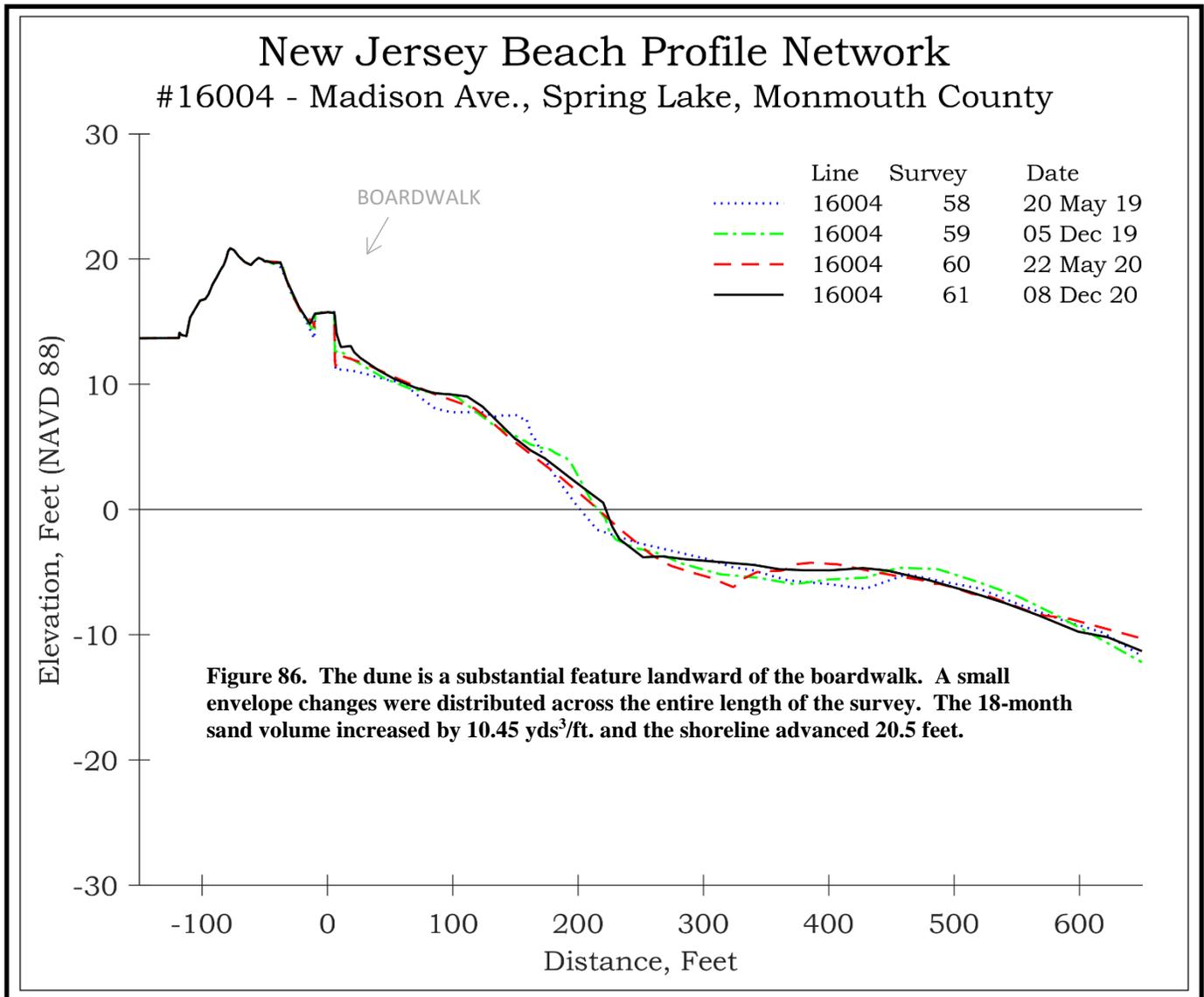
The left photo was taken Dec. 5, 2019 from the base of the boardwalk showing wind deposition at the structure because the dune is landward in Spring Lake. The December 8, 2020 view on the right shows a similar beach, with the storage sheds added.



NJBPN 16004 – Madison Avenue, Spring Lake



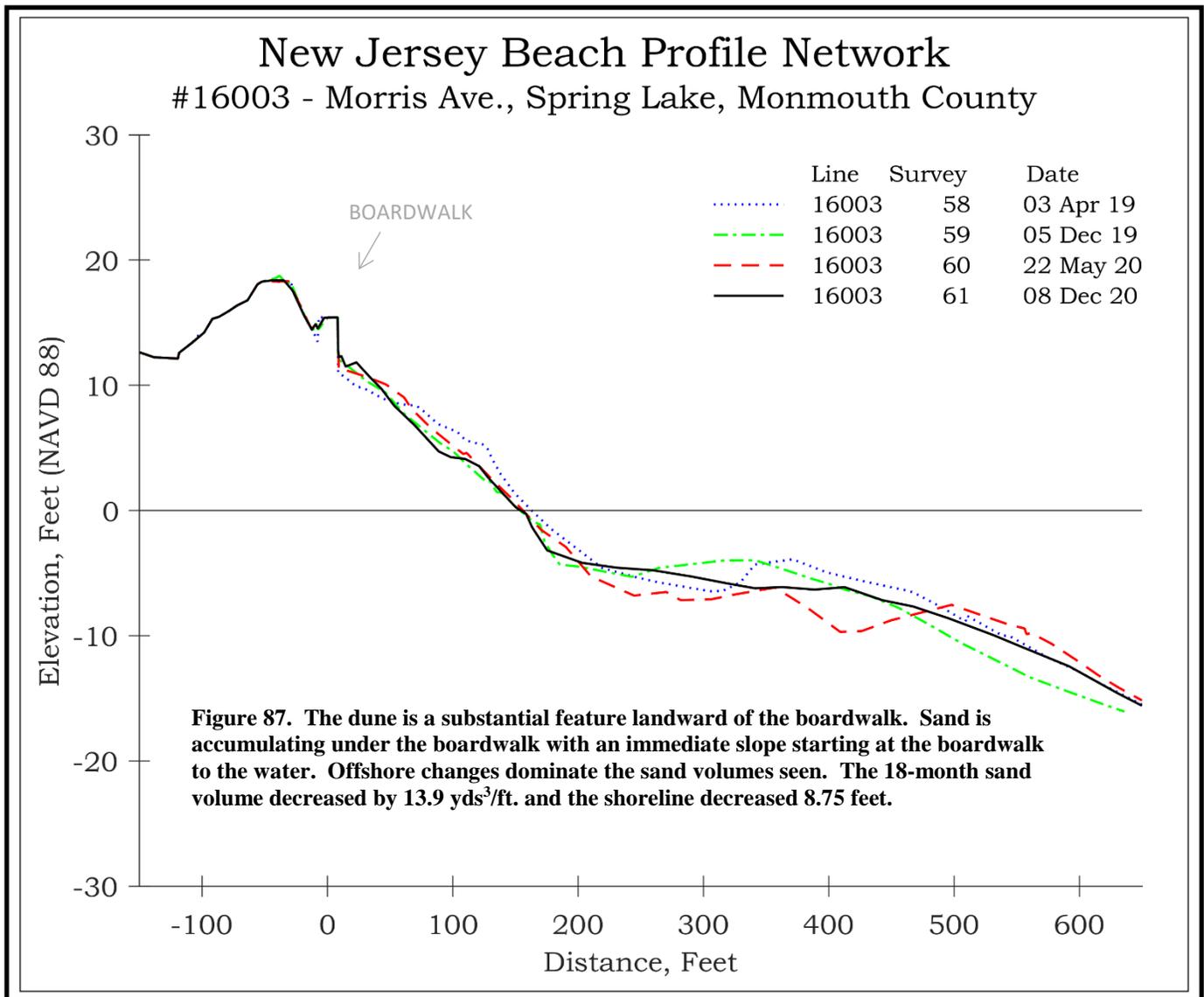
The dune is robust between Ocean Avenue and the boardwalk. The dune present at this site shows in the right photograph including the boardwalk and just a glimpse of the beach seaward. This dune view on Dec. 5, 2019 is to illustrate the Spring Lake dune system relative to the shoreline development. The right photograph illustrates the berm and beachface Dec. 2020.



NJBPN 16003 – Morris Avenue, Spring Lake



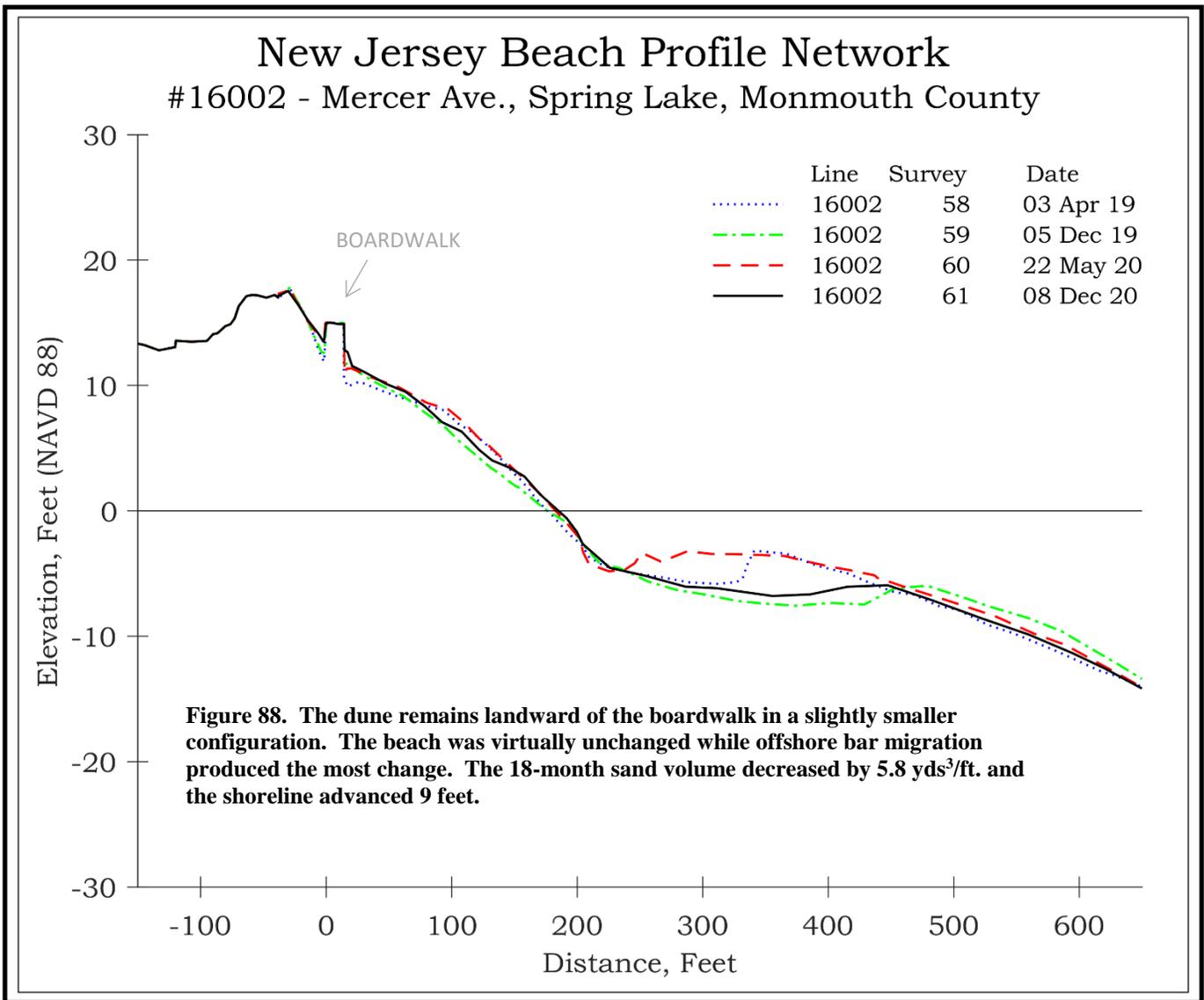
The left-hand photograph, taken on Dec. 5, 2019, shows the sand accumulating under the boardwalk, but some retreat in the beach width has occurred. The right-hand photo taken on December 8, 2020 shows a similar perspective.



NJBPN 16002 – Mercer Avenue, Spring Lake



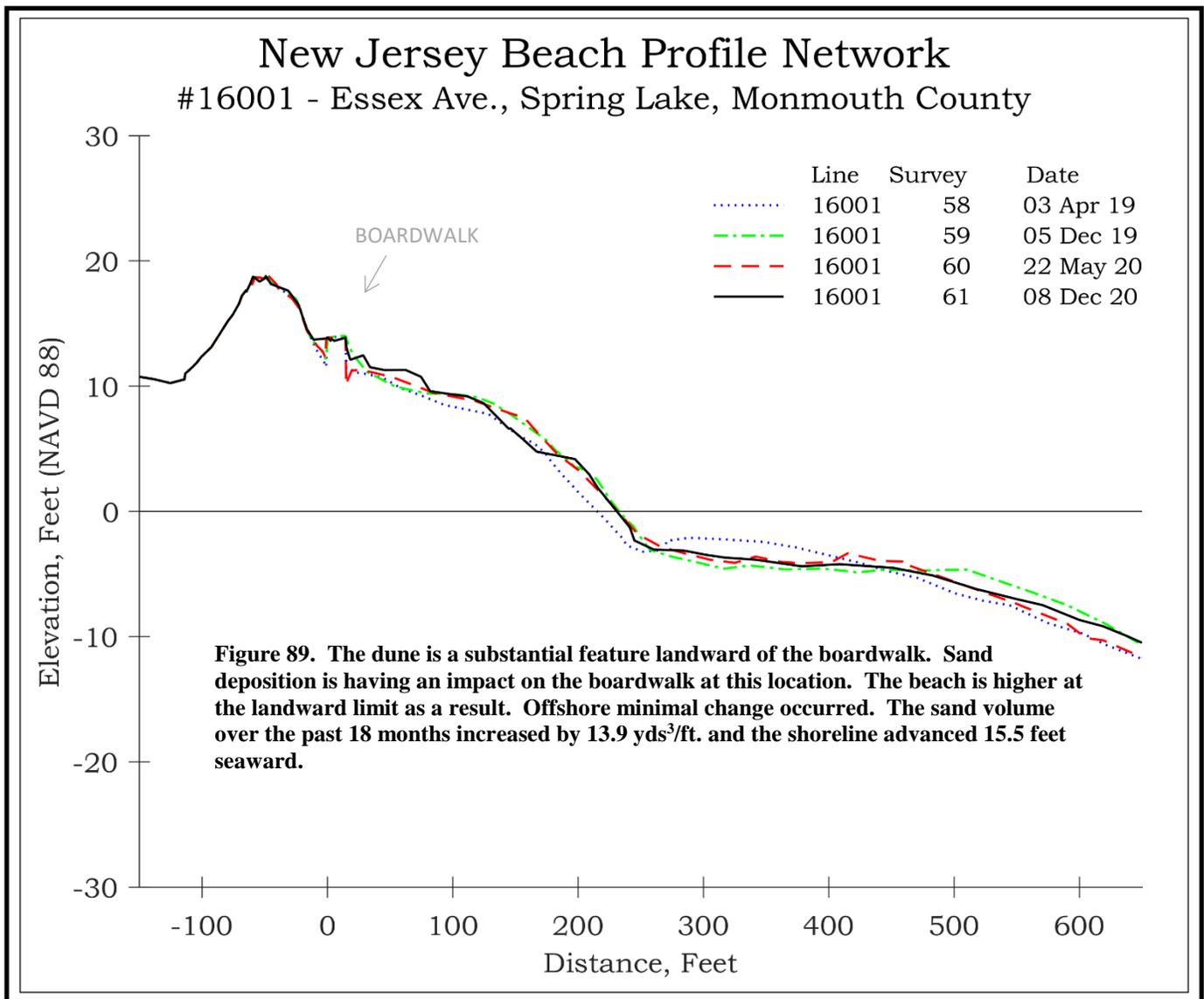
The dune is slightly lower and narrower at Mercer Avenue with a distinct separation from the boardwalk. The Dec. 5, 2019 view depicts the beach at the base of the boardwalk, and it appears to indicate a narrower beach than it had the year prior. The December 8, 2020 view on the right side shows the same perspective, facing north at the seaward base of the boardwalk, where a small sand ridge seems to have been constructed.



NJBPN 16001 – Essex Avenue, Spring Lake



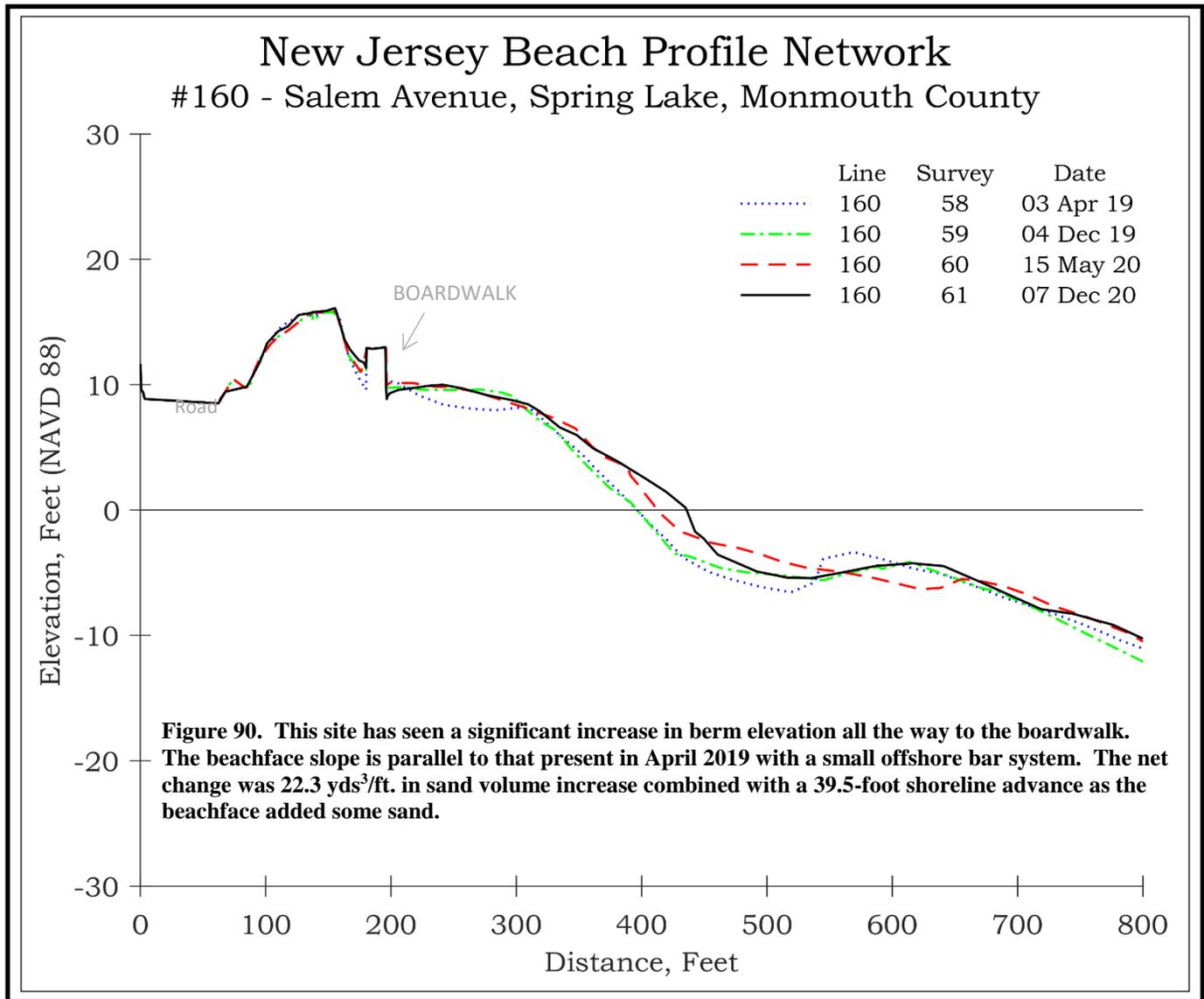
The dune/boardwalk combination are quite large as a storm barrier. The Dec. 5, 2019 view on the left demonstrates the sand deposition at the boardwalk ramping to the surface at this site. The right-hand side photo, taken atop the boardwalk on December 8, 2020, showcases sand blown onto the deck with no drop off at the landward edge..



NJBPN 160 – Salem Avenue, Spring Lake

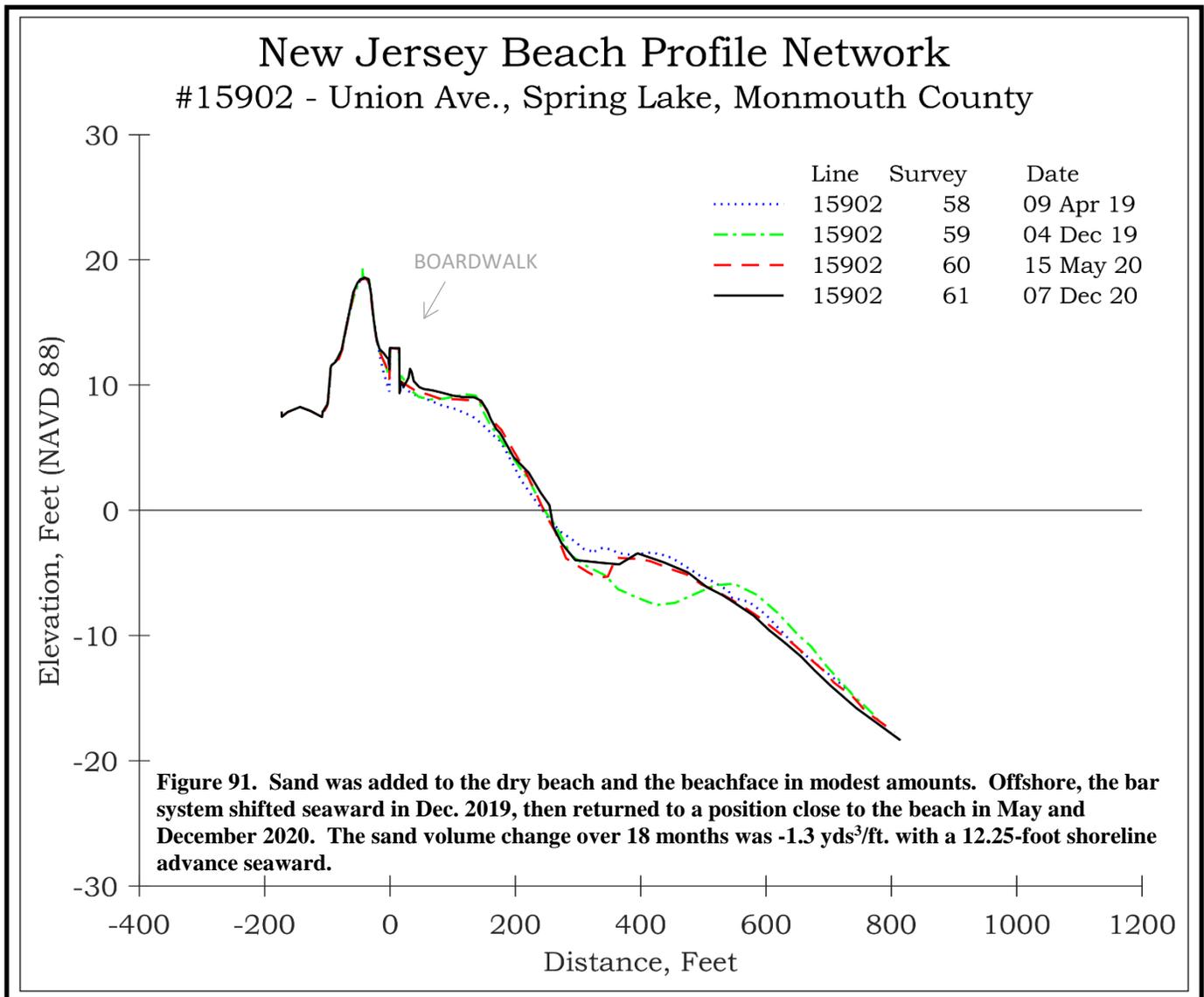


The Salem Avenue beach site lies just south of one of the municipal beach facilities. The left, the Dec. 3. 2019 shows the expanse of the beach during the winter, with a snow-covered boardwalk. The December 7. 2020 view on the right shows the same perspective of the beach, including the beginning of a construction project.





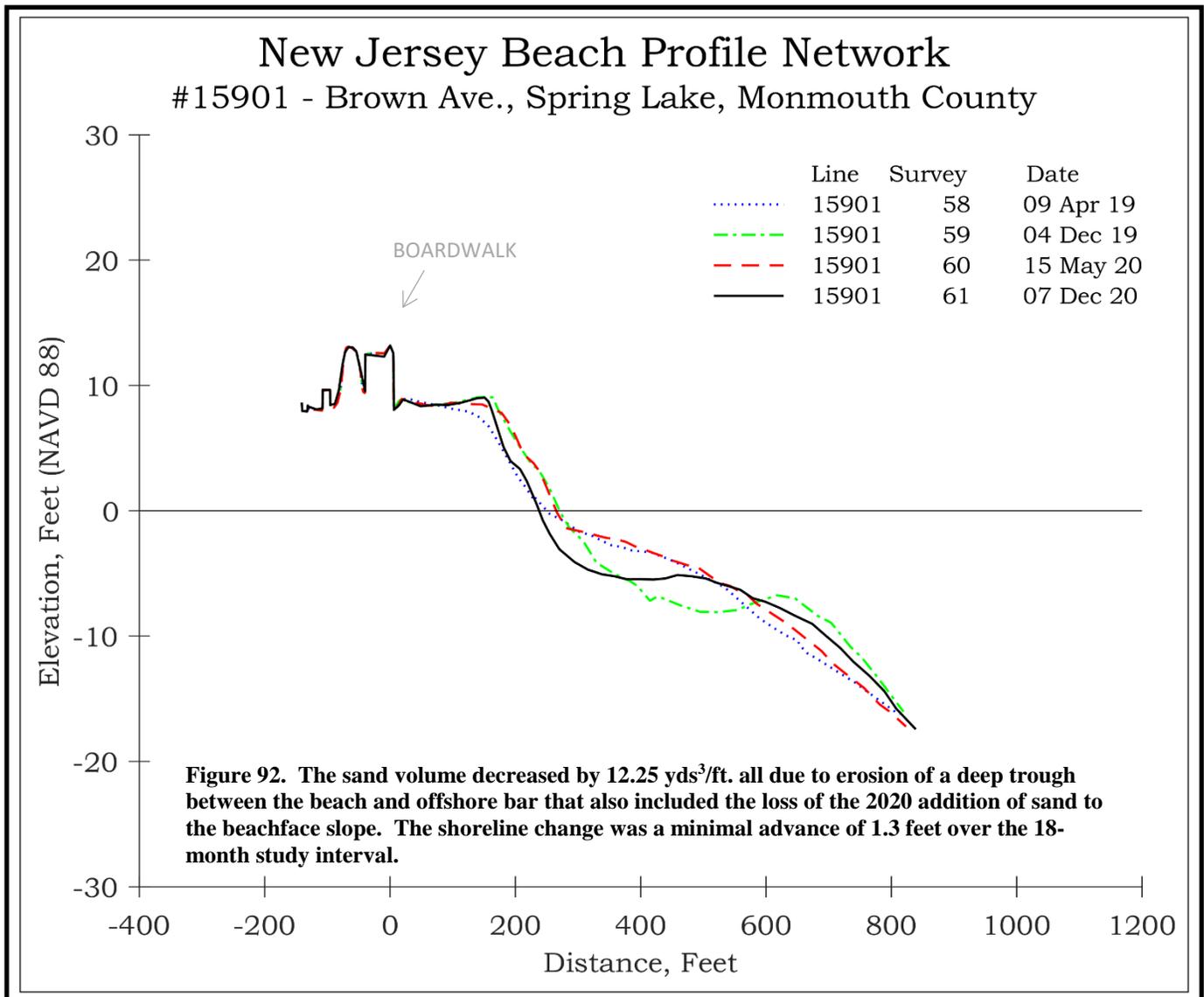
This site has a narrow dune with the boardwalk seaward of it. The Dec. 4, 2019 view on the left was taken at the berm crest following a minor snowfall. The December 7, 2020 view on the right presents a much less textured beach, smoothed out by wind action.



NJBPN 15901 – Brown Avenue, Spring Lake



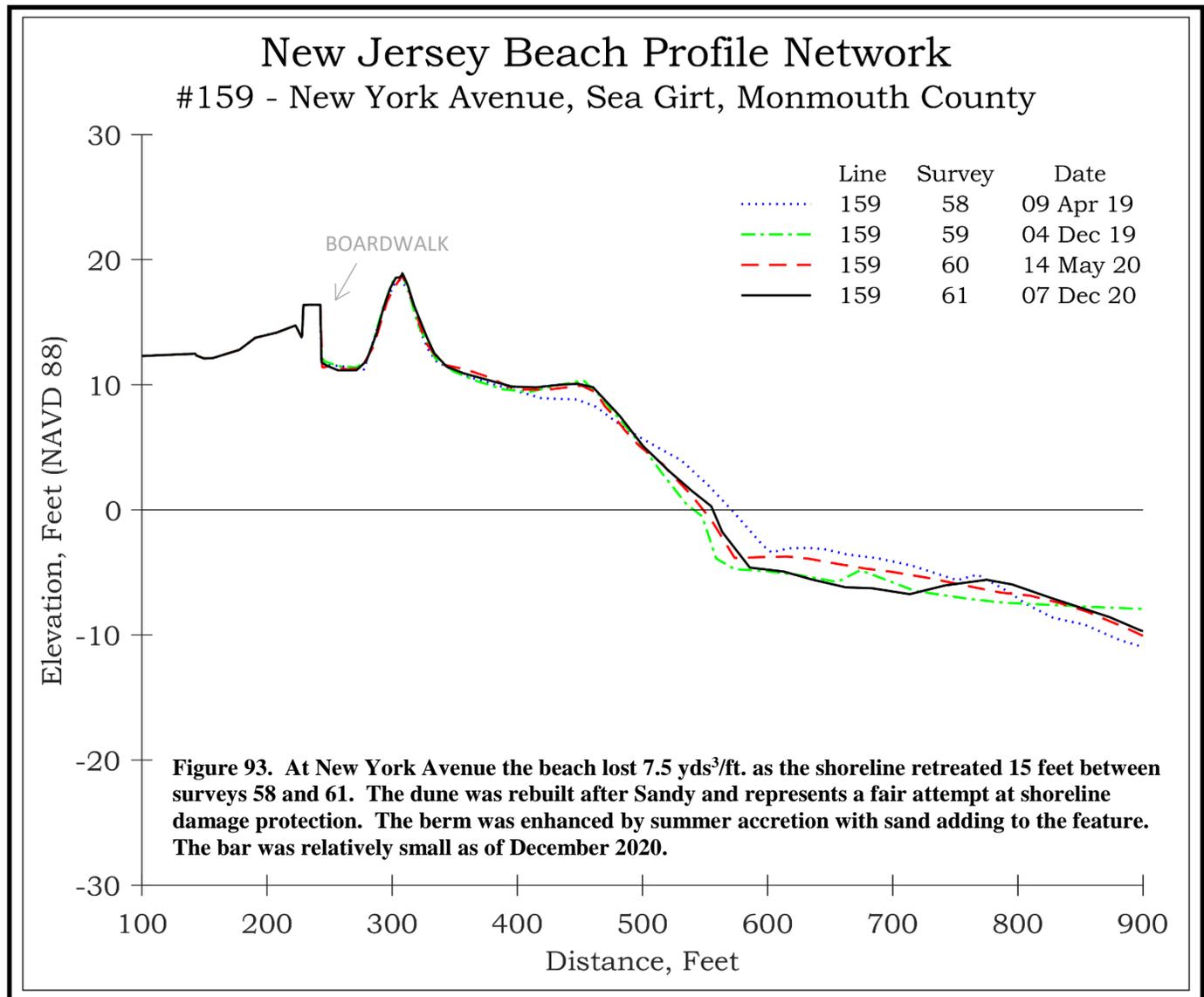
At the south end of Spring Lake, the dune is not significantly higher than the surface of the boardwalk. The Dec. 4, 2019 view on the left shows the boardwalk and dune system, along with a wide beach to the center of the view. The Dec. 7, 2020 view on the right shows a similar landscape with the introduction of some newly grown dune grass.



NJBPN 159 – New York Avenue, Sea Girt



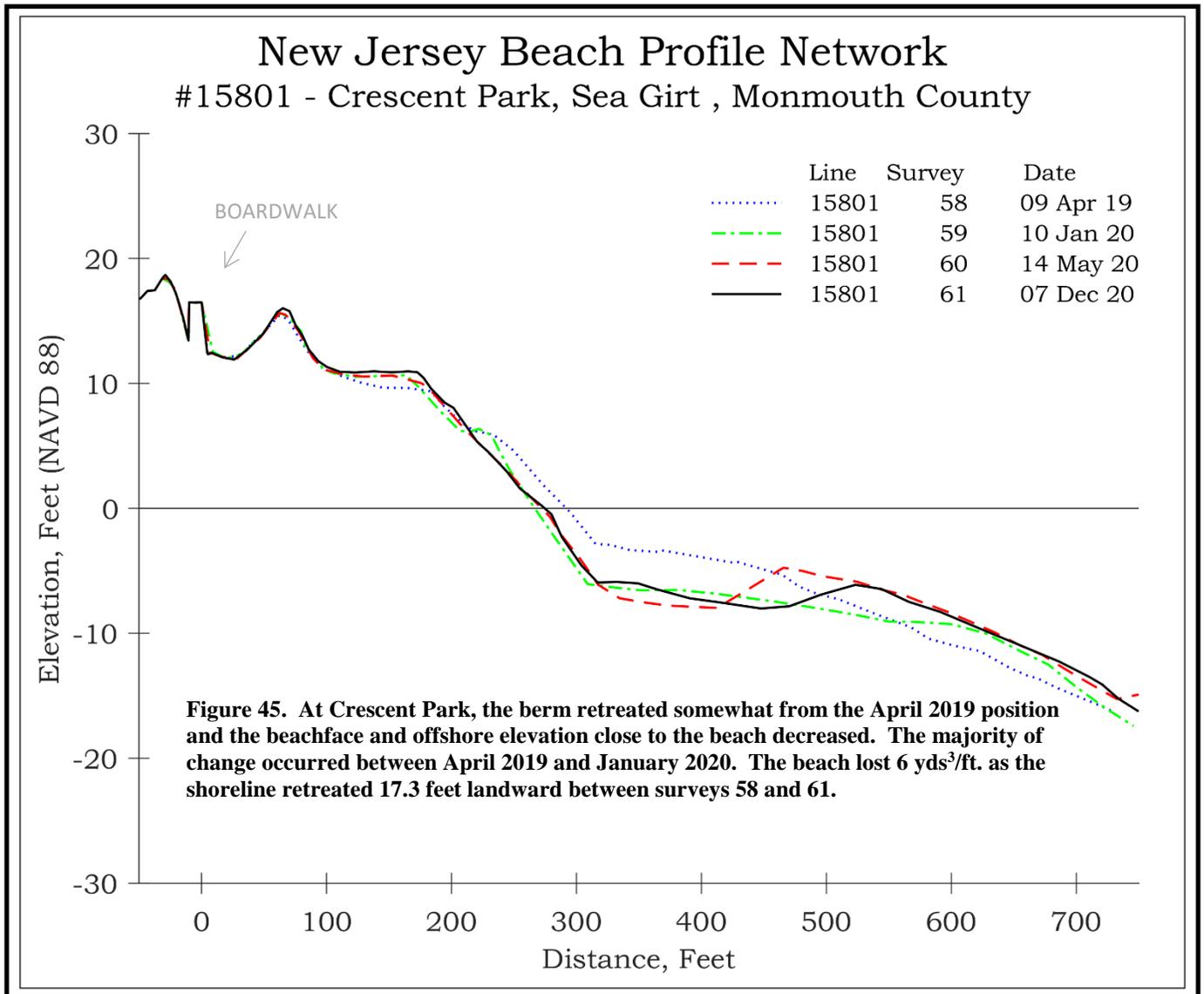
The Dec. 4, 2019 view on the left followed a snow storm that dusted the beach. The dunes were built after Sandy to have pedestrian paths through them that the Borough fills with sand prior to a storm. The right side photo is nearly identical, with the dune remaining the same.



NJBPN 15801 – Crescent Park, Sea Girt



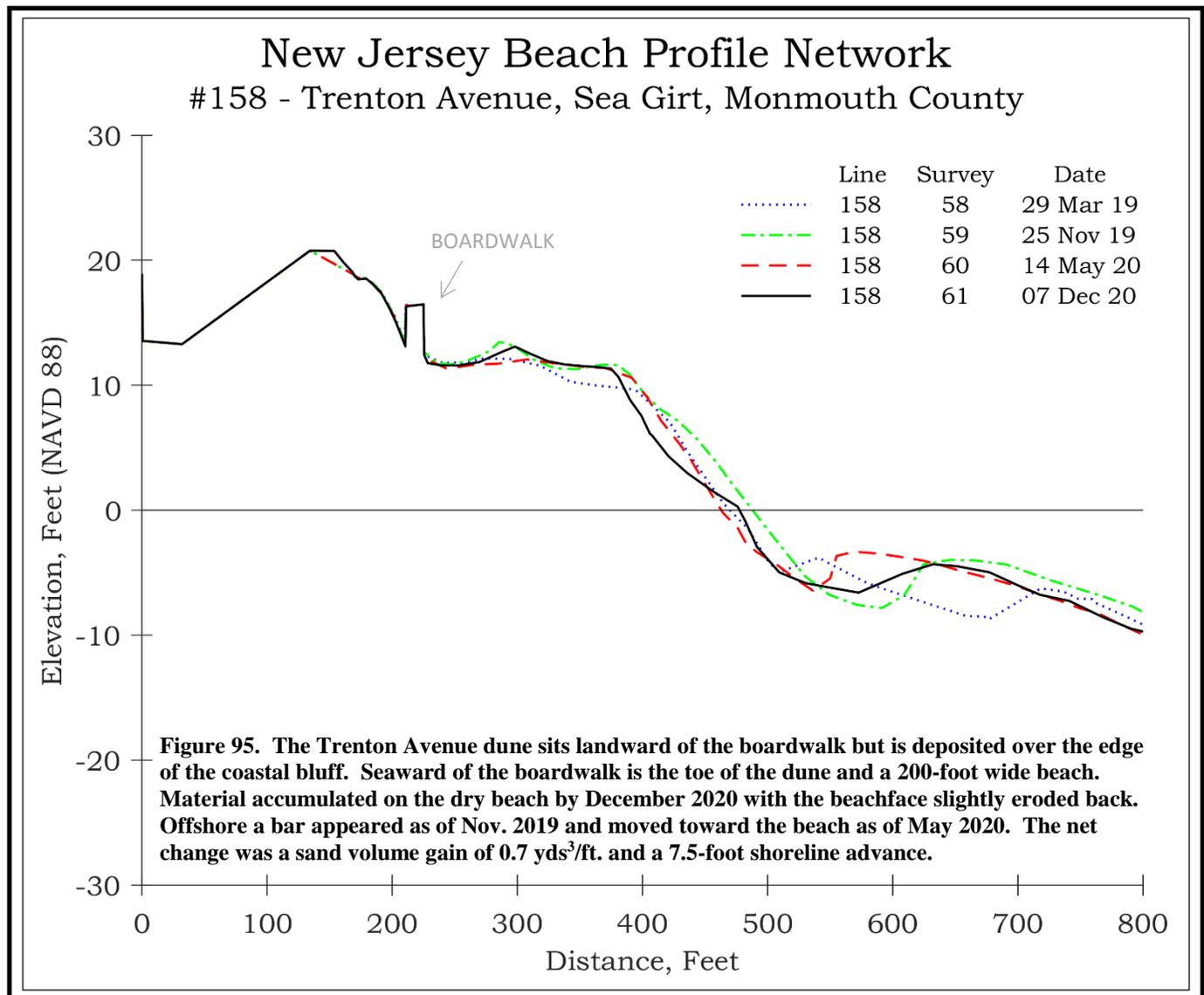
The photo on the left (Jan 10, 2020) shows the grass was partially buried by added wind deposition and the damaged fence was still unrepaired. The December 7, 2020 view on the right shows the fence once again, unrepaired but still capturing a minor amount of sand.



NJBPN 158 – Trenton Avenue, Sea Girt

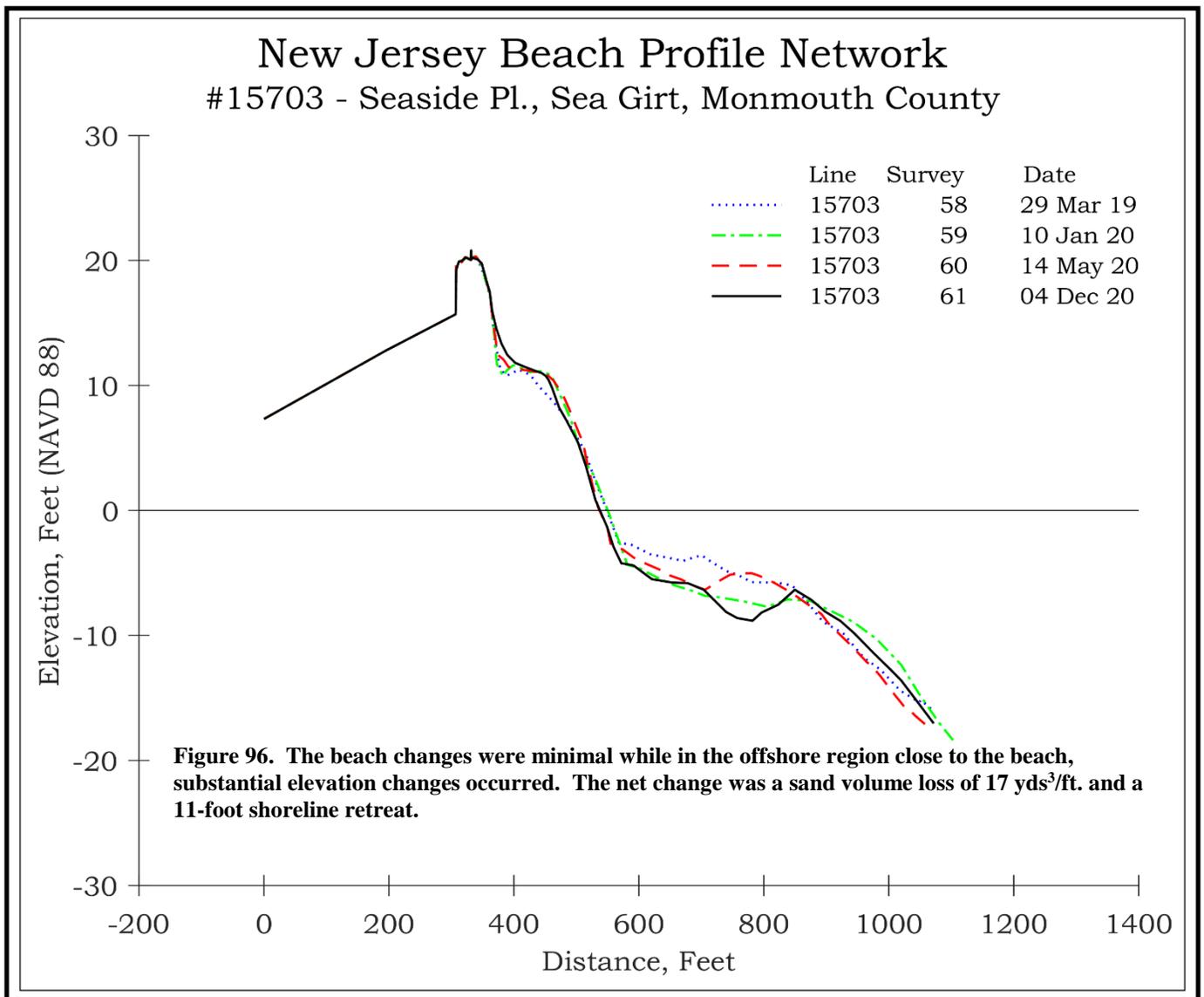


The Nov. 25, 2019 view (left photo) is at the toe of the dunes showing minor scarping and fence damage, like that seen to the north at site 15801. The right-hand side photo shows the damaged fence further buried, with dune grass growth proceeding seaward beyond the fencing.





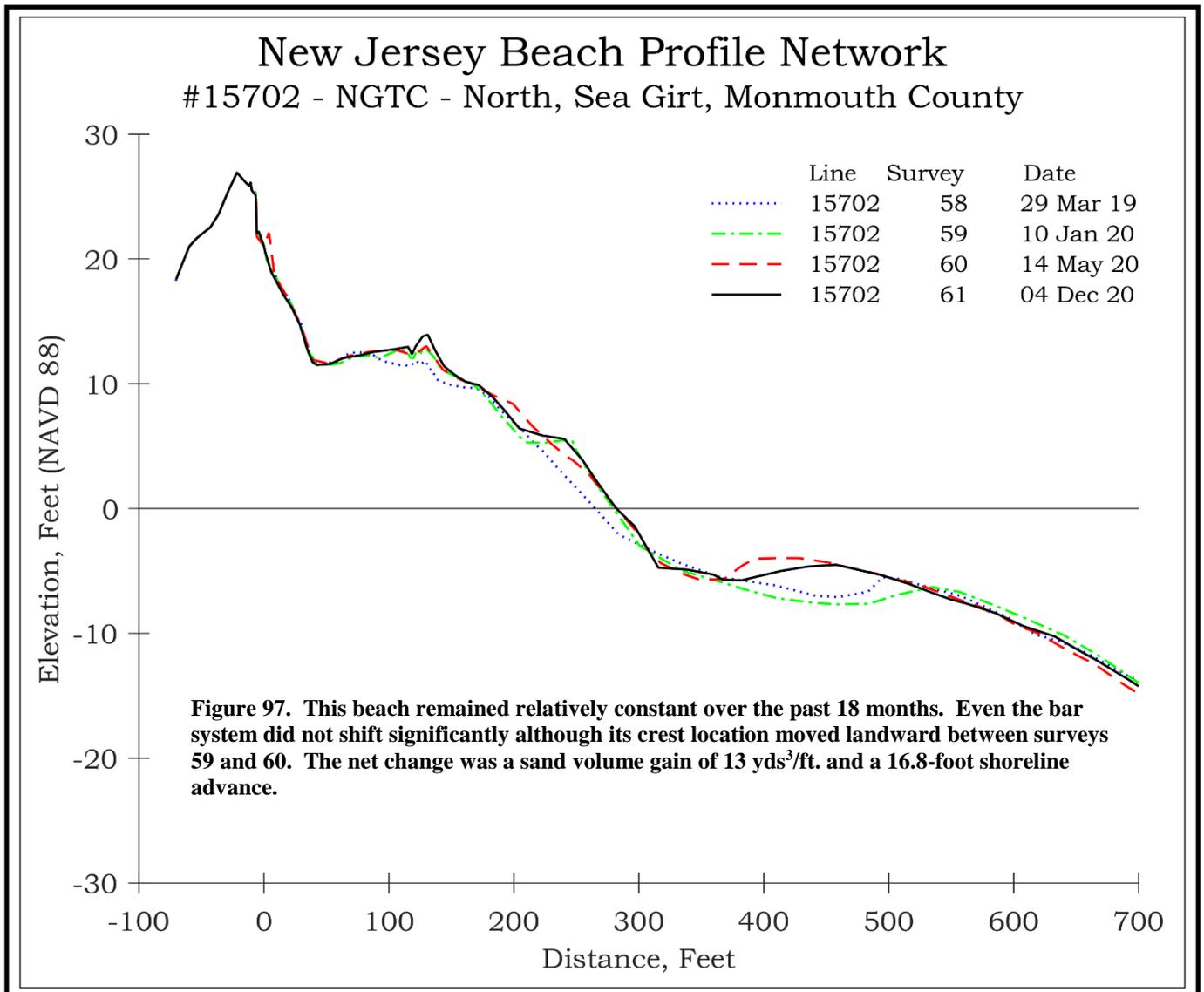
In the left-hand photo, wind transport appears to have replaced some dune toe sand as of Jan. 10, 2020. The photograph on the right seems to show the same trend of wind driven sand collecting at the toe of the dune (Dec. 7, 2020).



NJBPN 15702 – NGTC - North, Sea Girt



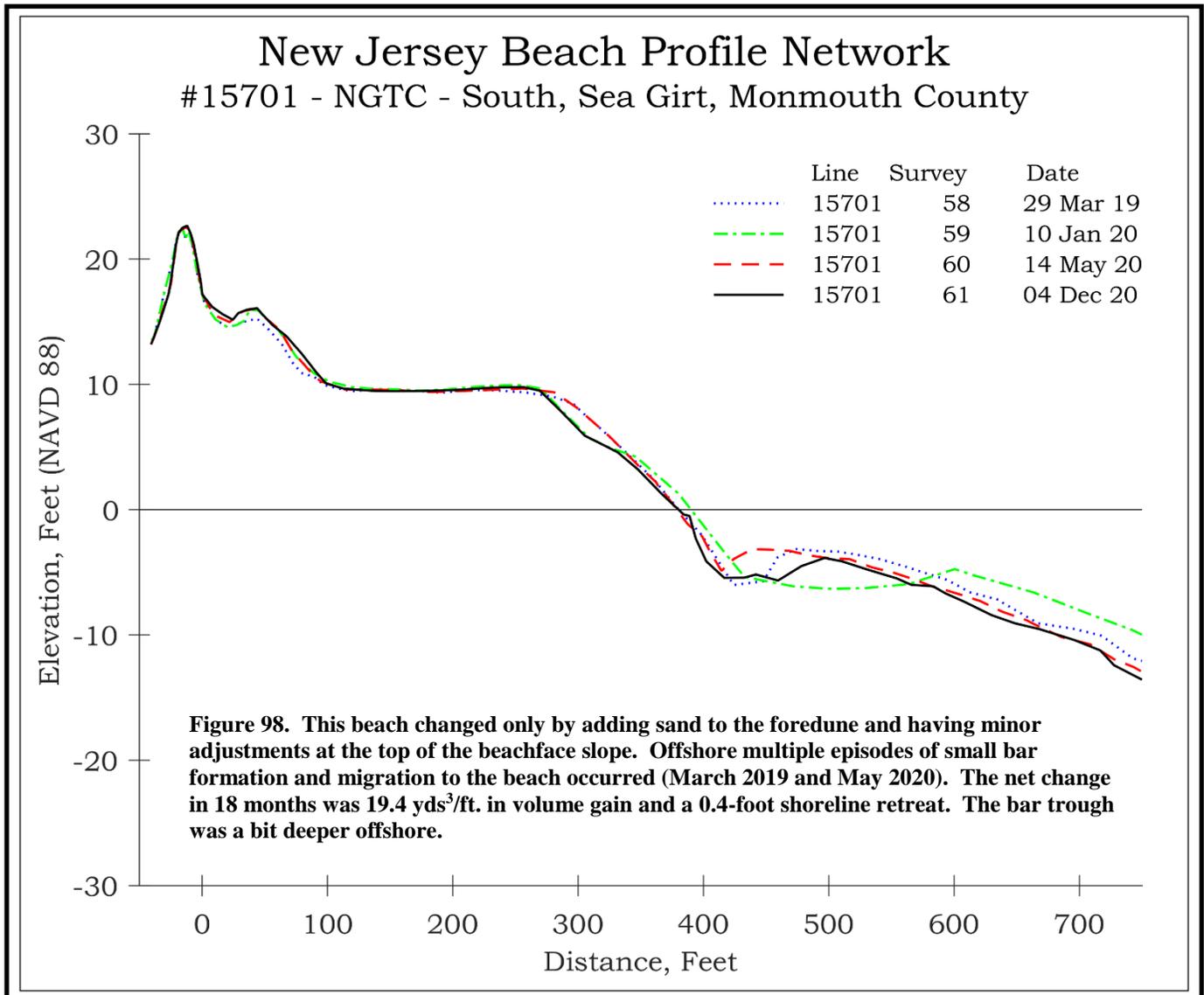
The extraordinary dune elevation is because the National Guard shooting range ends at its landward side, so the extra height was added to stop bullets years ago. The Jan. 10, 2020 view on the left shows the site continued to accumulate sand in the foredune zone as the main dune remained unchanged. The lush dune grass can be seen on the right with continued growth (December 4, 2020).



NJBPN 15701 – NGTC - South, Sea Girt



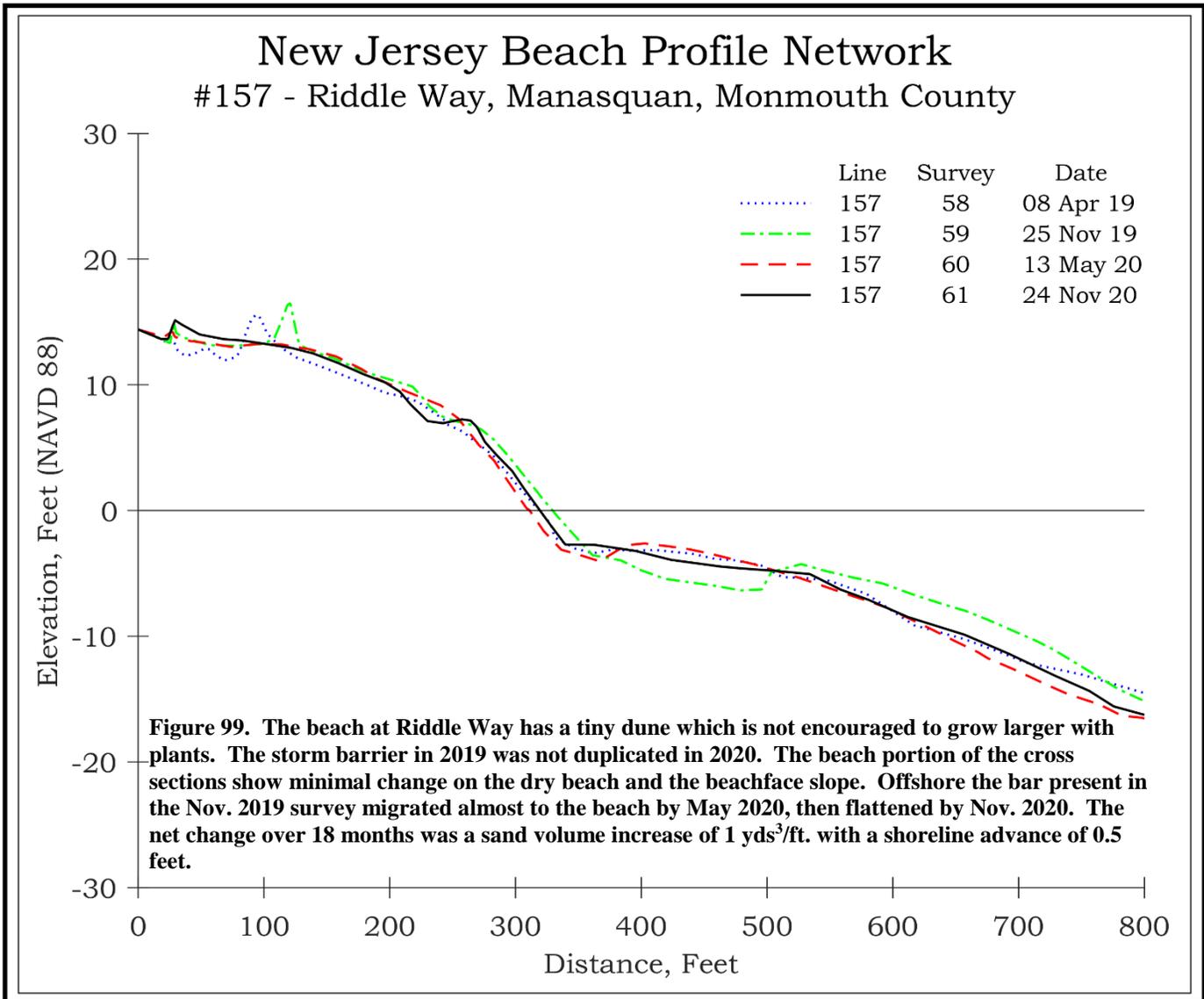
This site is located at the south end of the National Guard training facility beachfront. The dune is lower because it is outside the rifle range aiming area. The left photo was taken Jan. 10, 2020 showing little change in the upper beach and dune. The Dec 4, 2020 view on the right provides a view slightly closer to the toe of the dune.



NJBPN 157 – Riddle Way, Manasquan



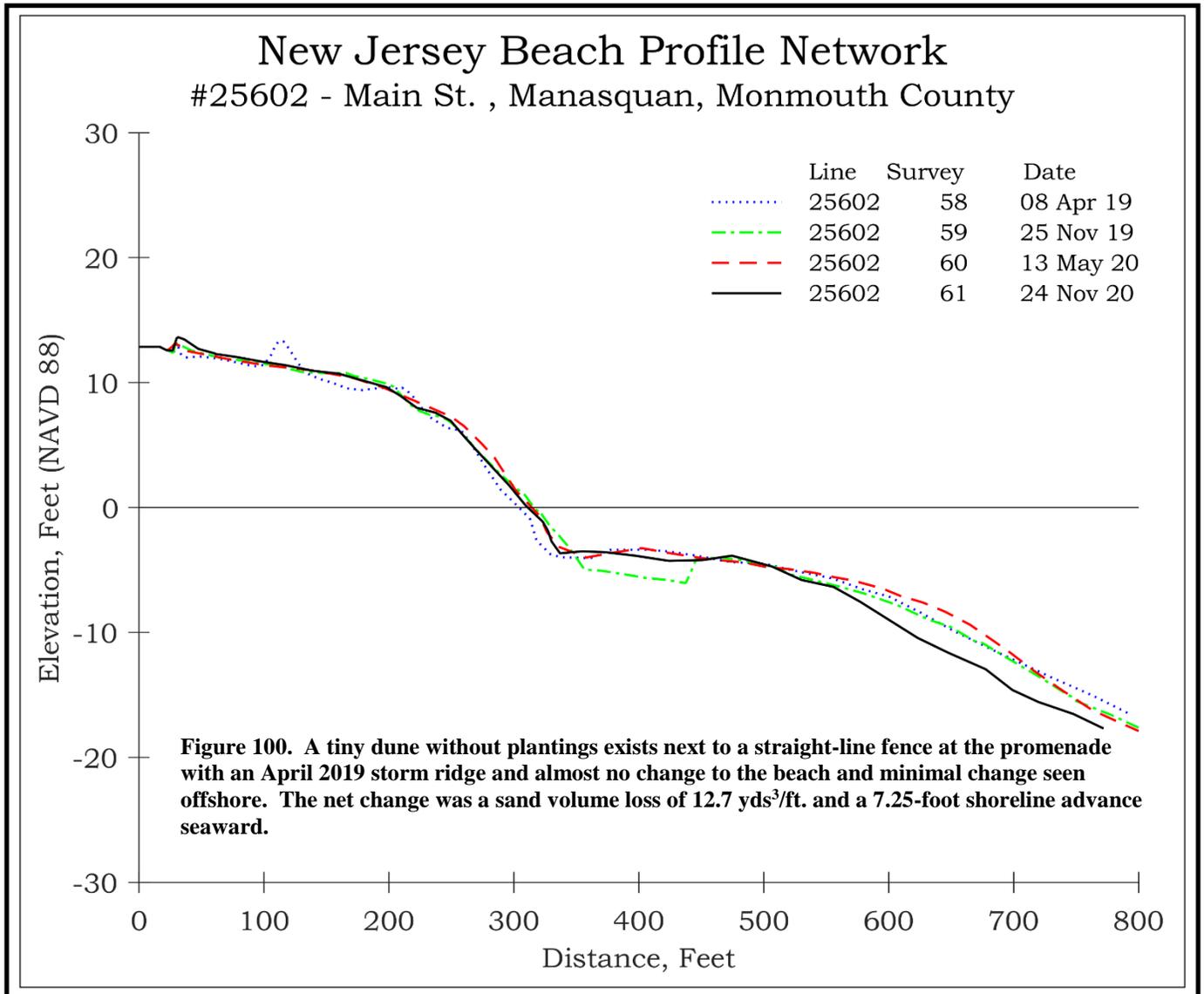
On the left is a view taken Nov. 25, 2019 showing the relative inadequacy of the single row of sand fence in stopping wind transport into both the promenade and development at Riddle Way. The right view taken November 24, 2020 shows sand still blowing onto the promenade but also collecting at the line of fencing.



NJBPN 25602 – Main Street, Manasquan



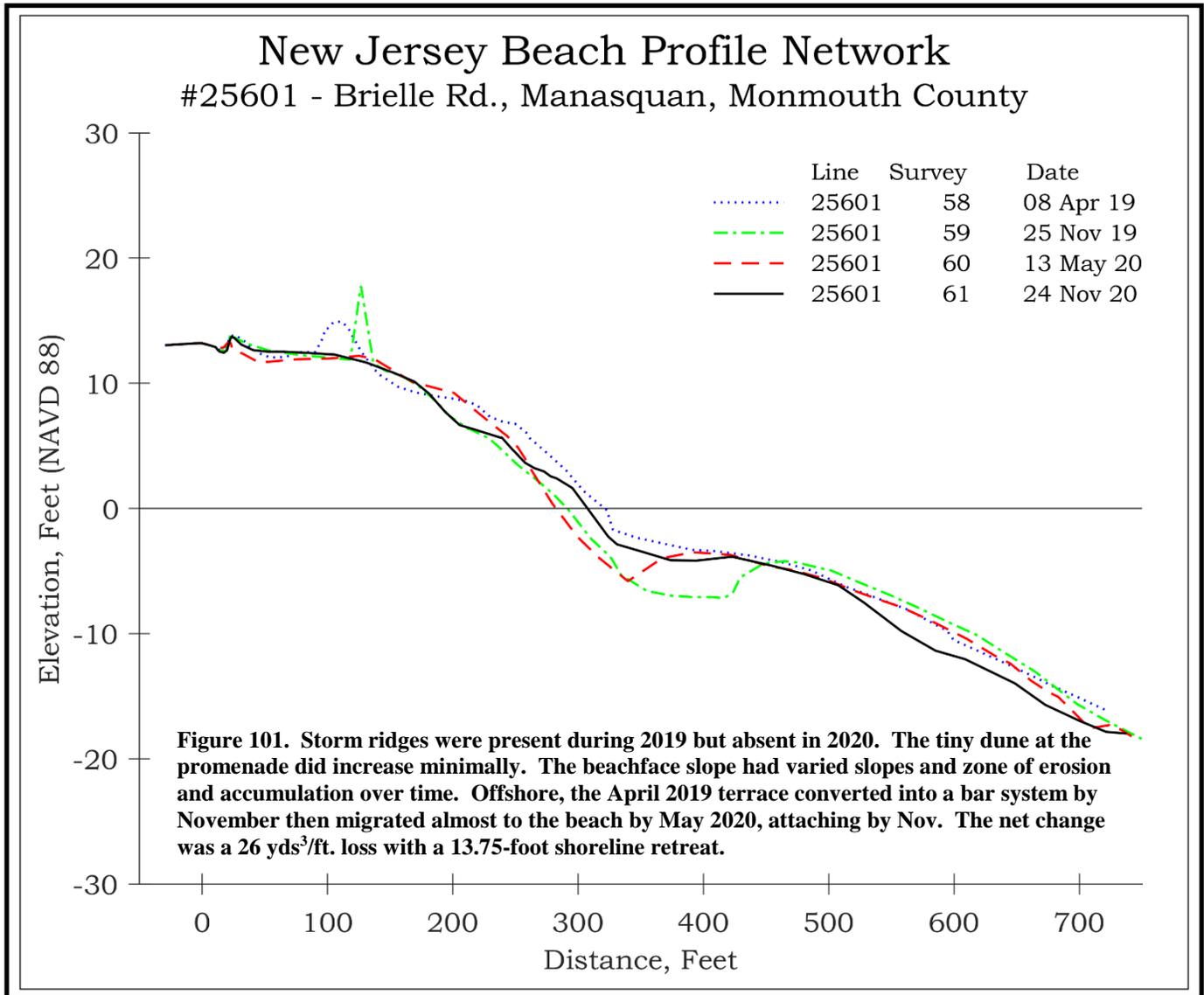
On the left, (November. 25, 2019) sand has collected at the sand fencing largely by having been pushed back off the promenade repeatedly. Sand hummocks appear on the open beach, but the storm ridge is absent. The photo on the right, taken November 24, 2020 shows the expanse of dry beach to the east.



NJBPN 25601 – Brielle Road, Manasquan



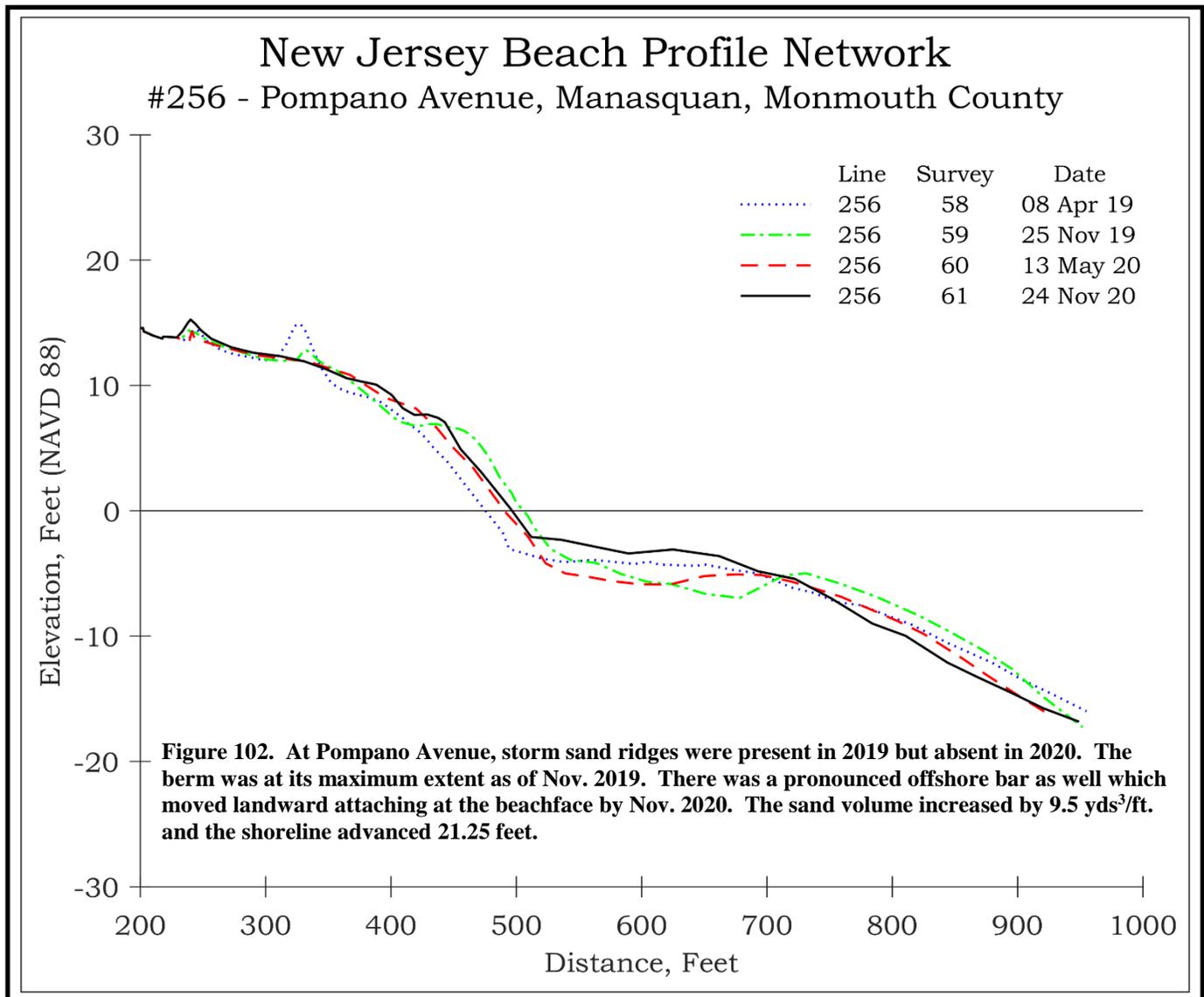
The Nov. 25, 2019 view on the left shows sand accumulating at the sand fencing by the promenade, but no dune present and no storm ridge as of the date of this survey. The photo on the right shows the beach east of the first photo, showing the dry beach with no sand mound (November 24, 2020).



NJBPN 256 – Pompano Avenue, Manasquan



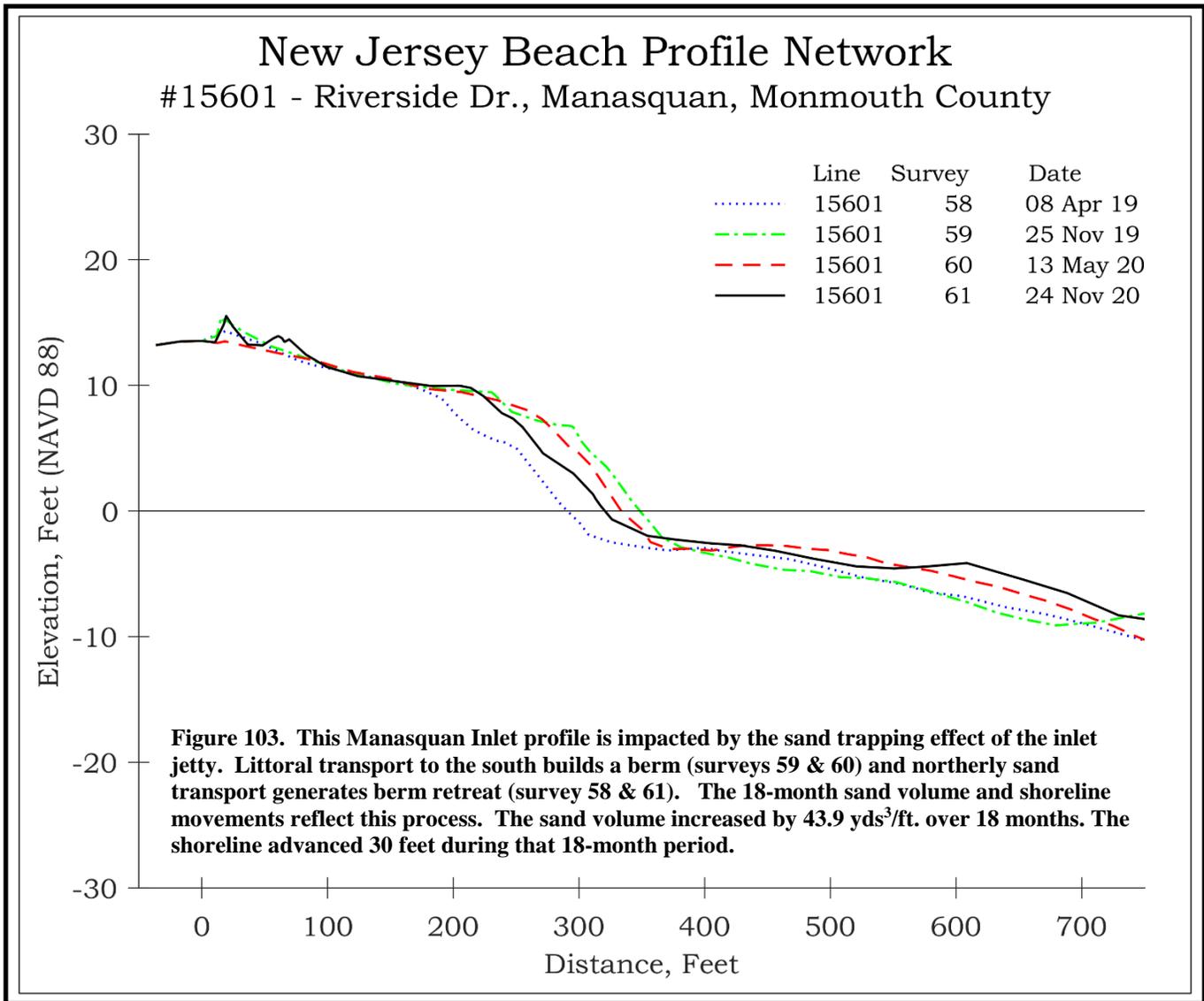
As of Nov. 25, 2019, conditions remained essentially the same where winds transport beach sand through the single line of fence adding material to the oceanfront “yards” of the homes facing the promenade. The right photo shows the same beach, with a promenade nearly free of sand (November 24, 2020).



NJBPN 15601 – Riverside Drive, Manasquan



The southernmost survey site in Monmouth County lies a few hundred feet from the north Manasquan Inlet jetty. The left photograph was taken Nov. 25, 2019 at the berm crest showing the very short distance between the transect line and the north jetty to Manasquan Inlet. The November 24, 2020 photo on the right shows the jetty of the Manasquan Inlet with the beachface slope just about the same position as the year previous.



Summary & Conclusions

The relative consistency in the Monmouth County beachfront performance is supported by this study interval's lack of serious erosion at the Phase 1 sites along the old Ocean Avenue in Long Branch, NJ. The National Seashore has and will be the recipient of any littoral transport reaching the southern park oceanfront boundary. Since initial sand placement occurred in Sea Bright 25 years ago more than 3.4 million cubic yards of sand were documented as being deposited between sites #183 and #285 within the park. Site #385 was added a few years ago to include more of the Sandy Hook oceanfront shoreline north of Gunnison Beach. The repetition of that series of cross section comparisons in 2020 produces a net Sandy Hook enhancement of 8,694,249 cubic yards of sand derived from the shore protection project redeposited between Via Ripa and Gunnison Beach on Sandy Hook. Taking the changes documented between fall 2016 when site #385 was established 3,078 feet further north of Gunnison Beach, the sand volume redeposited on Sandy Hook was 545,456 cubic yards in three years across a distance of 28,923 feet or 18.86 yds³/ft. The greatest shoreline advance was seen at North Beach in Sandy Hook where 80 feet of new dry beach was created in 18 months.

Sandy Hook continues to be of increased interest in the NJBPN research, since most Monmouth County project losses are moving onto the hook along its 6-mile reach. The Gunnison Profile site (#285) boasts a 2,500-foot wide dry beach half of which has accumulated since 1998 shortly following the initial USACOE work in Sea Bright. "The National Seashore Park sites' review only extends back to their 1994 establishment date, but the changes observed since their establishment 26 years ago was 232.53 yds³/ft. in added sand with a 564-foot shoreline advance". The recent addition (2015) of a new cross section 3,078 feet north of the Gunnison site also demonstrates continuous deposition and shoreline advances seaward as the Gunnison sand moves further north toward the tip of Sandy Hook's spit. This National Seashore coastline is a direct beneficiary of the vast quantities of sand pumped onto the developed Monmouth County oceanfront. The 2016 evaluation of this section of beach showed a gain of 3,445,514 cubic yards of sand all derived from the NY District beach restoration project between Long Branch and the National Seashore entrance. This amounted to 138.45 cubic yards of sand deposited on each of the 25,925 feet between Via Ripa (site #183) and Gunnison Beach (site #285). This was the motivation for adding the new site some 3,000 feet further north from Gunnison.

It has been suggested to fashion a plan to intercept this sand supply at some point north of the newer North Beach site #385 as it adds to the extension of the Sandy Hook spit and pump it south at least into Sea Bright to recycle the material to the southern beaches rather than mine new sand from a diminishing supply in the current offshore borrow areas.

While "hot spots" continue to exist, particularly at site # 179 at Cottage Road in Monmouth Beach, general trends of shoreline retreat were scattered along the oceanfront. The US Army Corps District conducted sand placement at the Cottage Road site #179 in 2020 with distribution extending north along the reach. Sand was also added in the vicinity of Pullman Avenue in Long Branch where erosion had taken most of the 2017 initial deposit away. No new material appears added south of Darlington Avenue in Deal by either direct placement or littoral transport. This includes all the project shoreline south of Deal to Manasquan Inlet.

The Raritan Bay restoration took place at Port Monmouth adding a half-million cubic yards of sand at a site covered by NJBPN site #185. More sand was added at Keansburg and has been surveyed for results since placement. These two projects are standing the test of time well with over 90% of the material still present at both sites. Army Corps (NY District) planning is continuing with ongoing construction toward full restoration and flood control efforts around Union Beach on Raritan Bay as well.

In 2017, the NY District Corps and the Division of Coastal Engineering collaborated with the CRC to establish an additional 66 profile locations between Gunnison Beach and Manasquan Inlet, positioned among the existing 34 NJBPN oceanfront sites, to gather a denser set of sand volume change and shoreline migration data for the District. The first cross section data was collected during the fall 2017 survey season.

Appendix Tables 2 and 3 provide the seasonal and annual profile volume and shoreline changes for Monmouth County. Seasonally, the oceanfront beaches gained 2.59 yds³/ft. between spring 2019 and fall 2019, then gained 3.44 yds³/ft. during the winter of 2019 to 2020. The oceanfront gained 2.10 yds³/ft. during the summer of 2020. The Long Branch oceanfront lost sand during the fall and winter of 2019 into 2020, then gained 25.34 yds³/ft. over the summer of 2020 due to work conducted by the NY District. Deal south the Long Branch oceanfront, gained sand (0.78 yds³/ft.). The Phase II sites from Asbury Park to Manasquan lost an average of 3.71 yds³/ft.

There were numerous minor northeast events, but they did little damage. The oceanfront shoreline advanced an average of 8.28 feet largely due to sand added to some beaches and transfer of sand from offshore to the beachface. Long Branch beaches advanced 17 feet on average, Sea Bright and Deal's advanced an average of 12 and 5.4 respectively while the Phase II sites advanced 7 feet on average.

The majority of the moderate losses occurred between Sea Bright and Deal while there were minimal sand volume losses or shoreline retreats seen south of Loch Arbor and Deal Lake. During 2020 the Corps District contractors pumped 2.8 million cubic yards of sand each onto Monmouth Beach and onto the beaches in southern Long Branch (Elberon oceanfront). Redistribution of these maintenance efforts can already be observed in the cross sections from the fall of 2020 at nearby locations to the direct placement sites.

One final note derived from the long-term trends revealed by this monitoring of NJ beaches was the identification of sand volumes transported north into the Sandy Hook National Sea Shore Park. Survey sites were established in 1994 to provide control information with a site added in 2016 north of Gunnison Beach to add as much shoreline length that was within vehicle access for the survey team. The survey data from fall 1994 was compared to that from fall 2019 for sites 285, 284 and 183 just south of the park entrance. The shoreline distance is 25,723 feet. Averaging the sand volume gains at sites 285 and 284 and sites 284 to 183 and multiplying by the distance between these sites one finds a sand volume added to the park beaches of **8,694,249 cubic yards**. This number is larger because the much shorter surveys back in 1994 were extended to the 2020 ending distance from the reference point, but at an elevation equal to the 1994 survey's ending elevation. The Gunnison Beach zero-elevation position advanced 670 feet seaward since 1994. The other three sites had 119, 263 and 250-foot shoreline advances over the same interval. Estimating an offshore slope present in 1994 out to the 2020 survey ending distance introduces more uncertainty than extending the 1994 ending distance horizontally. We know it was deeper 600 feet further out to sea in 1994 but there is no idea as to how much deeper it was. A horizontal extension allows the computer to calculate the sand volume known to be present to that 2020 survey ending point as compared to the 1994 survey. A precise number would require knowing the bottom slope between the 1994 end point and the end point in 2020.

To generate the accumulated sand volume deposited within the Sandy Hook Park oceanfront shoreline the distances between each of the CRC survey lines was determined from Profile instrument point GPS positions.

Between Gunnison Beach and Parking Lot E was found to be:	12,735 feet
Between Parking Lot E and Highlands Beach was found to be	10,737 feet
Between Highlands Beach and Via Ripa was found to be	2,453 feet

In 1994 these four sites were in existence and the total distance was 25,925 feet of oceanfront shore.

Figure 105 shows these four locations with the cross sections plotted without adding the horizontal 1994 ending point extension to the end point in 2020. The volume numbers in the calculation are done both with the actual 1994 ending point determining the final volume computation and again with the extension in place so that the sand deposited above the end point elevation in 1994 seaward to the end point in 2020 is included. The accumulation seaward of the 1994 berm crest location in each profile set is obvious that there have been extensive beach sand volume increases, but without any direct sand placement on any site except Via Ripa # 183. All increases since 1994 are the result of littoral transport of sediment from south to north along the Long

Branch through Sea Bright oceanfront following the US Army completing the initial sand placement starting in 1996.

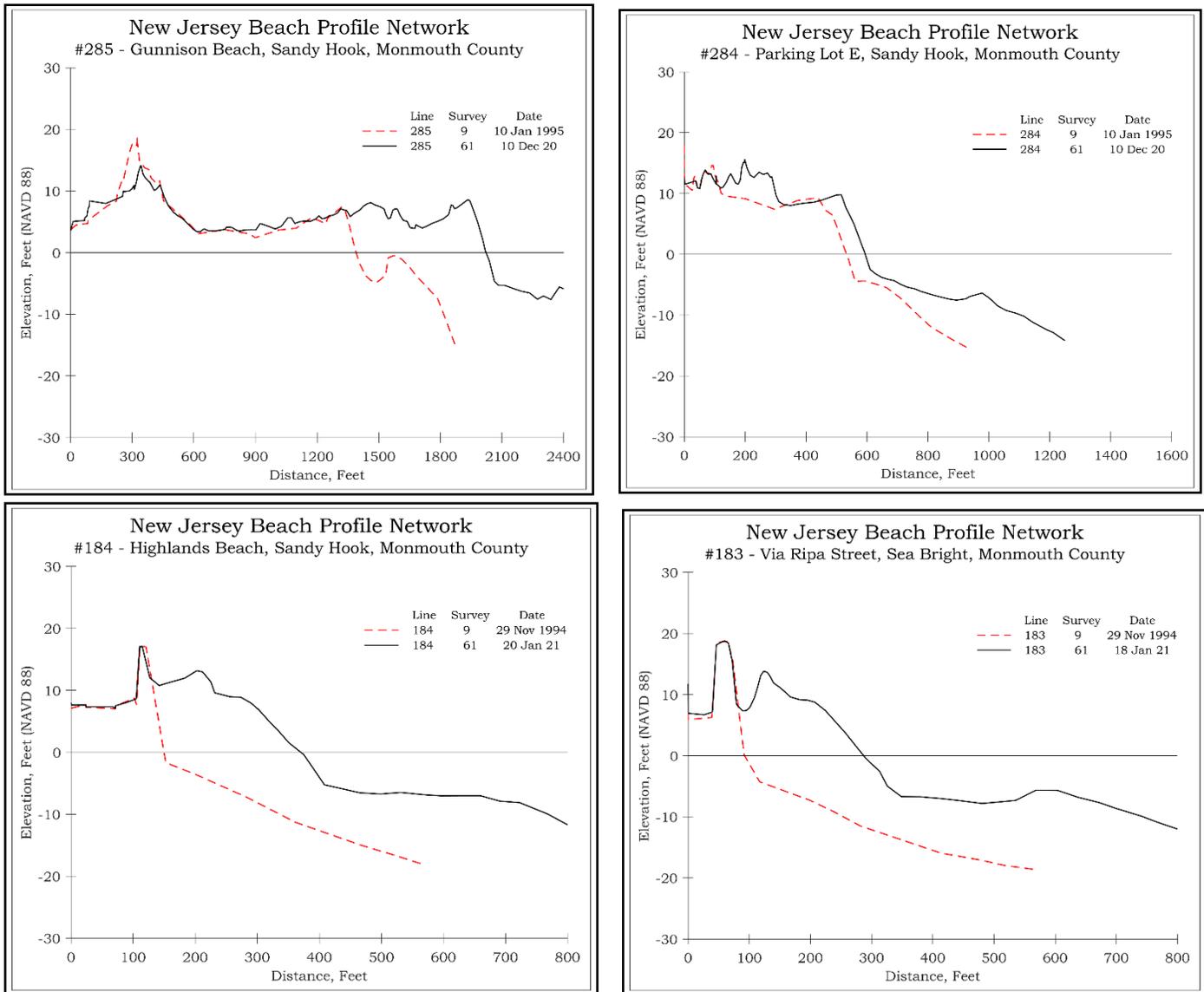


Figure 105a.-d. Four plots covering the 1994 survey locations established on Sandy Hook National Seashore compared to the fall 2020 survey at each location. These four plots vividly demonstrate the immense sand volume deposited on Sandy Hook derived from the USACOE Monmouth County Shore Protection project since 1996.

The next step was to incorporate the most recent array of cross sections adding in the recent North Beach site # 385 plus two US Army Corps location introduced in the fall of 2017. These are site # 28401 located at Area F Road and site # 18401 located at Parking Lot C making seven sites where cross-sectional data is collected. The computational results are presented for surveys from the spring of 2019 compared to fall 2020 information. The shoreline distance between site #385 and #183 is 29,003 feet where **226,133** cubic yards of new material was added. This although sites 183, 184, 285 and 385 returned negative sand volumes for the 18-month study interval. Sites 18401, 284, and 28401 showed positive gains up to 28.96 yds³/ft. If the same calculations are made for the 3 years since site #385 was established and surveyed and includes the added 3,078-foot shoreline distance the sand volume amounts to **545,456** cubic yards added to the Sandy Hook Park shoreline in 3 years.



New Jersey Beach Profile Network

Ocean County

Manasquan Inlet
to Little Egg Inlet

NJBPN Profile #'s
156 - 234

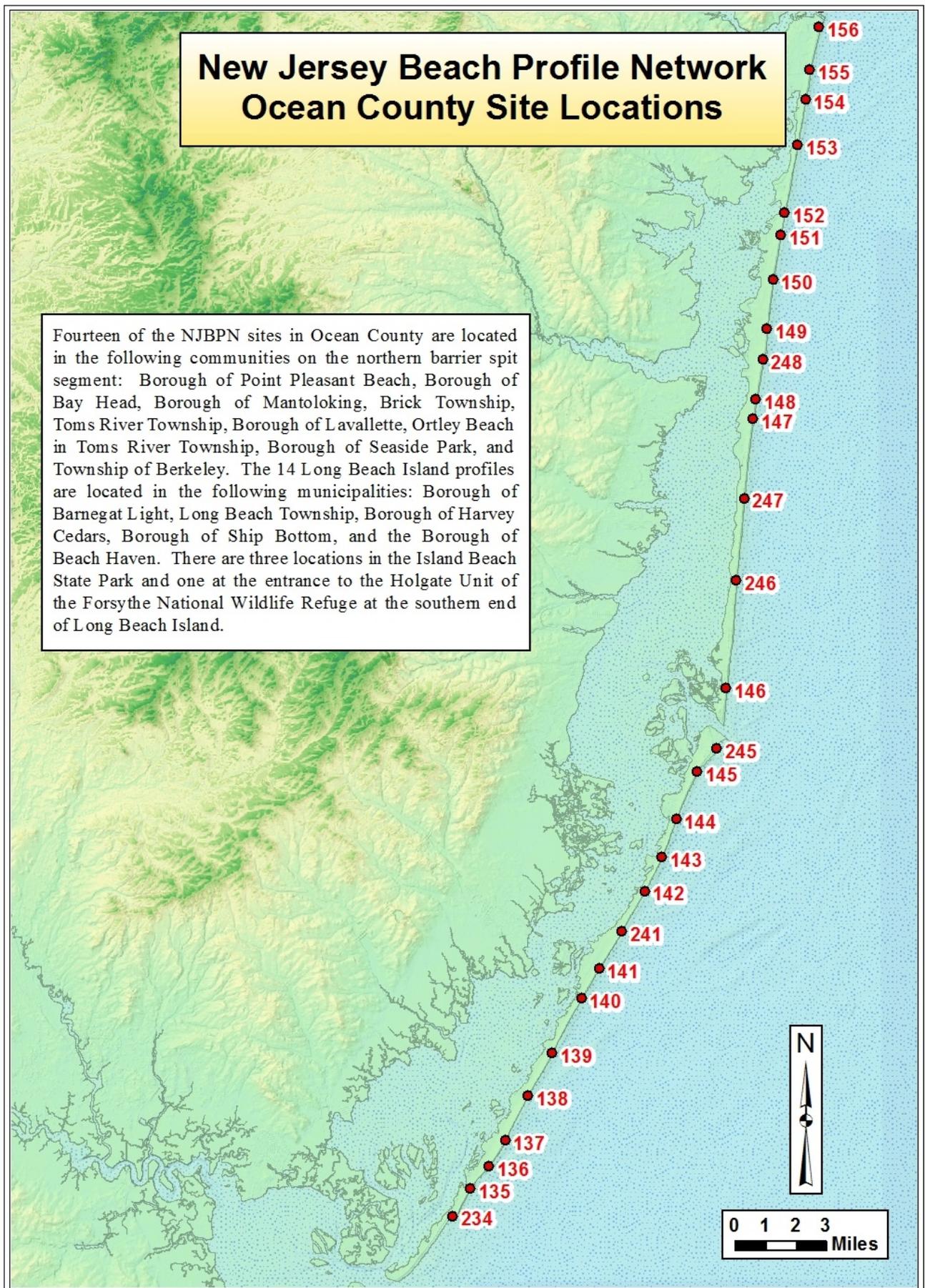


Figure 106. Locations of the 28 NJBPN profile stations in Ocean County, NJ.

2020 Beach Fills in Ocean County:

No beachfill activity took place in Ocean County in 2020. The federal/non-federal *Manasquan Inlet to Barnegat Inlet Coastal Storm Risk Management Project* (beachfill) in northern Ocean County commenced in May 2017 in Dover Township (Ortley Beach- NJBPN #149) and finished in Point Pleasant Beach in July 2019. More than 11 million cubic yards of sand were placed on nearly 14 miles of ocean shoreline between Point Pleasant Beach and Berkeley Township. No sand was placed on the beaches of Island Beach State Park. Periodic nourishment is scheduled for FY 2022 if funding is available.

<https://www.nap.usace.army.mil/Missions/Factsheets/Fact-Sheet-Article-View/Article/490786/new-jersey-shore-protection-manasquan-inlet-to-barnegat-inlet-nj/>

No federally-funded sand placement occurred on Long Beach Island in 2020. Periodic nourishment is scheduled for FY 2022 if funding is available. For more information regarding the Long Beach Island Coastal Storm Risk Management Project visit <https://www.nap.usace.army.mil/Missions/Factsheets/Fact-Sheet-Article-View/Article/490783/new-jersey-shore-protection-barnegat-inlet-to-little-egg-inlet-long-beach-islan/>.

Individual Site Descriptions:

Point Pleasant Beach, Water Street and Maryland Avenue; #156 and #155;

The recreational beach at Water Street does not include a dune due to local custom and high-volume beach use during the tourist season. A steel sheet bulkhead and rock toe were placed from the condo unit near Manasquan Inlet to about Trenton Avenue (Jenkinson's Beach). No sand was placed at the Water Street location during the federal beachfill. The Maryland Avenue location had a long-established dune with a crest near 16 ft NAVD88. The federal beach fill created a 20+ ft high engineered dune incorporating the former dune. Sand placement was complete in July 2019.

Bay Head, Johnson Avenue #154;

The profile is backed by a rock revetment that was constructed after the 1962 March northeast storm. This location has had an erratic history of shoreline stability with varying berm widths. Federal sand placement was completed in June 2019 and due to that activity, this site had the greatest volume gains of the Ocean County NJBPN locations between fall 2018 and fall 2019. In 2019-2020, the volume gain continued (12.72 yd³/ft).

Mantoloking, 1117 Ocean Avenue #153;

Sand placement for the federal coastal storm risk management project was completed at this site in December 2018 and there has been a progressive reduction in berm width since May 2019. The engineered dune that covers the 2015 steel bulkhead remained in position and elevation.

Brick Township, Public Beach #3 #152;

The vertical steel wall continued from the Mantoloking site extending south past Public Beach #3 and in spring 2016 was covered with sand through local efforts. By August 2018, federal sand placement was completed, and the template dune elevation remained consistent through 2020.

Toms River Township, Normandy Beach 1st Avenue #151 and Ortley Beach 8th Avenue #149;

Significant changes were made to the beaches by the federal project at both Township locations and included an engineered dune up to 23 ft NAVD88. Sand placement was completed in Ortley Beach (#149) in November 2018 and in December 2018 at Normandy Beach (#151). Design dune conditions and elevations remained at both sites, however berm widths continued to diminish in 2020.

Lavallette, White Avenue #150;

The federal project created a substantial dune with a base width over 100 ft and incorporated the sand from the dune that was created after Hurricane Sandy. Sand placement was completed in April 2019. Since the May 2019 survey the shoreline moved landward -58.25 ft.

Seaside Heights, Franklin Avenue #248;

Prior to the beachfill, the Franklin Avenue site did not include a dune due to local management and heavy beachgoer use. However, in January 2019, the federal project created a dune with a top elevation (+18.2 feet) to match the boardwalk. This profile lost the most sand of the northern Ocean County beaches between fall 2019 and fall 2020.

Seaside Park, 4th Avenue #148;

The Seaside Park profile contains a stable dune over 25 ft high that was only slightly eroded by Hurricane Sandy. The federal project placed sand only on the berm in January 2019. The profile had moderate losses in 2019-2020 (-13.65 yd³/ft).

South Seaside Park 6th Lane, Midway Beach #347 (formerly #147);

The Midway Beach profile contains dune (> 25 ft in height and 150 ft wide) that has been stable and maintained its shape since 2015. The federal project placed sand on the berm in February 2019 and most profile losses occurred between fall 2019 and fall 2020.

Island Beach State Park, Sites #247, #246, and #146;

Over the 2019-2020 timeframe, the northern (NJBPN #247) and southern (NJBPN #146) IBSP locations exhibited sand volume losses while the central location (NJBPN #246) gained a modest amount. (All in the reverse of observations from 2018-2019). The federal storm damage reduction project did not include the state park locations.

Long Beach Island; Barnegat Light Borough, 10th Street #245 and 26th Street #145;

The Barnegat Light Borough locations display different profile features. The 10th Street site is comprised of an extensive dune system (1,200 ft. wide) and a very narrow berm. Since 2015, this site eroded at high rates (-84.64 yds³/ft between fall 2018 and fall 2019) but the rate slowed to -8.43 yds³/ft in 2019-2020. The 26th Street location continued its volume gain and seaward movement of the shoreline in 2019-2020.

Long Beach Township, Loveladies La Baia Street #144;

This Loveladies site received federal beach fill and an engineered dune in 2016. Since then the dune has remained in place and at design elevation. There were modest volume gains over 2019-2020.

Harvey Cedars, 73rd Street #143 and Tranquility Drive #142;

Sand was placed in Harvey Cedars in spring/summer of 2018 as repair/periodic nourishment. This placement extended into the Long Beach Township communities of Loveladies and North Beach. The engineered dunes remained in position and elevation during 2019-2020; however, the 73rd Street profile had the greatest amount of volume loss of all Ocean County sites. The Tranquility Drive profile gained volume during the same timeframe.

Surf City, 20th Street #241;

The 20th Street site in Surf City received sand in the June-July 2018 supplemental beach fill. The engineered dune remained stable and the berm grew in elevation from its spring 2019 position. The profile gained a modest amount of sand over 2019-2020.

Ship Bottom, 8th Street #141;

For another year, the Ship Bottom profile retained its 150-ft wide dune and at least a 150-ft wide berm since the spring 2015 beachfill. This site gained volume and the shoreline moved seaward in 2019-2020.

Long Beach Township, Brant Beach 32nd St #140, Beach Haven Crest 81st St/Massachusetts Ave #139, and Beach Haven Terrace Old Whaling Rd #138;

All the Township NJBPN locations received post-Sandy restoration to the template design in 2015 or 2016 and each engineered dune remained as designed and constructed. NJBPN #140 received sand in April 2018 and berm width remained over 200 ft in 2019-2020. For another year, profiles #139 and #138 have shown modest volume gains and seaward movement of the shoreline. Inshore sand bars were observed at all three profiles.

Beach Haven, Taylor Ave #137 and Dolphin Ave #136;

Both Beach Haven sites are located within the federal beachfill and initial construction was completed by 2016. The design dune at the Dolphin Avenue location was modified to shift the crest landward and sand dredged from Little Egg Inlet was added to the berm in winter 2018. During 2019-2020, the Taylor Avenue profile gained volume in the berm. The Dolphin Avenue profile continued to lose volume as the berm retreated landward from spring 2019.

Long Beach Township, Holgate, Webster Ave #135;

Initial construction of the engineered dune and berm was completed in summer 2016 and these features remained stable in 2019-2020. The profile gained a small volume during that timeframe.

Long Beach Township/Forsythe National Wildlife Refuge boundary #234;

Profile #234 is located 200 feet south (downdrift) of the Holgate terminal groin that was replaced with steel sheeting in winter 2019. Since commencement of the federal beachfill in Beach Haven and the Holgate section of the Township in 2016, this profile has shown significant changes in the berm and inshore. The last beach fill occurred 1,500 ft on the north side of the terminal groin in winter 2019. Approximately 8,000 cubic yards of fine sand dredged from a small channel on the bayside of LBI was placed on the ocean beach. The fall 2019 to fall 2020 changes showed the greatest volume gain of all profiles in Ocean County (46.05 yds³/ft).

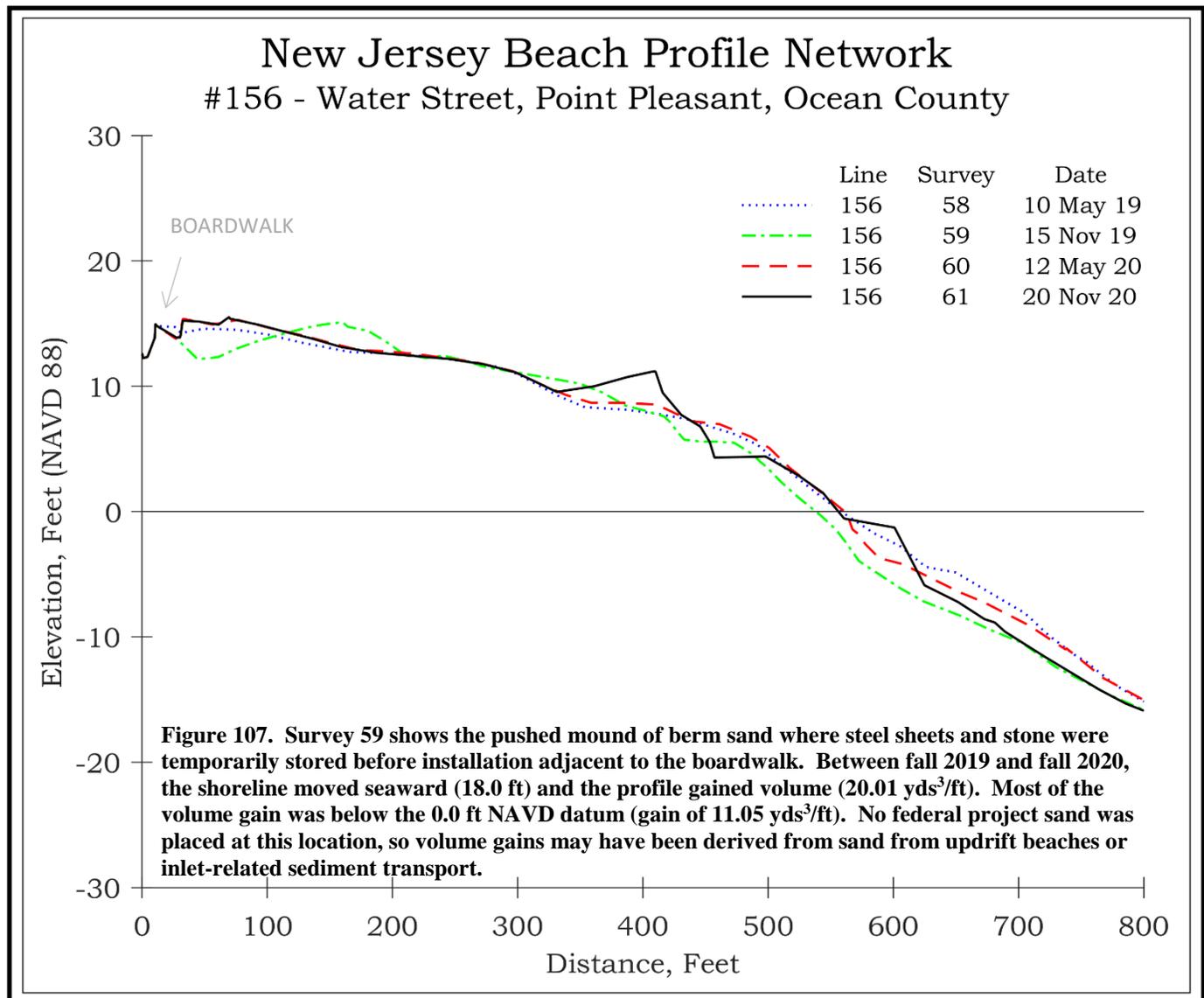
2020 Storm Activity

—Coastal low-pressure and tropical systems passing offshore New Jersey produced high winds, waves, rain, and flooding in eastern Ocean County in 2020. Between January 1, 2020 and January 31, 2021 eastern Ocean County was subjected to a coastal low (April 4, 2020) that produced high waves. High winds were recorded during Tropical Storm Fay (July 10, 2020) and Tropical Storm Isaias (August 4, 2020) that also produced a tornado in Ship Bottom and Brant Beach. During passage of TS Isaias, NOAA National Data Buoy Center Station 44091 (offshore Barnegat Light NJ) recorded a maximum wave height of 17.35 ft with a wave period of 7.76 seconds from the SE (167 deg) (NOAA, 2021). Tropical Storm Kyle (August 14, 2020) was located 250 miles east-southeast of Atlantic City and generated waves that created significant scarping along the Ocean County shoreline. Large swell from passing Hurricane Teddy occurred over a period of three days with over 6.5 ft waves (September 20-22, 2020). Remnants from Hurricane Eta produced waves greater than 12.0 ft (November 14, 2020 – considered a post-tropical cyclone). Three coastal low-pressure systems in late November and December also produced high waves with maximum heights ranging from 12.6 ft to 22.4 ft measured at Buoy Station 44091. The NOAA Storm Events Database did not show high surf events during 2020 (NOAA, 2021). Though there was no direct landfall and no defined high surf events, these passing storms and low-pressure systems generated waves that contributed to beach erosion in Ocean County.

NJBPN 156 – Water Street, Point Pleasant Beach



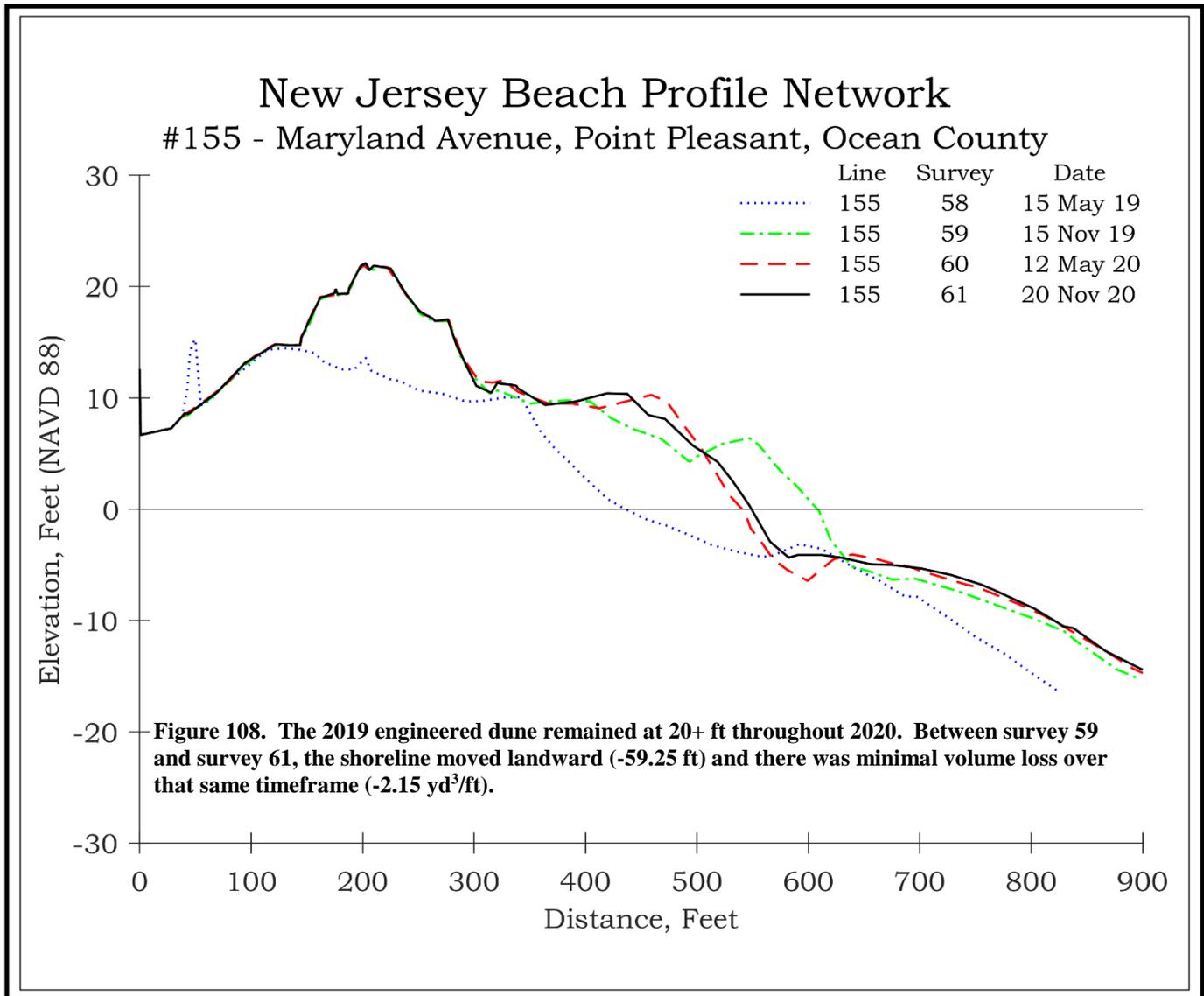
The Water Street site is located near the south end of the Point Pleasant Beach boardwalk and 1,400 ft south from the Manasquan Inlet jetty. The 2019 and 2020 fall surveys show scarps between the berm and the swash zone (left photo taken November 15, 2019 and right photo taken November 20, 2020).



NJBPN 155 – Maryland Avenue, Point Pleasant



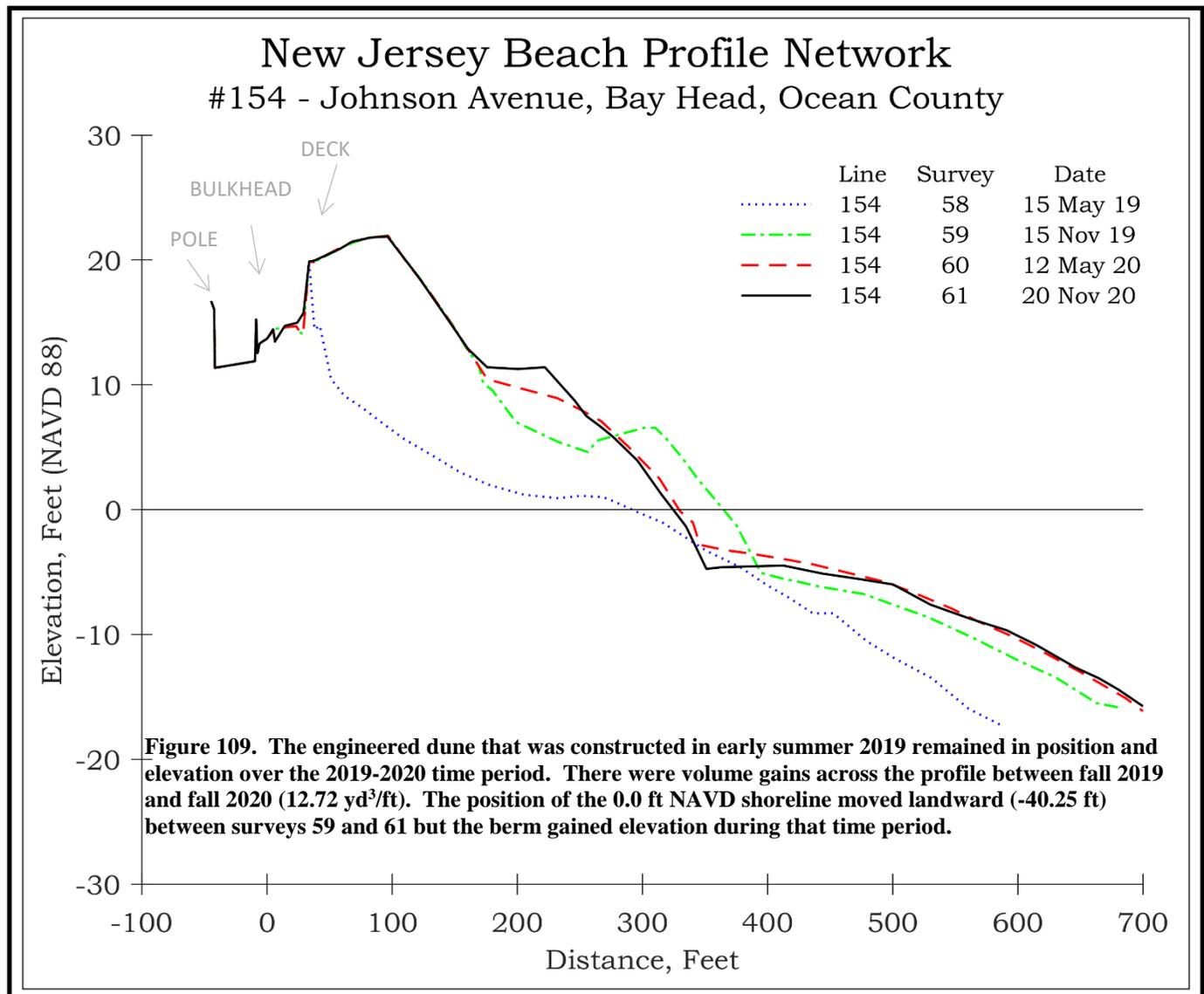
This Maryland Avenue profile site was included in the federal beachfill that was completed in July 2019. Since nourishment, the berm width decreased but the engineered dune remained as construction (left photo taken November 15, 2019 and right photo taken November 20, 2020).



NJBPN 154 – Johnson Avenue, Bay Head



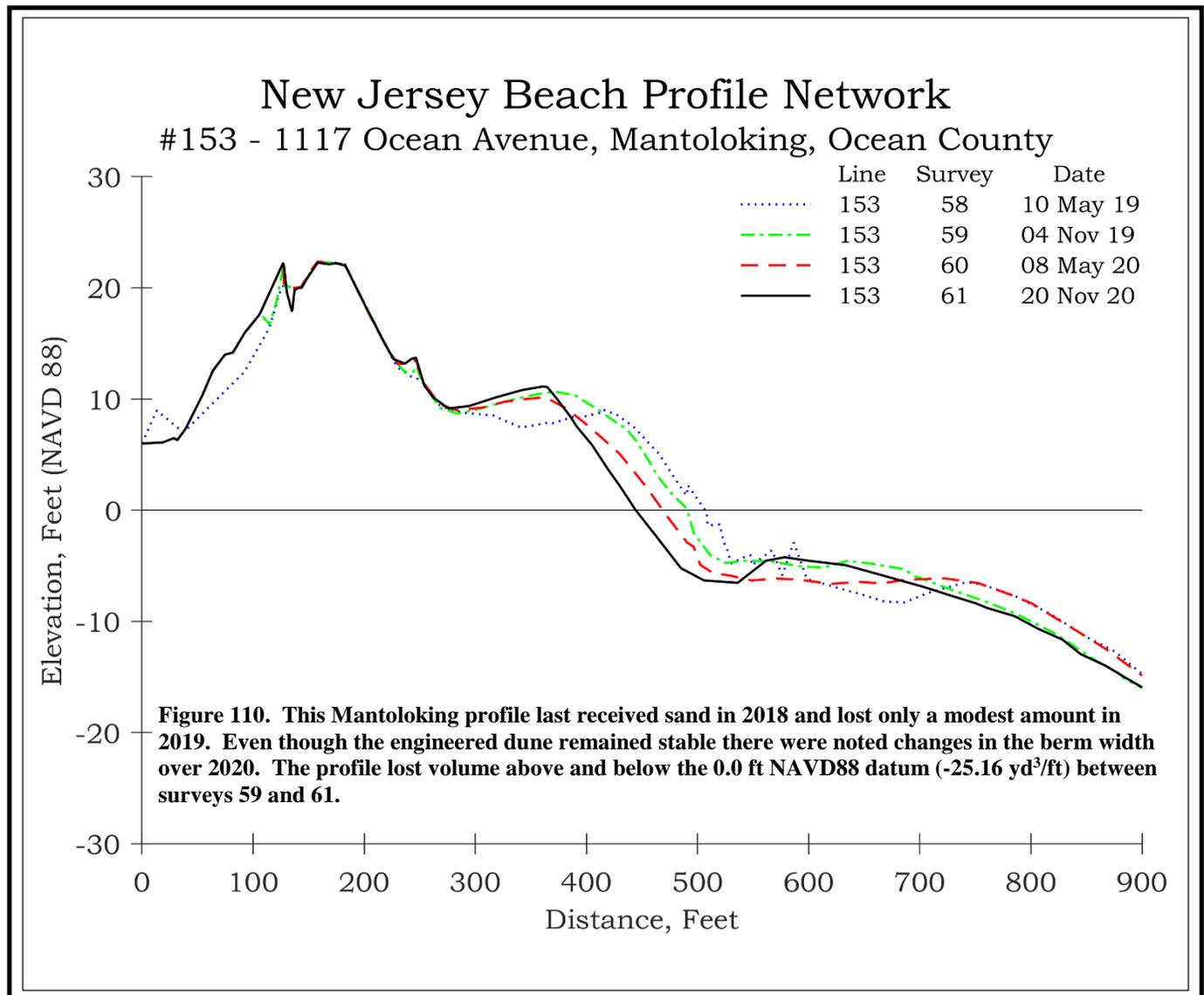
Sand placement was completed at the Johnson Avenue profile in June 2019. The photos show the extent of the berm during the 2019 and 2020 fall surveys (left photo taken November 15, 2019 and right photo taken November 20, 2020). The dry berm sand shown in the 2020 photo indicates higher elevation (not impacted by daily tides/waves) from the 2019 photo.



NJBPN 153 – 1117 Ocean Avenue, Mantoloking



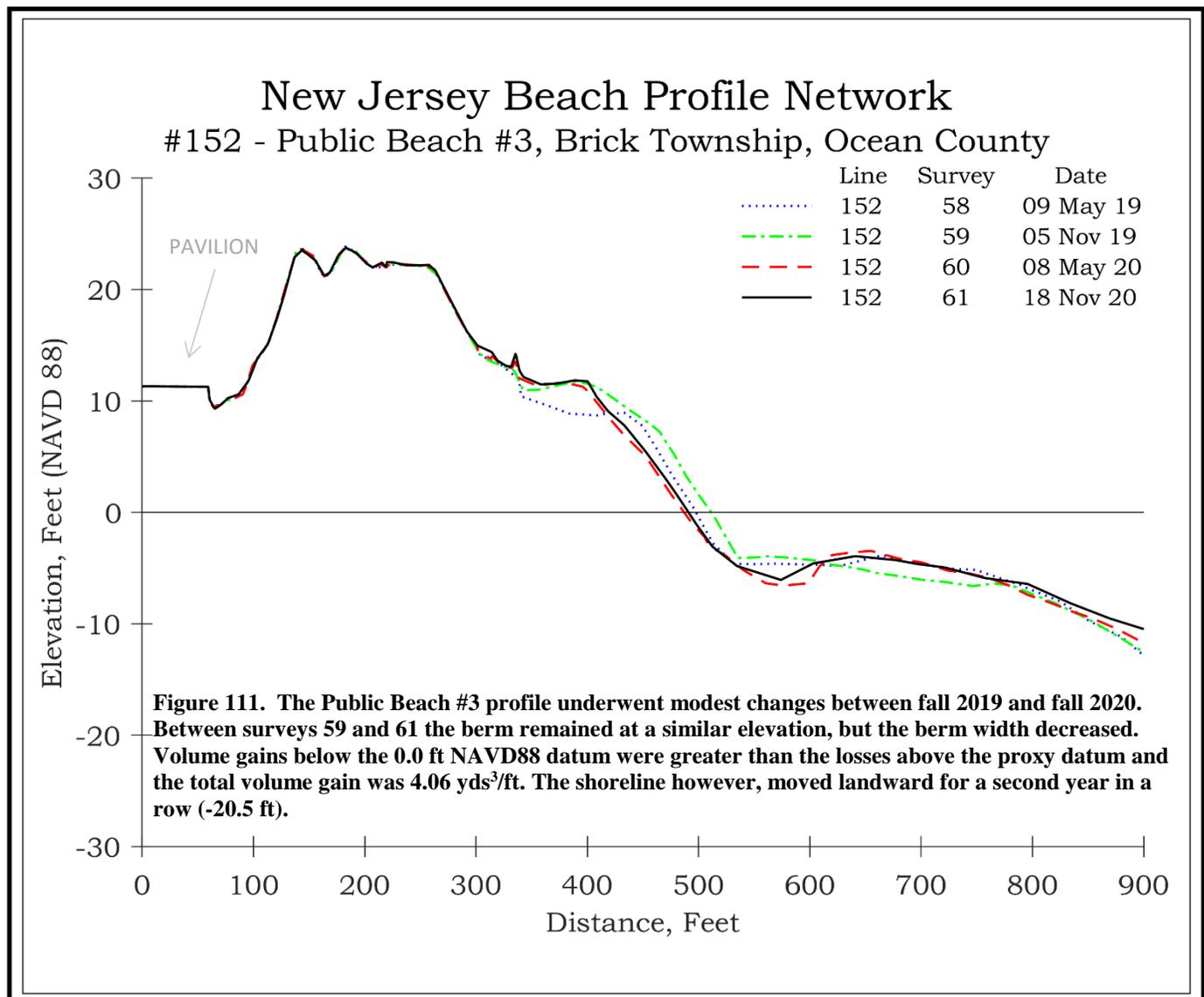
The photos of the 1117 Ocean Avenue profile show the condition of the engineered dune that covers a steel bulkhead that was constructed in 2015 (left photo taken November 4, 2019 and right photo taken November 20, 2020). The dune remained stable over the 2019-2020 time period, but berm width decreased. The 0.0 ft NAVD shoreline moved landward (-46.25 ft) from its fall 2019 position.



NJBPN 152 – Public Beach #3, Brick Township



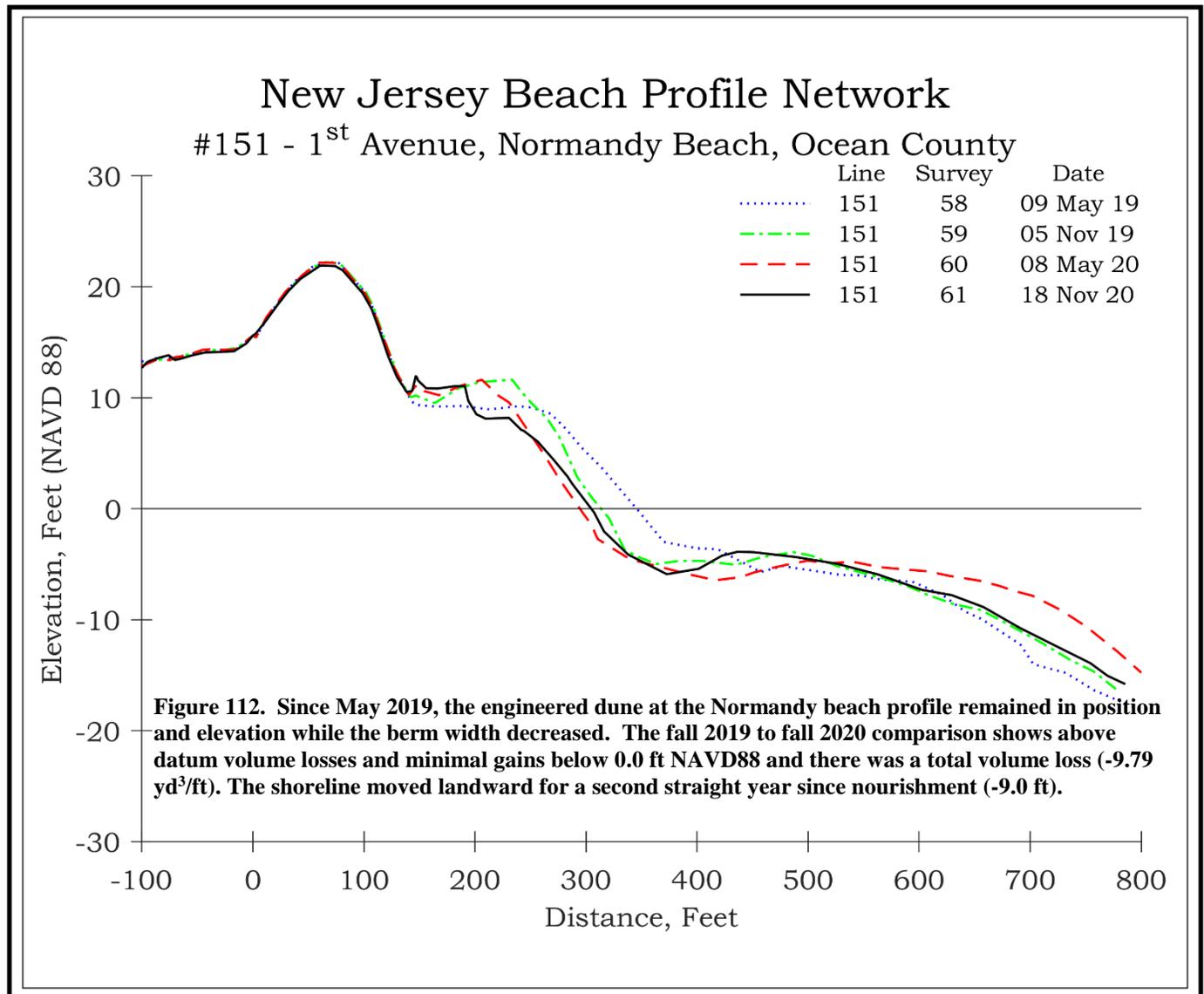
The beachfill was completed at the Brick Township Public Beach #3 profile site in summer 2018 with the engineered dune covering the steel bulkhead. The photos show the condition of the dune (left taken November 5, 2019 and right taken November 18, 2020). The dune remained in position and elevation throughout 2020.



NJBPN 151 – 1st Avenue, Normandy Beach



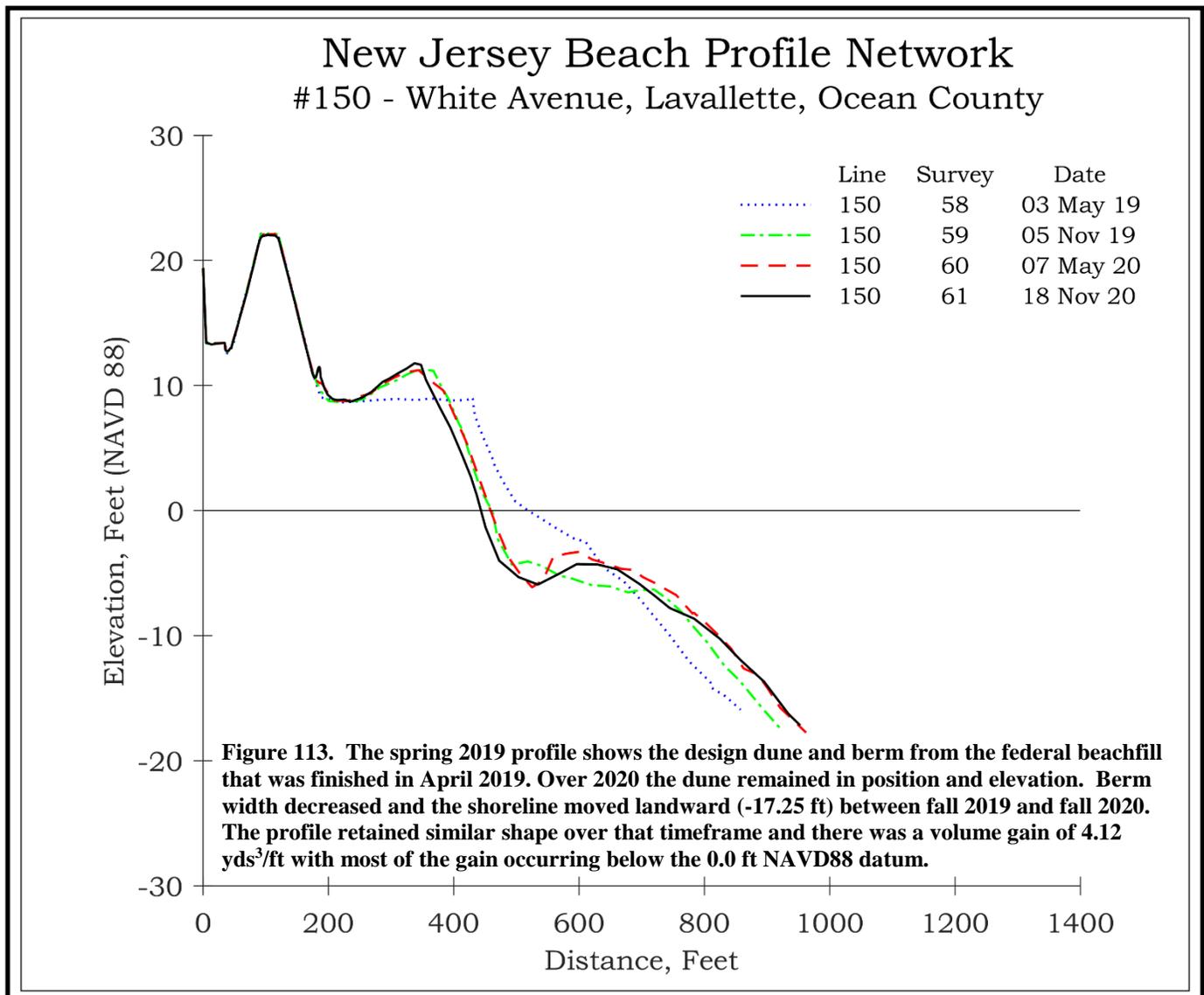
The photos of the Normandy Beach profile show the conditions of the seaward dune toe of the engineered dune that was completed in December 2018 (left photo taken November 5, 2019 and right photo taken November 18, 2020). The fall 2020 photo and profile show sand accumulated at the fence.



NJBPN 150 – White Avenue, Lavallette



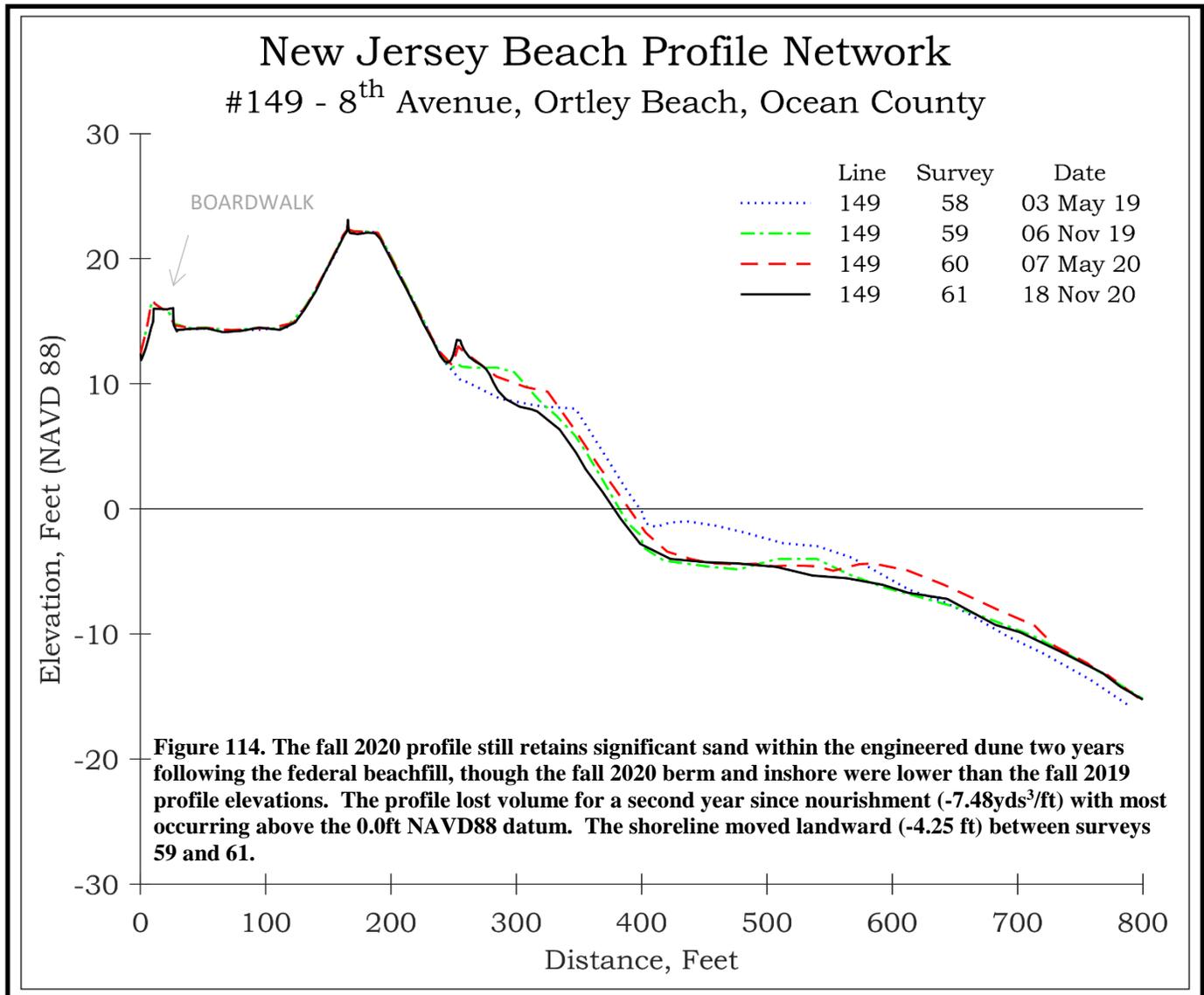
The left photo (taken November 5, 2019) shows the engineered dune which was created from the integration of sand recovered from Hurricane Sandy and the beachfill that was completed at this location in April 2019. The right photo (taken November 18, 2020) shows planted vegetation on the engineered dune.



NJBPN 149 – 8th Avenue, Ortley Beach



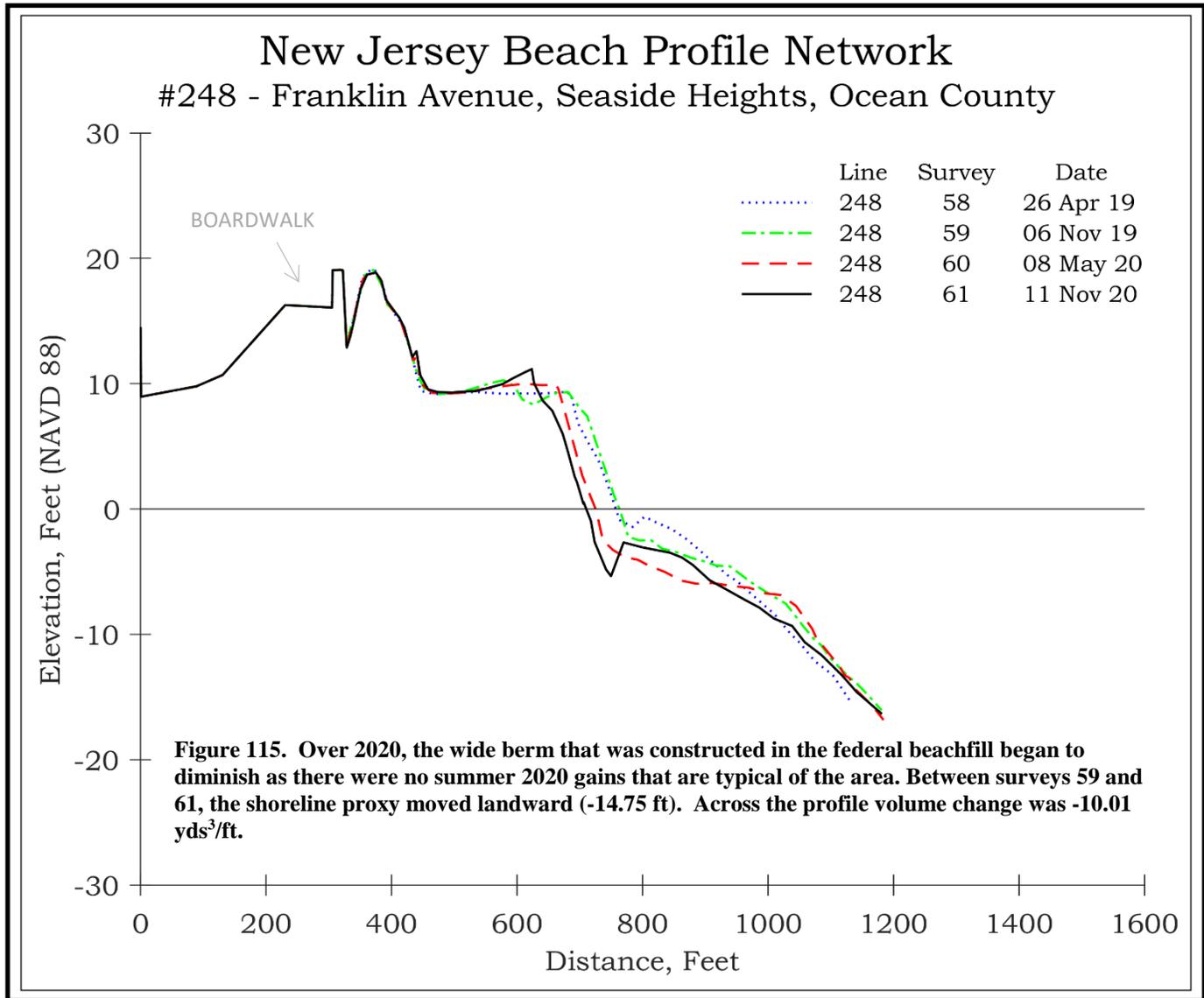
The Ortley Beach photos show conditions on the engineered dune that was completed in November 2018 (left photo taken November 6, 2019 and right photo taken November 18, 2020). Over 2019-2020, the 22 ft high dune remained in position and elevation.



NJBPN 248 – Franklin Avenue, Seaside Heights



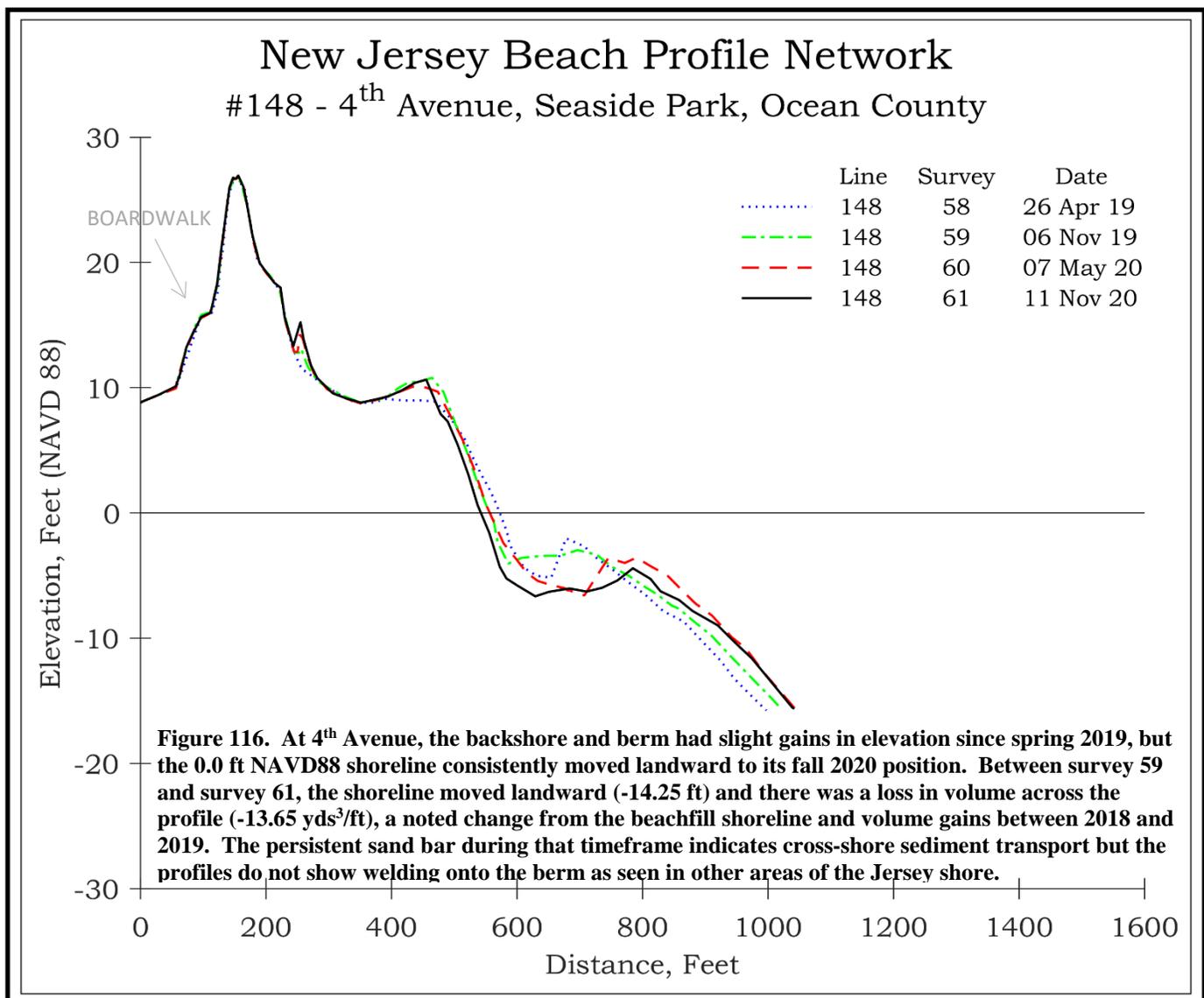
At the Franklin Avenue profile, an engineered dune was constructed within the federal beachfill in January 2019. No dune existed prior to the beachfill. The dune remained stable through 2020 (left photo taken November 6, 2019 and right photo taken November 11, 2020).



NJBPN 148 – 4th Avenue, Seaside Park



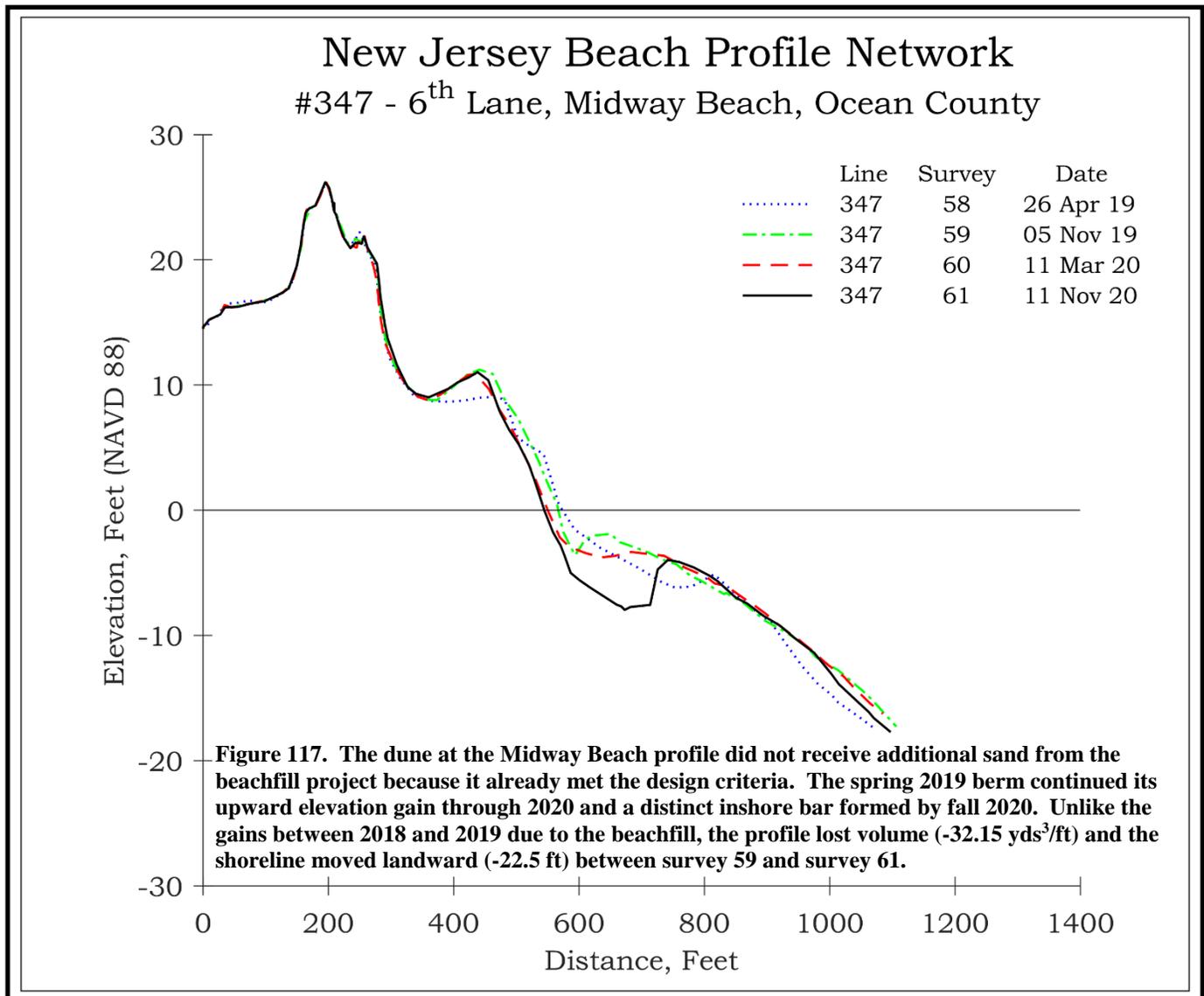
There was little change in the dune at 4th Avenue between fall 2019 and fall 2020 (left photo November 6, 2019 and right photo taken November 11, 2020). The beachfill at this Seaside Park location was completed in January 2019 and did not include additional sand on the dune. Backshore elevations also remained consistent over 2019-2020.



NJBPN 347 (formerly 147) – 6th Lane, Midway Beach (S. Seaside Park)



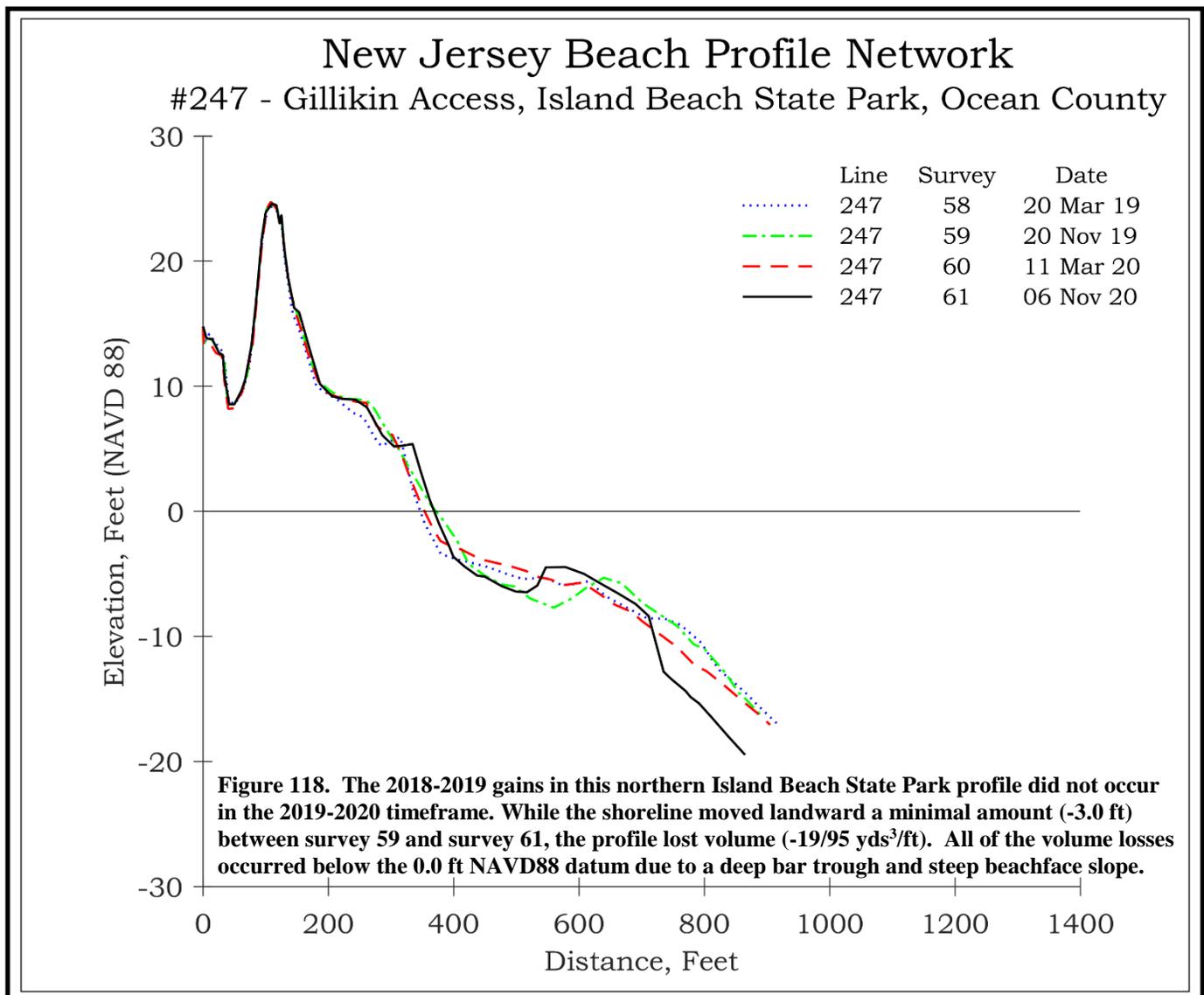
The photos of the 6th Lane location (left November 5, 2019 and right taken November 11, 2020) show the conditions of the berm since completion of the beachfill that occurred in February 2019. The seaward portion of the berm gained in elevation between spring 2019 and fall 2020.



NJBPN 247 – North End, Island Beach State Park



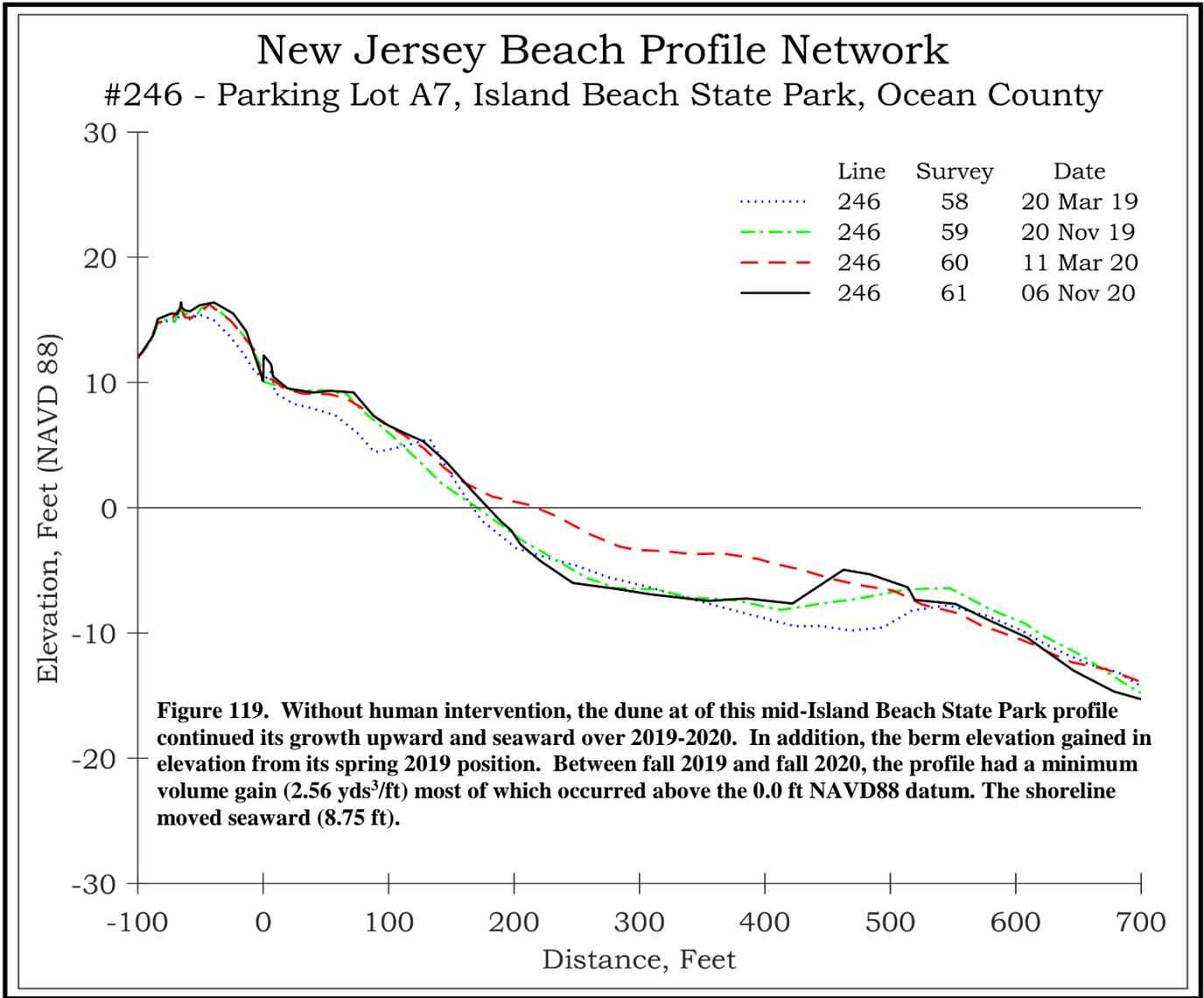
The dune at the Gillikin Access location has remained stable in shape and elevation since the seaward dune face was scarped during Hurricane Sandy in 2012 (left photo taken November 20, 2019 and right photo taken November 6, 2020). The Island Beach State Park profile sites were not included in the federal beachfill project but are downdrift. Accretion occurred at this state park location in 2018-2019.



NJBPN 246 – Parking Lot A7, Island Beach State Park



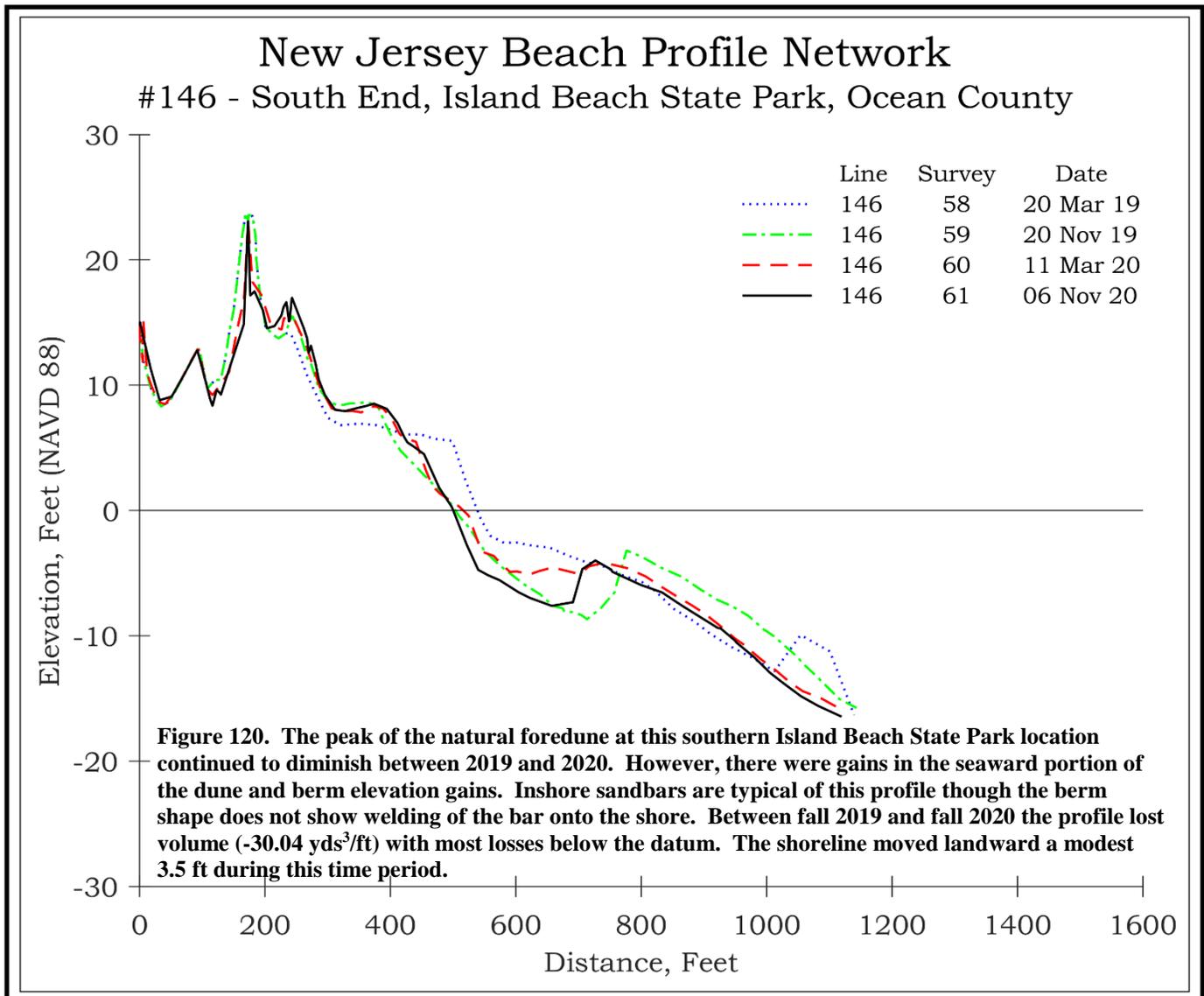
The IBSP Parking Lot A7 profile photos show a change at the dune toe. Sand accumulated and nearly covered the sand fencing poles by November 6, 2020 (right photo) and there was sparse dune vegetation coverage. The left photo (taken November 20, 2019) shows a similar berm width as in November 2020.



NJBPN 146 – South End, Island Beach State Park



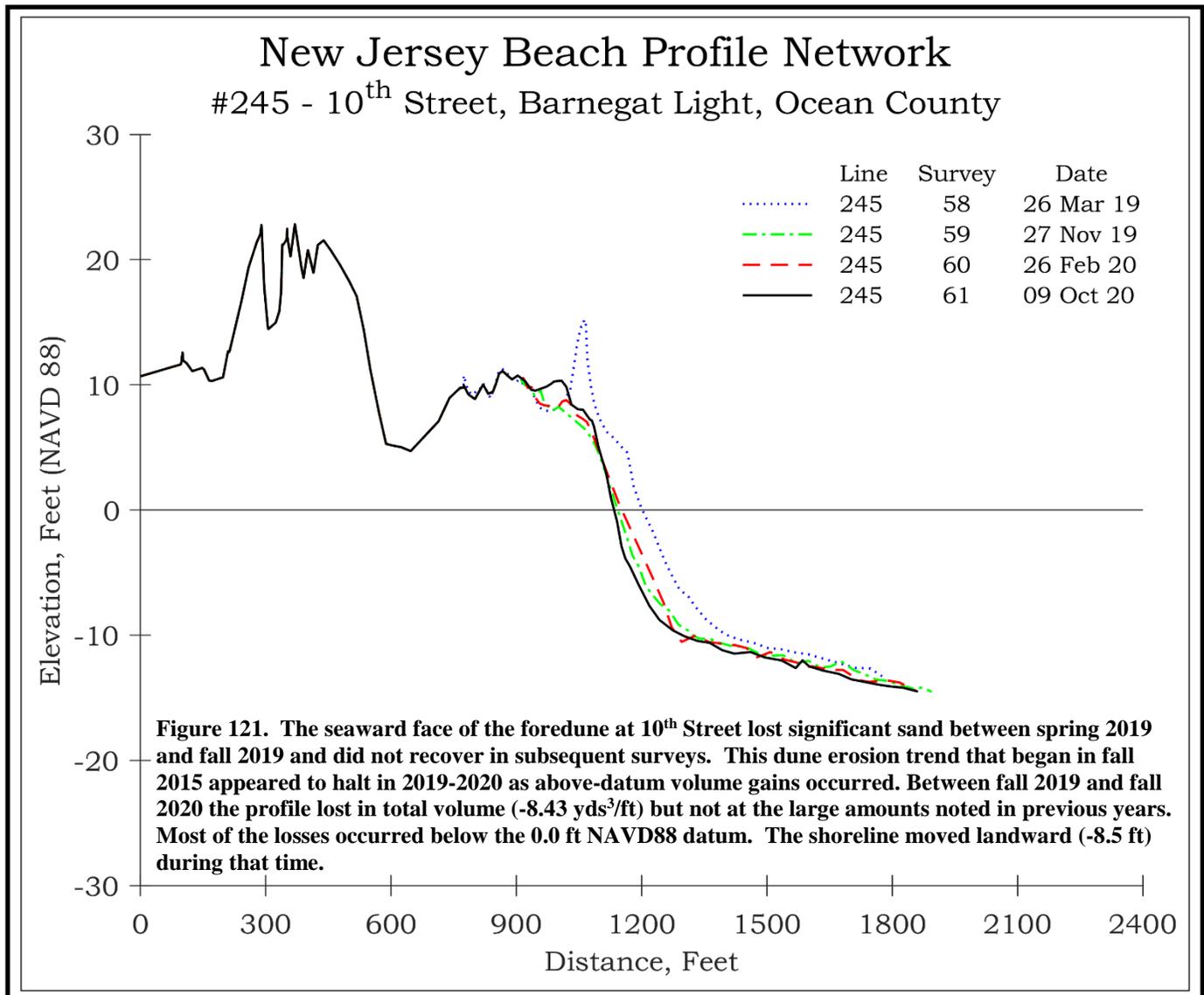
The 2019 and 2020 photos from the South End (IBSP) profile location show similar dune toe shape, elevation, and vegetation coverage. Berm elevations and extent were around 8.0 ft NAVD88. The berm was wider and lower in spring 2019 but berm width and elevation were similar from fall 2019 through fall 2020 (left photo taken November 20, 2019 and right photo taken November 6, 2020).



NJBPN 245 – 10th Street, Barnegat Light



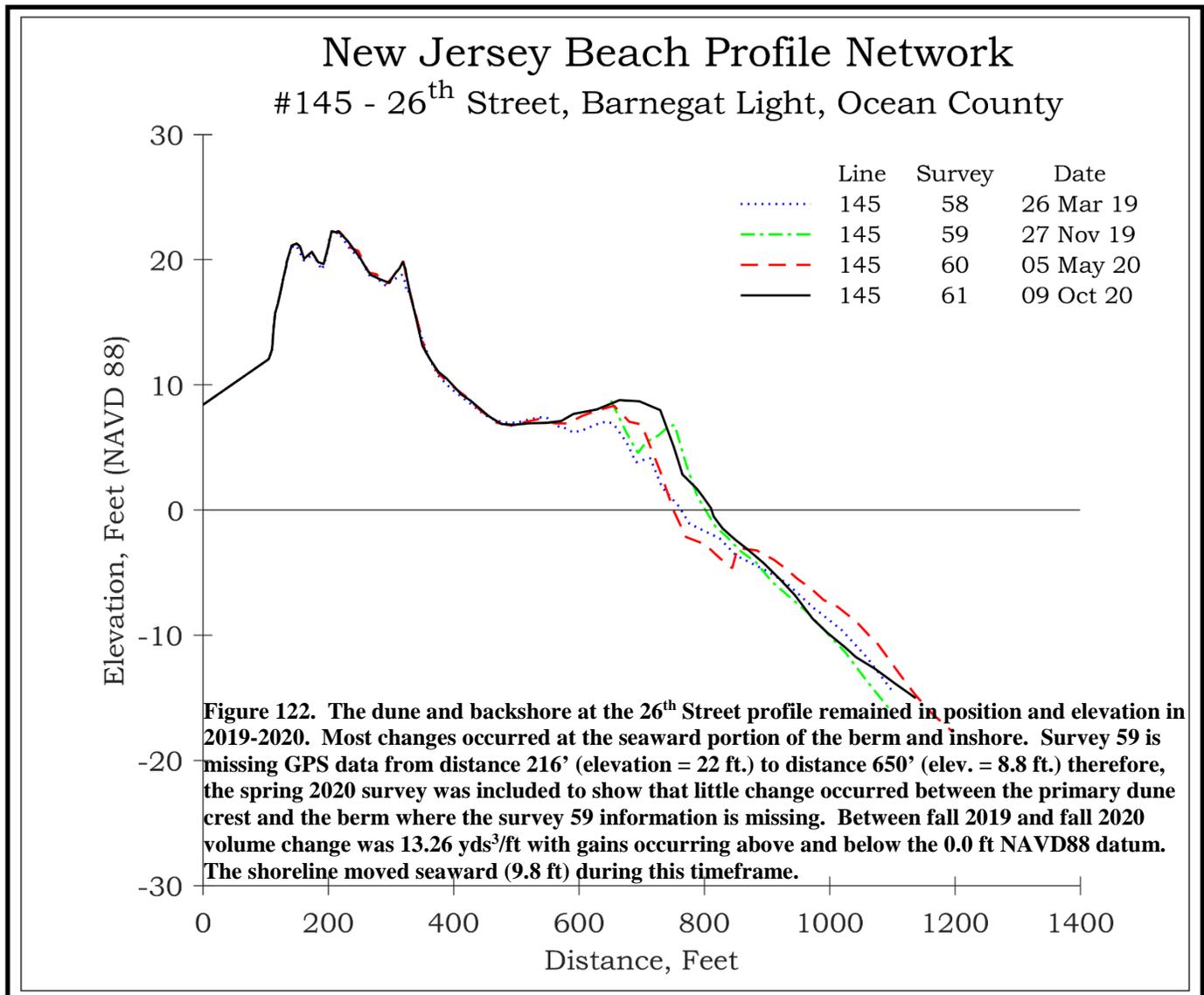
The 10th Street profile is characterized by a wide dune field and narrow berm but the foredune has been eroding and moving landward since the fall 2015 survey (left photo taken November 27, 2019 and right photo taken October 9, 2020). The mast of the shipwrecked Sea King (buried by sand and once well landward of the seaward dune toe) now stands on the backshore. Over the timeframe displayed by the photos the 0.0 ft NAVD88 shoreline proxy moved landward (-8.5 ft).



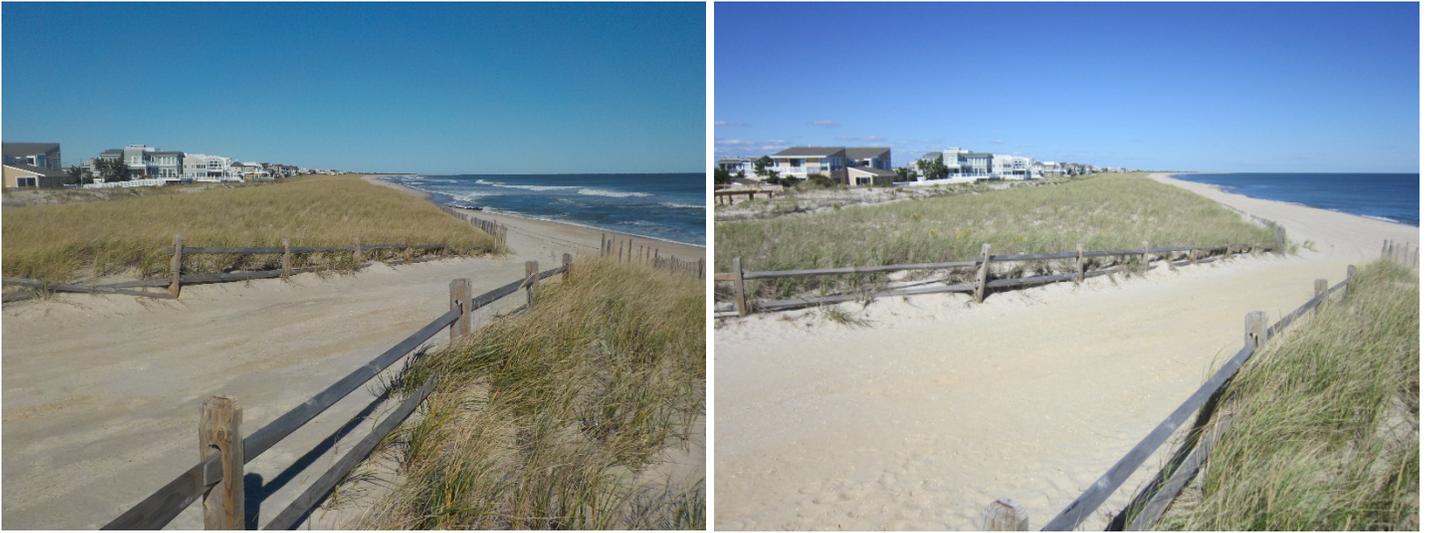
NJBPN 145 – 26th Street, Barnegat Light



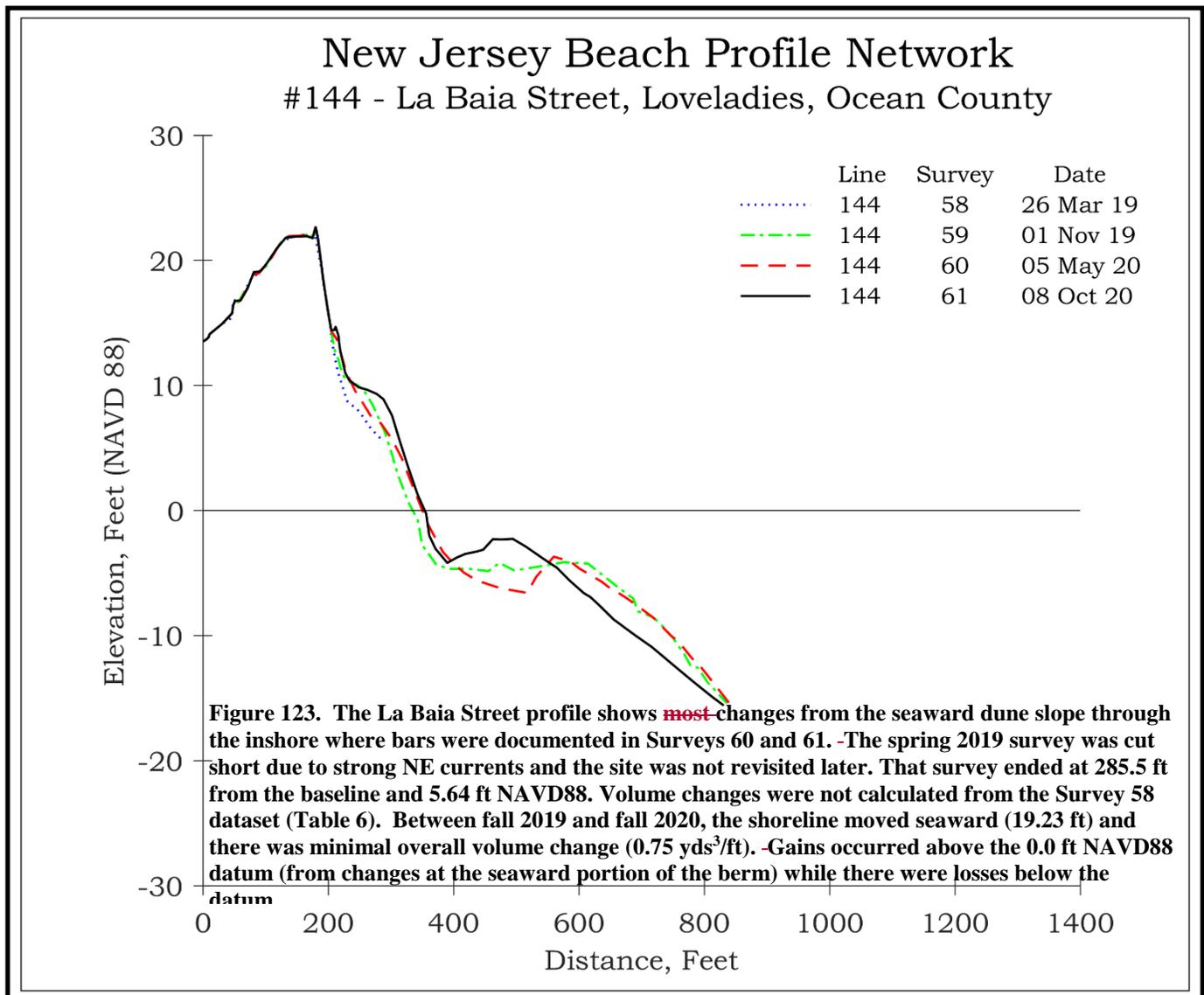
The berm at the 26th Street profile was similar in width in the fall 2019 (left photo taken November 27, 2019) and fall 2020 (right photo taken October 9, 2020). The natural dune at this location has remained at the same elevation and width for over a decade.



NJBPN 144 – La Baia Street, Loveladies



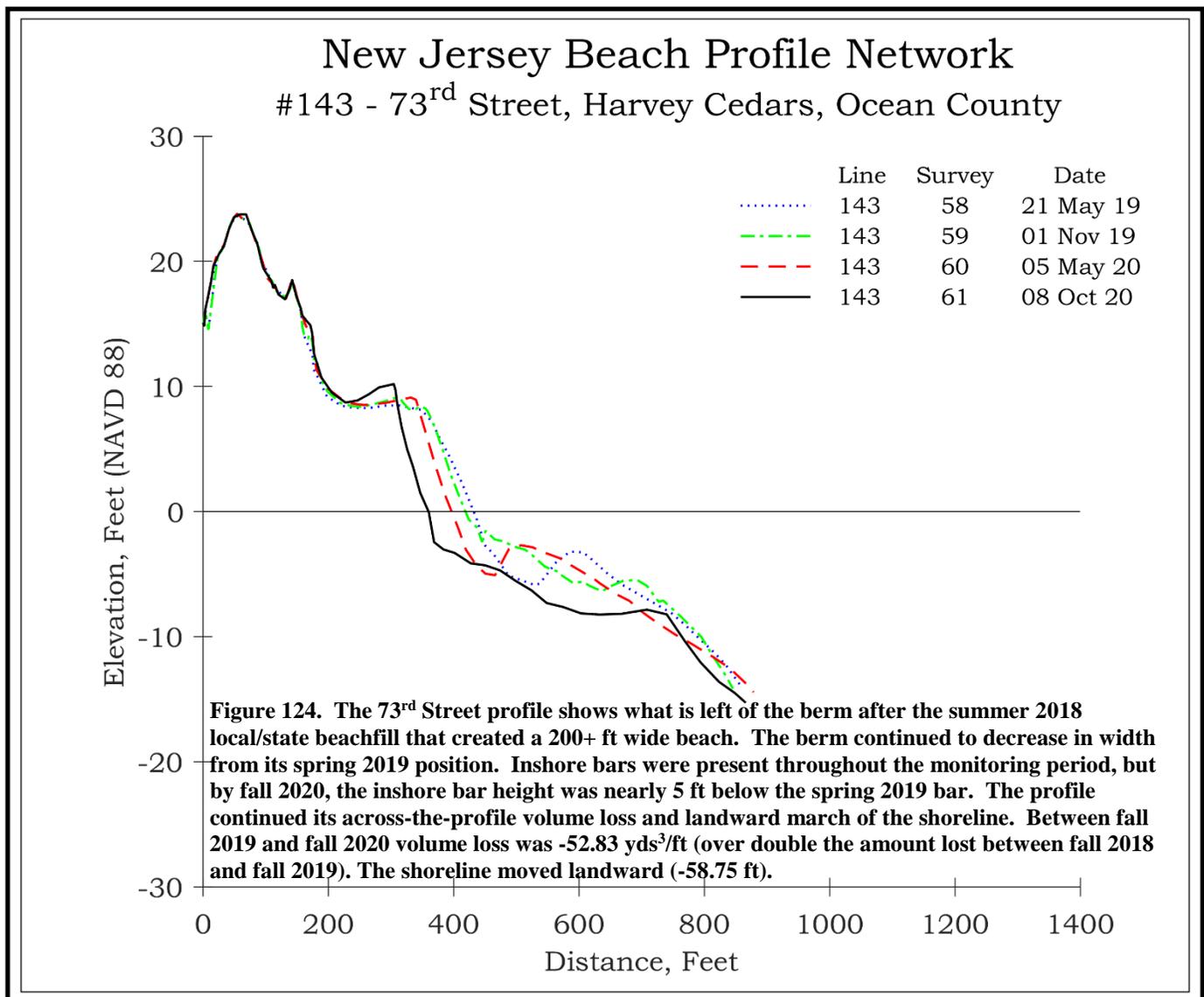
The photos show the vegetated engineered dune that was constructed at La Baia Street in 2016 (left photo taken November 1, 2019 and right photo taken October 8, 2020). The dune and berm remained in relative position and elevation in 2019-2020. Some sand accumulated along the landward side of the shore-parallel fencing that protects the dunes from foot traffic.



NJBPN 143 – 73rd Street, Harvey Cedars



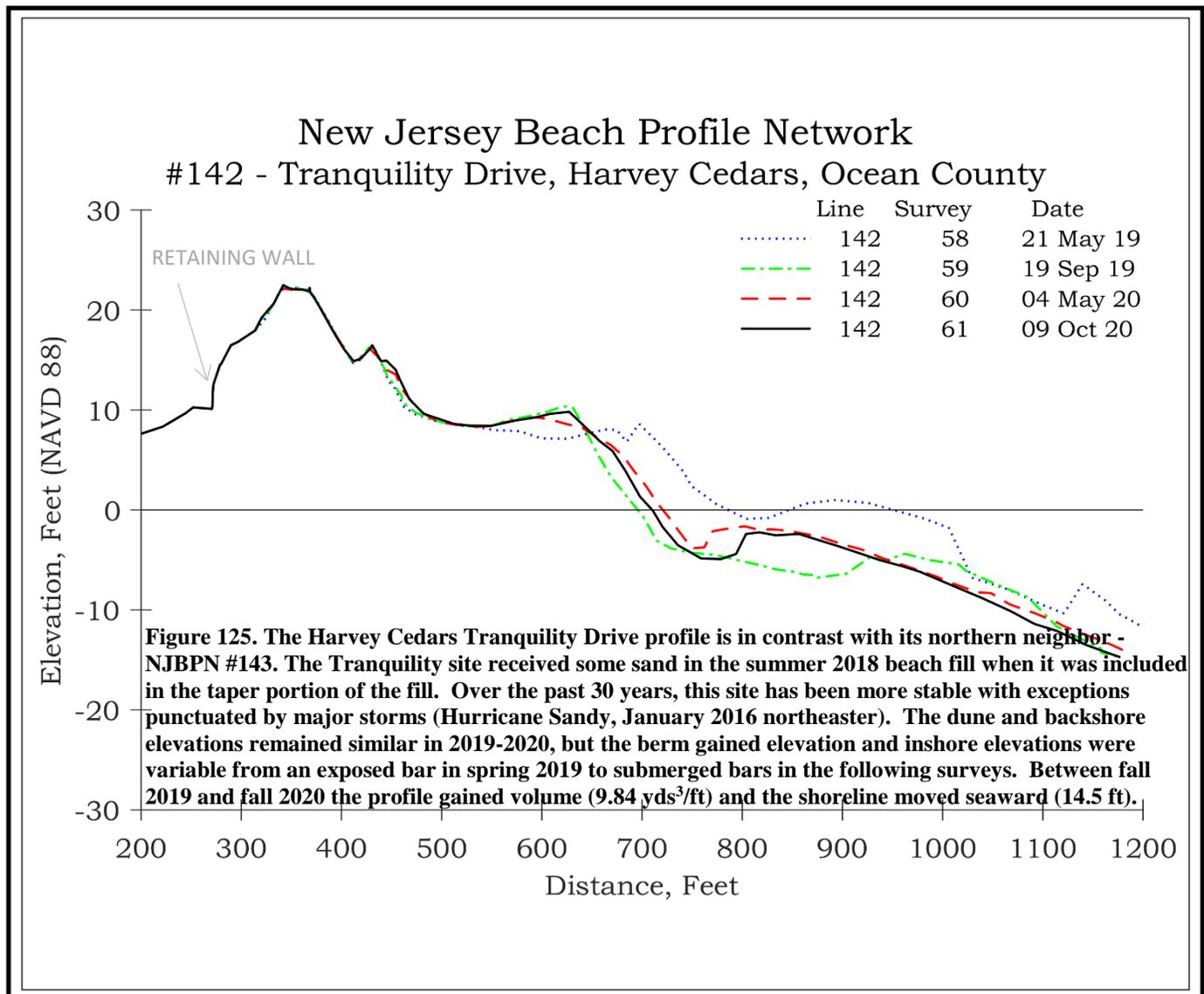
The berm at the 73rd Street profile reduced in width between fall 2019 and fall 2020 (left photo taken November 1, 2019 and right photo taken October 8, 2020). However, there was a modest amount of sand accumulation on the seaward face of the dune during that time period, but not nearly the amounts documented in the past few years.



NJBPN 142 – Tranquility Drive, Harvey Cedars



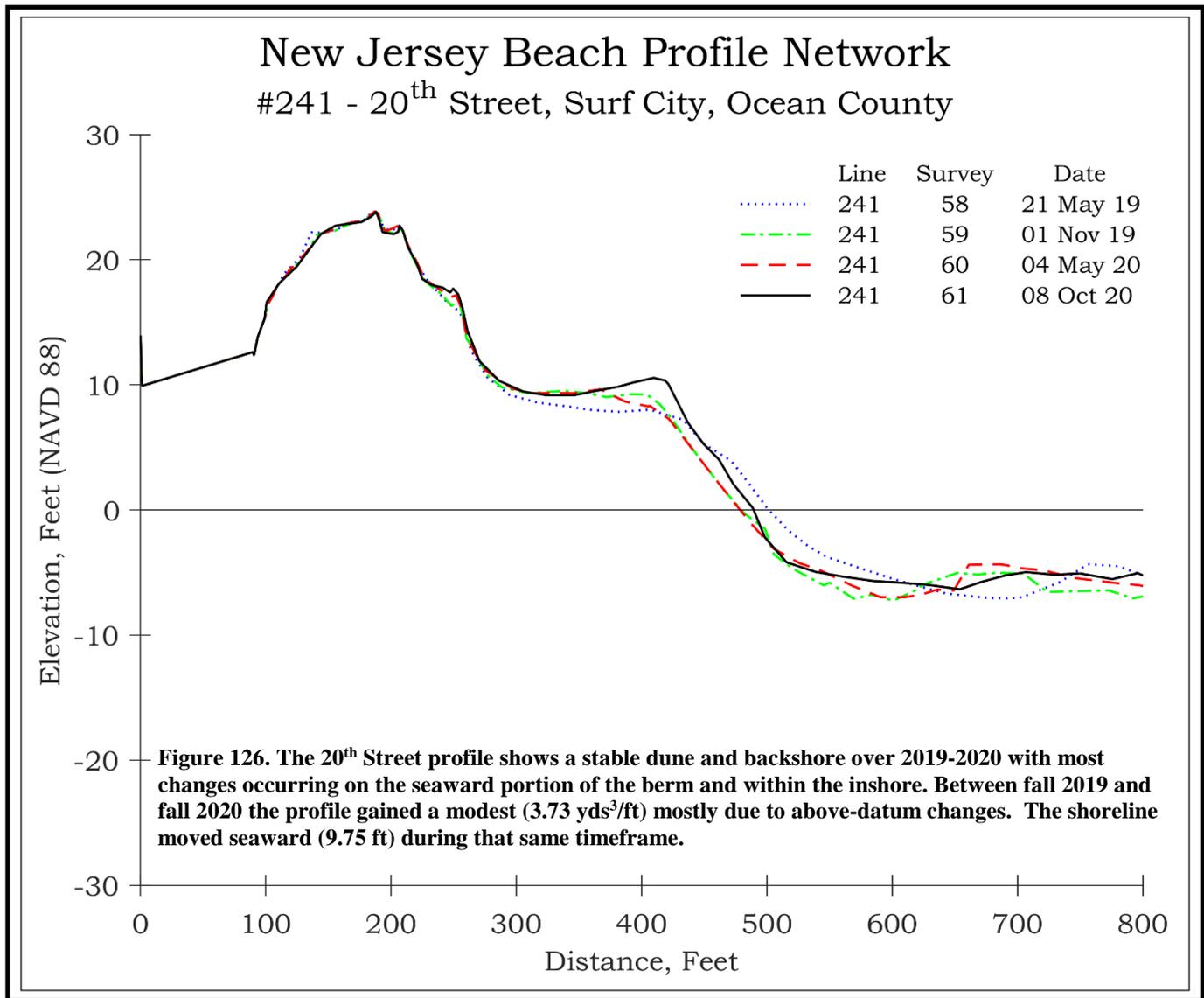
Vegetation on the engineered dune at the Tranquility Drive profile has not reached the density observed at the engineered dune at nearby NJBPN profiles (left taken September 19, 2019 and right taken October 9, 2020). Wind-blown sand contributed to gains at the dune toe from fall 2019.



NJBPN 241 – 20th Street – Surf City



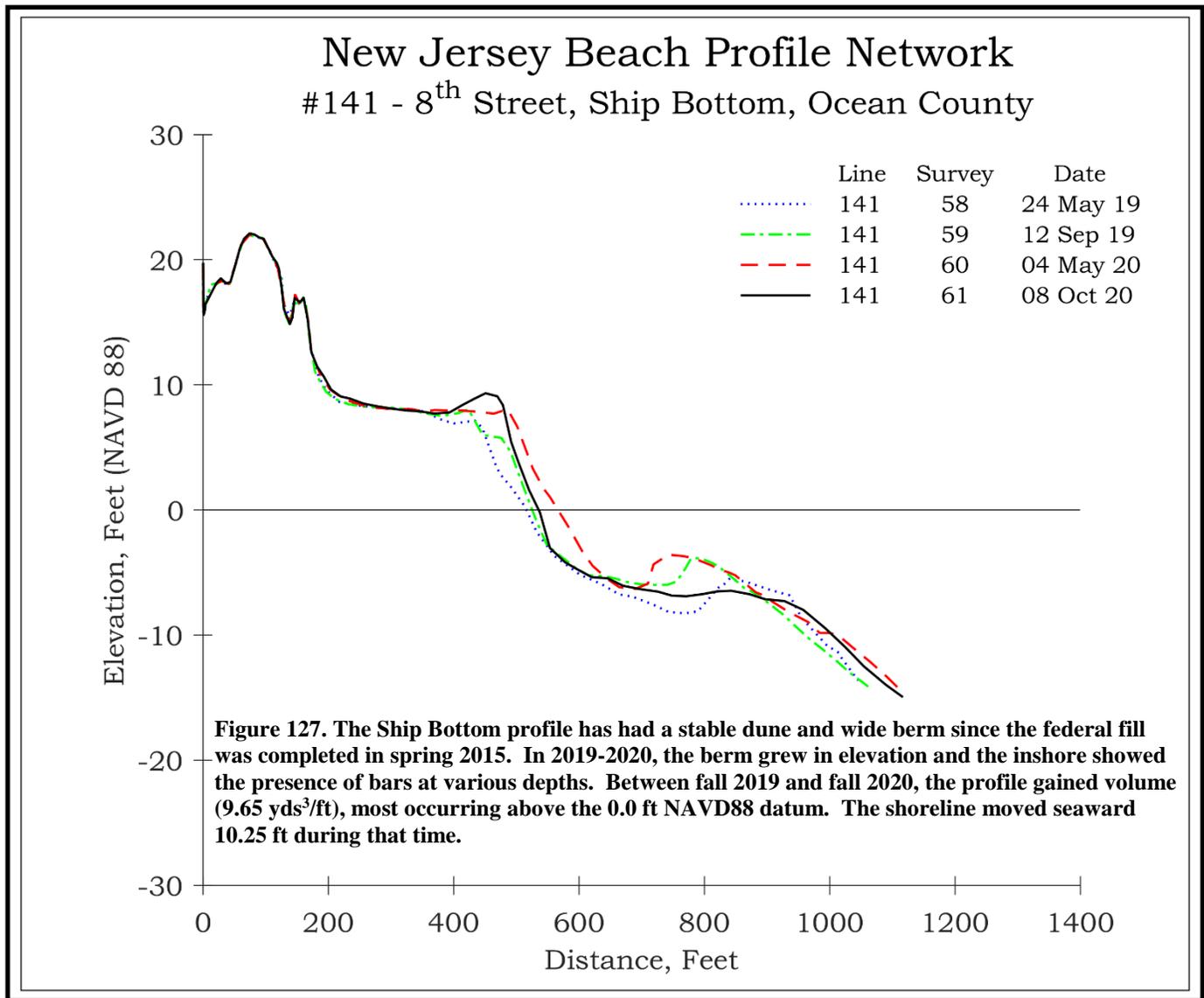
A supplemental beachfill was completed at the 20th Street profile in July 2018. By fall 2019 (left photo taken November 1, 2019) berm width was within 25 feet from the fall 2018 position. In fall 2020, berm width was similar to fall 2019 (right photo taken October 8, 2020).



NJBPN 141 – 8th Street, Ship Bottom



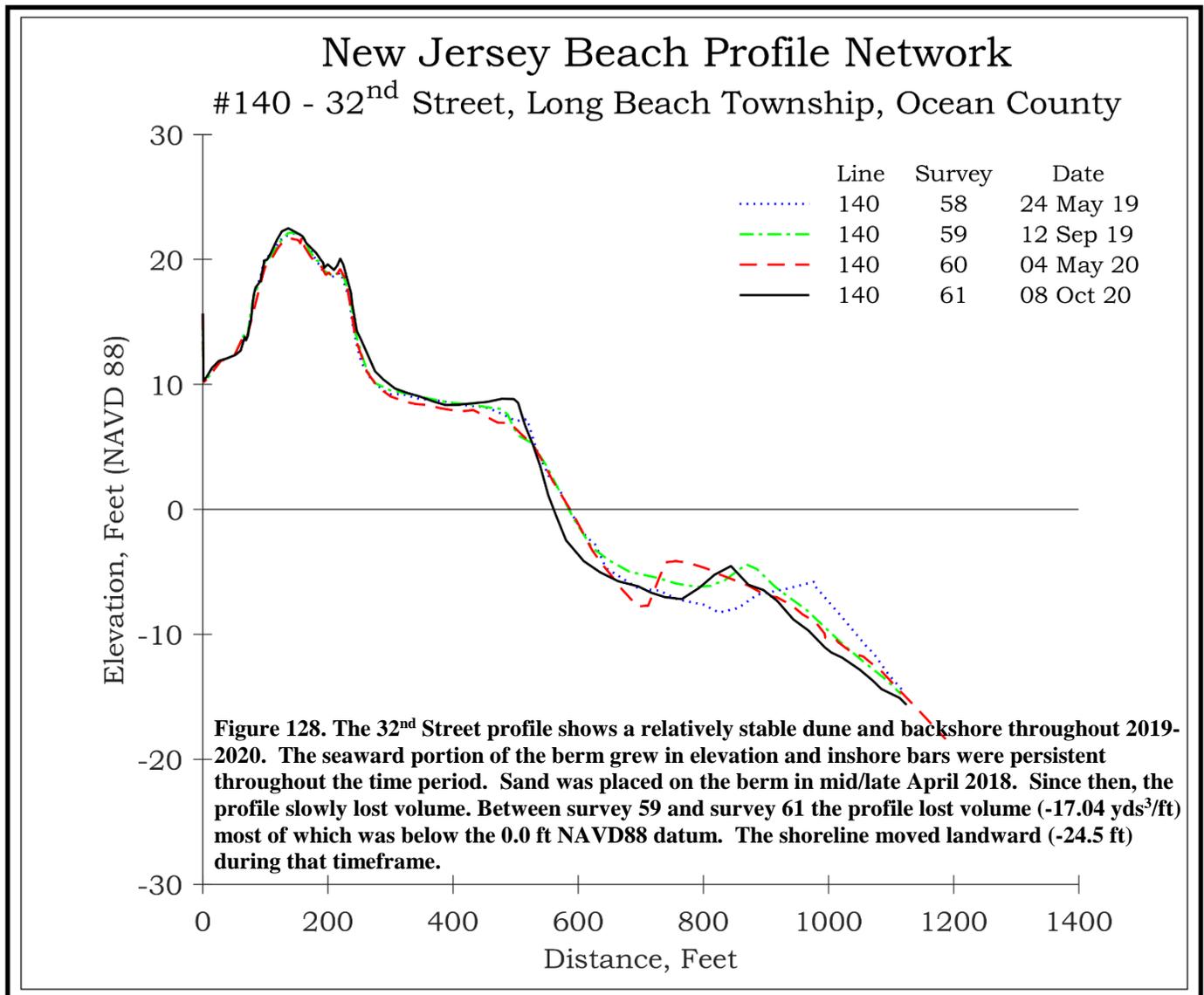
The Ship Bottom 8th Street photos show the views from the top of the foredune and to the north (left photo taken September 12, 2019 and right photo taken October 8, 2020). The dune and berm portions of the profile have maintained similar elevation and shape over the 2019-2020 time period.



NJBPN 140 – 32nd Street, Long Beach Township



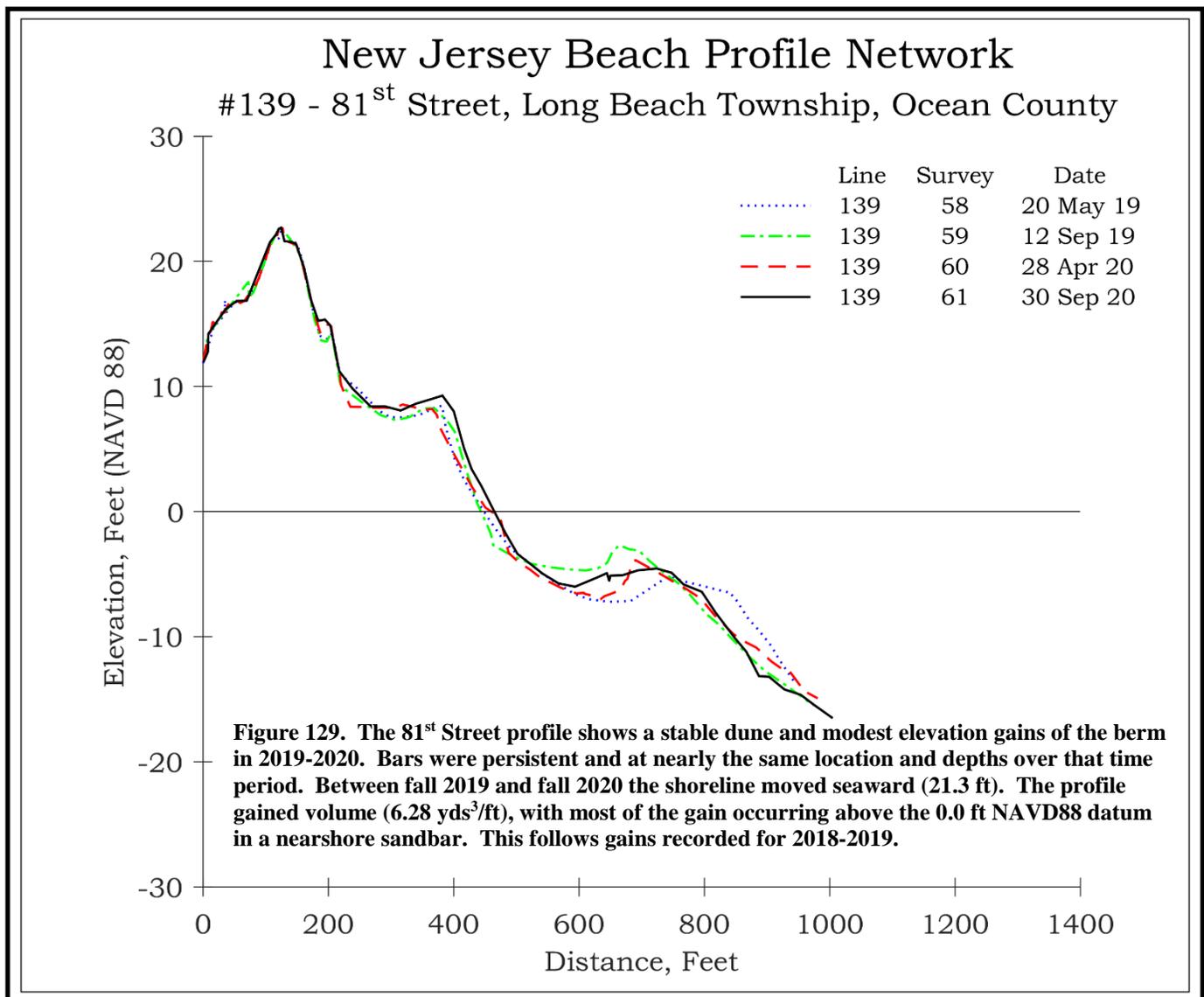
The photos show the view to the north of the dune toe and backshore at 32nd Street in Brant Beach (left taken September 12, 2019 and right photo taken October 8, 2020). The dune and berm elevations remained consistent throughout 2019-2020.



NJBPN 139 – 81st Street, Long Beach Township



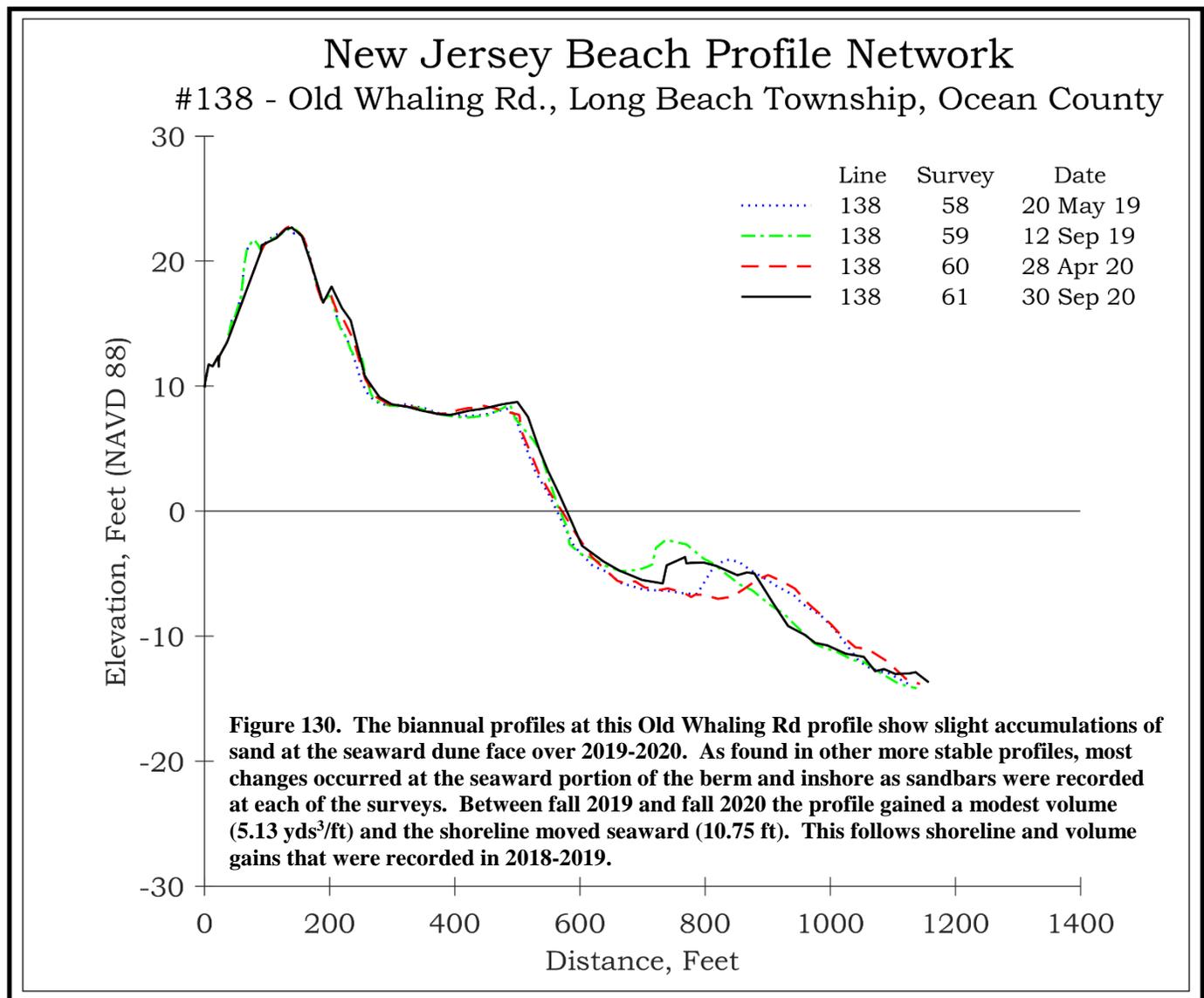
At the Township’s 81st Street profile there was a modest accumulation of sand at the seaward dune toe between 2019 and 2020 (left photo taken September 12, 2019 and right taken September 30, 2020). The engineered dune has remained at the same elevation since it was constructed in 2015.



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



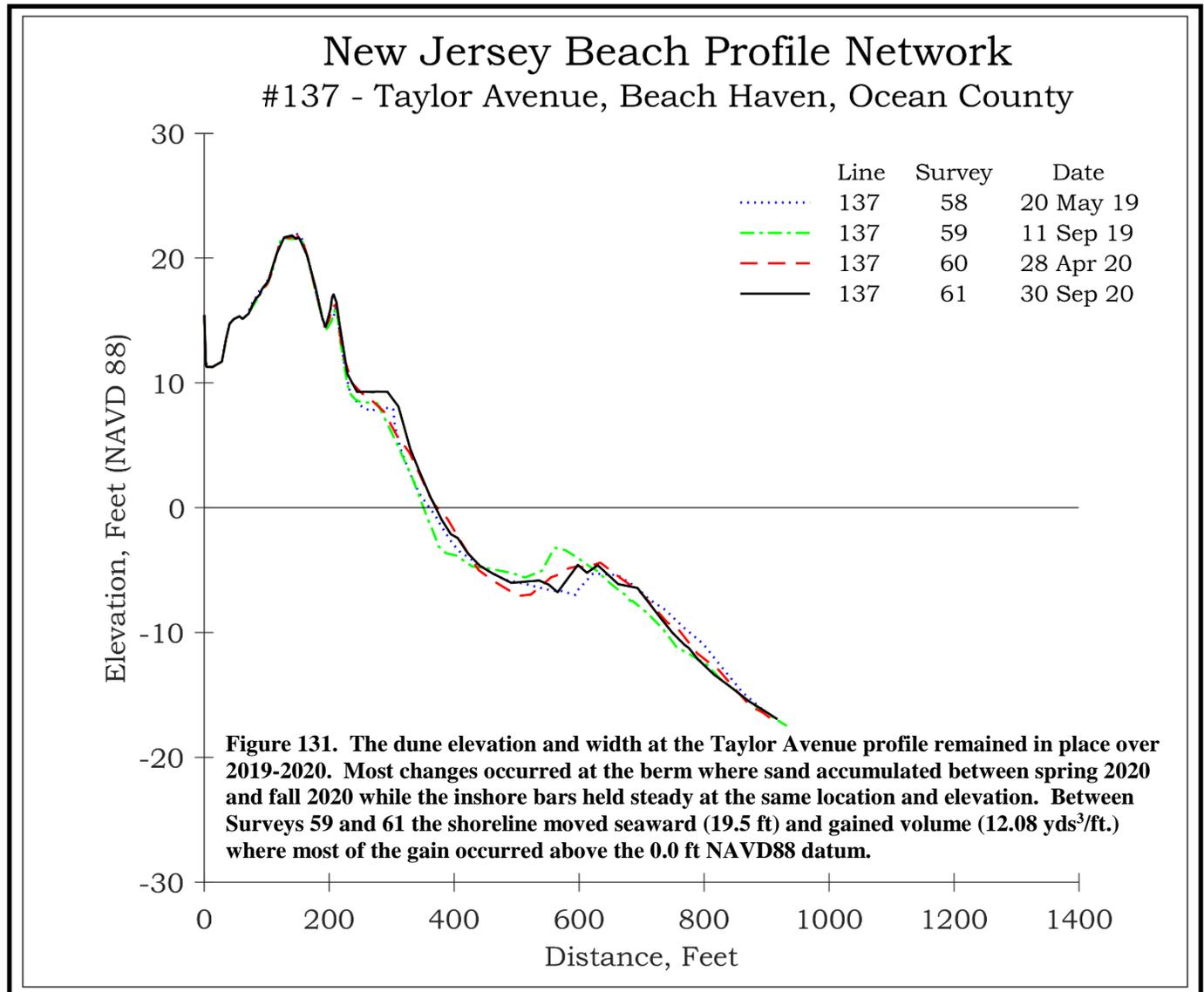
The photos show the view to the north along the dune toe at the Old Whaling Road profile (left taken September 12, 2019 and right photo taken September 30, 2020). This profile has shown consistent growth of the seaward portion of the dune from accumulations of windblown sand. The profile has retained a wide berm since the 2016 beachfill repairs.



NJBPN 137 – Taylor Avenue, Beach Haven



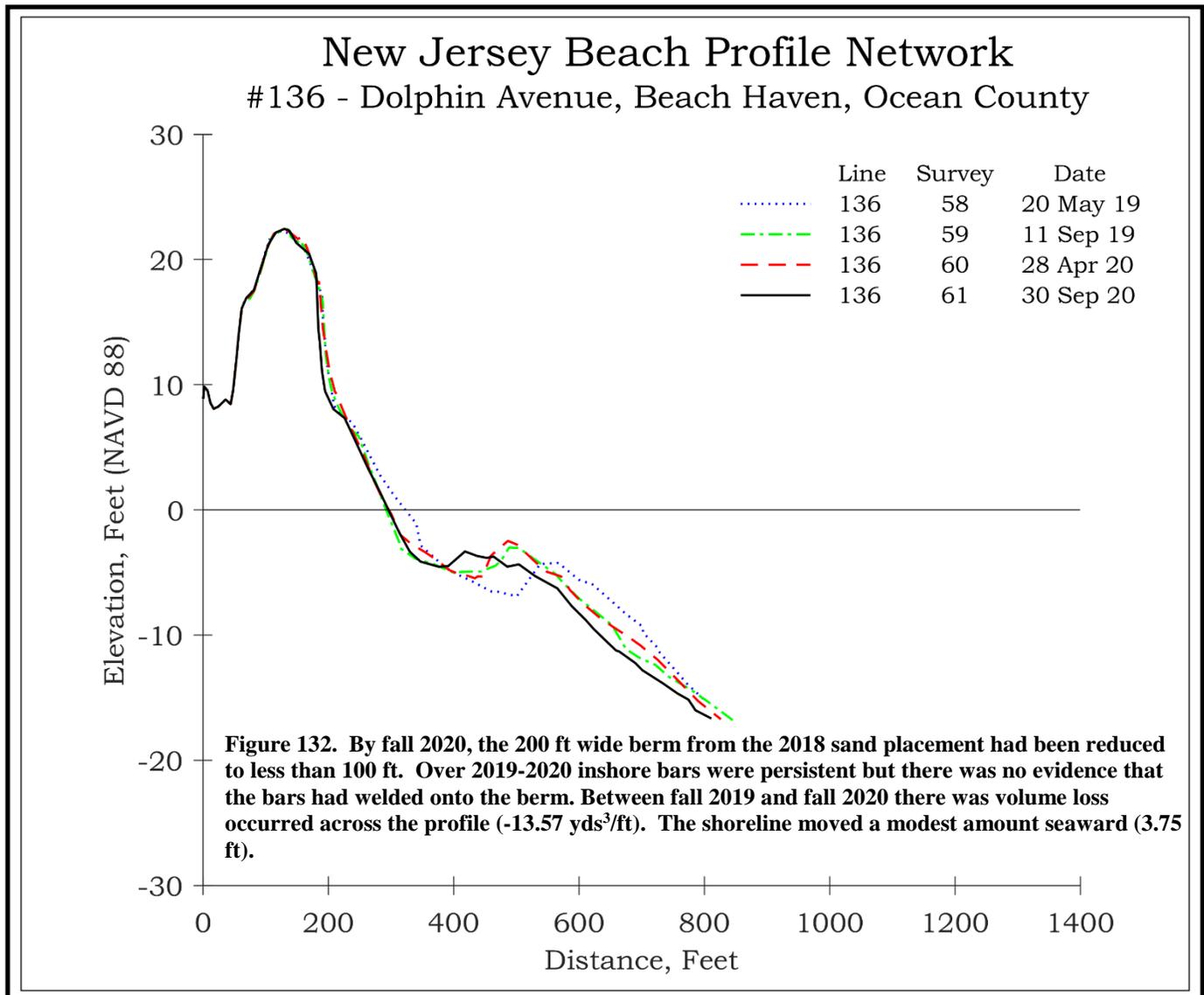
At the Taylor Avenue profile, there was a small gain in elevation of the berm over 2019-2020 (left taken September 11, 2019 and right taken September 30, 2020). This profile typically has narrower berm widths than those LB Twp. NJBPN profiles to the north.



NJBPN 136 – Dolphin Avenue, Beach Haven



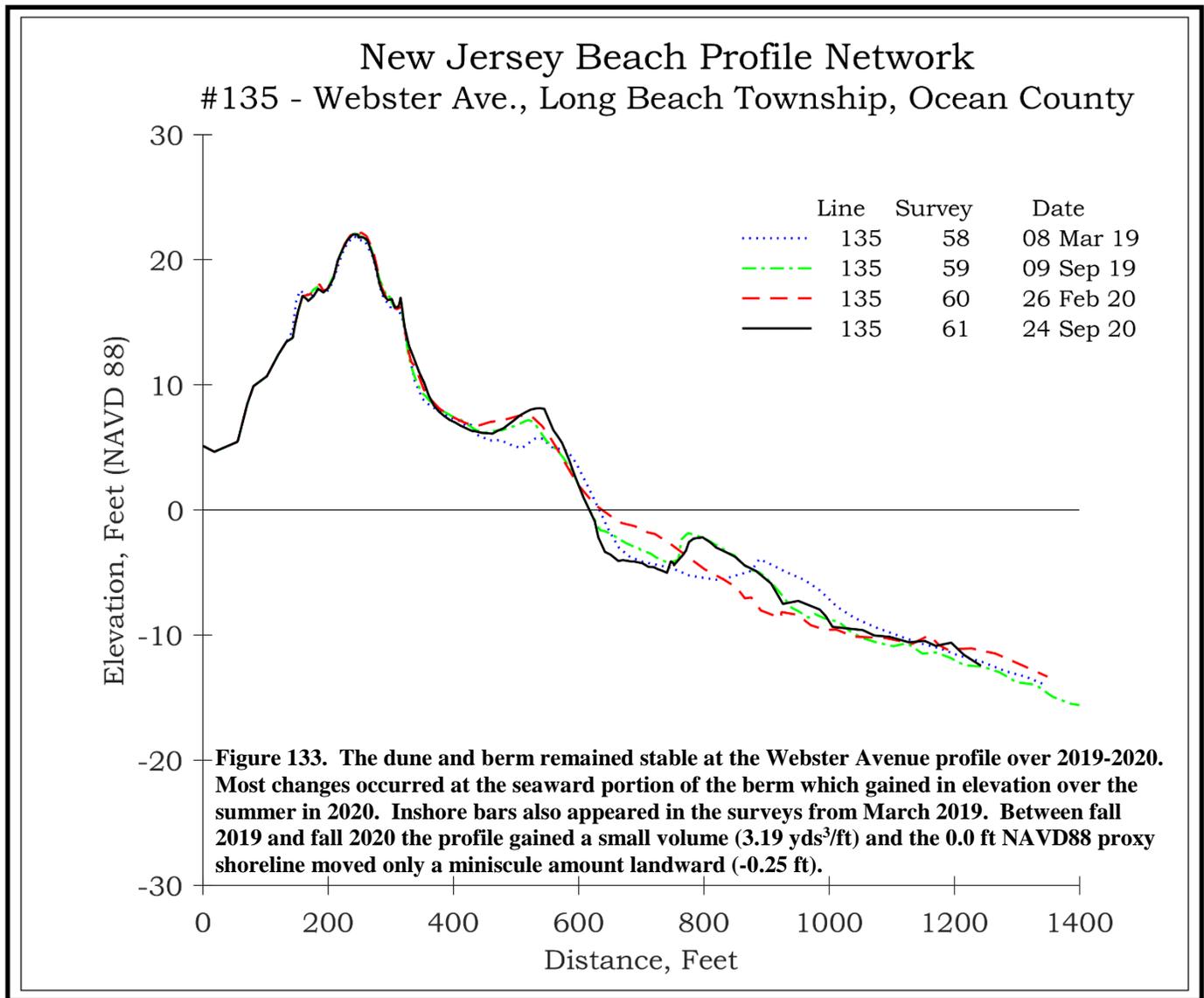
The Dolphin Avenue dune crest was shifted landward to accommodate changes to the USACE dune template and sand was added in early 2018 from the dredging of Little Egg Inlet. From 2019-2020 the elevation of the dune remained the same but scarping of the dune occurred in the September 2020 survey (probably the result from high surf generated a week earlier from the passing of Hurricane Teddy. (left photo taken September 11, 2019 and right photo taken September 30, 2020).



NJBPN 135 – Webster Avenue, Long Beach Township



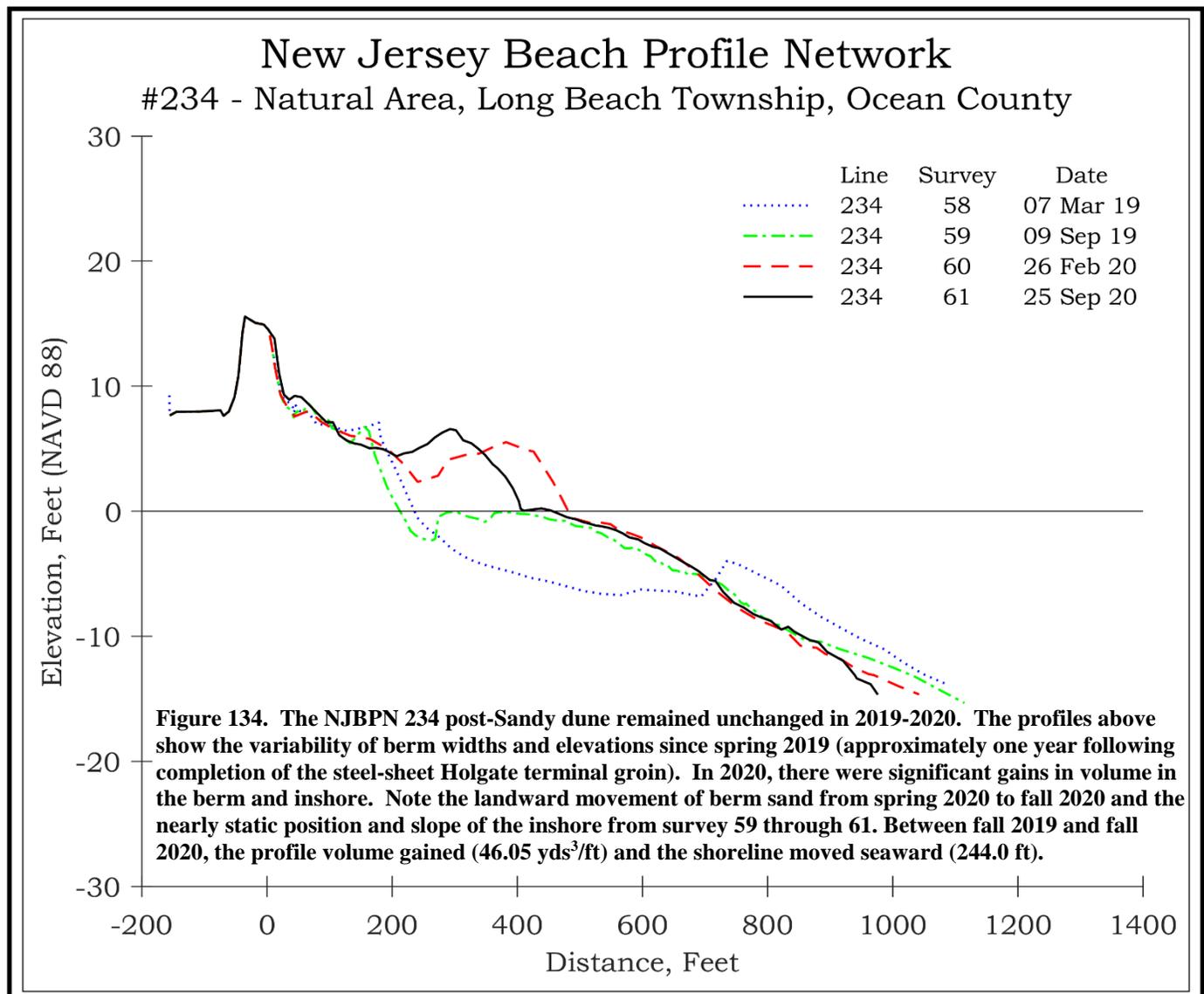
The Webster Avenue photos show the seaward portion of the dune which remained stable over 2019-2020 (left taken September 9, 2019 and right taken September 24, 2020). There was only a minor accumulation of sand at the dune toe over that timeframe.



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



The Holgate profile lies 200 feet downdrift of the Holgate terminal groin and the photos show the changes near the swash zone (left photo taken September 9, 2019 and right taken September 25, 2020). Berm widths and sand accumulations have been highly variable through the 26 years of profile monitoring largely due to large differences in sediment supplies passing the terminal groin onto this beach.



Summary & Conclusions

The federal/non-federal *Manasquan Inlet to Barnegat Inlet Coastal Storm Risk Management Project* (beachfill) commenced in May 2017 and continued through 2018-2019 for most of the beaches in northern Ocean County NJBPN station beaches and completed in Point Pleasant Beach in July 2019. The design template included a 22-ft (NAVD88) elevation dune and a berm width of 75-ft. No sand was placed on the beaches in 2020. Between fall 2019 and fall 2020, volume changes at the nourished beaches varied from gains at Point Pleasant Beach (NJBPN #156 [20.02 yds³/ft]) to volume losses at Seaside Heights (NJBPN #248 [-36.14 yds³/ft]).

The Island Beach State Park profiles showed volume losses in the northernmost location (NJBPN #247) and site closest to the north Barnegat Inlet jetty (NJBPN #146). This reversed the gains experienced in 2018-2019 at those locations. There was a minor volume gain mid-park at the IBSP NJBPN #246 (2.56 yds³/ft).

On Long Beach Island (LBI), no sand was placed on the beaches 2019. In winter 2020, the New Jersey Department of Transportation-Office of Maritime Resources, in cooperation with Beach Haven Borough and the Township of Long Beach, placed approximately 20,000 cubic yards of fine sand and silt that was dredged from Parker Channel onto the beaches near Berkeley Avenue and Harding Avenue. No sand was placed by the USACE and the next anticipated maintenance nourishment cycle is expected to commence in 2023.

Appendix Tables 3 and 4 provide the seasonal and annual profile volume and shoreline changes for Ocean County. There were no federal beachfills in Ocean County in 2020. The greatest volume gains between fall 2019 and fall 2020 occurred at NJBPN #234, the Natural Area on Long Beach Island just south of the Holgate terminal groin (46.05 yds³/ft). The greatest volume losses for the same time period was at NJBPN #143 in Harvey Cedars (-52.83 yds³/ft) but profiles in Seaside Heights, Midway Beach, and Island Beach State Park lost more than 30 yds³/ft. The greatest seaward shoreline movement between fall 2019 and fall 2020 was at NJBPN #234, the Natural Area on Long Beach Island at 244 ft which was about equaled the landward movement between 2018 and 2019. This site has had the greatest swings in shoreline position and volume change of all Ocean County NJBPN profiles. The sites with the most landward movement of the shoreline between fall 2019 and fall 2020 were at NJBPN #155 Point Pleasant (-59.25 ft) and NJBPN #143 Harvey Cedars (-58.75 ft).



New Jersey Beach Profile Network

Atlantic County

Little Egg Inlet
to Great Egg Harbor Inlet

NJBPN Profile #'s
134 - 126

New Jersey Beach Profile Network Atlantic County Site Locations

There are 10 NJBPN survey sites on the Atlantic County shoreline. The beach profile sites are located in the City of Brigantine, Atlantic City, the City of Ventnor, the City of Margate, and the Borough of Longport. The Atlantic County coastline consists of three barrier islands. Little Beach is part of the Forsythe National Wildlife Refuge and is not surveyed. Brigantine Island is south of Brigantine Inlet, the northern third of which remains undeveloped as part of North Brigantine Natural Area managed by the NJ Division of Lands and Forest. The Absecon Island communities, Atlantic City, Ventnor, Margate, and Longport, are all highly developed. There are six beach profile survey sites in the communities of Absecon Island.

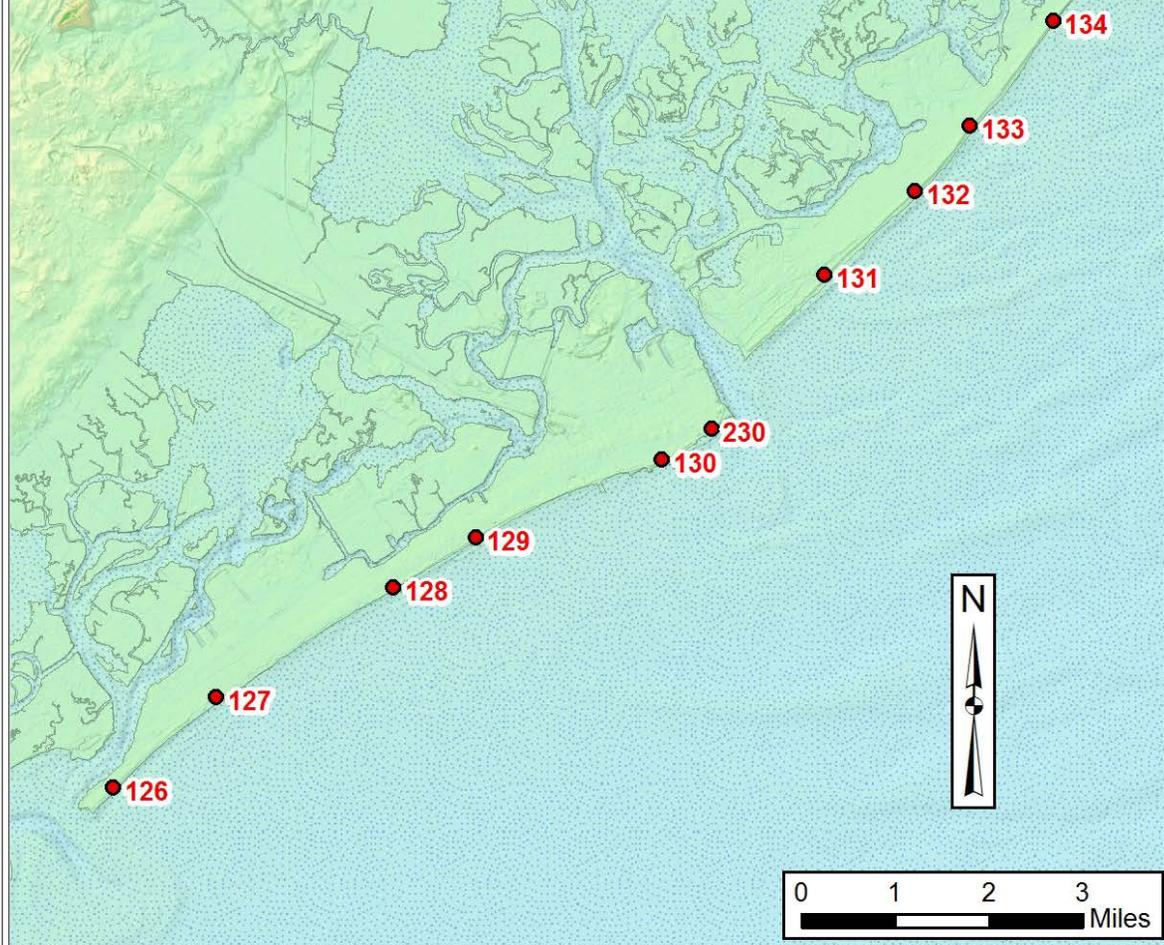


Figure 135. Location map for the 10 NJBPN profile sites in Atlantic County, NJ. There are four sites located on Brigantine Island with 6 sites located on Absecon Island

Atlantic County

Data collected at the ten Atlantic County NJBPN oceanfront beach profile locations cover the municipal beaches from the City of Brigantine Beach to the Borough of Longport. Little Beach on Pullen Island to the north of Brigantine is the third barrier island within Atlantic County but as a natural area is not included in the NJBPN assessment. The USACE has undertaken Brigantine and Absecon Islands as federal project beaches. The third nourishment cycle of the Absecon Island Storm Damage Reduction (beachfill) project was completed adding sand to Atlantic City and Ventnor and commenced initial construction in Margate and Longport. By spring 2018, work was completed. In 2018, the third federal maintenance cycle of the Brigantine Island Coastal Storm Risk Management (beachfill) project was completed. No additional sand was placed on either island in 2019. In fall of 2020, the USACE returned to Absecon Island for a scheduled periodic nourishment and placed an additional 1.2 million cubic yards of sand on the Absecon Island beaches.

Weather in 2019 was relatively mild with no major storm events recorded. In 2020, two fast moving tropical storms impacted New Jersey. Tropical Storm Fay made landfall northeast of Atlantic City in July while Tropical Storm Isaias struck New Jersey in August 2020. Fortunately, storm surges were modest 1-2 feet as the storms quickly exited towards New York but combined with the tropical force winds and heavy rain did cause minor flooding and erosion at the shore and power outages across the state. On December 16-17, 2020 a winter storm impacted New Jersey with gusts of 50-60 mph recorded at the shore. The storm lasted for two tide cycles and caused minor to moderate flooding and beach erosion. Unfortunately, damage caused will not be shown in this report as the fall Atlantic County profile surveys were completed before the time of this event.

USACE Shore Protection Project Summary;

In 2002-3 the USACE Philadelphia District with the NJDEP DCE and local municipal partners, conducted an initial shore protection project from Absecon Inlet south to the Ventnor City/Margate City boundary on Absecon Island. The design was for a 150-foot wide beach in Atlantic City and a 100-foot beach width in Ventnor backed up by a 14.5-foot elevation at the dune crest that was vegetated and fenced with sand fencing and pedestrian access pathways to the beach. Since Margate and Longport declined to participate, their municipal shorelines did not receive direct sand placement. The maintenance cycles began in 2011 when the USACE placed sand on the northern portion of the Atlantic City shoreline. Fortunately, this task was completed (June 2012) prior to Hurricane Sandy. Although Sandy caused extensive erosion, the beach and dune provided oceanfront properties with protection from direct wave and storm surge impacts. A second beach maintenance cycle began in July 2013 in response to Sandy. This project authorized under PL 113-2 emergency congressional funding restored the constructed federal project beaches on both Absecon Island and Brigantine Island to project specifications at 100% federal cost.

The City of Margate filed litigation in Superior Court seeking relief from having dunes constructed as part of the USACE shore protection project within City oceanfront limits on Absecon Island. The case went to trial in February 2016 and a decision rendered April 11, 2016, affirmed the federal design and the relevance of dunes to the protection levels sought by the project. With this decision, without Margate City's further appeals, the project went to initial construction in 2017. During this project, the third nourishment cycle was included for Atlantic City and Ventnor in conjunction with initial construction of dunes and beach enhancements for Margate and Longport. The project commenced in spring 2017 and completed in 2018. Also completed in April of 2018 was construction and rehabilitation of the Absecon Inlet seawall and boardwalk designed as a storm damage reduction project. No additional sand placement occurred in 2019. The most recent periodic nourishment project for Absecon Island started in October 2020 and was completed by February 2021 and was to place 1.2 million cubic yards of sand on the federal project beaches. Operations began in October for Ventnor City then moved to Margate and Longport with this phase completed in December utilizing a hopper dredge. Work in Atlantic City starting immediately after in December and finished in February 2021 using a cutterhead dredge.

To date, the Absecon Island storm damage reduction project has placed over 13.3 million cubic yards of sand on the Longport, Margate, Ventnor and Atlantic City project beaches from 2004 to February 2021. Figure 136 below is from the USACE Philadelphia District Fact Sheet on the Absecon Island Project and shows the typical beach profile design template.

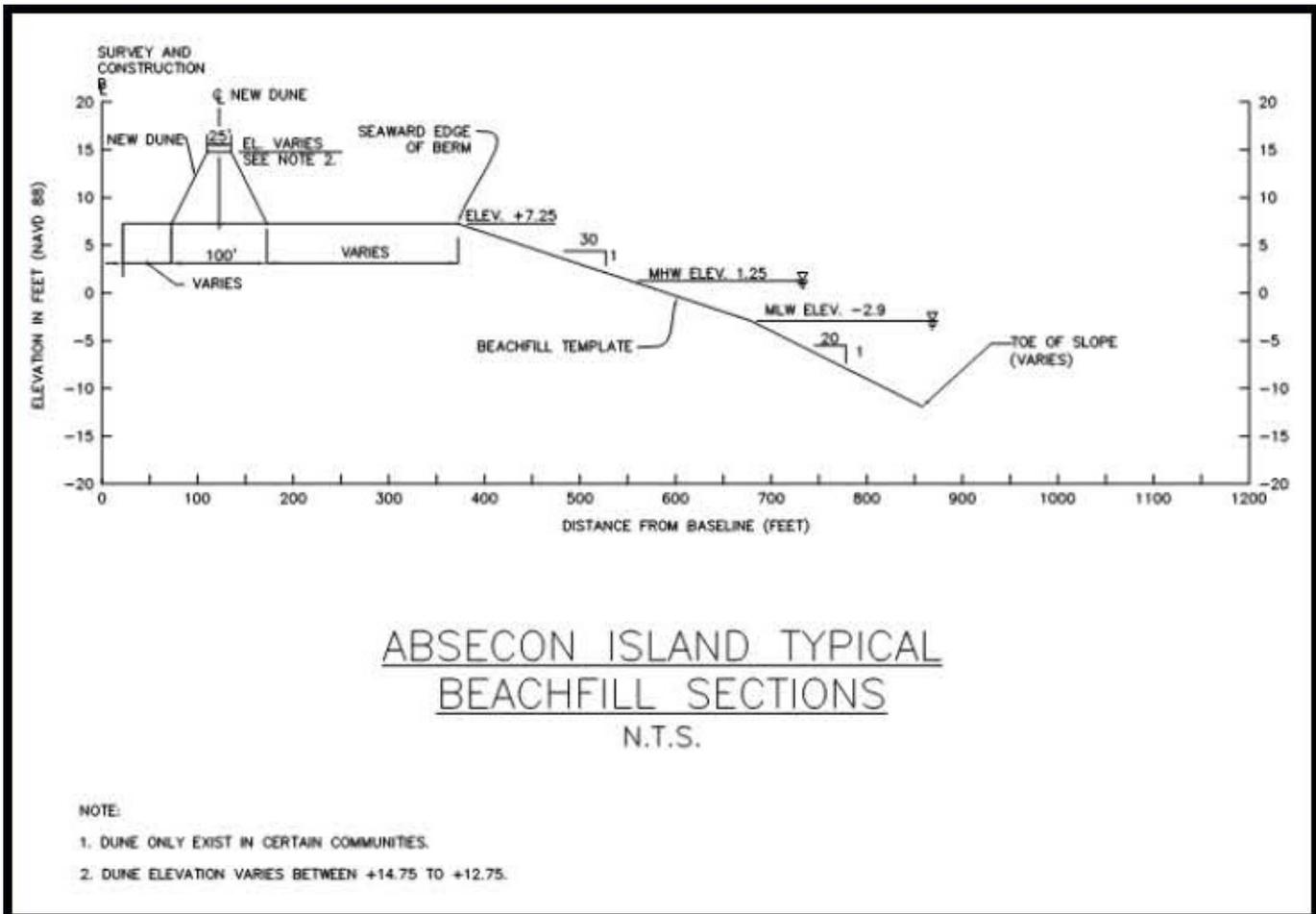


Figure 136 - Typical USACE beach design template for the Absecon Island project

For more information and the factsheet for the Absecon Island project please visit the USACE Philadelphia District website at <https://www.nap.usace.army.mil/Missions/Factsheets/Fact-Sheet-Article-View/Article/490776/new-jersey-shore-protection-brigantine-inlet-to-great-egg-harbor-inlet-absecon/> More on the Absecon Island Coastal Storm Risk Management Project please visit the USACE website at <https://www.nap.usace.army.mil/Missions/Civil-Works/Coastal-Storm-Risk-Management/Absecon-Island-Storm-Damage-Reduction/igphoto/2002245029/>

Six NJBPN beach profiles (sites #126-230) included in this report cover Absecon Island from Longport through Atlantic City and show the changes to the federal project beaches from spring 2019 into fall 2020.

Moving north, the USACE Brigantine Coastal Storm Risk Management project includes the northern third of the developed shoreline on Brigantine Island (approximately 1.8 miles.) A feeder beach designed into the project overfilled the 1,600 feet of the natural area north of development to supply sand to the southern downdrift beaches seaward of the developed areas. The project extends south to approximately 5th Street South in the City. In 2006, the initial federal beach restoration was completed and extended the engineered beach footprint south of two prior State and local projects completed in 1997 and 2001. In 2011, an emergency maintenance effort completed under the Flood Control and Coastal Emergencies (FCCE) funding program used trucked-in sand. By February 2013, the Brigantine portion of Atlantic County's post Sandy recovery was complete using appropriations from PL-113-2 placing an additional 667,000 cubic yards of sand on the beach. The third nourishment cycle commenced in 2018 over the winter to restore the project template (754,090 cubic

from this region. Periodic natural sand by passing of Brigantine Inlet (2.7 miles north) is the only source of new sand added to the natural area system to offset the storm erosion. The current dune width is approximately 80 feet wide with a crest elevation of approximately 13 feet. The beach is flat and low in elevation subject to wave runup with less than 50 feet of dry beach at or above elevation 5 ft NAVD88. Overall beach width above the zero datum is approximately 200 feet. During the 2019-2020 study interval, nearshore cross-shore sand transfer dominated the processes affecting changes with modest sand accumulation on the beach (6.62yds³/ft.) resulting in essentially no change (-0.3ft) in the shoreline position. While offshore a landward shift in the sand bar position resulted in a modest loss of sand below the datum (-3.39yds³/ft.). The profile's net sand volume change was a modest gain (3.23yds³/ft.) from spring 2019 to fall 2020.

South of the State Natural Area the municipal shoreline rapidly transitions from a natural beach to a fully developed shoreline. The approximately 2000 feet of transition zone has been incorporated into the federal project as a “feeder beach” for a highly erosional section of shoreline from 9th Street north to 15th Street north seaward of the Brigantine Avenue promenade and revetment. This section of beach suffers accelerated erosion due to the orientation difference between the revetment and fixed physical infrastructure along the north end of Brigantine Avenue and the long-term regressive changes in the natural shoreline to the north. Within this erosional hotspot, the beach is narrow with no oceanfront development on the east side of Brigantine Avenue a rock revetment provides the primary storm protection for public infrastructure and properties west of the road. This region's rapid erosion rate prevents development of a significant dune system despite several attempts during early-engineered beach projects to establish one. Consequently, this region has been subject to several episodes of storm overwash, the most recent occurred as Sandy moved onshore. No NJBPN profile exists in this immediate region although the municipality established a monitoring program with the CRC in 1992 to follow changes in this section of shoreline. The photo below shows the erosional hotspot along the northern developed shoreline in Brigantine one-year after completion of the third USACE nourishment cycle.



Photo by Kingston

Figure 138. Photo taken March 28, 2019, note orientation offset between the natural beach (north) and Brigantine Ave. At the erosional north end local engineered beach nourishment projects commenced in 1997 and 2001 with State sponsorship to mitigate deteriorating conditions. By 2006, the initial USACE project commenced along approximately 1.8 miles of coastline fronting the northern third of the city beaches, followed by maintenance projects in 2011, 2013. Brigantine beaches last received sand in 2018 during the 3rd USACE maintenance project (754,090 cubic yards, Erik Rourke, USACE).

Near 9th Street North, the bulkhead revetment bumps out seaward allowing development of properties east of Brigantine Avenue. Multiple engineered beach projects over the last two decades significantly increased the

sand budget in this region. Wider beaches and an increase in sand source along with the orientation of the shoreline and revetment allowed development of an expanding dune system through aeolian processes.

NJBPN site #133 located within the region immediately south of the erosional hotspot at 4th Street North. This region remains subject to long term erosion offset by periodic beach nourishment maintenance. In this location the primary dune width is approximately 100 feet with a crest elevation of 15 feet NAVD 88, seaward a developing foredune ridge has expanded to nearly 80 feet in width at a crest elevation of nearly 14.5 feet NAVD 88. Overall, the dune system provides significant shore protection and prevents storm waves from severely damaging the oceanfront properties and infrastructure in this section of Brigantine. Seaward of the dune, the project beach berm that originally extended over 100 feet to the beachface slope has been flattened eroding landward to within 25 feet of the dune toe. From June 2019 to October 2020, the post USACE beach berm configuration eroded landward nearly 75 feet, with 59 feet of shoreline position (zero datum) retreat. As of the October 2020 study, the beach extended 200 feet from the dune to the zero-datum position but was very low in profile with less than 45 feet of beach above elevation 5 feet NAVD 88. The low-profile beach increases the vulnerability of the foredune toe to storm wave runup. Offshore, the nearshore slope and bar position varied seasonally through the recent study interval with nearshore bars developing over the summer and flattening over the winter. During the recent study interval, moderate erosion continued and removed a net 33.31 yds³/ft. of sand from both the beach (-14.69 yds³/ft.), nearshore and offshore slopes (-18.63 yds³/ft.).

NJBPN site #132 located at 15th Street South is within the transition zone from a highly erosional to a depositional shoreline. A large, multi-story resort building interrupts the continuous footprint of the large dune system located north and south of this site. Instead, primary shore protection for this one-block region is the over 300-foot wide beach at elevation 6.5 NAVD 88 fronting a low timber bulkhead located at the street ends with a top elevation of approximately 8 feet NAVD 88. The lower elevation makes these street ends subject to potential storm surge and wave overtopping and localized flooding events. From 2019 through 2020, sand accumulated on the berm and beachface slope naturally expanding the beach width while a nearshore bar developed then welded to the shoreline in fall 2020. Further offshore, a new bar developed as longshore transport from north to south continued to move sand eroded from the USACE project beaches through this location and cross-shore transport moved sand landward. This influx of sand resulted in a net gain of 16.73 yds³/ft of sand, essentially split evenly between gains onshore (8.09 yds³/ft) and offshore (8.64 yds³/ft) with 62 feet of seaward shoreline advancement during the recent study interval. This continues an accretional trend observed since 2016.

South of 15th Street South the shoreline rapidly transitions into a highly accretional beach to the Absecon Inlet jetty. These seemingly ever-widening beaches continued to accumulate sand moving from north to south along the Brigantine shoreline. The wider beaches absorb storm wave energy allowing aeolian processes across these wide beaches to expand the dune system with a series of new foredune ridges forming a formal shore protection feature that protected the oceanfront properties in this region during Sandy.

NJBPN site #131 located at 43rd Street within the accumulation zone. From 1987 to 2020, the dune continued to accumulate sand and expand seaward into a system of multiple ridges with an overall width currently over 950 feet to the new foredune toe forming a formable shore protection feature. The expansive recreational beach berm extends seaward 600 feet from the foredune toe, from 2019 to 2020 the berm and beachface accumulated sand extending the shoreline an additional 107 feet. During the study interval, sand accumulated nearshore developing a new bar that became emergent during fall 2019. Longshore transport continued to move sand north to south with an additional 44.68 yds³/ft. accumulating here from spring 2019 to fall 2020. While sand accumulation on these southern beaches is typical, as prevailing sand movement along the Brigantine shoreline is from north to south, these large gains at 43rd demonstrates the extraordinary natural accretion rates and resiliency of this region as sand lost from the northern project area moves south accumulating updrift of the Absecon jetty. This region remains a potential source for mechanical sand back-passing efforts, moving sand north to the erosional area, as an option or complement to repetitive federal maintenance projects.

Atlantic City, #230, #130, and #129;

Absecon Island is the most densely developed barrier island in New Jersey. To protect the properties and infrastructure from storm damages, beach nourishment has been a part of the shoreline management strategy since the 1930's. Multiple projects including local, state, and federally sponsored projects constructed bolstered the islands storm protection. In 2003, the Federal project went to initial construction placing sand to restore dunes and widen the beaches. The USACE initial beach nourishment placed sand from Absecon Inlet to the Ventnor City/Margate City boundary. The towns of Margate and Longport (received 190,000 cubic yards in 1990) declined to participate in the Federal project. The dunes, constructed to an elevation of 14.5 feet NAVD88, were just high enough to withstand the wave run-up during Sandy. A maintenance project just prior to Sandy, restored the oceanfront beach and dunes that prevented damage to the City's famous boardwalk. Emergency restoration during 2013 put the beach width and dune back to the design specifications following erosion from Sandy. In 2017, the USACE began the 3rd periodic nourishment cycle for Atlantic City and Ventnor plus included construction of the full federal dune and beach project for Margate and Longport, work was completed in spring 2018 with 3,493,599 cubic yards placed from 2017 to 2018.

NJBPN site #230 the northernmost site in Atlantic City is located at Rhode Island Ave, approximately 1400 feet south of Absecon Inlet between the Vermont and Massachusetts Avenue groins. This site is subject to rapid erosion and is a hot spot of concern for Atlantic City due to its proximity to the inlet and associated wave and current dynamics. The USACE 3rd nourishment cycle restored the dune and beach in fall 2017. The project added 118.55 yds³/ft. of sand to the beach advancing the shoreline position. The cycle of erosion immediately returned, by October 2019 the dune width was cut back from 100 feet to 30 feet as the entire profile including the offshore and nearshore retreated landward. The remaining beach width by fall 2019 was less than 75 feet at approximately elevation 5 feet NAVD88 providing minimal storm protection to the dune and boardwalk. In 2020, the erosion continued with additional losses on the dune slope beach and nearshore as of April (-20.5 feet shoreline retreat & -20.9 yds³/ft net volume loss). By October 2020, the dune continued to erode but a wedge of sand moved onshore and onto the nearshore slope from further offshore, resulting in a stable shoreline position and minor net gain of 3.10 yds³/ft. of sand. The net change for the study interval was a loss of 25.54 yds³/ft. of sand mostly below the zero datum (-19.04 yds³/ft) with a shoreline position retreat of 10 feet. The 4th USACE nourishment cycle was scheduled to begin in late fall 2020 through winter of 2021 in Atlantic City.

NJBPN site #130 moving south towards North Carolina Ave, located just south of the Steel Pier dune, beach erosion rates slow as tidal effects associated with Absecon Inlet (4800 feet north) diminish. Although beach and dune stability improve in this region, the site is still subject to long-term erosion, especially evident nearshore during the recent study interval. The 2017 USACE project added approximately 56.77 yds³/ft. of sand to the site in response, the shoreline advanced 109 feet restoring the project dune and beach template. Net changes from spring 2018 to fall 2019 were a loss of 72.4 yds³/ft of sand with about two thirds of that lost from below the zero datum while the shoreline position retreated landward -102 feet. From 2019 to fall 2020, the dune remained stable. A small beach berm present in fall 2019 was flattened by spring 2020 with erosion continuing across the nearshore and offshore slopes. Over the summer of 2020, the beach was relatively stable while the offshore slope continued to lose sand. For the study interval, the beach lost 7.91 yds³/ft. of sand while below the zero datum the site lost another 40.86 yds³/ft. of sand for a net loss of 48.77 yds³/ft. across the profile while the shoreline position retreated 53 feet. The USACE 4th nourishment cycle for Atlantic City started in December 2020 completed in February 2021, following completion of the fall 2020 NJBPN survey.

NJBPN site #129 is located at Raleigh Avenue, the south end of Atlantic City, within the mid-section of Absecon Island where the beaches are wider, and the dune system was stable to accretive through natural aeolian processes. This region is a transitional zone between erosion to the north and stability to modest accretion on the southern Atlantic City beaches. No direct sand placement occurred here during the 2017 USACE project as sand moves longshore from the northern project area through this location. During the summer of 2019, the site continued to accumulate sand with 21.77 yds³/ft of sand added, primarily focused below the zero datum where sand accumulated nearshore. Over the winter of 2020, a developing foredune feature was removed, it is uncertain if this was natural or mechanically removed since the beach showed no

indication of severe erosion, indeed the berm and beach remained remarkably stable. The beach gained 2.23 yds³/ft. of sand as the shoreline position advanced seaward 78 feet. The dune, beach, and berm remained relatively stable through fall 2020 resulting in a minor gain of 0.1 yds³/ft. while the nearshore suffered modest losses (-13.11 yds³/ft.). During the study interval, the dune remained stable approximately 140 feet in width with a crest elevation between 15 to 16 feet NAVD88, despite the loss of the foredune ridge. The recreational beach was stable and accumulated sand along the berm and beachface. An impressive 300 feet of dry beach width provided both storm wave protection and a source of aeolian sand for continued dune growth over time. Net volume change for the recent study interval was a modest gain of 6.14 yds³/ft of sand with 31 feet of seaward shoreline position advancement. No sand was anticipated to be directly placed here during the 4th nourishment cycle scheduled for December 2020 – February 2021.

Ventnor City, #128;

NJBPN 128 located at Dorset Avenue in Ventnor City is approximately 850 feet north of the fishing pier. Ventnor received sand during the initial 2002-2003 USACE beachfill and continued to receive sand during subsequent maintenance nourishment projects including the 2017-2018 3rd nourishment cycle. The site is located about 15 blocks north of the original taper to the 2003 federal project beach and was subject to end-effect erosion as the adjacent downdrift unfilled beaches came to equilibrium with the up-drift filled beaches. In 2017, the USACE project in addition to maintenance nourishment finally constructed the full beach and dune template south of Ventnor City stabilizing the southern end of Ventnor City beaches, eliminating the end effect erosion here. In fall 2020, the USACE returned to Ventnor City beaches for the 4th nourishment cycle. Unfortunately, the October 19, 2020 NJBPN survey date occurred prior to the project reaching this site. Ventnor City beaches located within the mid-section of Absecon Island benefit from the supply of sand moving north to south along the Absecon Island shoreline, forming wider beaches and a stable to accretive dune system in this region. The dune width is approximately 100 feet with a 13-foot NAVD 88 crest elevation. A 200-foot-wide recreational beach extends seaward of the dune toe providing both storm protection and a source of sand for continued aeolian dune growth. During the recent study interval, the beach reversed trend with a 6.75 yds³/ft loss from spring 2019 to fall 2020 (-6.60 yds³/ft onshore) and 35 feet of shoreline position retreat. The largest gain occurred over the summer of 2019 with 18.28 yds³/ft. of sand added to the profile mostly nearshore resulting in 31 feet of shoreline advancement. Greatest losses occurred over the winter of 2020, reversing all the summer sand gain (-21.91 yds³/ft) with a shoreline retreat of 32 feet. Further offshore, a large bar accumulated sand as longshore transport of sediments along Absecon Island continued to feed this region with sand eroded from the northern beaches.

Margate City, #127;

Margate City declined to participate in the initial 2003 USACE project to construct dunes and widen beaches City beaches. These beaches did benefit indirectly from the project through an influx of sand carried by littoral currents moving sediment from the up-drift project beaches towards the downdrift Margate shoreline (end effect erosion). Hurricane Sandy over-washed this beach depositing 3 feet of sand into Benson Avenue. By 2017, Margate and Longport had agreed to participate in the USACE flood and coastal storm damage reduction project for Absecon Island, construction work was completed in spring 2018 placing approximately 117.48 yds³/ft. of sand here. The dune system created during the project was approximately 150 feet wide at the base with a crest elevation at 14 feet NAVD88. A beach berm extends approximately 200 feet seaward of the seaward dune toe significantly enhancing storm protection.

By spring 2019, the site accumulated sand offshore developing a significant bar feature while nearshore sand moved onshore developing a wider seasonal berm crest. During the same time period, the dune feature was apparently modified mechanically to a smaller configuration as there is no evidence in the data or photos that indicate natural erosional processes. The modified dune feature was reduced to 100 feet wide at the base. Overall, the beach and dune width extended over 400 feet seaward of the street end revetment as of spring 2019.

From 2019 to fall 2020, the dune remained relatively stable while the beach elevation deflated slightly. Most significant onshore change occurred in the berm width, eroded by approximately 75 feet, as the beach profile adjusted to the wave climate. Nearshore, a large bar developed by October 2020 with a deep trough located between the beach and bar and deflated offshore slope. Net change for the study interval from spring 2019 to fall 2020 was a loss of -34.74 yds³/ft. of sand with a shoreline position retreat of -32 feet, as the beach profile adjusted to the wave climate post project. The 4th nourishment cycle reached this site shortly after the October 19, 2020 NJBPN survey, the spring 2021 survey will provide data on this USACE beach restoration effort.

Borough of Longport, #126;

The site at 17th Street in Longport (NJBPN 126) is the southernmost site on Absecon Island. Located approximately 1800 feet north of the Great Egg Harbor Inlet, the beach is subject to inlet dynamics that affect sediment distribution around the mouth of the inlet. Like Margate, construction of the initial USACE project in Longport was declined in 2003, local agreement eventually allowed this project to be completed in 2017-2018. The beach, prior to nourishment, was narrow with a low elevation. It lacked any dune and had an old concrete seawall with a buried rock revetment protecting some of the development. Hurricane Sandy overtopped this wall damaging homes immediately landward. The 2017 local agreement, following superstorm Sandy, resulted in Longport's inclusion in the Absecon Island shore protection plan, completing the Absecon Island from Absecon Inlet to Great Egg Inlet USACE project.

The USACE project pumped 95.33 yds³/ft. of sand onto this beach. The shoreline advanced seaward 116 feet supporting development of a wider beach berm and a new dune ridge. This new dune feature was established approximately 20 feet seaward of the concrete and rock revetment, approximately 100 feet wide at the dune toe with a crest elevation of approximately 14 feet NAVD88. A beach berm at approximately 8 feet NAVD88 extended nearly 250 feet seaward of the seawall location. Both features significantly enhance storm protection for the local community.

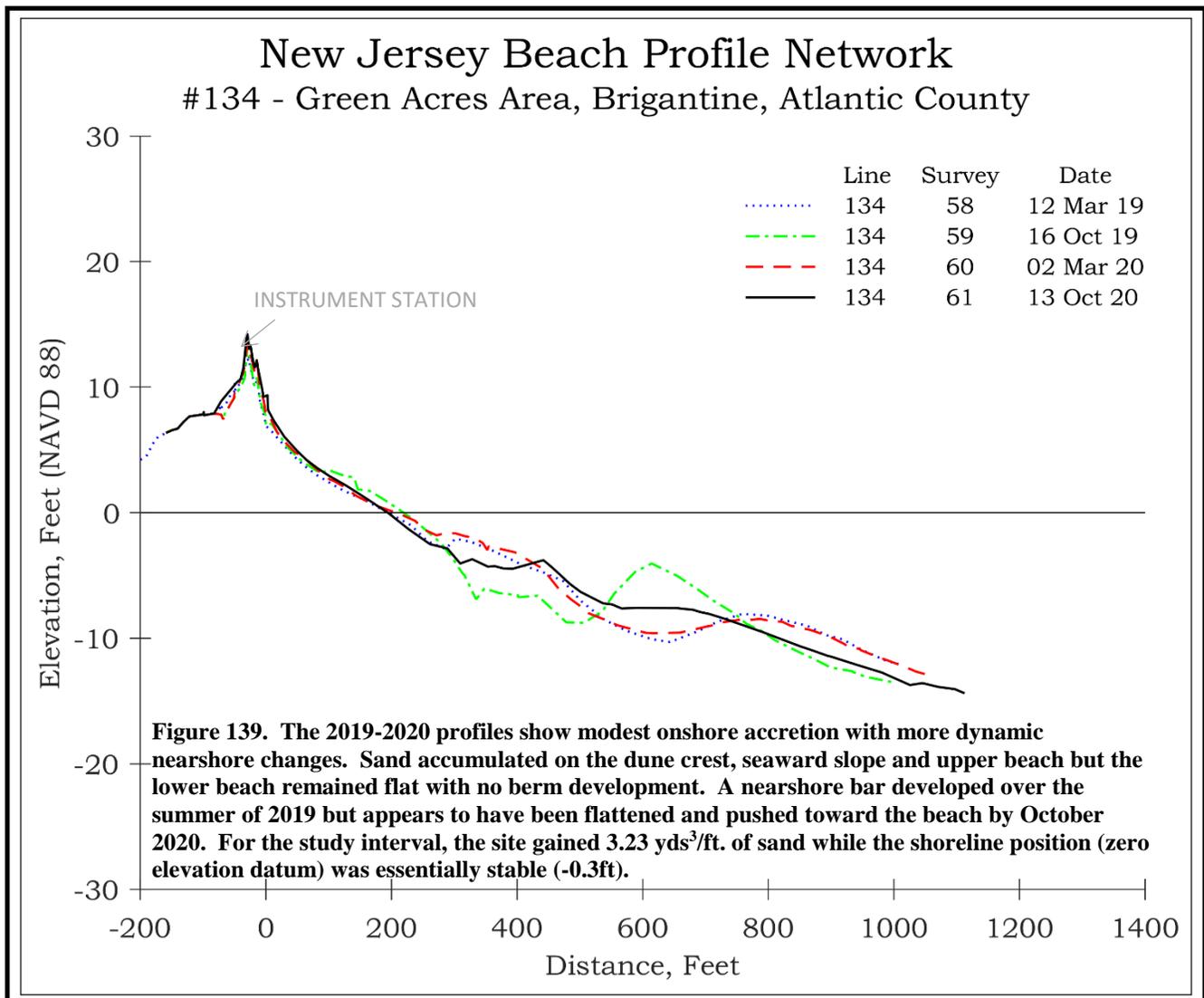
Following the USACE beach nourishment, the project beach profile began to adjust to the local wave climate. By December 2019, the shoreline position retreated landward -98 feet with a loss of -41.01 yds³/ft. of sand following completion of the USACE project. After initial erosion the site began to accumulate sand in 2020, partially restoring the berm width and a nearshore bar developed as well as accumulation further offshore. Despite this partial late recovery in 2020 the site continued to overall erode with a nearshore scour trough developing. The dune and upper beach were modestly accretive during the study interval through aeolian processes. Net change for the study interval was a loss of -33.00 yds³/ft of sand with most (-28.06 yds³/ft) occurring below the zero datum. Nearshore scouring and beachface erosion caused the shoreline position to retreat 48 feet. The USACE 4th Nourishment cycle was scheduled to reach this location by December 2020, not captured by the fall 2020 NJBPN survey conducted in October. NJBPN spring 2021 survey should show the benefits of this recent USACE /State and local nourishment effort.

Site Photographs and Profile Plots:

NJBPN 134 – Green Acres Area, Brigantine



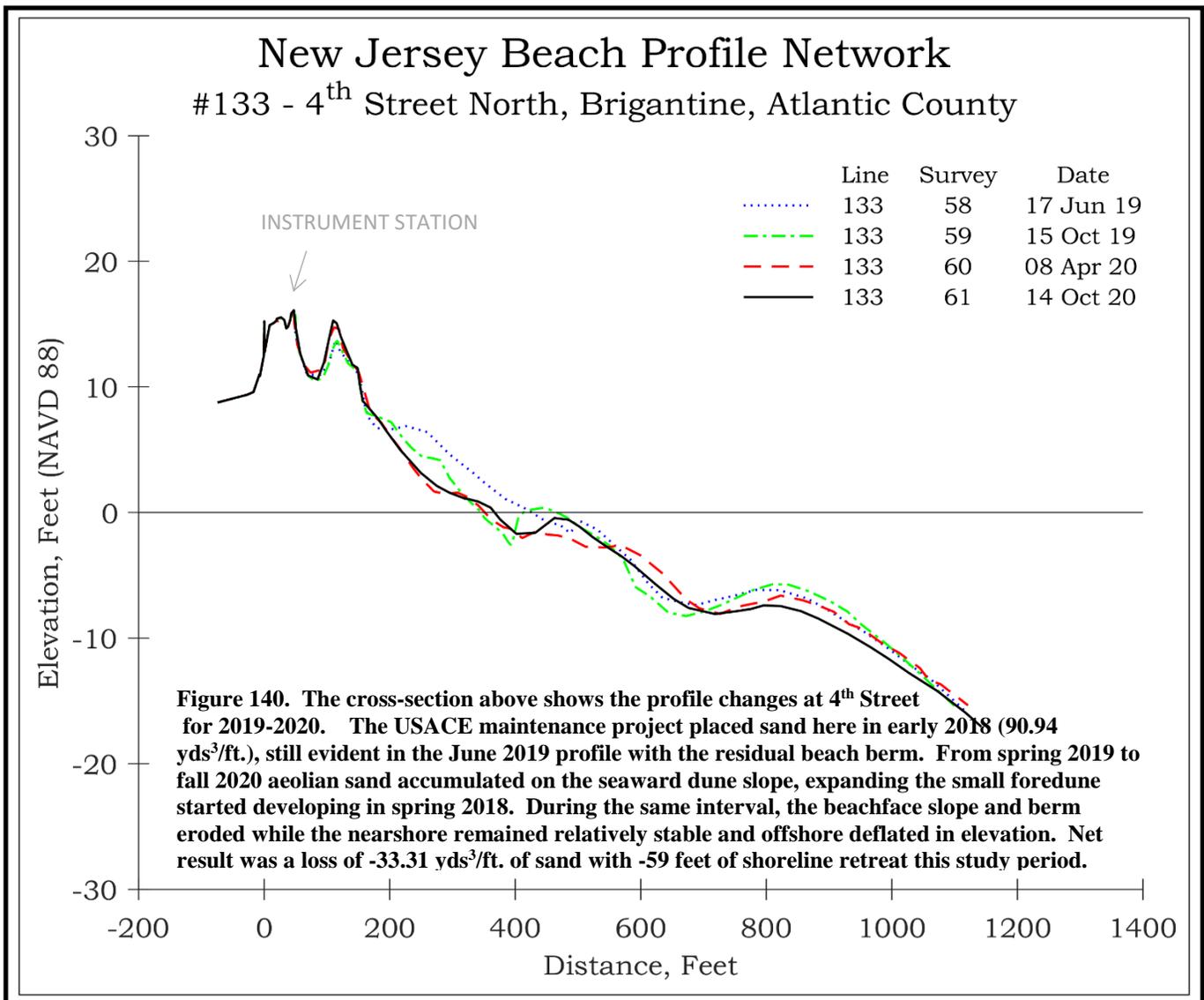
This site is in the natural area on the northern segment of Brigantine Island preserved as public open space. On the left (October 16, 2019) the view is south along the seaward dune crest. The seaward slope rapidly transitions into a narrow beach with a nearshore sand ridge visible in the distance just beyond the shoreline. Photo on the right taken October 13, 2020 is a similar view from the seaward dune crest showing modest sand accumulation on the seaward dune slope and the upper beach but no summer berm is evident. This low-profile beach remains vulnerable to storm wave overwash.



NJBPN 133 – 4th Street North, Brigantine



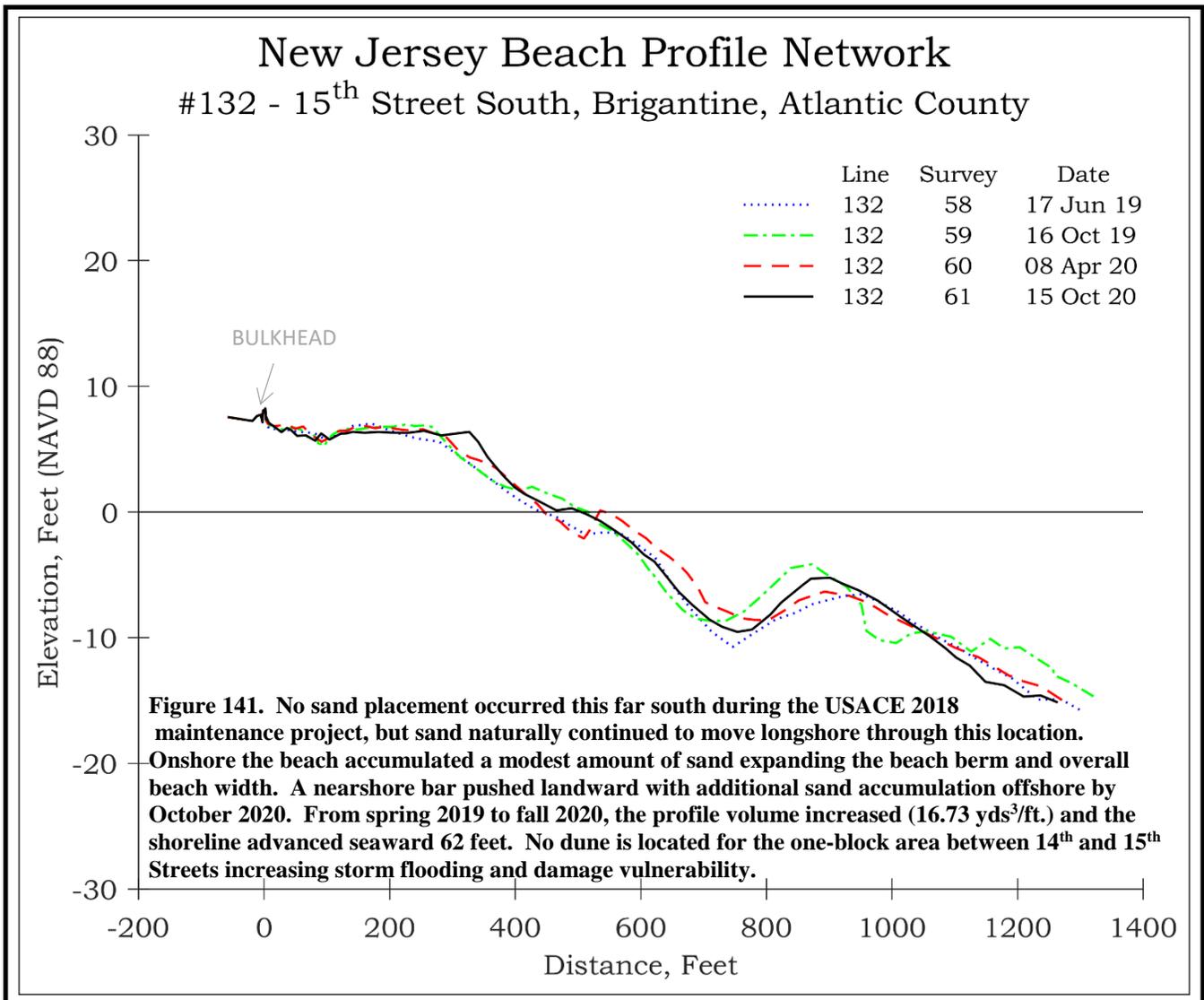
This site is located near the northern limit of development and within the 1997, 2001, 2006, 2013 and 2018 beach fill projects. Photo on the left (October 15, 2019) is a view south along the foredune ridge built naturally from aeolian processes over time and now fully colonized by American Beach grass. The wider project beach berm is evident in the background. Photo on the right (October 14, 2020) shows modest sand accumulation at the seaward dune toe while the beach berm eroded.



NJBPN 132 – 15th Street South, Brigantine



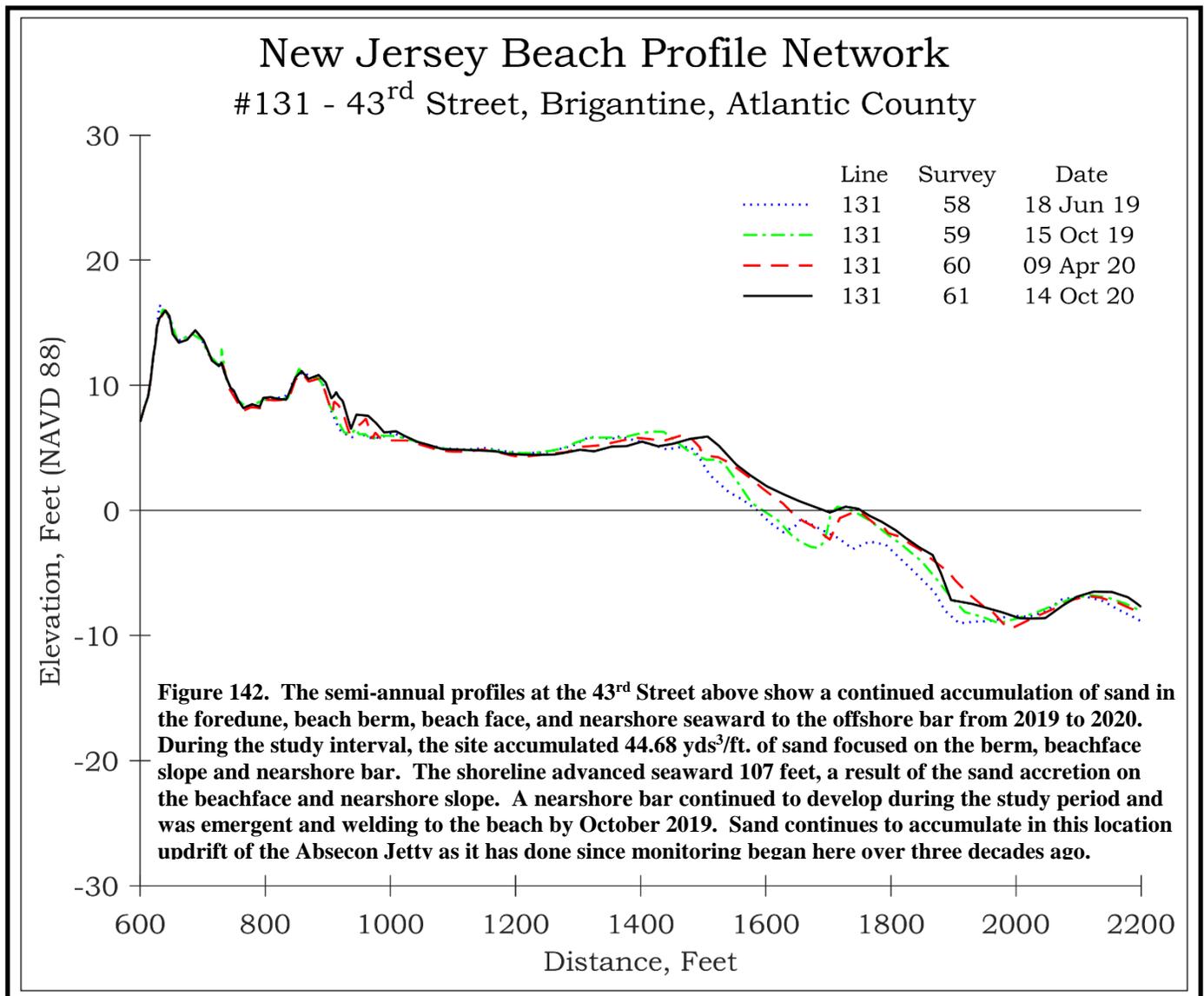
The left photo taken October 16, 2019, shows the view north and seaward of the beach club, the dune is absent here, but the beach is wide providing some storm protection. There is visible evidence (wrack debris) of recent tides reaching the beach club fence. Photo on the right shows a similar view on October 15, 2020, immediately seaward of the beach club the beach is wide and dry while to the north the dune is well developed and visible in the distance providing enhanced storm protection.



NJBPN 131 – 43rd Street South, Brigantine



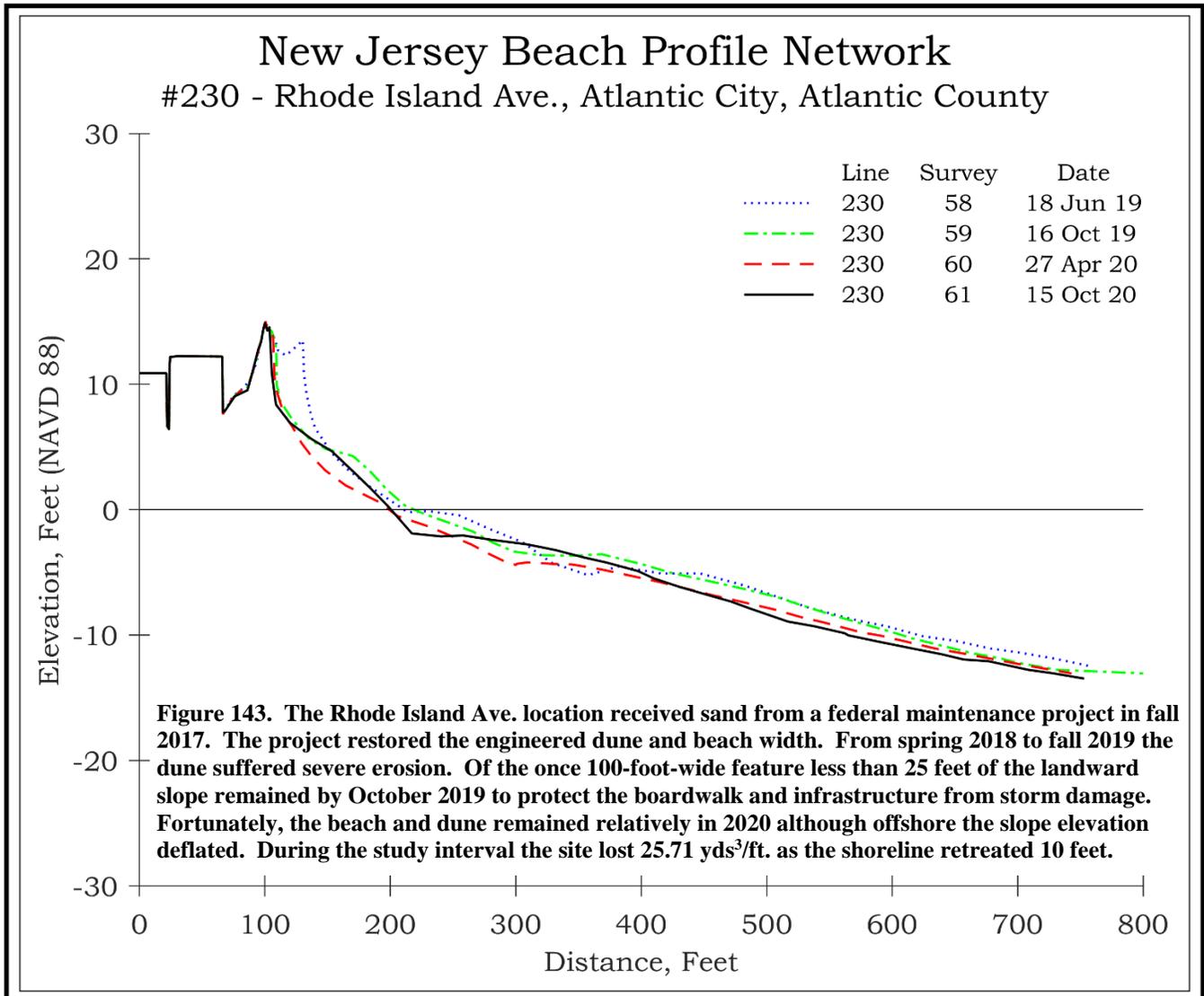
The photo on the left is a view to the north taken on October 15, 2019, shows the massive 600-foot wide recreational beach located between the dune and high-water line. Photo on the right taken October 14, 2020 shows the section of beach continued to accumulate sand along the seaward beach berm ridge. The line of waves breaking just offshore indicates the position of a nearshore sand bar building landward. The dune system not visible in this photo provides an additional 950 feet of protection.



NJBPN 230 – Rhode Island Avenue, Atlantic City



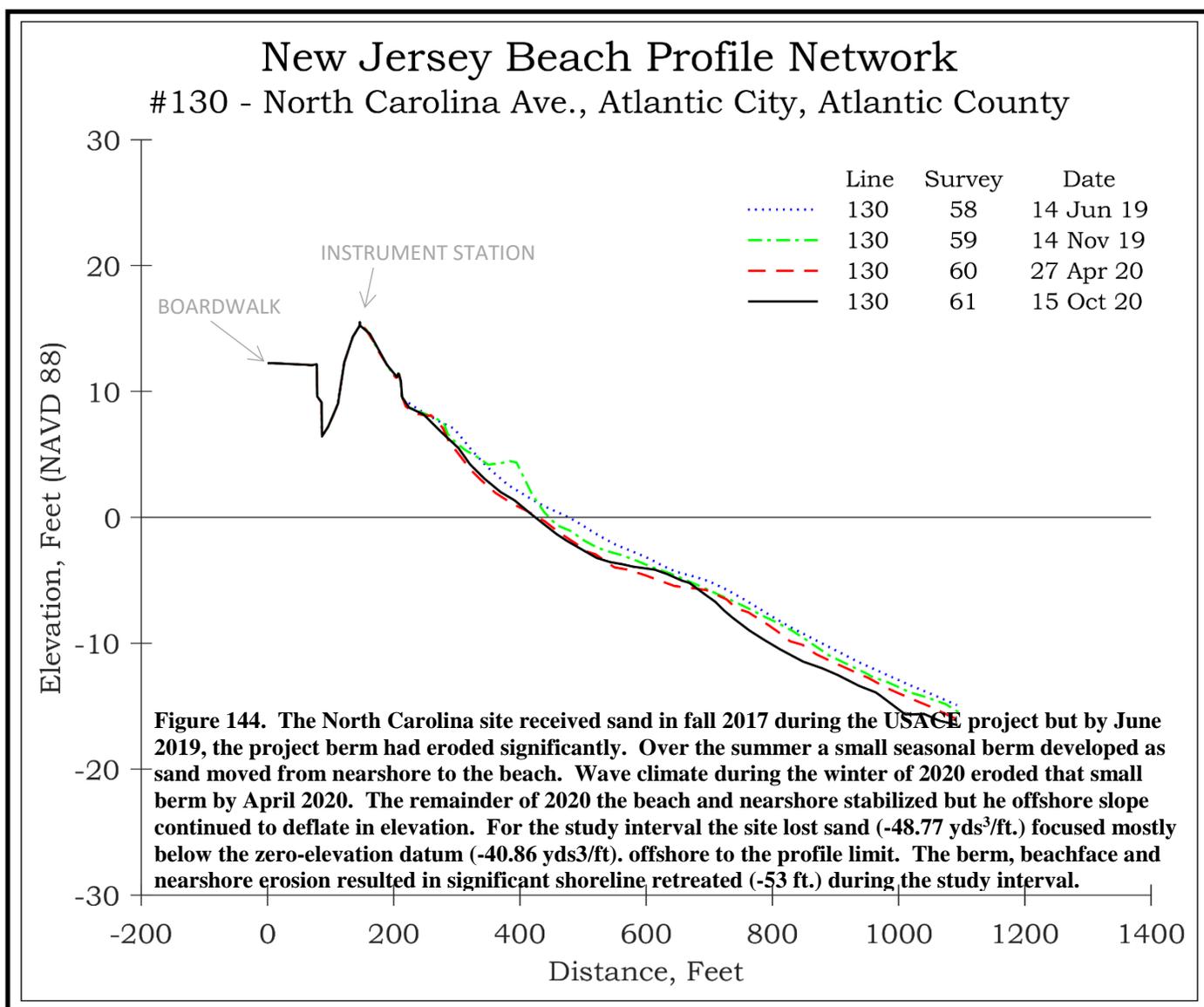
This profile site is located near the Absecon Inlet south jetty. The left photo (taken October 16, 2019) shows the remaining fill material placed in 2017 following erosion, the beach was narrow with waves starting to cut into the seaward dune slope. By October 15, 2020 (right photo) erosion had cut the away the dune to the landward crest and reduced the overall beach width. This site remains an erosional hotspot for Atlantic City despite rehabilitation and modifications to the adjacent rock groins. The 4th nourishment cycle was scheduled to start in December 2020.



NJBPN 130 – North Carolina Avenue, Atlantic City



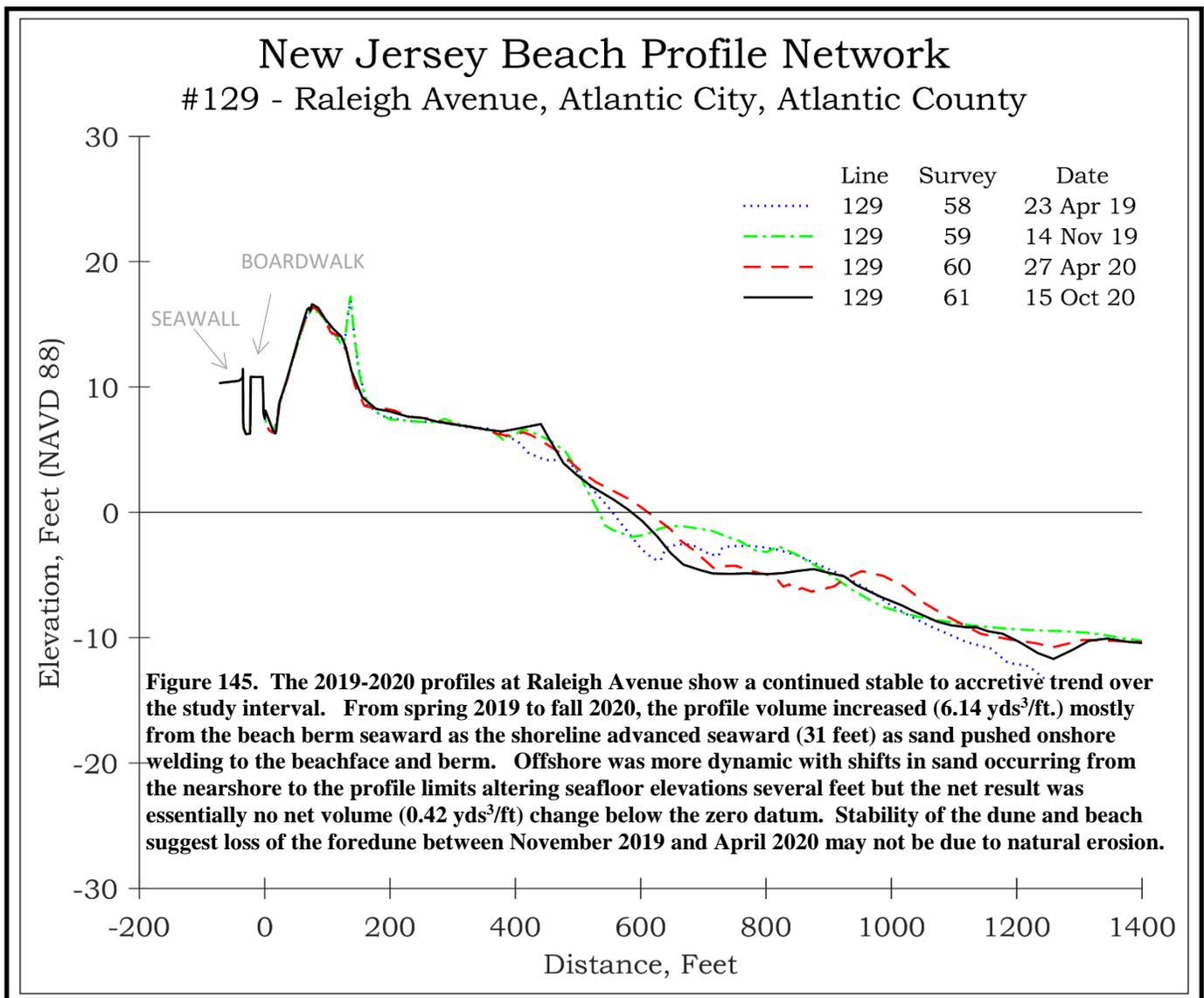
This Atlantic City site is located south of Steel Pier with Central Pier visible to the south. The left photo, taken November 14, 2019, shows the beach after grading with the well-established dune system. Photo on the right, taken October 15, 2020, shows loss of the beach berm and modest reduction in overall beach width but the upper beach and dune remained intact.



NJBPN 129 – Raleigh Avenue, Atlantic City



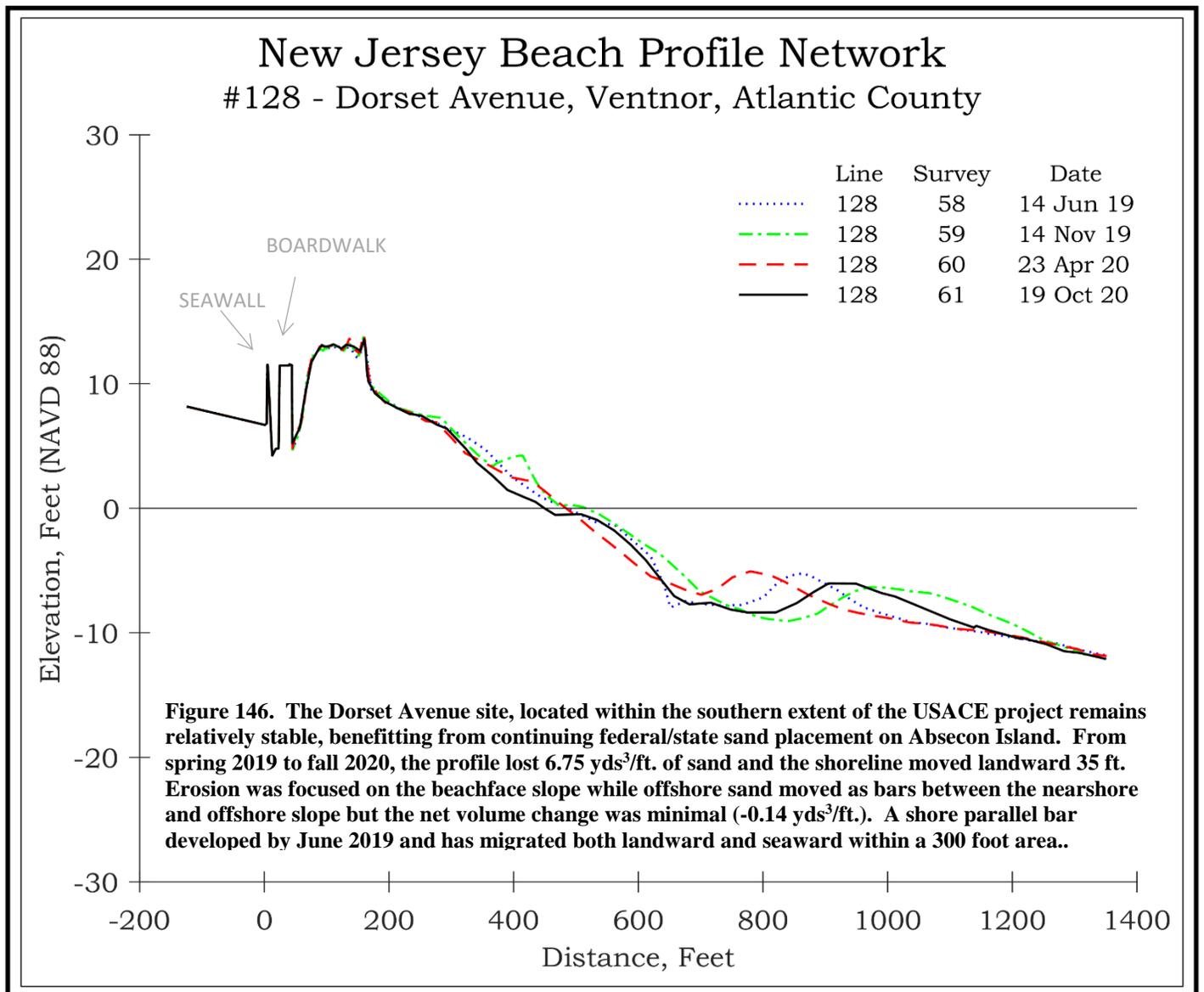
This site lies near the south end of Atlantic City and middle of Absecon Island where erosional loss is minimal. Photo on the left taken November 14, 2019 shows the wider beaches and an expanding foredune nearly burying the dune fence. Photo on the right taken October 15, 2020 shows the foredune growth was flattened but the beach remained stable to accretive. Beach and remaining dune stability make wave runup, storm erosion or wind deflation unlikely forces for this foredune flattening.



NJBPN 128 – Dorset Avenue, Ventnor City



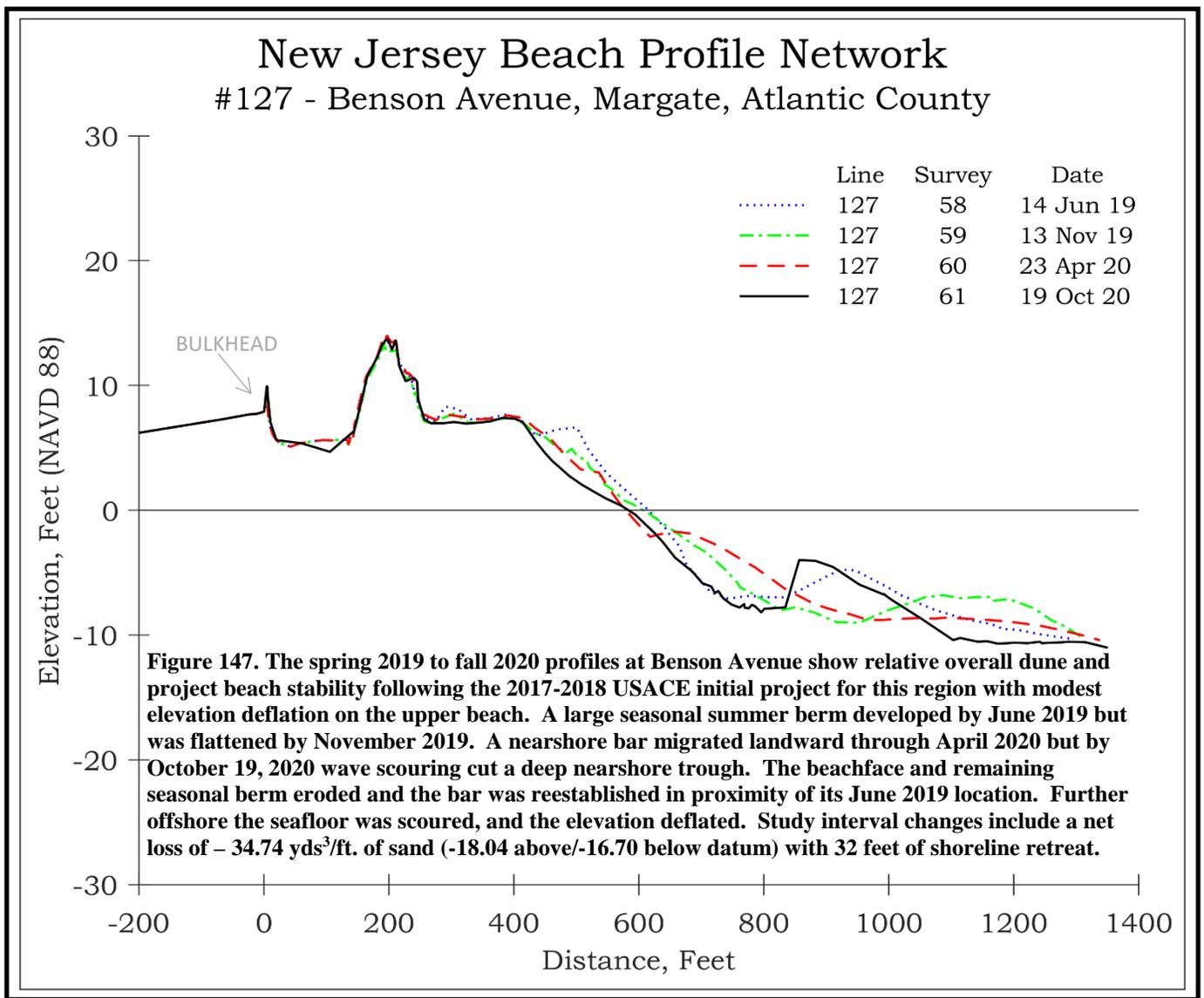
The Dorset Avenue site positioned centrally on Absecon Island is stable in terms of net losses, seasonal changes and any long-term erosion trends. Left photo taken November 14, 2019 shows a view to the south of the dune and beach with the Ventnor pier in the background. A similar view taken on October 19, 2020 shows minor variations in the beach and dune conditions.



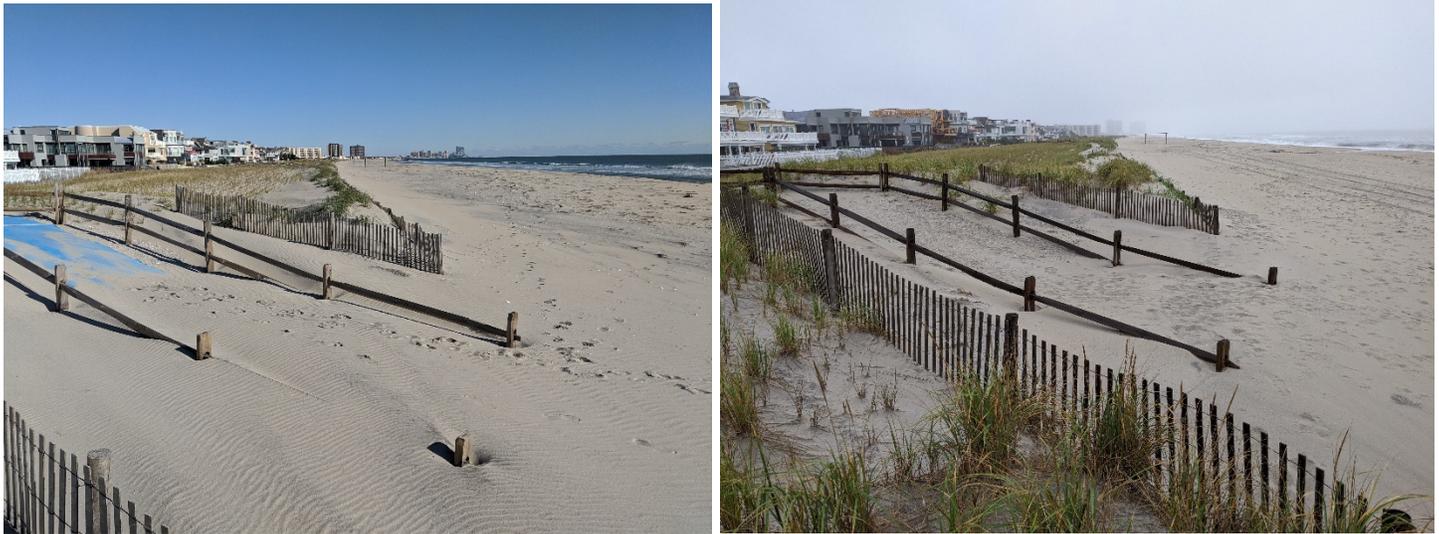
NJBPN 127 – Benson Avenue, Margate City



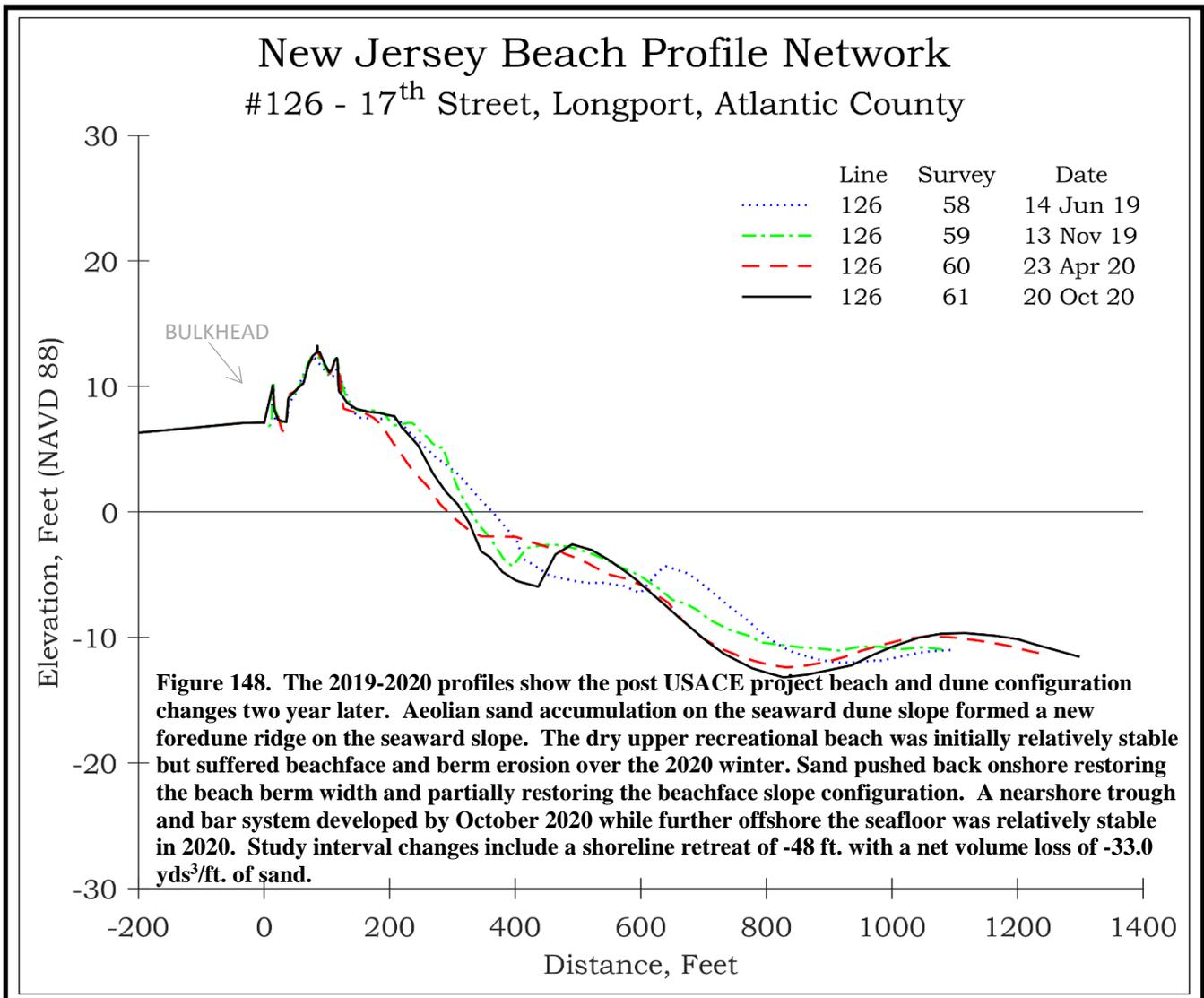
The Benson Avenue site is located approximately one mile south of the end of the original USACE project in Ventnor. The left photo taken November 13, 2019 shows the post project dune and beach configuration with a wide dry beach berm and newly planted dune and installed dune fence. By October 19, 2020, the dune fence is accumulating sand and the vegetation flourishing on the crest. Following construction, the beach has remained relatively stable throughout the study interval.



NJBPN 126 – 17th Street, Longport



The 17th Street profile is located about 6 blocks north of the Great Egg Harbor Inlet. The left photo, taken November 13, 2019, shows the post USACE project established dune and wider beach conditions. Aeolian sand accumulated along the seaward dune slope has nearly buried the seaward beach access and dune fence. A similar view taken October 20, 2020 (right photo) shows sand continued to accumulate at the seaward end of the access path and along the dune fence. Dune plant colonization and propagation improved vegetation density coverage as the plants flourished over the past year. The recreational beach width remained relatively stable providing an ample source of aeolian sand to continue dune growth.



Summary & Conclusions

The USACE completed the scheduled the 3rd nourishment cycle on Absecon Island in spring 2018 which following a Superior Court ruling upholding federal completion of the entire Absecon Island project from Absecon Inlet to Great Egg Harbor Inlet. Storm damage from Sandy in Longport convinced Borough officials to seek inclusion in the 2017 USACE project to continue construction of the full dune and beach design template south from Ventnor. Some residents in Margate continued to oppose the USACE project design and took legal action to block the construction were denied by the 2016 court ruling. On Brigantine Island, USACE restoration work was also completed in spring 2018. The scheduled 4th nourishment cycle for Absecon followed the 2020 NJBPN survey in late fall and was completed in February 2021. The 4th nourishment cycle for Brigantine is scheduled for FY 2023.

The Absecon Island average beach change at the six cross sections lost -23.81 yds³/ft. in sand volume accompanied by a -24.6-foot average shoreline retreat from spring of 2019 to the fall of 2020. These numbers provide an average across the federal project beach with readjustment of the recent USACE nourishment project sand to the prevailing currents and wave climate the major influencing factor in the absence of a major storm event. Significant changes continued to occur at Rhode Island Avenue at the north end of Atlantic City within the erosional hotspot where the seaward dune slope retreated landward an additional 25 feet to within about 50 feet of the boardwalk by fall 2020. By fall 2020, the shoreline had retreated 10 feet with a loss of -25.71 yds³/ft. of sand. The North Carolina site showed the worst erosion during this study interval continuing the north end erosional pattern -48.77 yds³/ft. of sand from spring 2019 to fall 2020 as the shoreline retreated -53 feet. Changes at the mid-island sites on Absecon Island were more positive, ranging from a gain of 6.14 yds³/ft. at Raleigh Ave in Atlantic City to a modest loss of -6.75 yds³/ft of sand at Dorset Avenue in Ventnor. This relative stability indicates a net transfer of sand north to south along the Absecon northern shoreline as sand eroded from the northern sites moved longshore towards the middle of the island. At Benson Avenue in Margate, the site showed initial adjustments to the local wave climate with seasonal berm development in spring 2019 followed by erosion the project beach as well as scouring nearshore and offshore with a net loss (spring 2019 to fall 2020) -34.74 yds³/ft. of sand. The 17th Street site in Longport is heavily influenced by inlet dynamics due to its proximity to the Great Egg Harbor Inlet, from spring 2019 to fall 2020 it suffered a net loss of -33 yds³/ft. of sand while the shoreline retreated -48 feet. There was seasonal variation in the beach berm width contributing to these changes but with nearshore and offshore scouring a major factor in the net losses.

In contrast to the erosion on Absecon Island, the four Brigantine Island cross sections gained an average of 7.83 yds³/ft. of sand from spring 2019 to fall 2020. The site at 4th Street north located within the federal project received 90.94 yds³/ft. of sand during the 2018 USACE maintenance project but was the only site to show a net loss of sand (-33.31 yds³/ft.) from spring 2019 to fall 2020. The northern Green Acres site was relatively stable with a net gain of 3.23 yds³/ft of sand during the study interval while the remaining two southern sites (15th St, 16.73 yds³/ft. & 43rd St, 44.68 yds³/ft.) gained on average 30.71 yds³/ft. of sand from spring 2019 to fall 2020. The average shoreline change for the four Brigantine profile sites was a seaward advance of 27 foot during the study interval. The 4th Street North site with a large shoreline position retreat of -59 feet continues to demonstrate the rapid losses within the erosional hotspot region for the engineered beach. With scheduled maintenance not expected until FY 2023 this section of shoreline will become more vulnerable to storm wave runoff, overtopping of the revetment and dune breaches as erosion and dominant southerly longshore drift continues to remove sand from this region. The two southern sites in Brigantine advanced 62 feet and 107 feet with the largest advance occurring at 43rd Street South. The Natural area remained relatively stable by comparison with a minor net shoreline retreat of -0.3 feet for the study interval.

Absecon Island with the highest density of development on any New Jersey barrier island has a moderate storm exposure risk, even with completion of the federal project. Completion of the initial construction for Margate and Longport with maintenance nourishment for Atlantic City and Ventnor City increased the Absecon Island sediment budget. With this additional sand and completion of the southern community beaches, the stable middle segment of the Absecon Island oceanfront expanded to include Margate. The northern hotspot persisted between Absecon Inlet and Steel Pier driven by proximity to the inlet and island orientation. This area

continued to suffer disturbingly higher erosion rates that threatened exposure of the boardwalk infrastructure near Rhode Island Ave. At the south end of Absecon Island, the southern beaches also experienced significant erosion rates following sand placement. With its proximity to Great Egg Harbor Inlet and no modifications to the terminal groin at 11th Street or jetty system at the southernmost tip of Longport Point, terminal losses and sand bypassing is showing problematic initial loss rates mostly into Great Egg Inlet.

From the Oriental Jetty towards Gardner's Basin the USACE constructed 0.3 miles of bulkhead, seawall and boardwalk, completed in April 2018. This work replaced an aging rock structure and the severely damaged inlet boardwalk. The project design reduced coastal storm damage risk while restoring city access and recreational opportunities along the inlet. Approximately 99,000 tons of stone placed in the new shore protection structure extending 1,776 feet fronting 2,650 feet of new boardwalk. Information regarding the project can be found at the USACE Philadelphia District website (<http://www.nap.usace.army.mil/Media/News-Stories/Article/1534767/district-celebrates-completion-of-absecon-inlet-seawall-and-boardwalk/>).

The southern third of Brigantine Island continues to have the lowest storm damage risk exposure due to continued natural expansion of the dune and beach width over the last 80 years, a result of extending the north jetty at Absecon Inlet and a persistent southerly littoral drift, moving sand along the shoreline. Consequently, sand placement on the federal project beach at the northern erosional hotspot continues to migrate north to south along the island shoreline. This continuing process supports the concept for development of a sand back-passing program be established on the southern beaches to remove a percentage of the accumulated sand and transfer it north back to the federal project beaches. Moving sand at a sustainable rate from the southern beaches to the federal project area would keep sand in the system and benefit the regional sediment budget significantly extending the period between required large scale and expensive nourishment projects.



New Jersey Beach Profile Network

Cape May County

Great Egg Harbor Inlet
to Stow Creek

NJBPN Profile #'s
225 - 100

New Jersey Beach Profile Network Cape May County Site Locations

There are thirty-one NJBPN survey sites along the beaches of Cape May County, consisting of a combination of barrier islands, coastal headlands and the Delaware Bay shore. Twenty-seven sites are Atlantic Ocean profiles and the remaining four are set along the Delaware Bay shoreline of western Cape May County. The ocean profile sites are located in the following municipalities: the City of Ocean City, Strathmere in Upper Township, the City of Sea Isle City, the Borough of Avalon, the Borough of Stone Harbor, the City of North Wildwood, the City of Wildwood, Lower Township, the City of Cape May, and the Borough of Cape May Point. Profile #112 on South Pointe in Stone Harbor was lost due to erosion and was replaced by profile #212, which is located south of 121st Street in Stone Harbor. Development forced the shifting of three sites over the years to allow an unobstructed survey line. The four Delaware Bay profiles are located in the communities of Reeds Beach in Middle Township, Villas in Lower Township, North Cape May in Lower Township and at the Higbee Beach State Park.

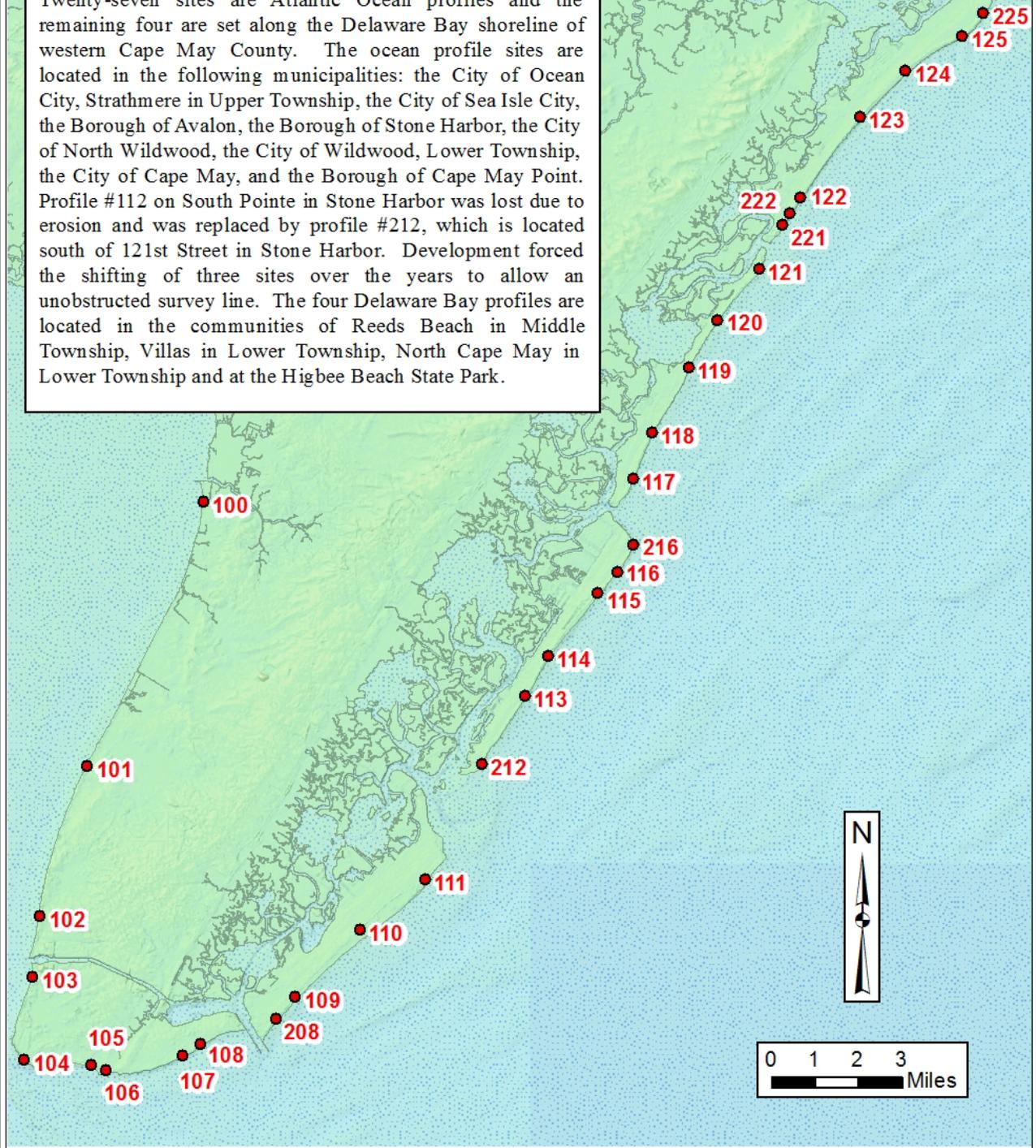


Figure 149. Map of Cape May County showing the locations of the 31 profile sites in the county.

Cape May County Oceanfront and Delaware Bay:

There are 31 NJBPN survey stations in Cape May County between Reeds Beach on the Western Cape May County Delaware Bay shoreline, around Cape May Point, and up the ocean coastline to Great Egg Inlet in Ocean City. This county has five tidal inlets separating four barrier islands and a coastal geomorphic compartment that is the site of Cape May City, a US Coast Guard base, and Cape May Point. This southernmost shoreline in New Jersey consists of barrier beaches, a low-relief bluff of older sediments at the shoreline, plus the possible presence of a relict barrier beach (called Cape Island on old maps) from an earlier high stand in sea level prior to the Wisconsin ice sheet advance (~32,000 years ago).

Each oceanfront inlet has near identical geomorphic conditions with a narrow, rapidly changing southern spit that curves deep into the inlet, a large ebb-tidal delta offshore, and a distinct offset in the seaward position of the southern inlet shoreline due to wave refraction around the ebb-tidal delta. This makes the northeast corner of each island vulnerable to northeast wave conditions especially when the main tidal channel lies close to the southern shoreline of the inlet. The general northeast to southwest coastal orientation in Cape May County exacerbates the impact of northeast storms on each island's northeast-facing beaches particularly the northernmost oceanfront. This impact includes all three Atlantic County barrier islands as well, where maintaining the beach and dune system in each of the affected communities is a difficult battle with the elements.

Each island has at least one profile location where the 34-year surveying history is one of repetitive erosion cycles following each restoration attempt going back to 1983 in Ocean City and 1984 at Strathmere (NJ State/local projects followed later by Federal shore protection work). Avalon conducted a State/local project in 1987, followed 22 years later by the State and North Wildwood in 2009. Episodic deposition has occurred in the mid-section of the four barrier islands yielding generous dunes and wide beaches (20th Street in Ocean City, Williams Road in Strathmere, 35th to 56th Streets in Avalon, and Cresse Avenue in Wildwood Crest). Sand moves eventually to the southern tip of each island creating a rapidly changing environment at the northern side of each tidal inlet (Corson's Inlet state park, Townsend's Inlet, South Point in Stone Harbor, the USFWS Cape May National Wildlife Refuge Two Mile Unit, and USCG Facility at Cold Springs Inlet). The Nature Conservancy owns property between Cape May City and Cape May Point. During an extended period of sand starvation along the Stone Harbor shoreline in the late 1980's, the entire South Point spit eroded away and became an array of shallow sub-tidal shoals in Hereford Inlet. A state/local project in 1997 built a base sand supply for rapid spit growth following the 2003 initial federal project in Stone Harbor eventually to recreate South Point (in 2016) as a 7,500-foot long supra-tidal platform for shore birds. This spit remains as a reconstituted feature, the direct result of beach nourishment sand supplies moving south adding to the spit.

The large-scale federal shore protection projects did guarantee the acceleration of these two processes evidenced by the expansion of the Corson's Inlet State Park, the growth of beach width at the south end of Sea Isle City and the spectacular growth in South Point on Seven-Mile Island since 1995 are all entirely due to beach nourishment in Cape May County coastal communities. The expansion of The Nature Conservancy beach south of Cape May City since 1989 beach nourishment commencement in Cape May City is also due to sand migration via longshore transport. In winter 2017, the USACE completed the third periodic nourishment in the area from Lower Cape May Meadows to Cape May Point (345,000 cubic yards). 2017 also saw sand placement in both Avalon and Stone Harbor derived from Townsends Inlet. Avalon Borough received about 650,000 cubic yards as of November 2019, with work completed in Ocean City and Strathmere as well. Between January and August 2020, periodic beach nourishment projects were completed as part of the coastal storm risk management program in three locations within the confines of Cape May County. Two cycles occurred in Ocean City and one in Strathmere and Sea Isle City.

Delaware Bay Shoreline of Western Cape May County;

Restoration efforts focused on sediment distribution budgets and documentation of wave energy flux (heights, periods, and direction of travel) along the lower Delaware Bay NJ shoreline. Installation of various structure types supporting oyster growth and development is providing interesting data on wave energy reduction at the sand beach. The structures act as nearshore oyster reefs to attenuate wave energy, reduce erosion rates, and prolong the stability of the rebuilt beaches. Local oystermen are interested in this and similar approaches to oyster propagation as aquaculture opportunities, especially if viable along the bay front in Cape May County. Structures range from natural shell to “oyster castle” concrete shapes and timber and rebar platforms. These structures are placed nearshore, in water depths that expose the structures at low tide, but covers them completely during the higher tide cycle. Wave measurements have shown a reduction in incident wave energy at the beach landward of the structures versus open approach sections of the coastline. The impact is greatest during the lower tidal cycle creating sheltered water favored by horseshoe crabs for spawning. The combined efforts and methodologies helped restore the degraded shoreline and assist the migratory shorebirds including the Red Knot that depends on nutrients from horseshoe crab eggs to gain weight to complete their migration and for successful breeding.

In 2018 and 2019, maintenance nourishment occurred in the Pierces Point to Reeds beach complex with sand placement focused on the Cooks Beach segment. This region has acted as a feeder beach shedding material to the adjacent shorelines at south Reeds Beach and Kimble’s Beach. Oyster reefs were installed nearshore at Cooks Beach to reduce erosion rates and create a sheltered environment. National Fish and Wildlife Foundation (NFWF) funds were acquired by the American Littoral Society (ALS) to plan and develop a major effort to protect the mouth of the Maurice River. This included holding multiple stakeholders meeting and technical committees to address local concerns and develop the best concepts to protect areas suffering from long term erosion. Permits were issued in the summer 2021 for a restoration project that would focus on protecting Basket Flats from further erosion and shelter the Northwest reach from further loss of marsh and potential breaching of the Matts Landing road dike. These actions are designed to enhance ecological and community resiliency in the region. Construction funds were provided by NFWF in 2021 with matching funds provided by the state. Construction is slated to begin in 2022 for the Basket Flats portion of the project. The USACE completed a feasibility study to use dredged sands from Delaware Bay to reduce coastal storm risks in three bay-shore communities, Gandy’s Beach and Fortescue in Cumberland County, and Lower Township in Cape May County. Potential sources of sand are from maintenance of the Delaware River Main Channel-Lower Reach E or from the Buoy 10 open water disposal site located one mile east of the Delaware Main Channel. In March 2018, the Township of Lower submitted a proposal to the US Army Corps of Engineers (Section 1122 of the Water Resources Development Act) for the use of this source of dredged material to improve shore protection. This project is currently awaiting a funding source and is dependent on the work to dredge the lower Delaware Bay navigation channel for sand placement. Additional Delaware Bay Beach Profile (DBBPN) topographic/bathymetric lines were added to the overall NJBPN project and have provided an extremely important method of studying conditions at and around the ongoing projects and communities along the Delaware Bay.

Cape May Point benefits from both direct sand placement and the southerly littoral transport direction from Cape May City’s beach project. Both the Cape May City project and its extension into the Nature Conservancy segment north of the State Park continuously feed sand into Cape May Point reducing the net erosion rates seen. USACE sand placement was completed in late 2016 with 110,484 cubic yards placed starting at Lighthouse up to Coral Avenues. No direct sand placement projects occurred during this report’s survey intervals.

Cape May City;

Cape May City beaches continue to shed sand into the “Cove” beach belonging to The Nature Conservancy. These losses are remedied during the US Army Corps of Engineers work between Cold Spring Inlet and Cape May Point. The City dunes are slowly growing with sand derived from wind transport into vegetation

propagating naturally. The beach club profile (#108) did show a continued moderate retreat of the beach-face beginning in the fall 2019. The most volatile region lies at the southern terminal groin leading onto the Nature Conservancy beach where the shoreline shifts landward with a steep beach followed by a spit growth from Cape May City's beaches.

The Wildwoods;

The North Wildwood beaches have become critically eroded particularly between Hereford Inlet and 15th Avenue where emergency bulkhead installations and complete erosion of the dunes have occurred. Inlet/oceanfront sediment exchange continues to complicate the sand positioning both on the beach and offshore. Currently, the inlet channel exists well northeast of the 2nd and Kennedy Boulevard point where the inlet and oceanfront meet with very shallow inlet or ocean floor extending over 1,000 feet offshore from the beaches, but with no singular indication of where sand might build up above either low or high tide elevations.

Emergency installation of sheet pile bulkhead extension has progressed south from 3rd Avenue to 12th Avenue and discussions are underway with the NJ Division of Coastal Engineering to renew the 2009 State-sponsored beach restoration project prior to the US Army Corps going to construction with its shore protection project for the Wildwoods. Meanwhile, North Wildwood has continued to truck sand north from the stormwater outfall positions on the beach for placement in the erosion zones. Since 2013, the City has moved over a million cubic yards of sand from both Wildwood Crest (2013 only) and Wildwood City (2014 to 2020). As of June 2021, at least 220,000 cubic yards of material was transferred in from Wildwood beaches and placed in large stockpiles at the toe of the remaining dunes on the beach. Some was distributed into a ridge of sand north of 11th Avenue to 7th Avenue to provide a small measure of protection at this vulnerable area. The first six city blocks south of the inlet jetty are solely dependent on the rock revetment and bulkhead for storm protection. This methodology is similar to the proposal from the US Army Corps project, but with the larger plan to incorporate hydraulic dredging and sand pumping from Wildwood City to North Wildwood instead of using trucks.

Hydraulic beach restoration from Hereford Inlet is still possible if just the State of NJ and North Wildwood participate in the project at the 75% State vs. 25% Local cost split. The federal project in a long post design, pre-construction phase does not utilize Hereford Inlet sand for North Wildwood. Should the City seek to conduct another hydraulic project, both NJDEP and US Army Corps permits need to be re-applied for. The current permits were modified to capture the Wildwood City sand instead of the inlet material. Should the Division of Coastal Engineering offer to renew the 2009 project at some level, they would do the permit work, design and bid the project, then monitor its implementation, leaving the City to monitor the change following construction in order to continue FEMA Category G disaster relief eligibility.

Wildwood City, Wildwood Crest, and Lower Township oceanfront beaches continue to remain very stable as surplus sand supplies generating abundantly wide beaches with and without a dune system. Dunes vary between excellent and absent entirely depending on specific locations. The US Army project will establish a consistent dune footprint within the project extent that will provide more consistent protection for the development on this barrier island.

Avalon & Stone Harbor;

Both Avalon and Stone Harbor have been leaders in shore protection by having successfully managed to have Federal shore protection projects constructed and, for years, have promoted wider, higher dunes with coordinated development of pedestrian access pathways that do not make a breach easier at street end access points. The US Army Corps of Engineers completed a project restoration from the 8th Street jetty to 31st Street in Avalon and from 70th Street in Avalon south to the terminal groin south of 123rd Street in Stone Harbor with initial sand placement in 2002 and 2003. Work following Hurricane Sandy was completed under PL 113-2 Emergency Restoration funds for Sandy damage to the federal project. Since that was completed in early 2013, erosion claimed the sand to the revetment rocks at 12th Street in Avalon. The Borough conducted its individual

beach project in 2015 adding 740,000 cy between 9th and 25th Streets. The USACE returned in 2017 adding over 900,000 cy to the Avalon beach. Avalon also employs a sand back-passing operation to move sand from the mid-island borrow zone beaches to the erosional part of the island. The US Army Corps returned to Avalon in 2019 to pump 745,000 cubic yards of sand onto the beach between 9th and 25th Streets, but the CBRA prohibition forced the Corps to seek Stone Harbor's consent to extract surplus sand supplies from the dune system for additions to the beaches. Following consideration of those impacts, Stone Harbor declined to allow that to occur and there was no work done on their beaches in 2019. By the spring 2020, the beachfill efforts can be seen at the north end of the island, with erosional trends shown in the beachface and nearshore following initial sand placement. Overall, the mid and southern portions of the island displayed very stable conditions throughout the entire length of the study profiles.

Stone Harbor's southern oceanfront has suffered severe loss rates culminating in NE storm damage in early 2016 that were addressed in 2017 with some Hereford Inlet sand. Sand was also pumped from Townsend's Inlet ebb-tidal delta to Stone Harbor due to issues related to Hereford Inlet being located within a unit of the Coastal Barrier Resource System (CBRS) that prohibits federal funds for use to promote "development" within or for extraction of sediment out of the CBRS unit. Following a meeting arranged by Congressman Van Drew with municipal officials from Stone Harbor, North Wildwood, and Avalon, Department of the Interior Secretary David Bernhardt issued a letter rescinding the 2013 legal interpretation prohibiting sand extraction from CBRS Unit 9 in NJ (Hereford Inlet shoals) for beach nourishment. However, its implementation remains uncertain due to litigation in opposition filed by the National Audubon Society to preclude its utilization for such activities including for Stone Harbor nourishment. To date, no federal funds have been committed to pump sand directly from the authorized borrow sites in Hereford Inlet for beach nourishment. In 2019, the Borough declined to allow the US Army Corps to excavate dune sand concentrated between 111th and 117th Streets plus adjacent areas to augment beach widths along the oceanfront. However, the survey work since the 2017 maintenance fill was complete indicates that the Stone Harbor oceanfront shoreline has done remarkably well in terms of sand losses and shoreline retreat. Both NJBPN profile locations within the confines of the borough of Stone Harbor performed well throughout the 17 months of study. The seaward dune scarp present in the fall of 2019 at the southernmost profile has filled in by spring 2020.

Sea Isle City & Strathmere;

Following Hurricane Sandy, the USACE project replaced the approximately 230,000 cubic yards lost during the storm with projects starting with Ocean City in April 2015 and continuing onto Ludlam Island. This project covered from 42nd Street to 59th Street in Ocean City and extended from Seaspray Avenue south to 93rd Street in Sea Isle City and was accomplished using sand from offshore borrow sites. Over 3.4 million cubic yards of new sand was pumped onto this island from offshore borrow sites by 2016.

Modest restoration work was completed on both the Strathmere side and north of the State Park on the Ocean City side of Corson's Inlet using ebb-tidal delta sand in 2019. Periodic nourishment was completed in Strathmere in January of 2020, and Sea Isle City's scheduled maintenance nourishment was completed in the spring of 2020. There is only one monitored site in Strathmere. At William's Road, profile 121, the nourishment was completed in January 2020. Comparing the fall 2019 survey to the spring 2020 survey shows an increase of 120 cubic yards of sand. In Sea Isle City, from the spring 2020 survey (survey 60) to the fall 2020 survey (survey 61) the four monitored profiles gained 70.2 cubic yards of sand.

Ocean City;

Ocean City has been under USACE jurisdiction since 1992 with the initial 6.2 million cubic yard shore protection project sand placement between Surf Road and 34th Street. Periodic nourishment has occurred approximately on a 3-year cycle with 10 projects from Dec 1994 through 2020 focused on the erosional zone between North Street and 12th Street at the northeast facing part of the barrier island. Early beach-fill attempts centered at 6th Street all had short survival times due to rapid rates of sand loss both back to Great Egg Inlet and

south along the beachfront. This transport mechanism is so effective that since the 1992 episode of sand placement south of 14th Street to 34th Street in 1992, no additional material has been needed. The survey site at 20th Street has one of the widest, most stable dunes with a 250-foot wide dry beach seaward of those dunes. In 1991, the low tideline was located at the boardwalk at this site which is now over 500-feet landward of the current low tideline.

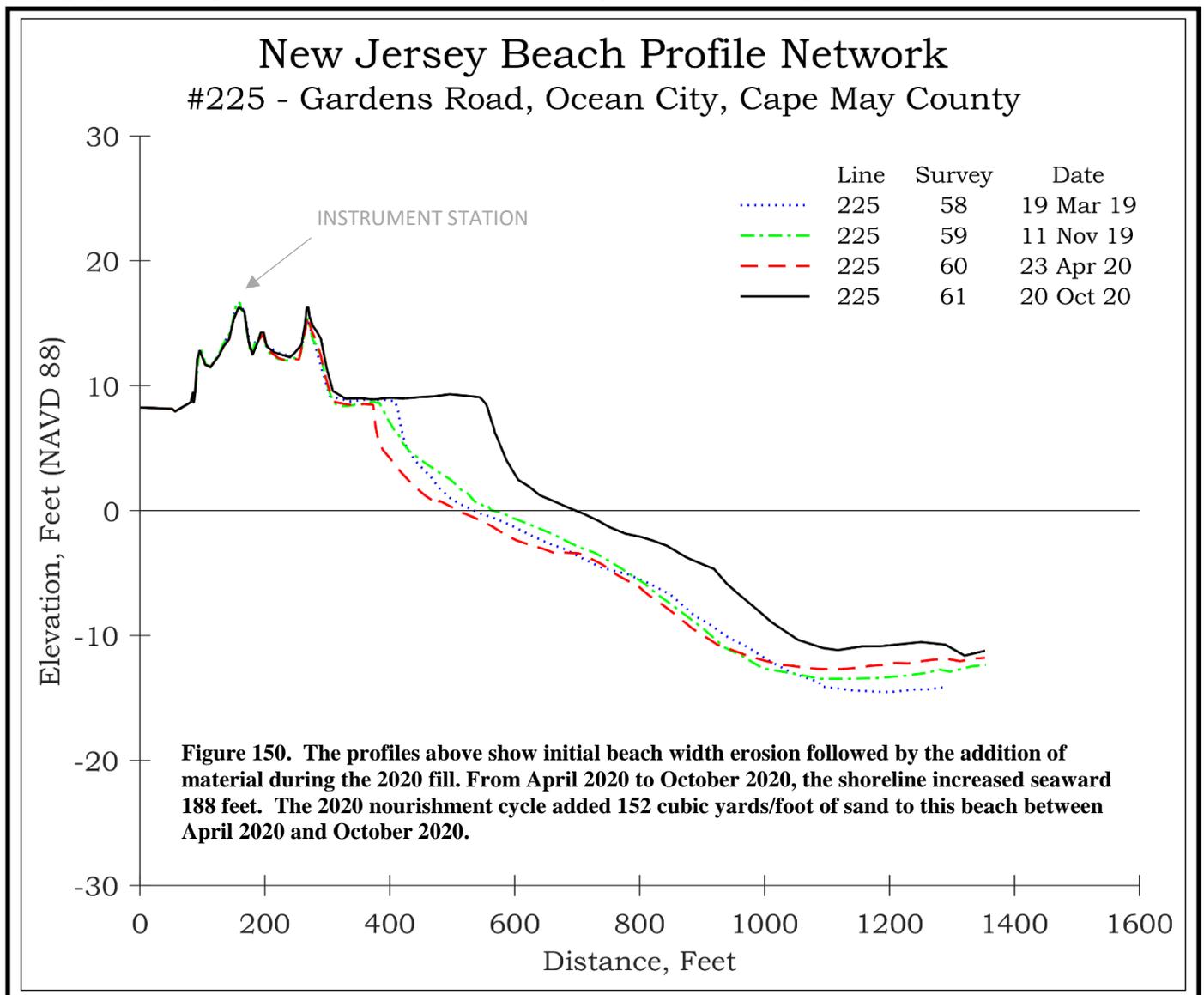
The Ludlam island project also included 1.5 million cubic yards of sand for the southern shoreline of Ocean City that was damaged by Hurricane Sandy due to low, narrow dunes. Completion of this project places the shoreline between Great Egg Inlet in Ocean City and Hereford Inlet in Stone Harbor under USACE project jurisdiction with a 3 to 5-year expectancy of maintenance work on restoring these beaches to the design specifications. A maintenance nourishment was finished in the southern section of Ocean City in January 2020, and the northern section of Ocean City received sediment beginning in May and completed as of August 2020. This maintenance fill was highly beneficial enhancing storm protection and useable beach for the tourism season.

Site Photographs and Profile Plots:

NJBPN 225 - Gardens Road, Ocean City



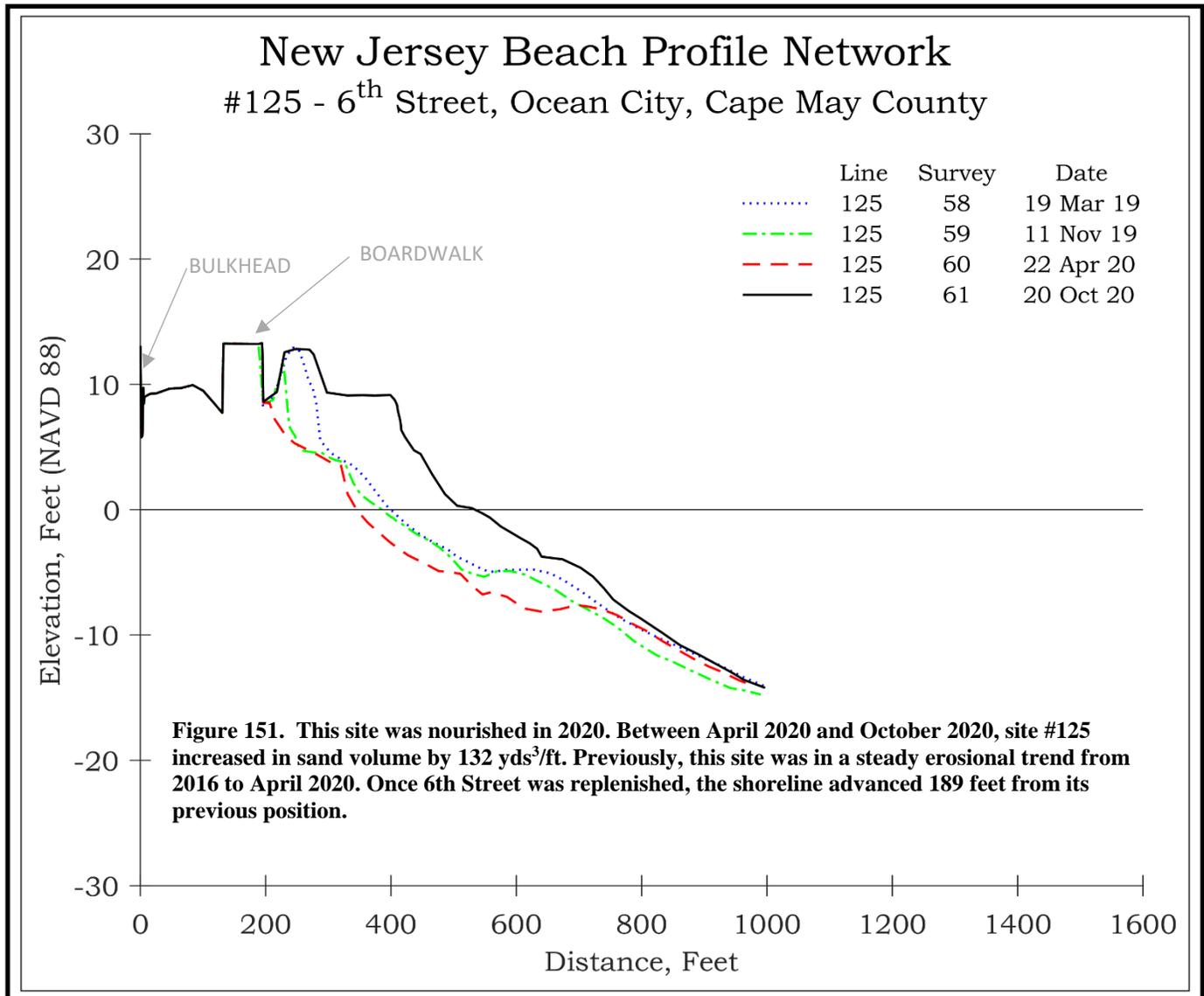
The Gardens Road site is the northernmost profile in Ocean City and located near Great Egg Harbor Inlet. (Left photo is from April 23, 2020. Right photo is from October 20, 2020). In August of 2020, sand was added to the beach once again showing significant improvement to the elevation of the beach profile and increasing the width of the beach.



NJBPN 125 - 6th Street, Ocean City



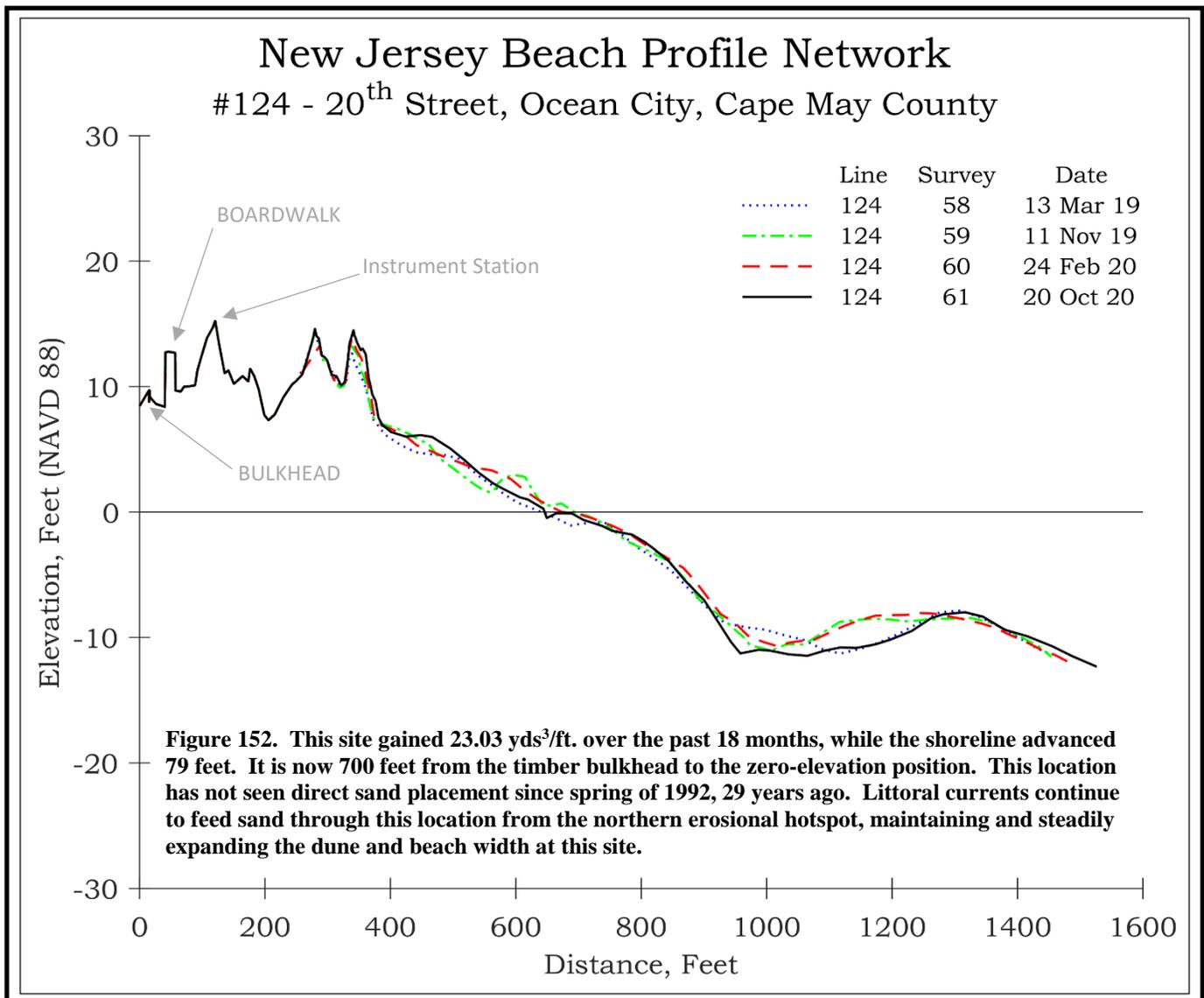
The left photo (taken November 11, 2019) displays the magnitude of erosion at this location. A significant scarp has formed deep into the primary dune while the beach face has experienced continuous erosion. The right photo (taken October 20, 2020) shows the dune and beach entrance to have completely eroded but does display a wider beach and higher elevation due to the beachfill that was completed in 2020.



NJBPN 124 - 20th Street, Ocean City



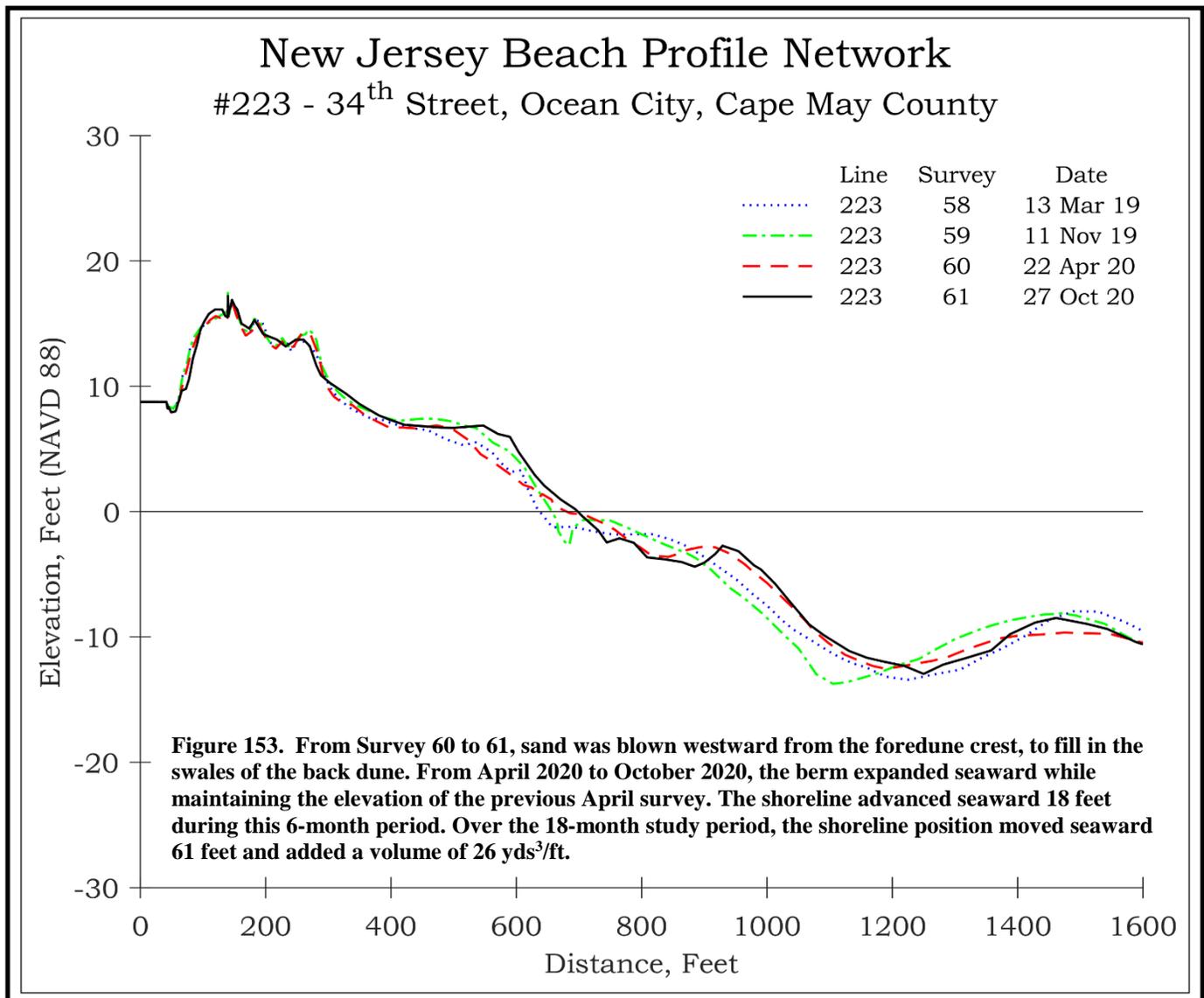
The 20th Street profile is located near the center of the island and hosts an extensive dune and wide beach. The area has been stable since the initial beach restoration in 1992. Photo on left was taken November 11, 2019. Right photo was taken October 20, 2020. The view from the instrument station location provides a panoramic feeling for the expanse of this beach. In 1991, the low tide line was under the boardwalk to the extreme left of the pictures.



NJBPN 223 - 34th Street, Ocean City



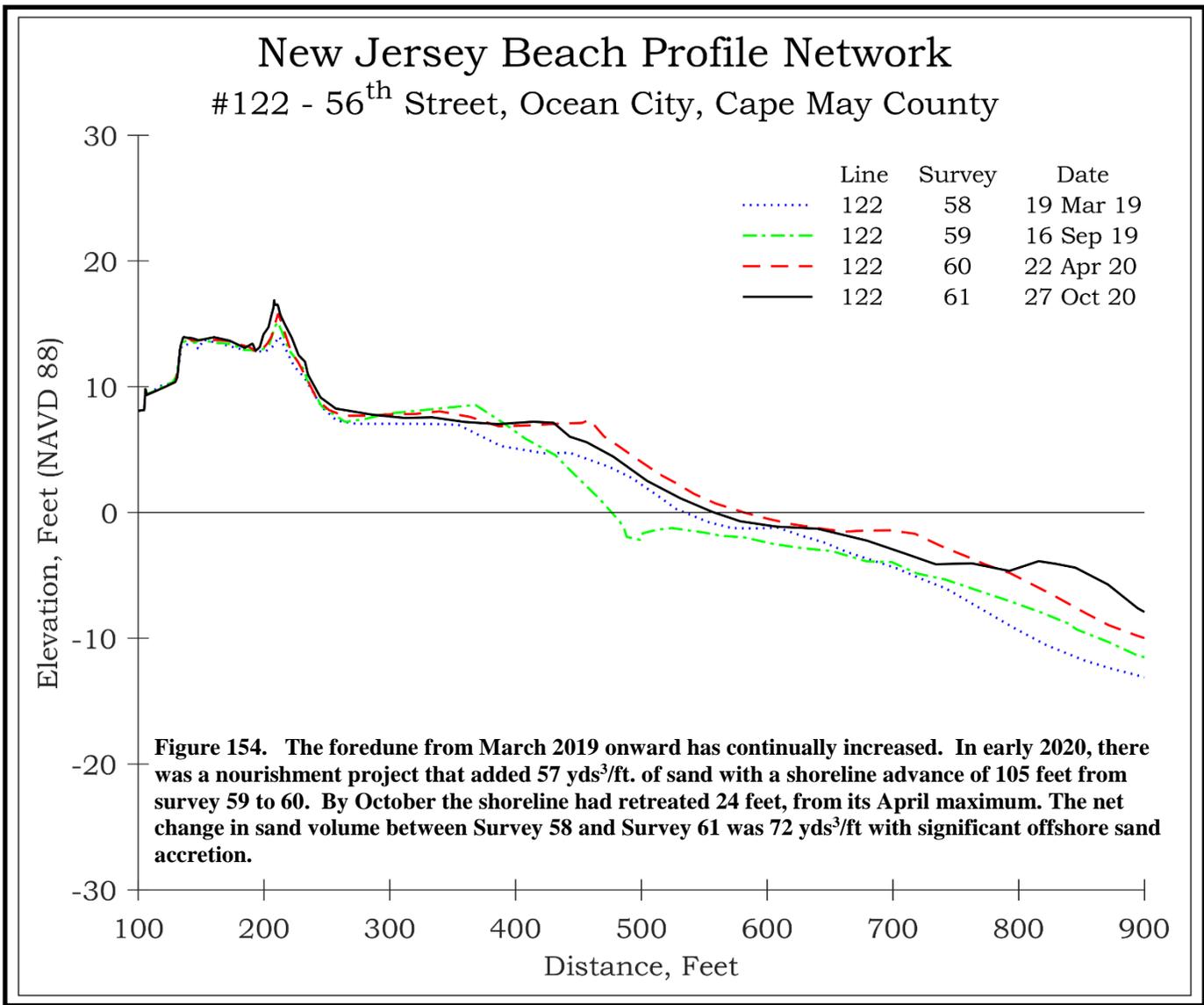
The comparison photos, with the view to the south, (left taken April 22, 2020 and right photo taken October 27, 2020) show changes in dune composition over the past 7 months. The old fence from 2014 has been buried with accreted sand, and a newer fence is nearing complete burial by October 2020.



NJBPN 122 - 56th Street, Ocean City



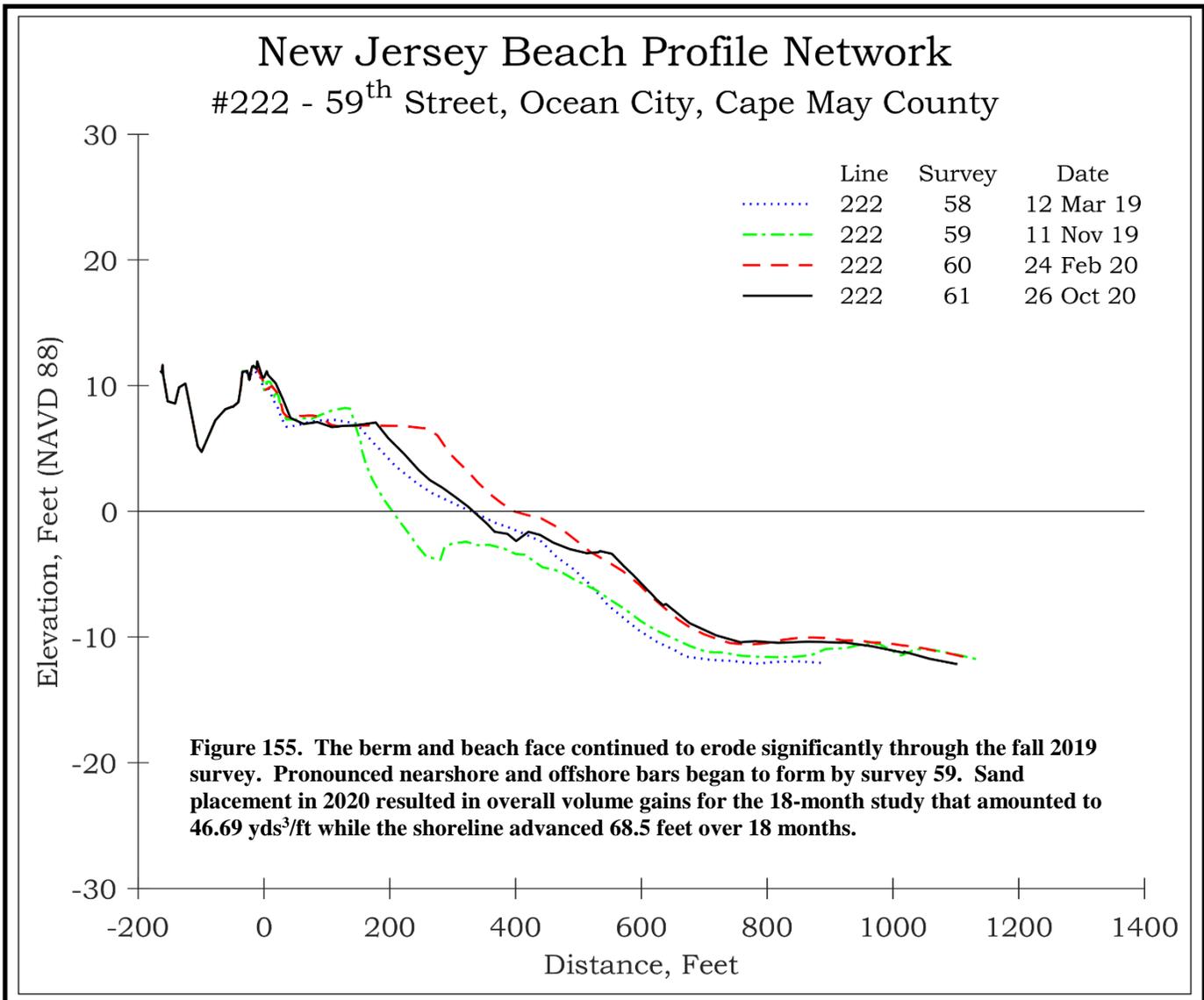
In 2015, the 56th Street site received its first sand replenishment since the 1995 state beach fill. The new dune was planted and a fence that was placed then is now covered by sand as shown on the left photograph (November 11, 2019). The right view was taken October 27, 2020 and shows that the newest line of sand fencing is now completely buried by accreting sand with the foredune vegetation growth remaining strong. The images also show the growth in height of the foredune crest.



NJBPN 222 - 59th Street, Ocean City



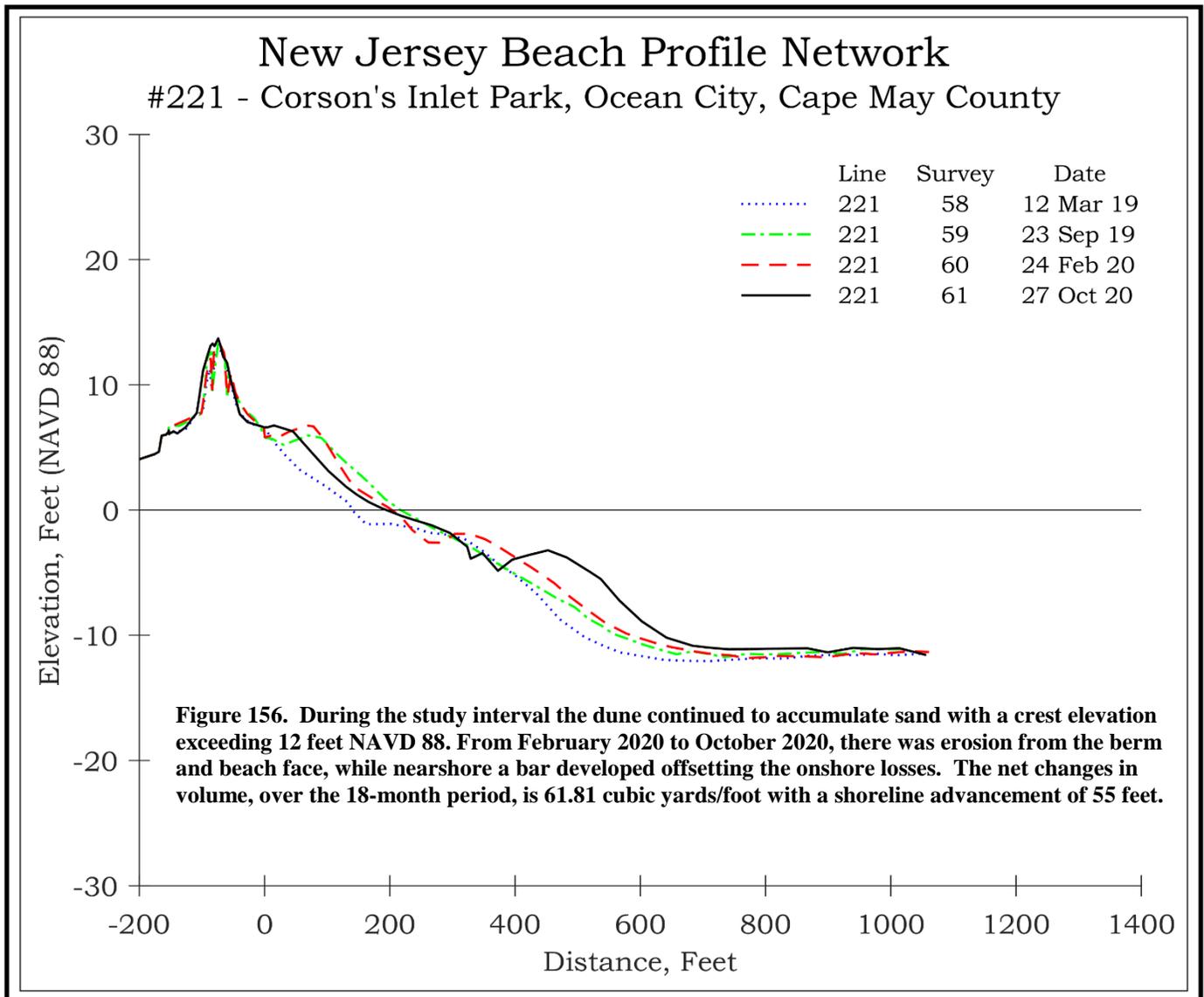
The 59th Street site is located at the southern end of the developed section of Ocean City within the Corson's Inlet State Park. This site is also within the 2015 federal beach fill project area. (Left photo taken November 11, 2019. Right photo taken October 26, 2020). The beach and berm are in an erosional state on November 2019. By October 2020, remaining project sand from the recent nourishment cycle had advanced the shoreline and raised the beach elevation.



NJBPN 221 - Corson's Inlet State Park, Ocean City



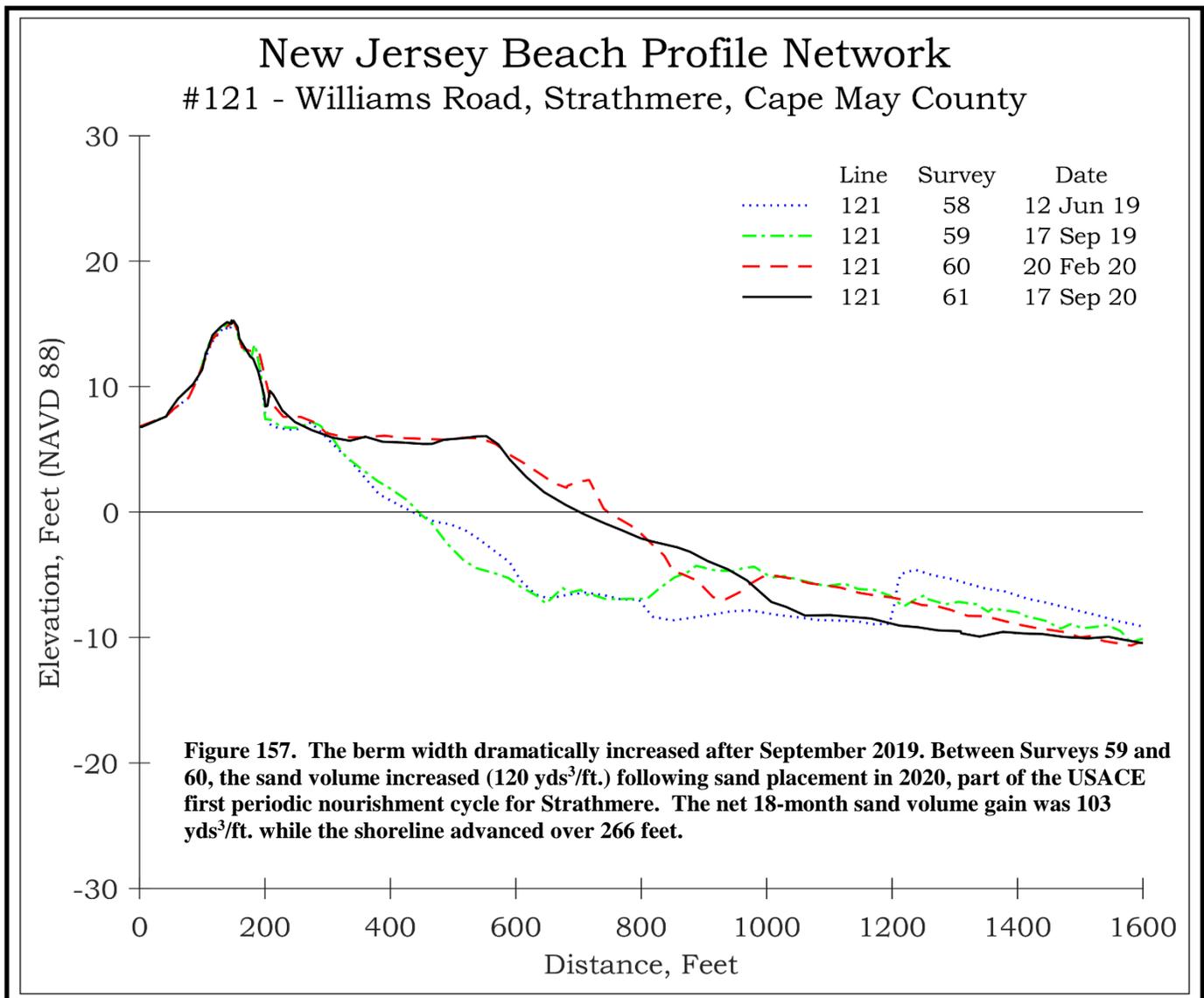
Natural dune recovery has continued following Hurricane Sandy which destroyed the foredune. The left photograph, taken September 23, 2019 shows the beach view to the south from the toe of the foredune with a dry beach berm extending seaward. By October 26, 2020 (right photo), the dune continued to accumulate sand around the vegetation, but the beach had eroded leaving a narrower dry recreational beach.



NJBPN 121 - Williams Road, Strathmere



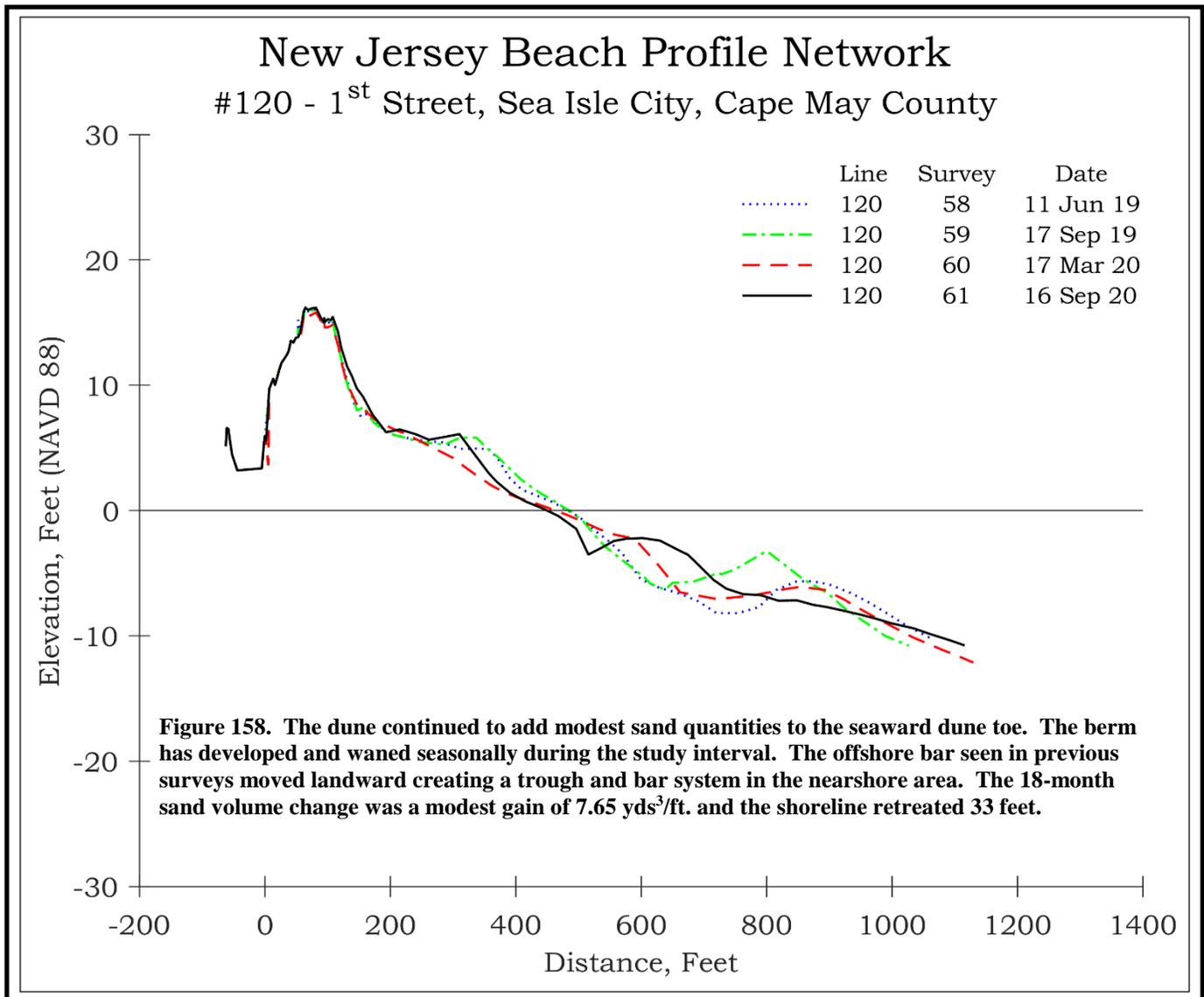
The Williams Road site is dominated by the ebb-tidal delta at Corson’s Inlet. The extensive width of the dry beach serves to protect the dunes from wave damage. The post summer beach had eroded back to the proximity of the seaward dune toe as of September 17, 2019 (left photo). The photo on the right (taken September 17, 2020) shows evidence of a wider beach profile following the 2020 USACE nourishment cycle.



NJBPN 120 - 1st Street, Sea Isle City



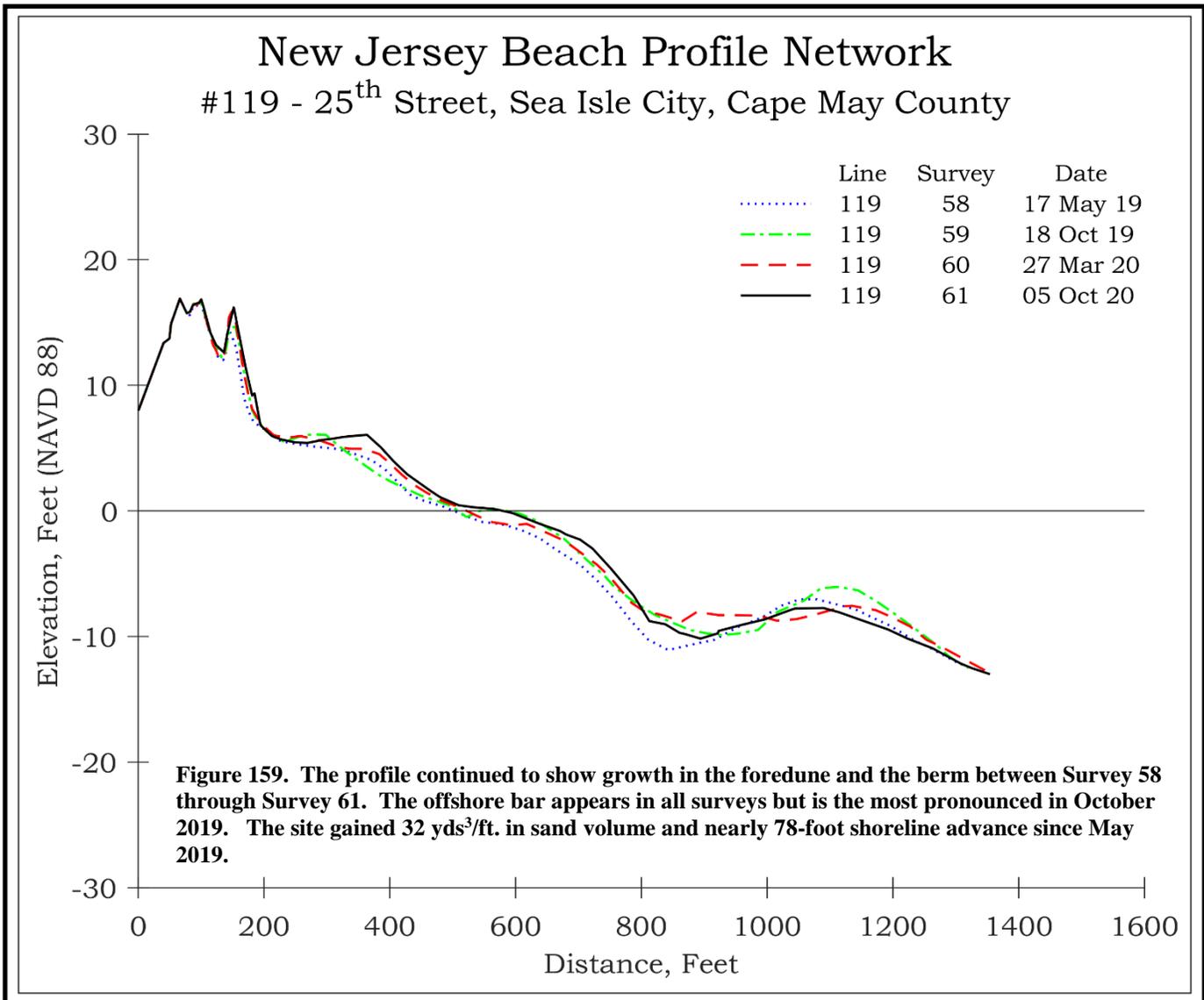
The dune here at the 1st Street location consists of a geotextile core covered by sand. The core has been in place for 26 years without failure. However, more extensive beach maintenance has occurred since 2001 leading to the federal project in summer 2015. The left photograph was taken September 19, 2019 and shows dense dune grass with extensive foredune development that has buried fencing that had been installed in 2015. The right view was taken September 16, 2020 and shows that the dune grasses have flourished.



NJBPN 119 - 25th Street, Sea Isle City



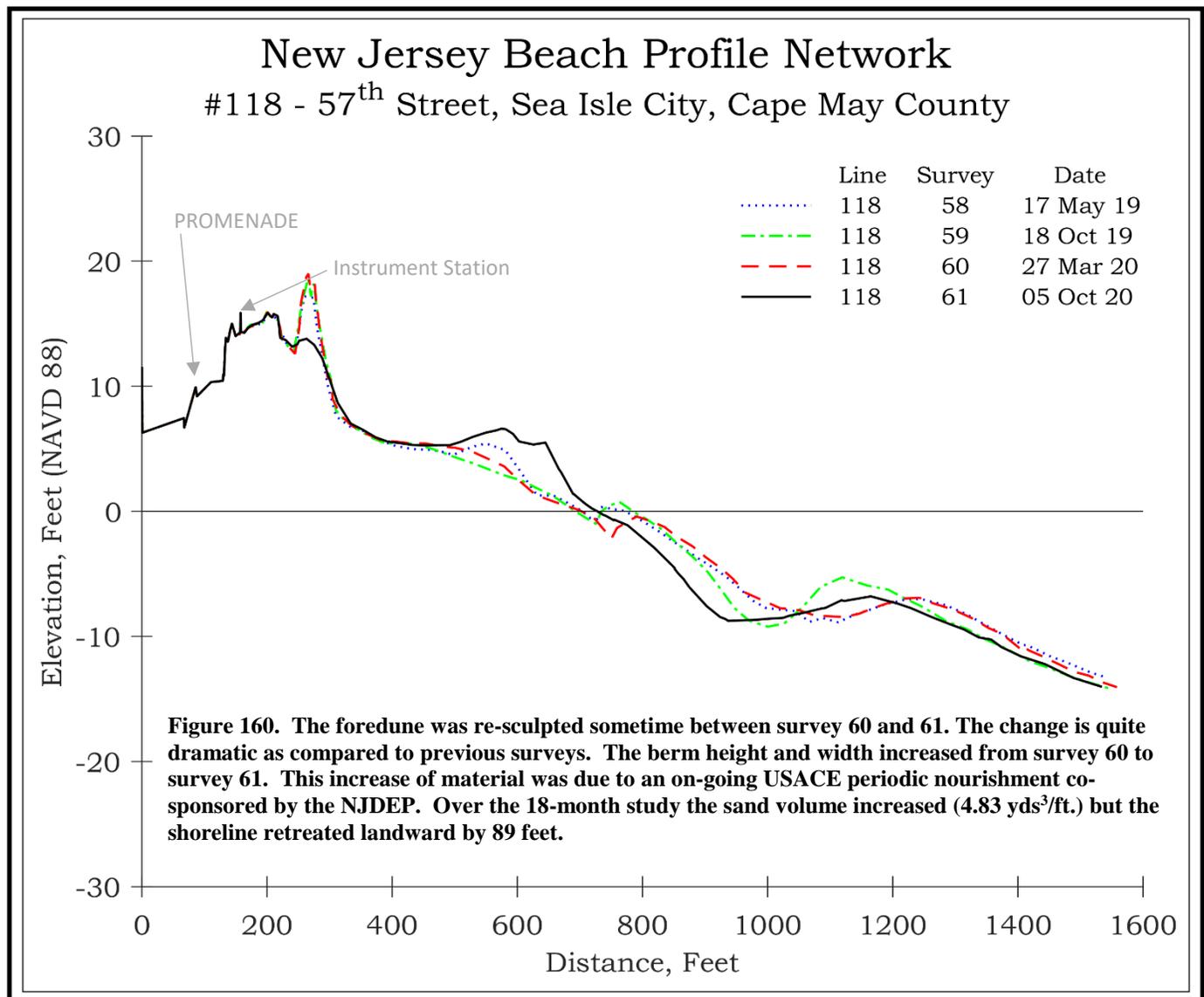
The 25th Street site is reasonably stable and was enhanced in 2009 under the NJ State project and then again in 2015 during a federal project. The 2015 project greatly widened the beach and added to the dune. The left photograph from October 18, 2019 shows the foredune development with the growing vegetation and accreted sand having buried the 4-foot fencing. The right photo taken on October 5, 2020 shows dune grasses have remained and matured on the seaward dune face.



NJBPN 118 - 57th Street, Sea Isle City



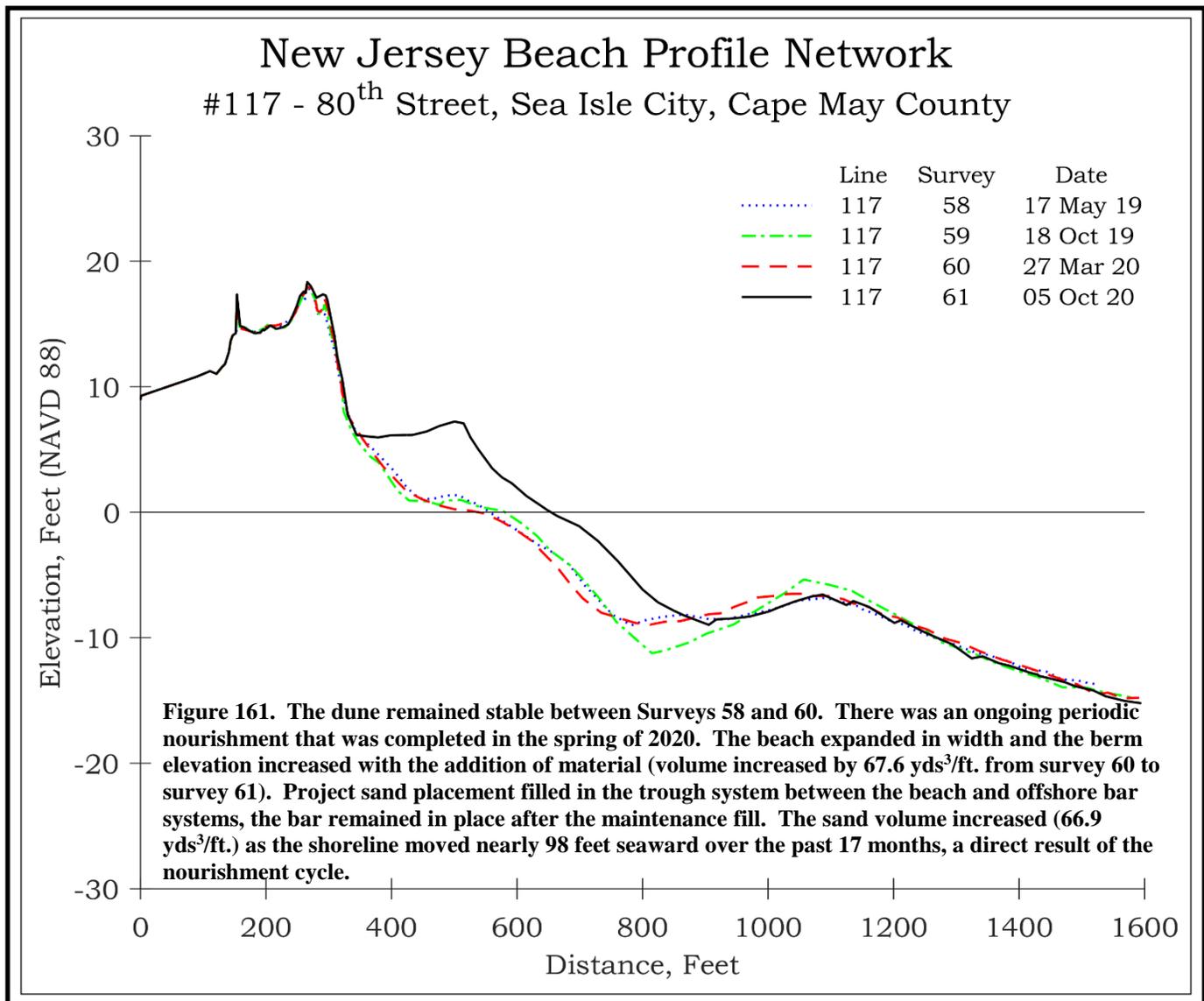
The left photo (taken October 18, 2019) shows established dune grass on a healthy foredune; a nearly buried dune fence is visible along the foredune toe. The right photo (taken on October 5, 2020) shows a complete loss of the established foredune, its grasses, and the fence that existed at its toe. Aside from the complete loss of the foredune, the beach face remains wide and stable. Not clear if this dune change was mechanical or natural.



NJBPN 117 - 80th Street, Sea Isle City



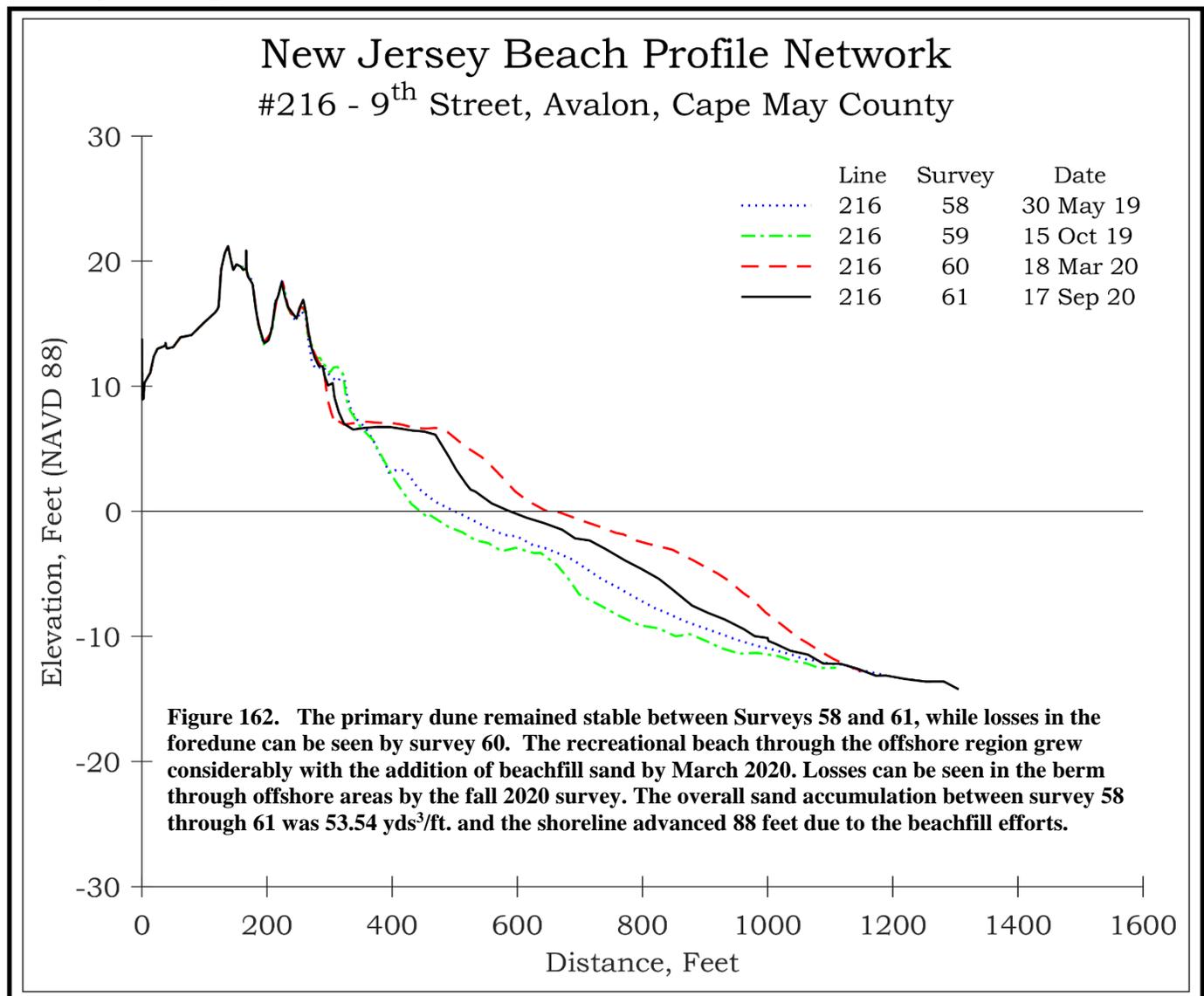
The left photo was taken October 28, 2019 and shows the southern end of Sea Isle City facing North. The fore dune crest is well established and nearly fully vegetated. The right photo (taken on October 5, 2020) shows the dune has remained stable and fully vegetated a year later. The fore dune in October 2020 seems to have accreted sand from wind deposition on the landward edge of the fore dune crest, partially burying the vegetation in spots.



NJBPN 216 - 9th Street, Avalon



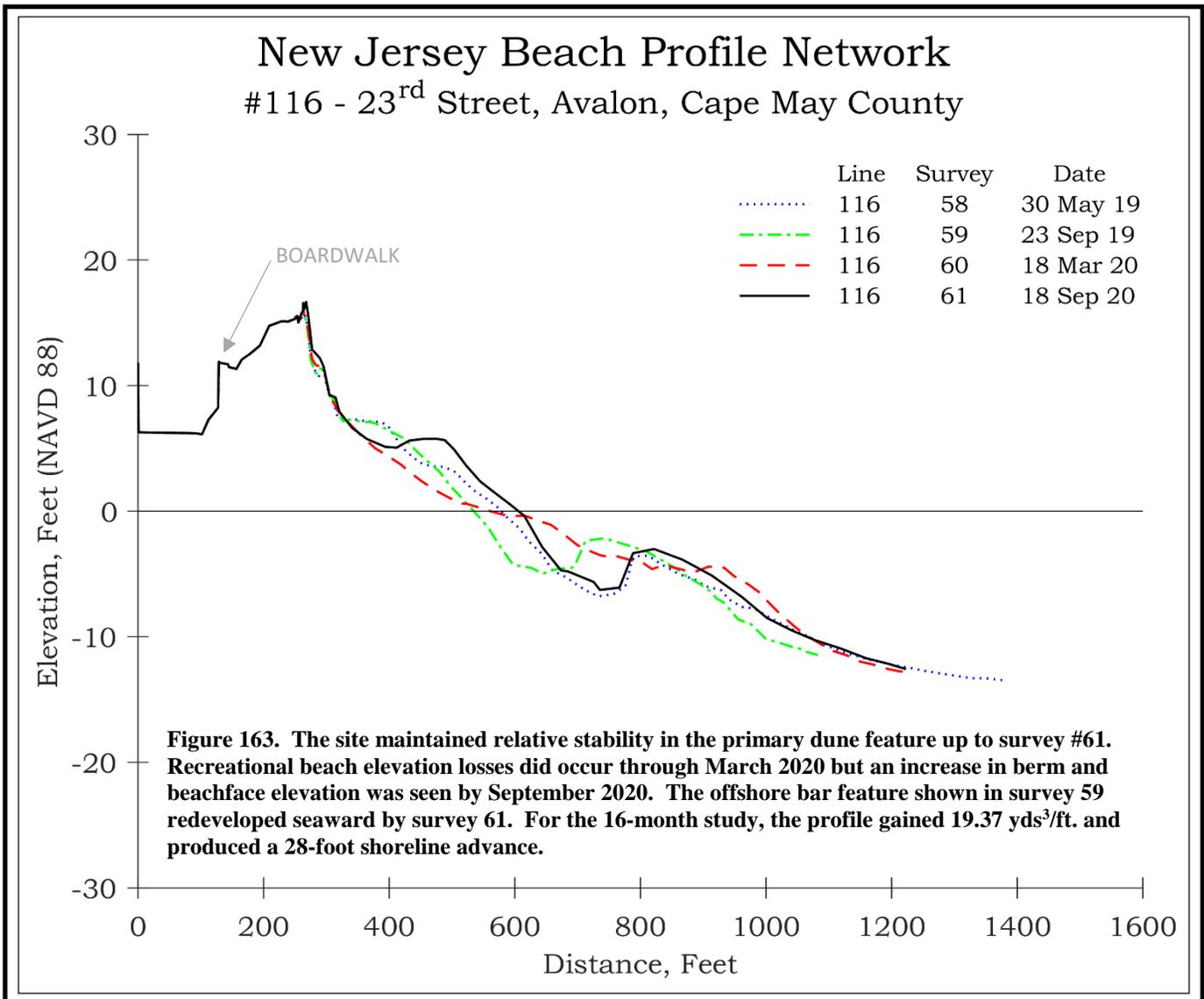
The 9th Street site is located near the Townsend's Inlet south jetty. The fall of 2019 survey (left photo taken October 15, 2019), shows the beach remained virtually unusable for recreational use, as the beachface had eroded back to just in front of the primary dune. The dune here remained unaffected. The right photo (taken September 17, 2020) shows the effects of the 2020 winter beachfill with the expanded recreational beach. The previous fence has been completely covered by sand and a new fence was placed along the seaward dune at the toe.



NJBPN 116 - 23rd Street, Avalon



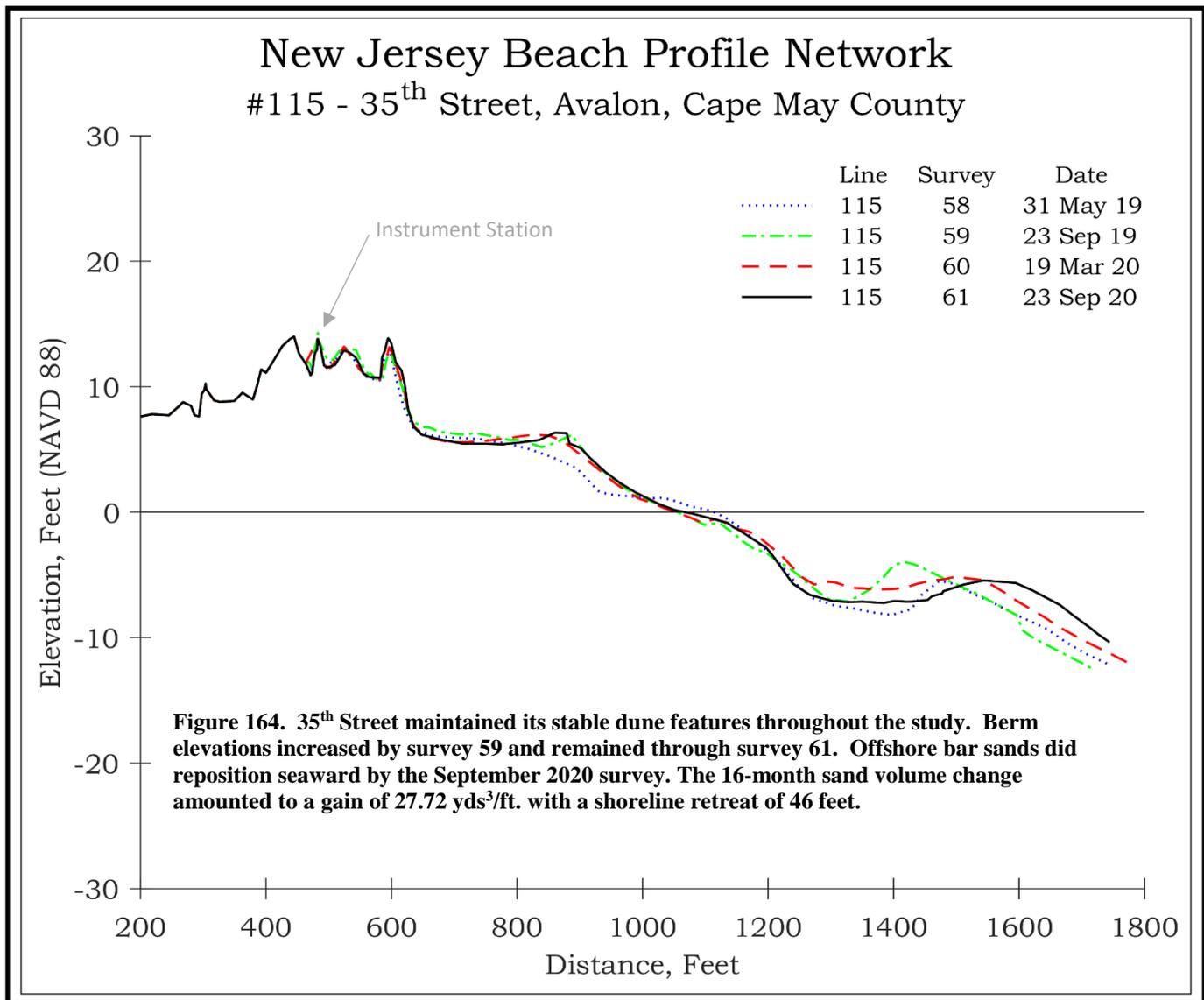
The left photo (September 23, 2019) shows the foredune fencing virtually covered by accreting sand, while the berm elevation has eroded landward. The right photo taken on September 18, 2020 displays the decreased elevation of the recreational beach while the primary dune remains unchanged.



NJBPN 115 - 35th Street, Avalon



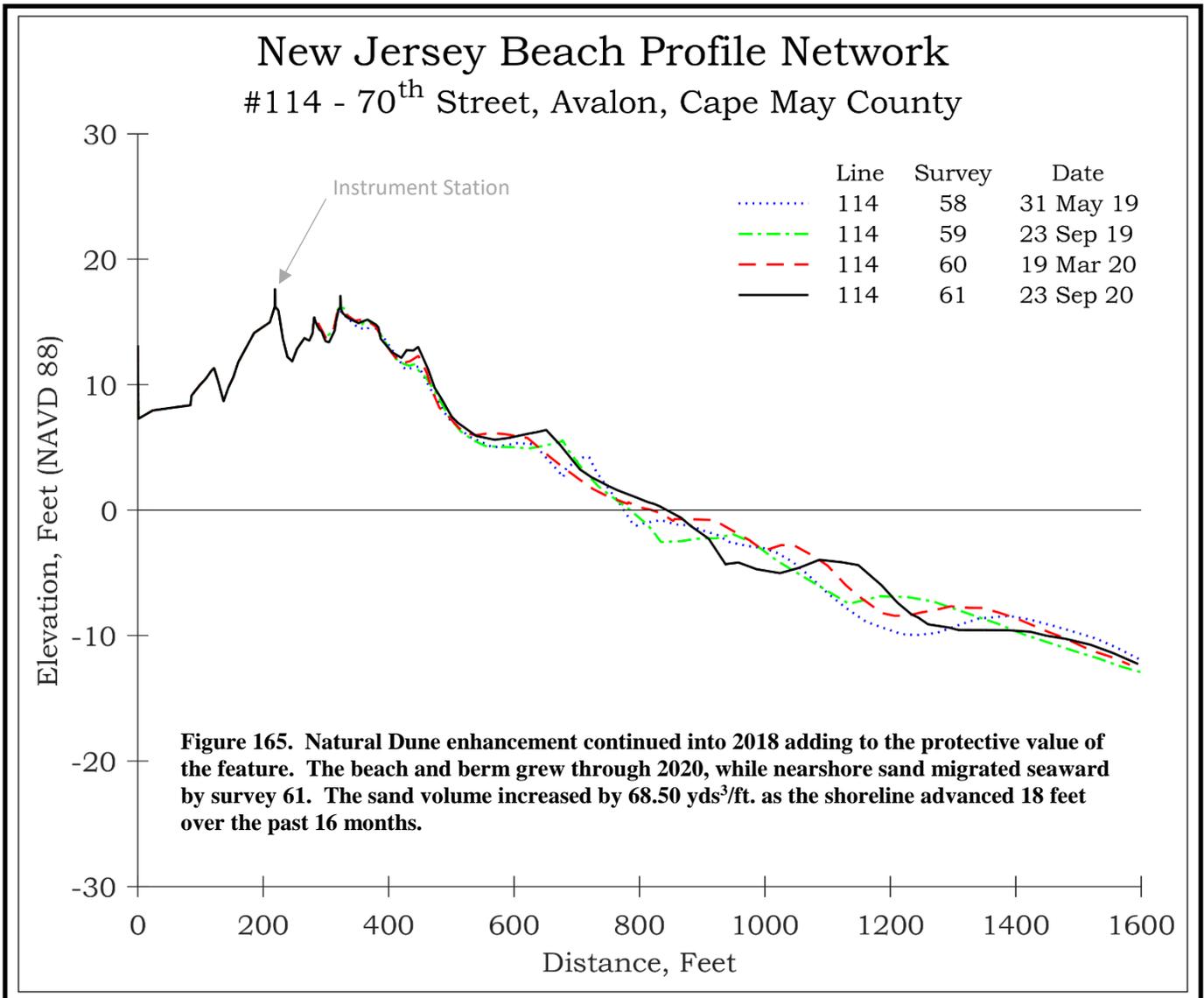
This site lies south of the Avalon beach nourishment project zone and is generally within an accretion zone that is owned by the Borough. The left photo, (view to the south) taken September 23, 2019 looking to the south, displays very healthy dune system and recreational beach area. The right photo, taken on September 23, 2020 looking to the south, displays denser dune vegetation and a stable recreational beach.



NJBPN 114 - 70th Street, Avalon



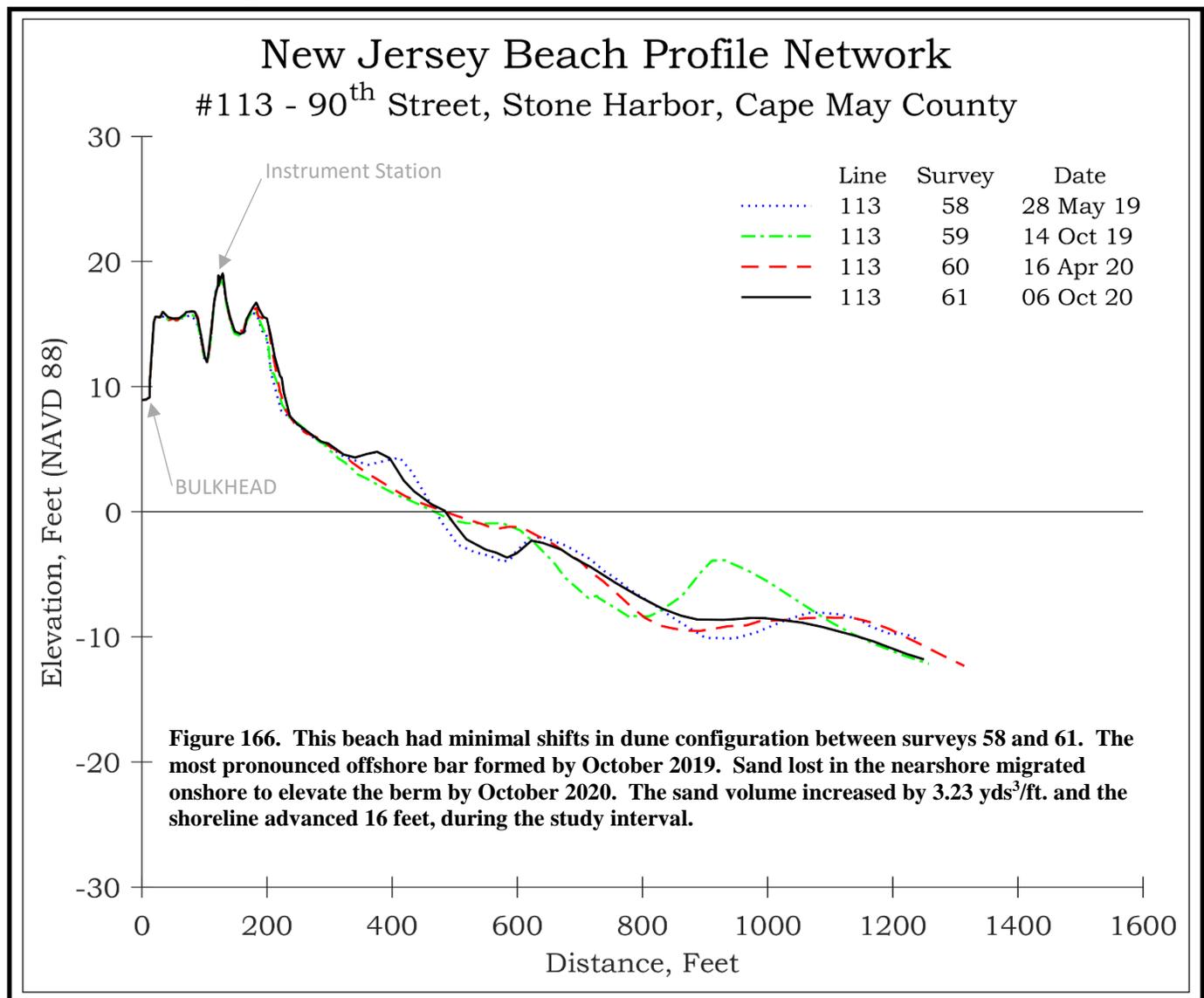
The 70th Street location has been a stable area for decades and lies at the very north limit of the Stone Harbor segment of the USACE Seven-Mile Island shore protection project, which breaks between 31st Street and 70th Street due to that shoreline not requiring maintenance. The left photo was taken September 23, 2019 looking north, shows the buried dune fencing and low lying recreational beach. The right photo, taken September 23, 2020, displays the slightly over-washed beach at a higher tide stage.



NJBPN 113 - 90th Street, Stone Harbor



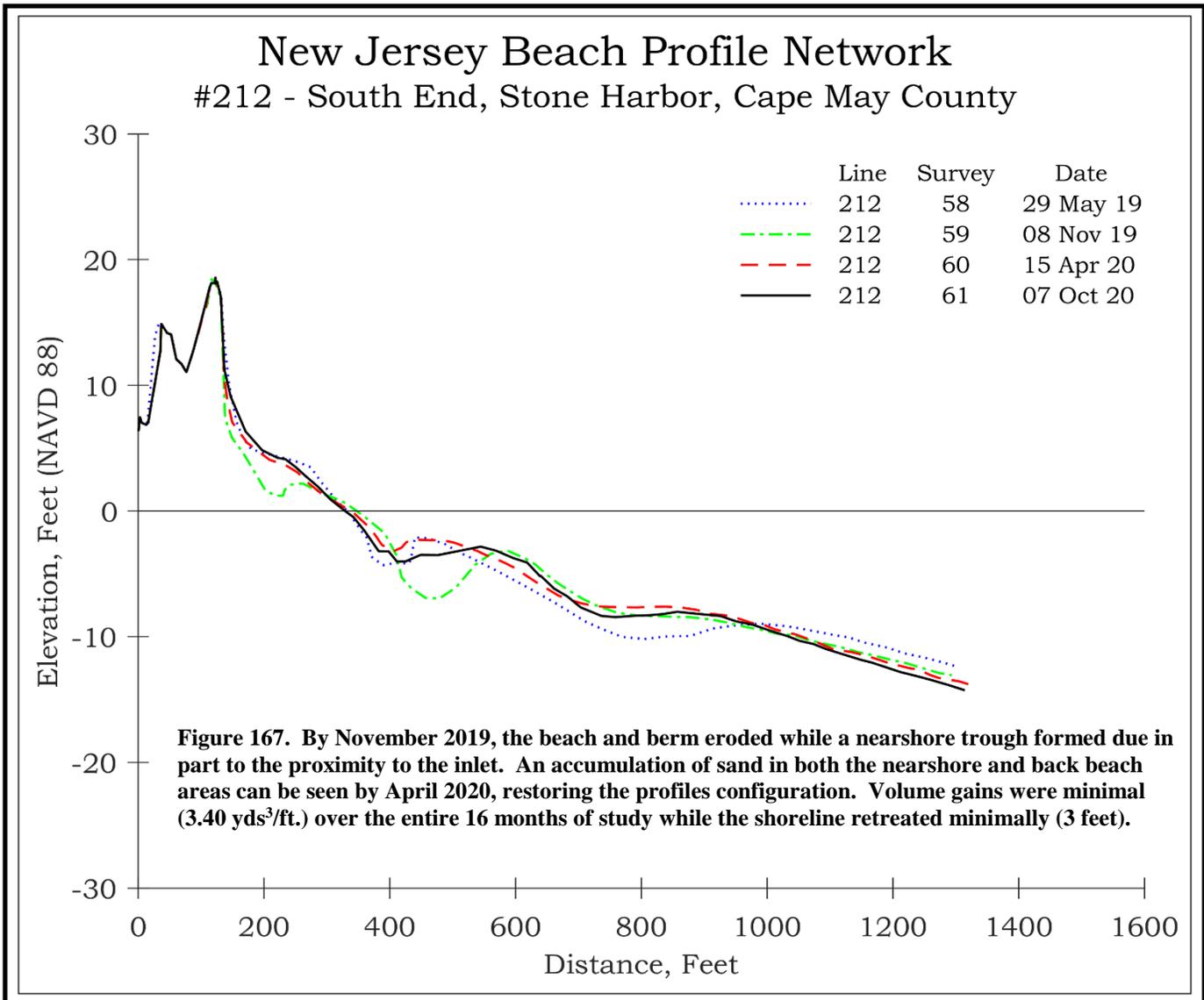
The 90th Street location has been quite stable not needing maintenance as frequently as sites further south. The left photo, taken October 14, 2019, includes the berm and seaward dune toe. The right photo, taken on October 6, 2020, shows a slightly wider beach with a more pronounced berm.



NJBPN 212 - 121st Street, Stone Harbor



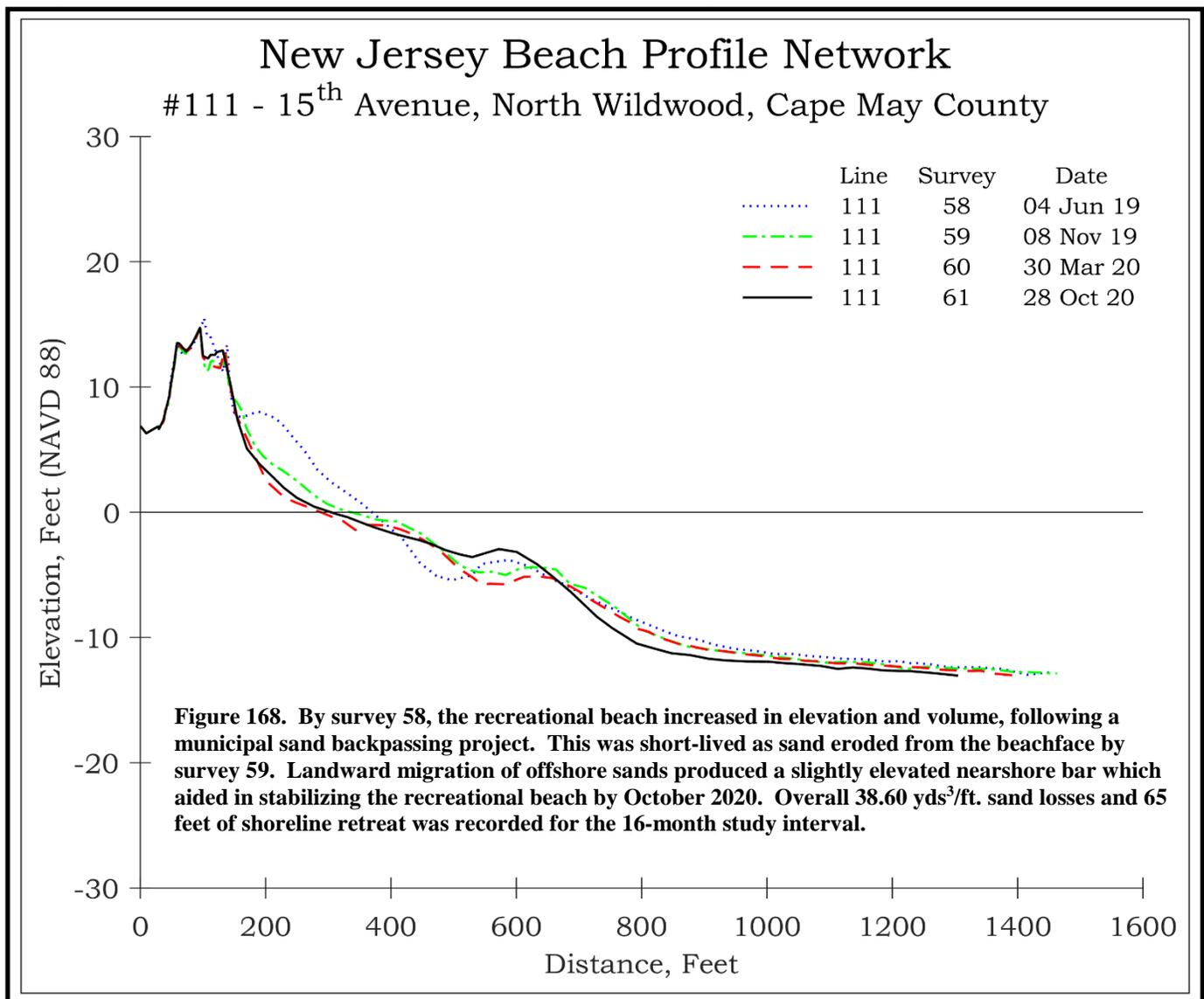
The south end Stone Harbor site has shown a long-term erosional trend that may be influenced by changes surrounding Hereford Inlet. The site has been the recipient of numerous beach nourishment projects including municipal and Federal efforts. November 8, 2019 (left photo) shows a new fence line on the beach, a profusion of seaside goldenrod plants at the dune crest and a slightly wider beach. The photo also shows a seaward dunescarp had formed along with a noticeable pocket of sand added to the shoreline. The right photo, taken on October 7, 2020, shows the seaward dunescarp shown in survey 59 has filled in as sand accumulated on the back beach area.



NJBPN 111 - 15th Avenue, North Wildwood



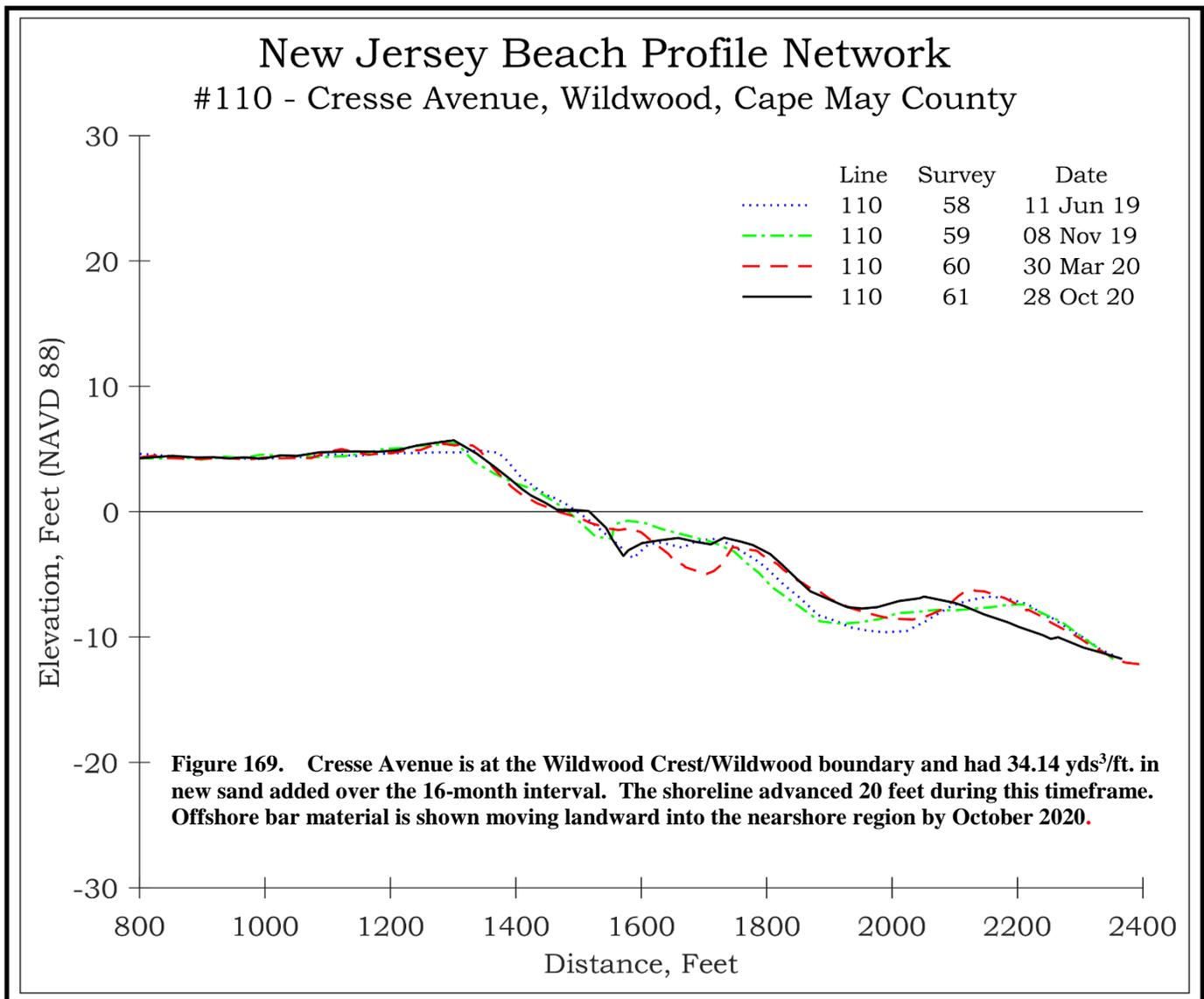
The 15th Avenue site began to incur some of the erosion problems seen to the north. The November 8, 2019 view to the left, shows some dune retreat had occurred. Notice the high tide line positioned at the toe of the dune. By October 28, 2020, the dune system and recreational beach both remained at their March 2020 positions.



NJBPN 110 - Cresse Avenue, Wildwood



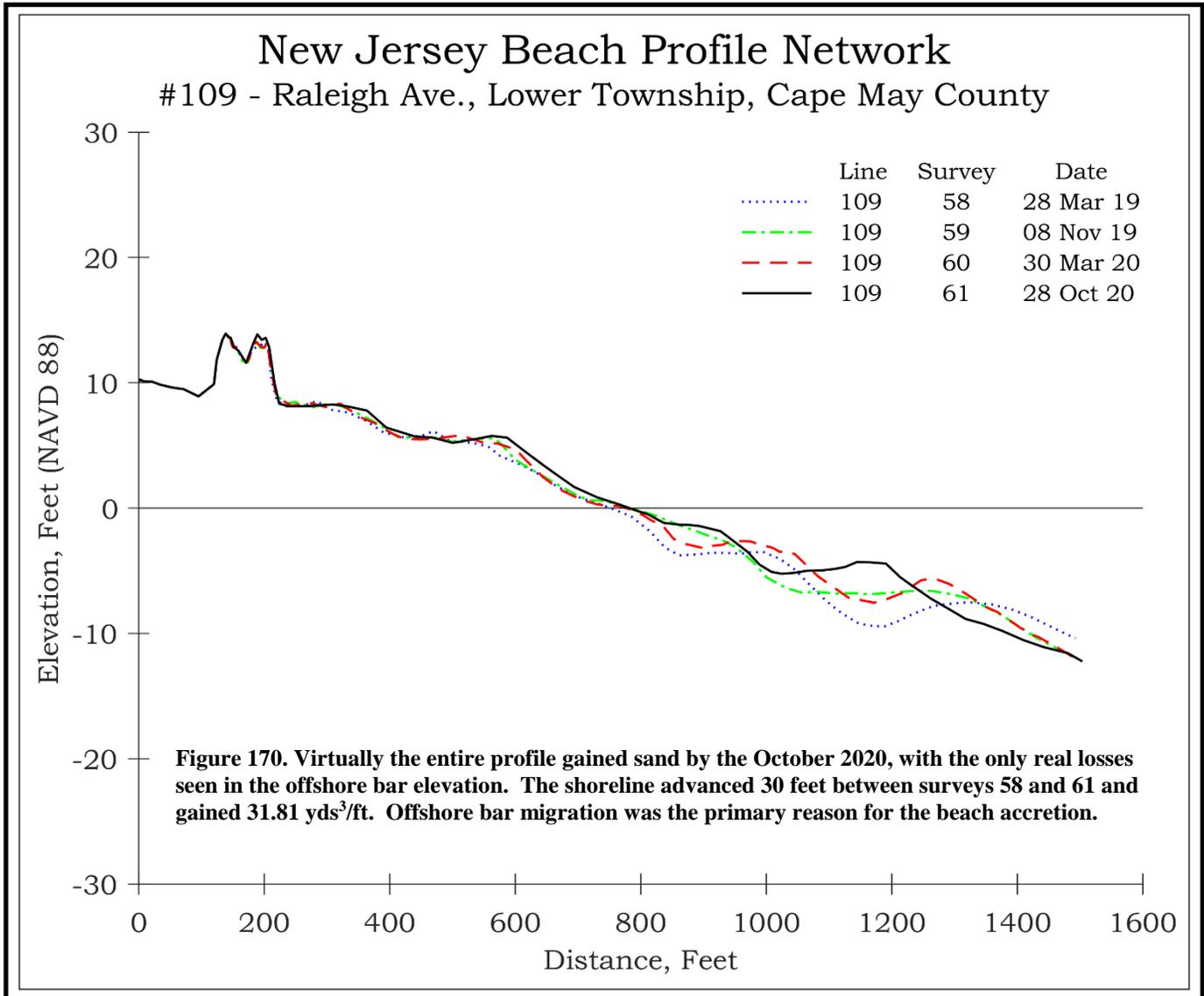
The Cresse Avenue site has been accumulating sand volume since 1992. Sand lost from North Wildwood migrates south adding to the beach width each year. The left photo, taken November 8, 2019, shows the beach width accompanied by the migration of the offshore bar onto the beachface. The right photo, taken on October 28, 2020, shows the extensive low-lying beach along with a construction crane in the distance.



NJBPN 109 - Raleigh Avenue, Lower Township



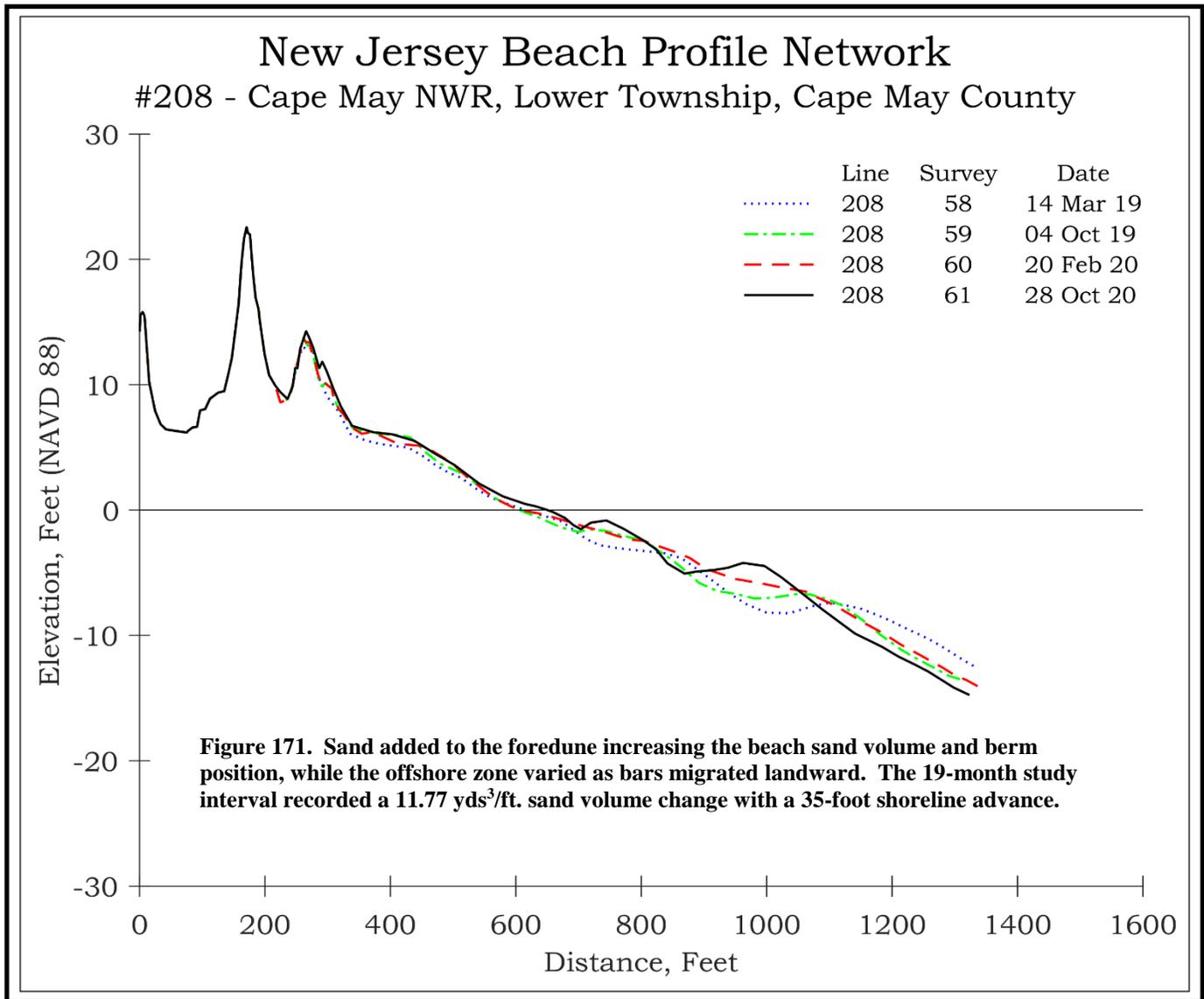
The left photo (taken on November 8, 2019) shows the wide beach present in Lower Township. The right photo, taken on October 28, 2020, shows the bottom zone of the beach and gives a good view of the width which continued to increase through the fall 2020



NJBPN 208 – Cape May National Wildlife Refuge, Lower Township



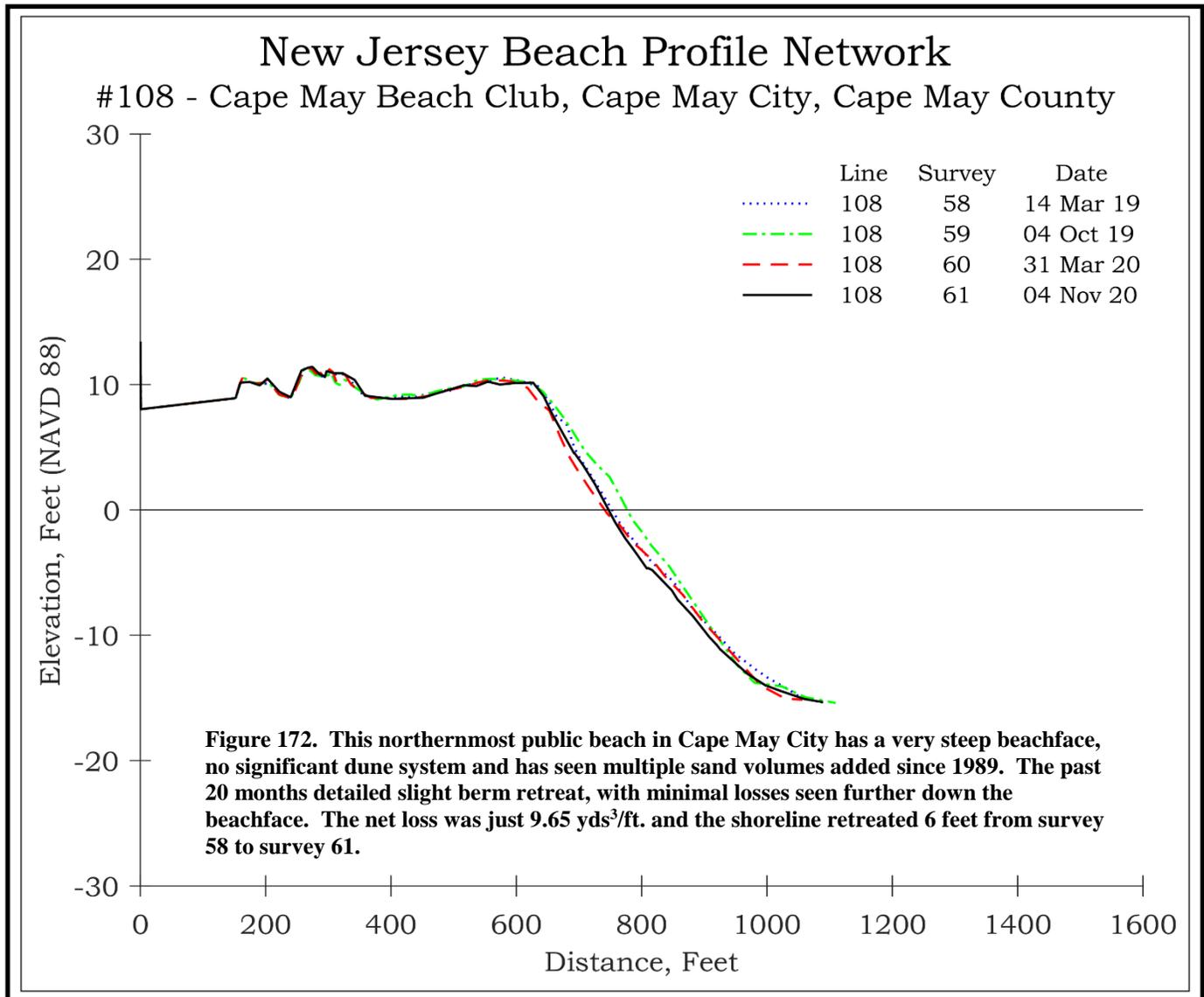
The left photo was taken October 4, 2019 and is a view along the foredune crest to the north displaying the gentle shoreward gradient occurring on the wide beach. The right photo was taken on October 28, 2020, and shows improvement in the grass coverage in the foredune area.



NJBPN 108 - Cape May Beach Club, Cape May City



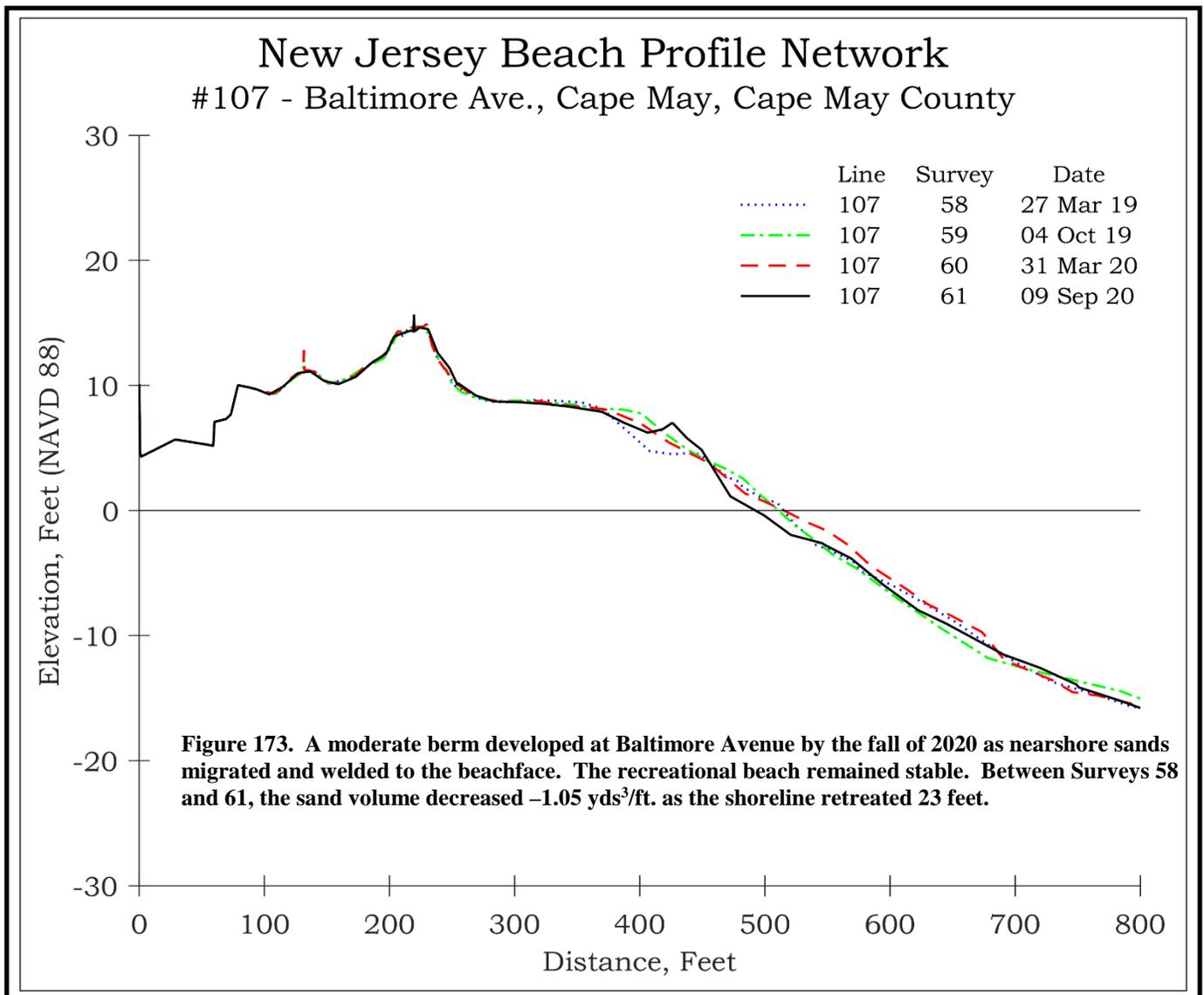
The left photo was taken October 4, 2019. The right photo was taken on November 4, 2020, and in comparison, shows consistency in configuration and beach elevation. The berm did retreat minimally over the 20-month interval.



NJBPN 107 - Baltimore Avenue, Cape May City



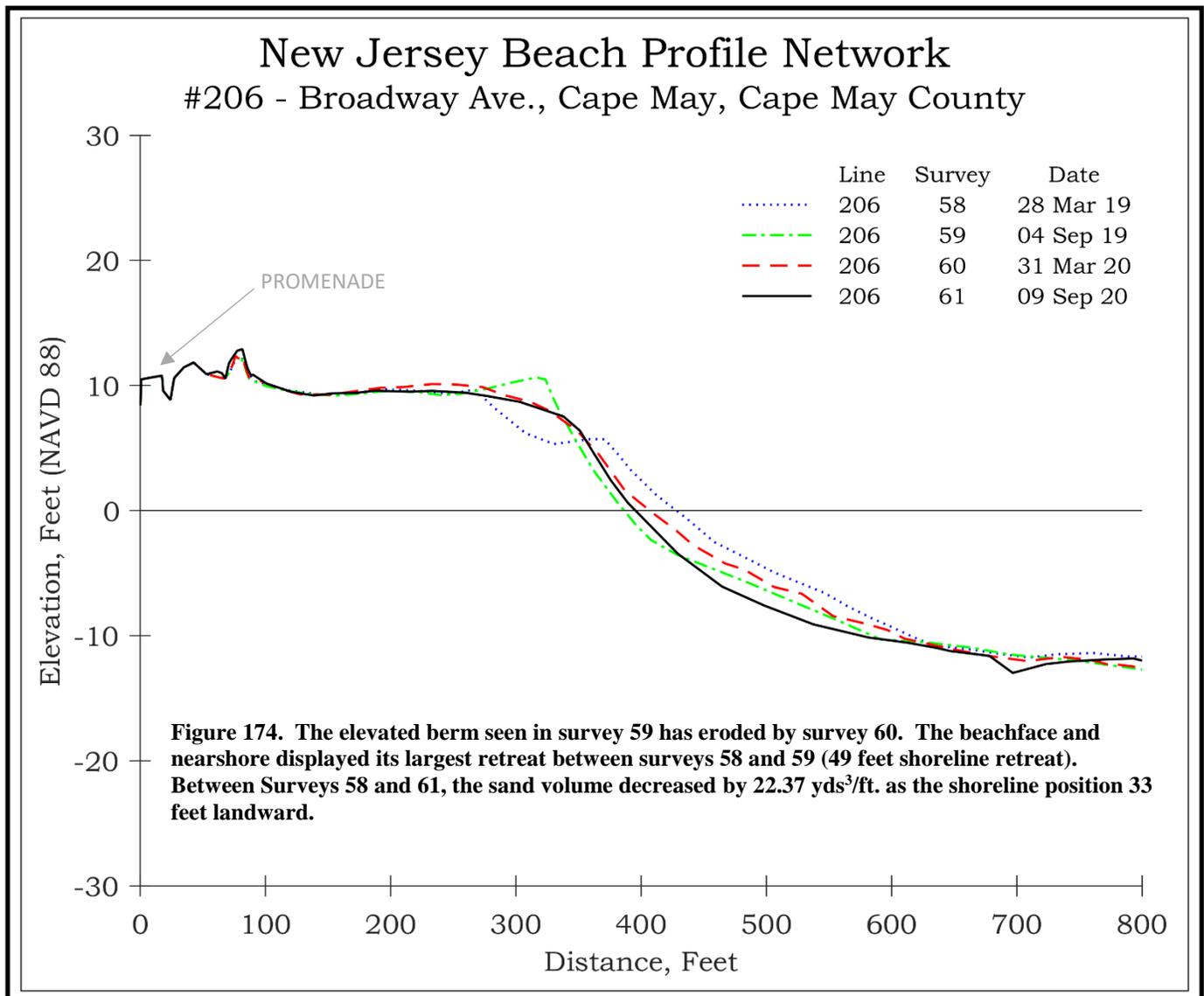
The post-beach restoration is remarkable given that in 1989, the waves broke on the rock seawall at low tide at Baltimore Avenue. The left photo was taken on October 4, 2019. The right photo was taken on September 9, 2020. The September 2020 photo displays a similar beach and berm over the last 18 months.



NJBPN 206 - Broadway Avenue, Cape May City



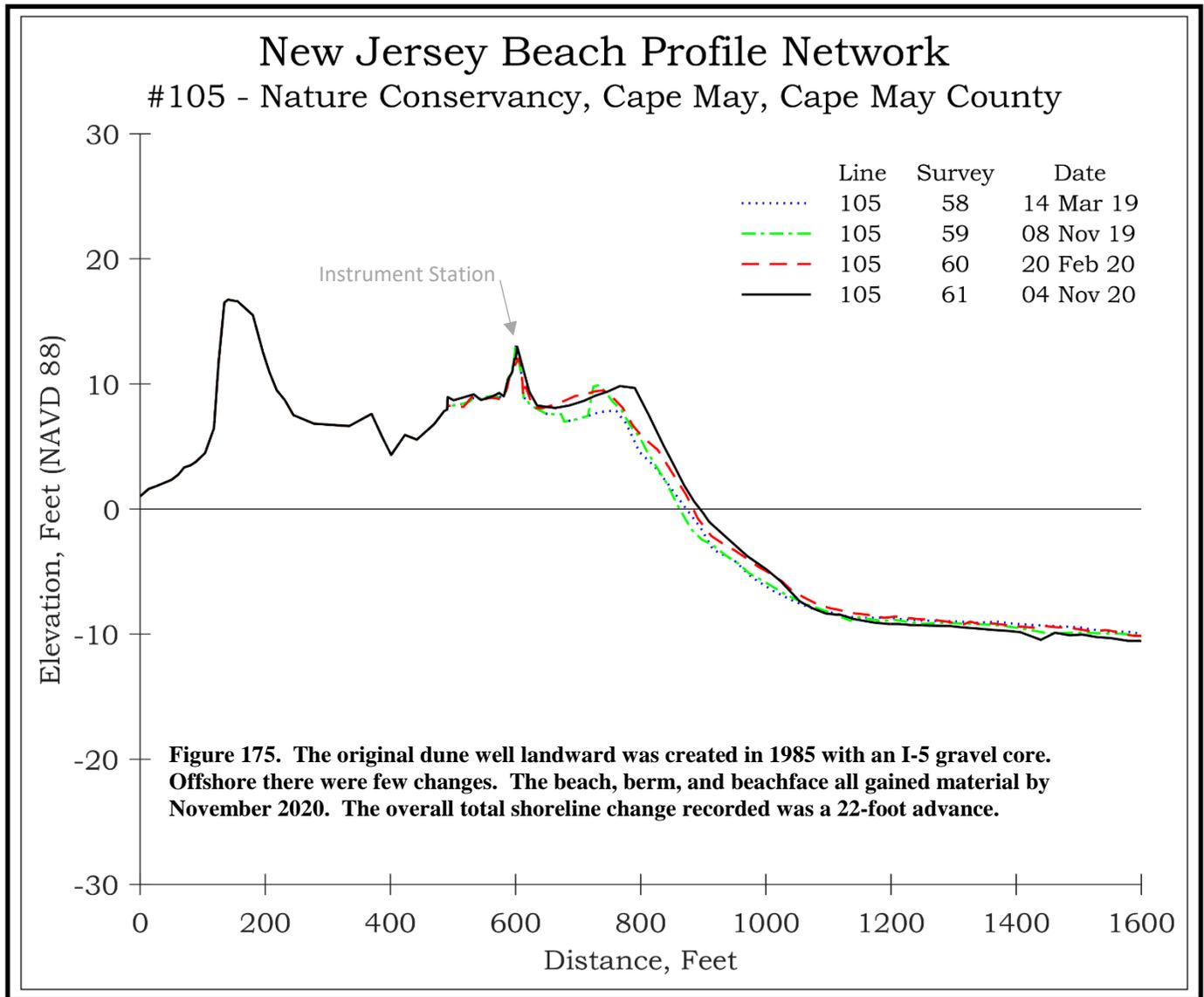
The left photo was taken on September 4, 2019. The right photo (206) was taken on September 9, 2020 and shows similar conditions within the dune system. The cross sections below display changes in the berm elevation and position by the fall 2020.



NJBPN 105 - Nature Conservancy, Cape May



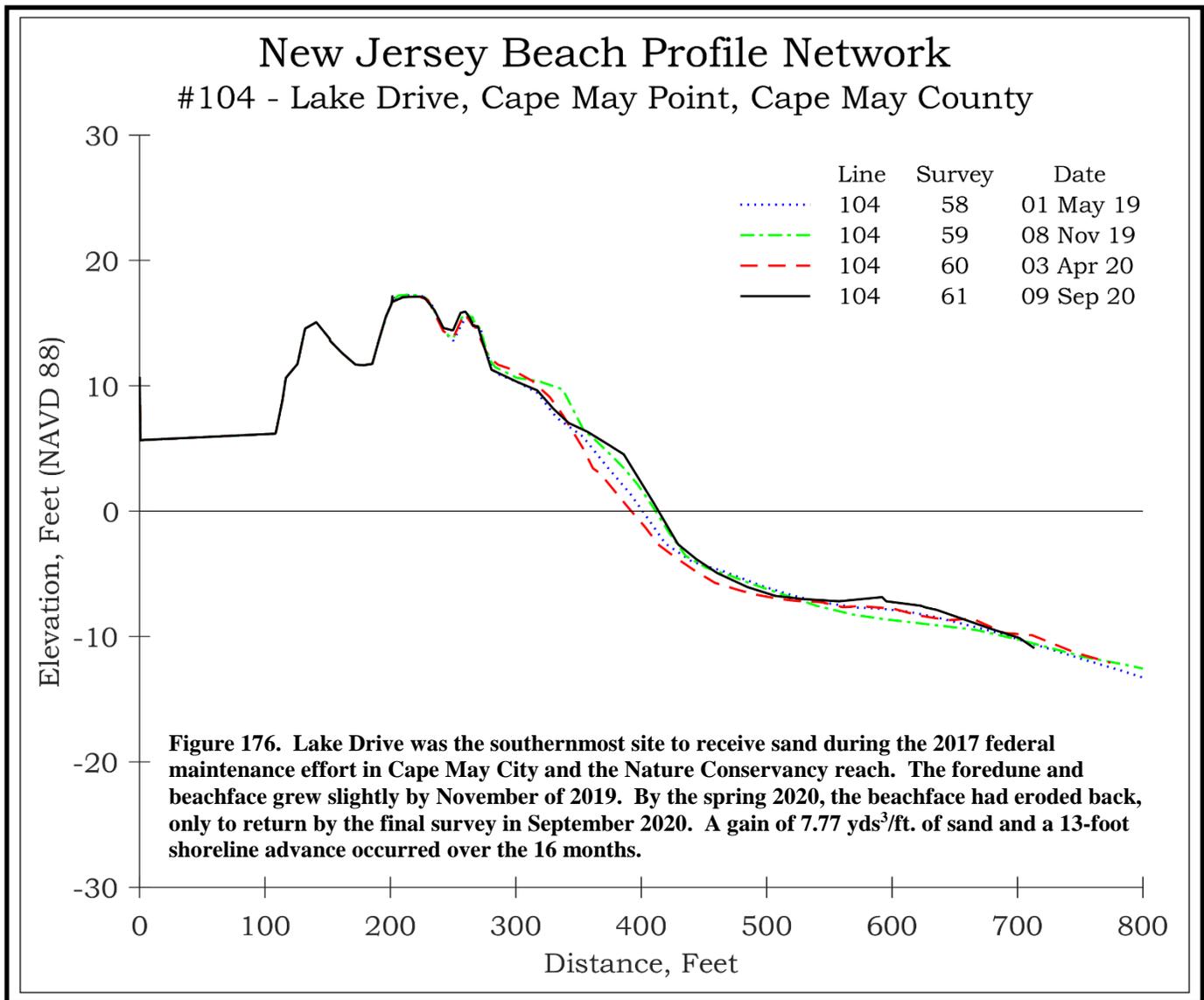
The left photo was taken November 8, 2019. The right photo taken on November 4, 2020, and shows a slightly wider beach 12 months later. The dune system remained substantial and very stable.



NJBPN 104 - Lake Drive, Cape May Point



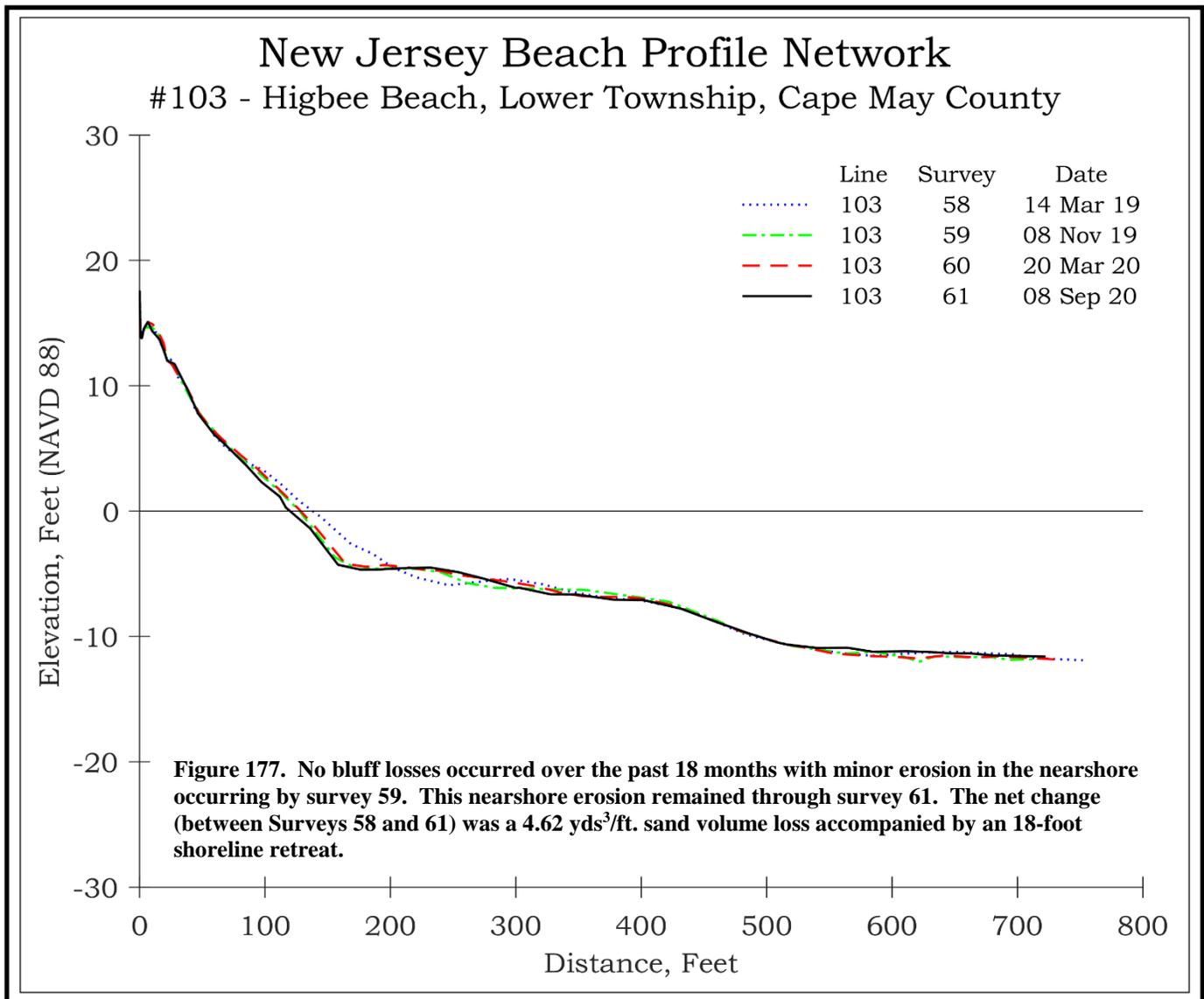
The left photo was taken on November 8, 2019. The right photo was taken on September 9, 2020. The berm in the right photo is positioned slightly seaward than the photo on the left but at a lower elevation.



NJBPN 103 - Higbee Beach State Park, Lower Township



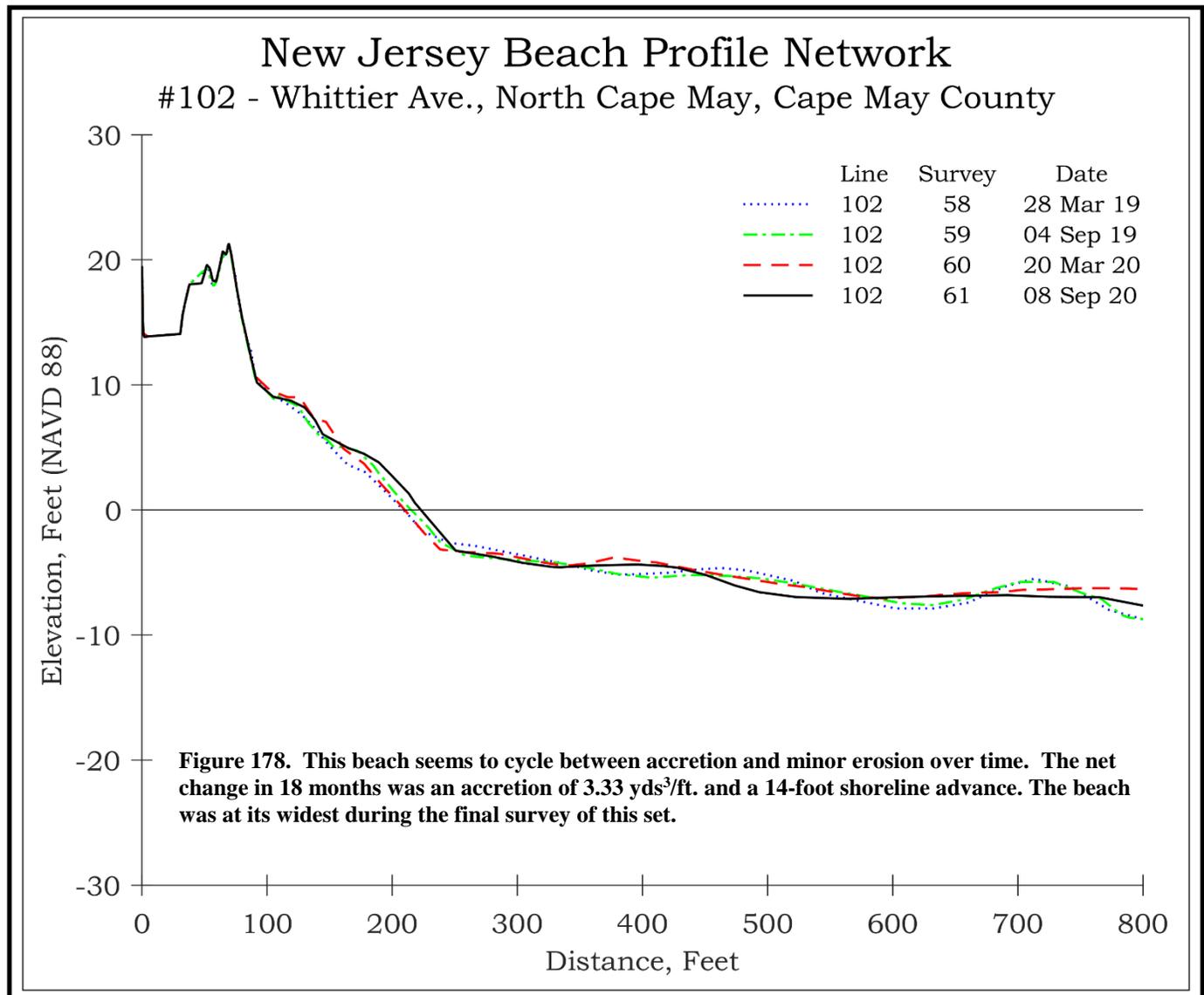
The left photo was taken November 8, 2019. The right photo taken September 8, 2020, shows minimal changes. Both photographs are looking in the northern direction. Notice the storm and high tide wrack lines in the earlier photo.



NJBPN 102 - Whittier Avenue, North Cape May



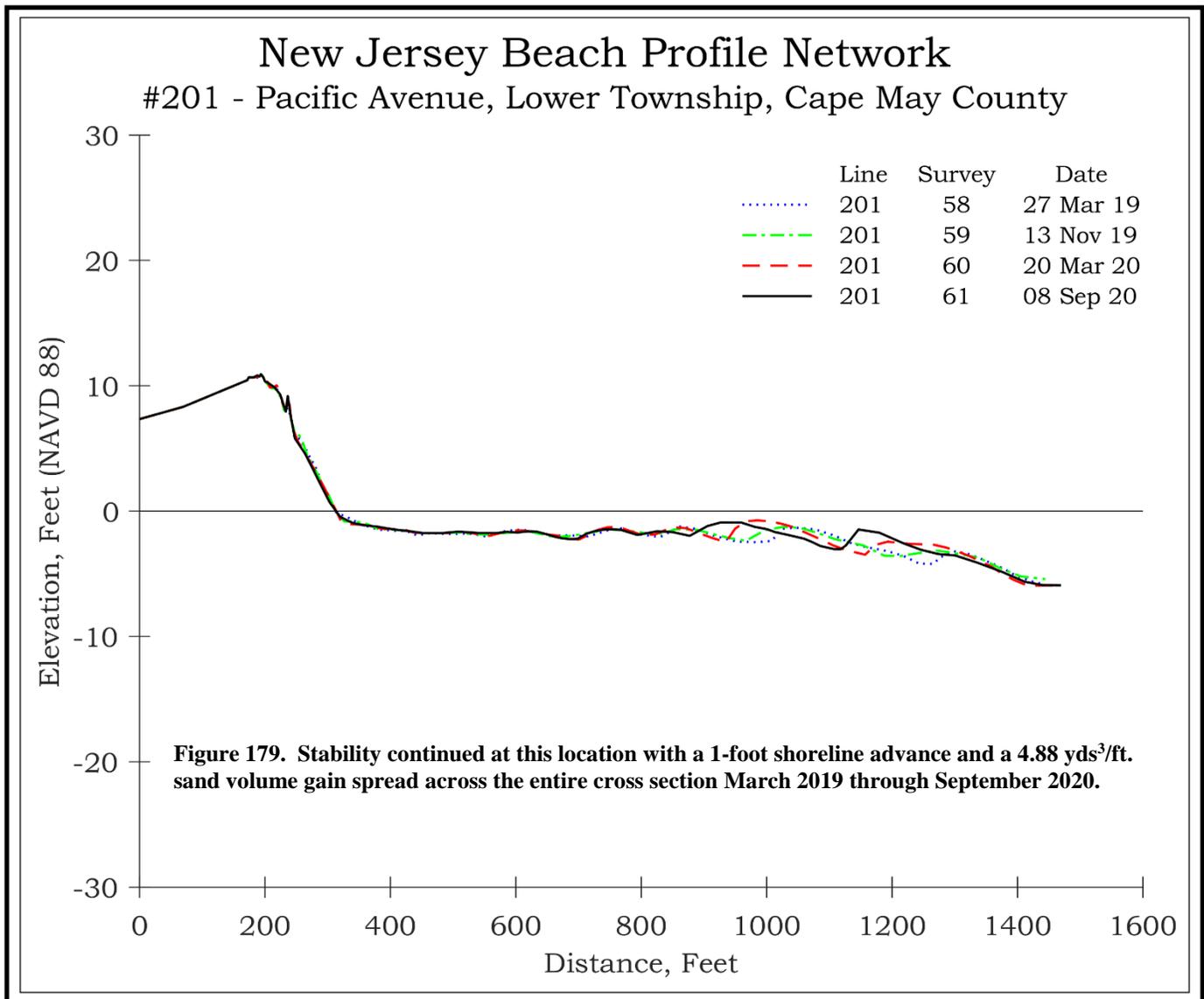
The left photo was taken on September 4, 2019. The right photo, taken on September 8, 2020, shows a continued growth in seaward dune slope. Denser vegetation and a wider recreational beach is present by survey 61.



NJBPN 201 - Pacific Avenue, Villas



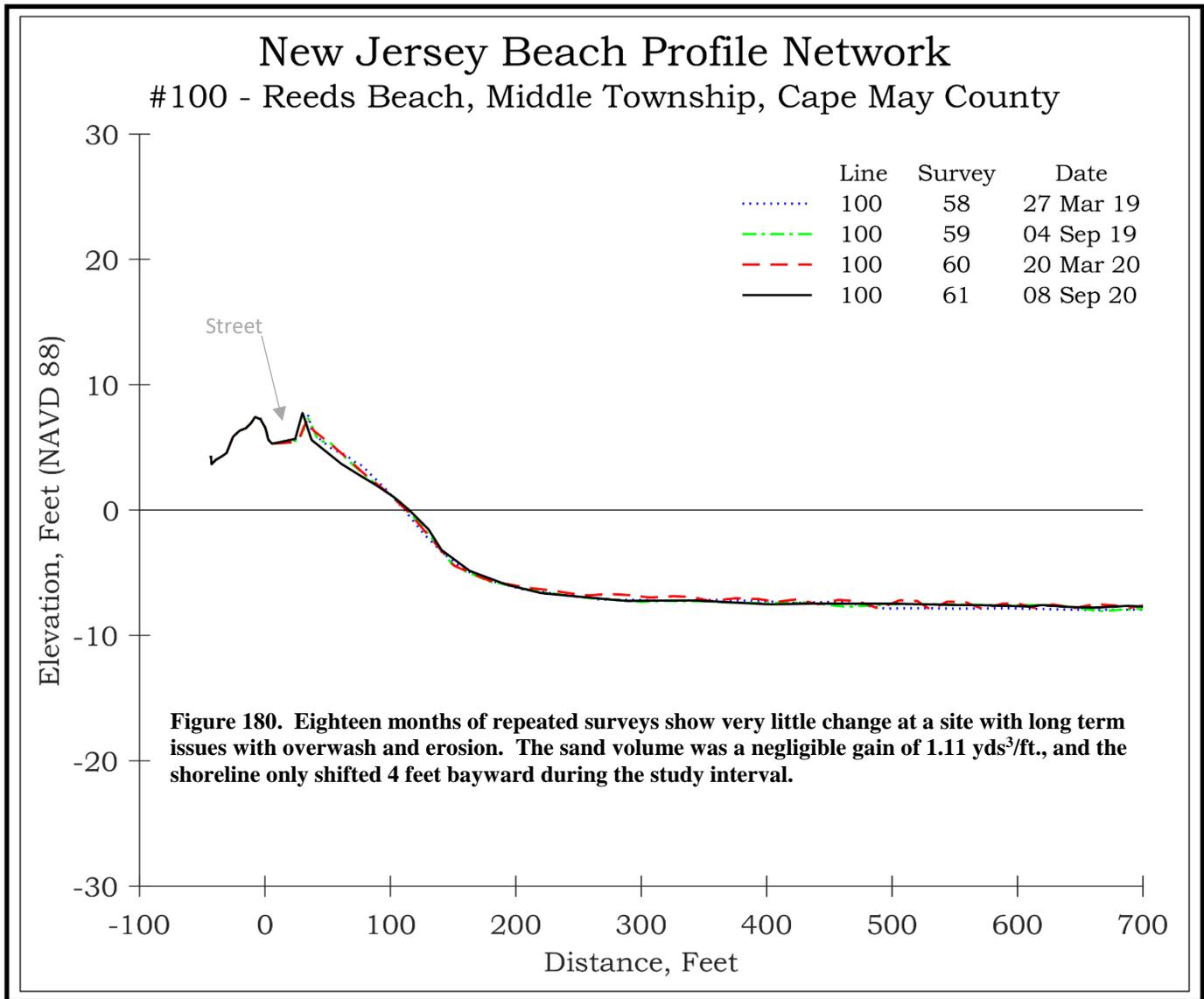
The left view was taken November 13, 2019. Right photo (201) was taken on September 8, 2020. Minimal changes occurred in this photo comparison at Pacific Avenue with only some recession of dune grass growth landward.



NJBPN 100 - Reeds Beach, Middle Township



The left photograph was taken on September 4, 2019 which shows dune grass growth and a noticeable wrack line. The right photo was taken on September 8, 2020. There is a lack of dune grass in the September 2020 photograph and the storm wrack has since been carried away.



Summary and Conclusions for Cape May County:

The USACE Ocean City to Townsends Inlet Shore Protection Project initially placed approximately 1.54 million cubic yards of sand on the Strathmere end of Ludlam Island. An additional 4.09 million cubic yards of sand were placed on the southern Ocean City and Sea Isle City beaches, all complete by 2016. Throughout 2020, the USACE continued maintenance of its projects in Cape May County. Recently completed work included Southern Ocean City (beginning in 2019 and completed by January 2020), which covered 4.5 miles south of 34th Street and added 1.1 million cubic yards of sand to the beaches. This work was performed by the Great Lakes Dredge and Dock company. A 2.6 mile stretch of beach running north of 34th Street in Ocean City was also replenished, adding an additional 1.1 million cubic yards of sand. This phase was completed by August 2020. Erosional trends continued throughout 2019 and into 2020 at the north end of Ocean City prior to the latest nourishment cycle. The mid portion of the island remained stable throughout the survey time period of this report. Berm and beachface retreat of the renourished beaches along the southern region had begun by the fall 2020.

In Strathmere and Sea Isle City 2.6 miles of beaches received 1.1 million cubic yards of sand by August 2020 during the USACE shore protection project. As of the September 2020 survey, the north end profile at Williams Avenue in Strathmere remained stable along the recreational beaches but offshore sand losses were recorded. The north end of Sea Isle City's recreational beaches from 1st Street through 57th Street did not display significant changes over the 17-months of study, apart from the sculpted foredune at profile #118. By October 2020, the southern profile at 80th Street recorded a major loss of beachfill sand from the dune toe through the nearshore.

Avalon and Stone Harbor received almost a million cubic yards of material by spring 2017 from Townsend's and Hereford Inlets with NJ Division of Coastal Engineering funding the Hereford Inlet work because the Coastal Barrier Resource System CBRS rules at that time prohibited the USACE from funding such activities in the CBRS NJ-09 unit. In the fall of 2019, the USACE added 564,264 cubic yards of sand in Avalon between the jetty and a point south of 17th Street to restore early erosion damages augmenting the 940,000 cubic yards added during their 2017 effort. The beachfill efforts can be seen by the spring 2020 at the north end of the island, with erosional trends shown in the beachface and nearshore following initial sand placement. The mid and southern portions of the island displayed overall stable conditions throughout 2020. By 2019, the dunes in Stone Harbor had expanded seaward onto the federal dry beach template. A USACE proposal to extract sand from this region and push it onto the beachface to widen the beach, was declined by the borough due to the cost per cubic yard and the general loss of storm protection. Both NJBPN profile locations within the confines of the borough of Stone Harbor, performed well by remaining stable throughout the 17 months of study.

The Wildwoods remain the only NJ coastal oceanfront communities not under either the jurisdiction of the New York or Philadelphia District Army Corps Divisions with completed beach nourishment projects. North Wildwood's northernmost oceanfront suffers erosional issues from sand starvation due to ebb channels adjacent to the inlet shoreline directing sand to the northeast and not depositing any quantity offshore of the northern beaches where wave action could move it landward and add it to the beach. During 2020 at least 220,000 cubic yards of material was transferred in from Wildwood beaches and placed in large stockpiles at the toe of the remaining dunes on the beach. Some was distributed into a ridge of sand north of 11th Avenue to 7th Avenue to provide a small measure of protection at this vulnerable area. The first six city blocks south of the inlet jetty are solely dependent on the rock revetment and bulkhead for storm protection. Wildwood City, Wildwood Crest and Lower Township oceanfront beaches continue to remain very stable as excess sand supplies generating lavishly wide beaches. The dunes vary between excellent and absent entirely depending on specific locations.

Cape May City's dunes are slowly growing with sand derived from wind transport into vegetation propagating naturally. The beach club profile (#108) did show a continued moderate retreat of the beachface beginning in the fall 2019. The beach in the Nature Conservancy into the eastern few groin cells of Cape May Point received

federal maintenance in 2016. The dune remained very stable through the fall 2020 at the Conservancy profile with significant gains in the berm and beachface recorded between the spring and fall 2020.

The Delaware Bay shoreline remained relatively stable with no significant sediment additions. Permits were issued in the summer 2021 for a restoration project that would focus on protecting Basket Flats from further erosion and shelter the Northwest reach from further loss of marsh and potential breaching of the Matts Landing road dike. Funding for construction was provided by the National Fish and Wildlife Foundation (NFWF) in 2021 with matching funds provided by the state of New Jersey. Construction is set to start in 2022 for the Basket Flats portion of the project. The goal of the project is to improve ecological and community resilience in this region suffering from long term erosion. The USACE completed a feasibility study to use dredged sands from Delaware Bay to reduce coastal storm risks in three bayshore communities, Gandy's Beach and Fortescue in Cumberland County and Lower Township in Cape May County. Potential sources of sand are from maintenance of the Delaware River Main Channel-Lower Reach E or from the Buoy 10 open water disposal site located one mile east of the Delaware Main Channel. This project is currently awaiting a funding source and is dependent on the work to dredge the lower Delaware Bay navigation channel for sand placement. Smaller beach restoration projects took place at Cooks Beach in 2019 and 2020 in Middle Township, Cape May County. These included placement of approximately 5,000 cubic yards of sand and were focused on improving Red Knot and Horseshoe Crab habitats, primarily funded through NFWF, USFWS and private grants.

The additional Delaware Bay Beach Profile (DBBPN) topographic/bathymetric lines added to the overall NJBPN project, have provided an extremely important and useful method of studying conditions at and around the ongoing projects along the Delaware Bay. The ability to customize the locations of these profile lines through this DBBPN program provides a vital tool that will be used by both the state and local communities along the Bayfront as efforts continue to enhance ecological and community resilience along the Bayshore.

APPENDIX – COUNTY ANNUAL BEACH VOLUME AND SHORELINE CHANGES

TABLE 1						
MOMOUTH COUNTY						
SEASONAL; OVERALL; ANNUAL SPRING & FALL BEACH VOLUME CHANGES						
	Survey & Time Period					
	Seasonal			Overall	Annual Spring & Fall	
	58 - 59	59 - 60	60 - 61	58 - 61	58 - 60	59 - 61
PROFILE SITE LOCATION	S19-F19	F19-S20	S20-F20	S19-F20	S19-S20	F19-F20
Volume Change (cubic yards per foot)						
187: Cliffwood Beach, Beach Park	-1.52	-3.40	-2.16	-7.06	-4.92	-5.52
286: Union Beach, Beach Street	-0.53	-1.68	-0.60	-2.97	-2.14	-2.47
185: Port Monmouth, Spy House	29.54	23.35	9.10	58.67	50.82	32.21
385: Sandy Hook, North Beach	-13.70	-6.64	-4.54	-28.20	-21.93	-11.66
285: Sandy Hook, Gunnison Beach	4.38	-7.17	0.56	-2.32	-2.88	-6.58
28401: Sandy Hook, Area F Rd.	-9.20	20.37	12.95	24.71	11.60	33.56
284: Sandy Hook, Parking Lot E	-27.50	19.05	38.03	28.96	-9.26	56.32
18401: Sandy Hook, Parking Lot C	51.88	-45.02	-2.34	5.51	6.79	-47.04
184: Sandy Hook, Highlands Beach	-5.43	-7.20	9.57	-4.05	-14.35	2.87
183: Sea Bright, Via Ripa Street	29.96	-46.10	-3.80	-19.51	-15.89	-49.58
28202: Sea Bright, 300 Ocean Ave.	15.11	31.84	-15.46	31.09	46.92	14.25
28201: Sea Bright, 436 Ocean Ave.	-0.76	-7.68	-26.30	-34.53	-8.41	-34.45
282: Sea Bright, Shrewsbury Way	3.89	1.89	-12.35	-7.39	5.80	-10.55
18202: Sea Bright, 678 Ocean Ave.	-15.51	0.64	21.03	7.52	-15.56	20.79
18201: Sea Bright, 801 Ocean Ave.	29.76	-13.48	-17.13	-1.40	16.32	-30.10
182: Sea Bright, Public Beach Lot	8.97	-12.93	20.05	20.27	-3.93	7.84
181: Sea Bright, Municipal Lot	-17.00	22.96	21.02	22.49	2.10	25.89
18003: Sea Bright, 1201 Ocean Ave	-6.77	21.52	43.46	67.09	15.05	66.93
18002: Sea Bright, 15 Tradewinds Ln.	-3.52	113.87	-45.86	67.28	110.89	62.77
18001: Sea Bright, 1485 Ocean Ave.	9.15	74.97	-22.83	62.19	96.33	37.07
180: Sea Bright, Sunset Court	0.51	50.69	16.67	47.12	43.88	56.27
17901: Monmouth Beach, 122 Ocean Ave.	-32.16	35.38	33.69	28.77	2.07	62.15
179: Monmouth Beach, Cottage Road	8.47	123.69	51.51	178.29	139.76	159.37
17801: Monmouth Beach, 65 Ocean Ave.	-9.89	56.47	-22.52	11.08	42.78	26.74
178: Monmouth Beach, Monmouth Beach Club	31.35	1.83	-26.76	6.95	35.23	-27.11
17701: Monmouth Beach, 9 Ocean Ave.	3.18	11.14	-13.79	1.85	16.35	-5.86
177: Long Branch, Ocean Avenue	15.93	-9.65	-4.83	2.86	6.39	-15.71
17601: Long Branch, 300 Ocean Ave North	9.05	-9.78	-0.53	-0.76	-0.46	-9.95
176: Long Branch, Seven Presidents Park	-5.12	-2.05	26.85	19.87	-7.16	23.10
17501: Long Branch, Ocean Terr.	9.53	6.56	96.26	112.22	16.01	102.71
175: Long Branch, Broadway Avenue	1.55	-4.26	18.05	16.64	-2.61	14.86
17402: Long Branch, 45 Ocean Ave.	-3.14	7.94	6.62	10.41	5.03	11.37
17401: Long Branch, N. Morris Ave.	-14.70	8.31	-8.65	-14.43	-8.01	-3.92
174: Long Branch, S. Morris Avenue	-8.43	5.24	9.00	2.42	-3.45	13.47
17303: Long Branch, 276 Ocean Ave.	18.31	-12.59	13.59	15.79	5.05	-0.59
17302: Long Branch, 378 Ocean Ave.	28.68	-47.79	21.30	3.49	-19.35	-30.26
17301: Long Branch, Wooley Ct.	-22.88	-23.18	41.32	-4.66	-46.58	14.18
173: Long Branch, West End Avenue	14.78	16.37	37.11	69.38	29.70	49.88
27201: Long Branch, 717 Ocean Ave.	-21.82	19.79	51.37	47.38	-1.69	66.68
272: Long Branch, 805 Ocean Avenue	0.53	-22.36	65.72	42.50	-21.46	41.01
17101: Long Branch, Plaza Ct.	-9.88	-18.53	104.47	77.19	-29.08	82.86
171: Elberon, Pullman Avenue	17.89	-19.59	57.44	56.38	-1.43	38.26
17005: Long Branch, 981 Ocean Ave.	-27.42	8.70	27.91	13.37	-18.42	40.11
17004: Long Branch, 1115 Ocean Ave.	-18.44	-4.04	-18.30	-39.12	-21.83	-18.91
17003: Long Branch, Ocean Ct.	-7.13	-0.83	3.59	-8.21	-9.95	2.68
17002: Long Branch, Garfield Rd.	-13.18	13.86	-41.51	-37.80	5.11	-24.60
17001: Deal, Jerome Ave.	34.71	-15.93	5.23	24.06	18.89	-12.47
170: Deal, N. Roosevelt Avenue	14.10	-2.68	-1.87	9.56	11.53	-4.54
16905: Deal, S. Roosevelt Ave.	5.65	-37.40	25.40	-7.06	-31.96	-12.65
16904: Deal, 71 Ocean Ave.	-18.31	26.60	-14.05	-5.81	8.22	12.48
16903: Deal, Ocean Ln.	25.74	-7.99	1.97	20.15	18.02	-5.95
16902: Deal, Brighton Ave.	-8.75	7.82	7.74	2.86	-1.49	13.18
16901: Deal, Wallace Rd.	-11.37	-12.49	-2.93	-27.25	-23.50	-15.03
169: Deal, Darlington Avenue	-7.76	-13.59	-5.94	-26.96	-21.31	-19.42
16802: Deal, Monmouth Dr.	-7.15	10.99	-19.81	-15.99	4.03	-8.88
16801: Deal, Neptune Ave.	47.99	-26.83	18.22	34.28	21.08	-13.42

168: Allenhurst, Corlies Avenue	-23.97	0.43	3.98	-17.54	-21.56	4.88
26703: Loch Arbour, Euclid Ave.	27.68	-35.80	19.67	8.62	-7.51	-17.67
26702: Loch Arbour, Edgemont Ave.	11.42	-10.82	-51.19	-62.73	-11.75	-23.73
26701: Asbury Park, 1740 Ocean Ave.	1.81	-4.84	3.47	-2.04	-0.76	-1.05
267: Asbury Park, Seventh Avenue	-24.42	10.99	-4.46	-18.69	-13.53	6.31
16701: Asbury Park, Sunset Ave.	1.32	8.68	-20.44	-13.29	9.77	-12.81
167: Asbury Park, Third Avenue	-3.43	-8.87	-14.14	-28.25	-11.77	-22.37
16602: Asbury Park, Asbury Ave.	37.71	0.73	-38.65	0.12	37.35	-37.08
16601: Ocean Grove, Spray Ave.	-3.84	5.44	-18.57	-19.60	1.61	-13.75
166: Ocean Grove, Ocean Pathway	0.00	-10.92	-12.66	-23.04	-12.05	-22.80
16502: Ocean Grove, Broadway	7.27	-8.82	9.20	6.51	-1.20	0.46
16501: Bradley Beach, Cliff Ave.	22.76	1.15	-6.78	13.78	23.70	-7.22
165: Bradley Beach, McCabe Avenue	-3.43	19.58	-25.67	-6.69	15.57	-7.49
16402: Bradley Beach, 4th Ave.	-11.19	9.62	-19.18	-22.38	-3.33	-11.52
16401: Bradley Beach, 2nd Ave.	20.59	-14.28	-6.19	-0.36	6.91	-20.60
164: Avon-By-The-Sea, Sylvania Avenue	6.99	11.08	-13.76	5.41	18.35	-2.20
16303: Avon-By-The-Sea, Garfield Ave.	6.65	11.26	-39.88	-21.69	18.01	-28.51
16302: Avon-By-The-Sea, Washington Ave.	-5.36	27.59	3.60	26.67	21.89	29.29
16301: Belmar, 2nd Ave.	-16.11	25.51	-1.68	8.15	9.81	24.05
163: Belmar, 5 th Avenue	28.48	-10.24	-9.35	10.89	18.39	-18.74
16202: Belmar, 8th Ave.	5.11	1.74	-15.59	-16.64	0.33	-15.83
16201: Belmar, 14th Ave.	27.46	-8.91	-13.55	6.01	18.12	-20.87
162: Belmar, 18 th Avenue	-1.47	19.67	-18.81	2.14	17.86	3.34
16104: Belmar, North Blvd.	9.44	-2.73	-8.64	-3.80	6.78	-12.64
16103: Spring Lake, Remsen Ave.	6.18	6.22	-5.03	8.17	13.25	1.73
16102: Spring Lake, Lorraine Ave.	-24.14	21.46	-20.15	-22.68	-0.79	0.87
16101: Spring Lake, Tuttle Ave.	20.36	-18.13	11.31	13.54	2.26	-6.77
161: Spring Lake, Brighton Avenue	1.93	6.68	-17.14	-8.49	8.45	-10.36
16004: Spring Lake, Madison Ave.	4.16	2.57	2.75	10.45	7.19	5.12
16003: Spring Lake, Morris Ave.	-19.16	-0.36	5.28	-13.88	-19.10	5.43
16002: Spring Lake, Mercer Ave.	-7.13	22.09	-20.93	-5.84	14.99	1.23
16001: Spring Lake, Essex Ave.	12.75	-6.12	8.07	13.93	6.46	0.95
160: Spring Lake, Salem Avenue	-4.10	21.96	5.01	22.30	17.84	26.36
15902: Spring Lake, Union Ave.	-8.94	4.09	2.45	-1.27	-4.53	6.77
15901: Spring Lake, Brown Ave.	10.63	7.58	-16.88	1.34	18.47	-9.39
159: Sea Girt, New York Avenue	-8.69	0.85	0.25	-7.55	-7.85	1.16
15801: Sea Girt , Crescent Park	-18.74	15.12	-2.25	-6.08	-4.62	13.44
158: Sea Girt, Trenton Avenue	29.66	-22.57	-6.30	0.70	6.81	-28.77
15703: Sea Girt, Seaside Pl.	-6.62	-2.84	-7.34	-17.04	-9.39	-10.43
15702: Sea Girt, NGTC - North	1.42	11.59	-0.50	13.32	14.39	11.10
15701: Sea Girt, NGTC - South	10.21	-15.76	-12.99	-19.14	-5.78	-29.23
157: Manasquan, Riddle Way	16.06	-21.87	6.08	1.05	-5.77	-15.32
25602: Manasquan, Main St.	-5.14	11.96	-20.47	-12.70	6.94	-8.17
25601: Manasquan, Brielle Rd.	-22.82	1.42	-4.75	-25.85	-21.30	-3.30
256: Manasquan, Pompano Avenue	42.00	-9.66	12.24	43.85	31.94	1.90
15601: Manasquan, Riverside Dr.	10.55	-13.87	12.82	9.45	-2.30	-1.24
	S19-F19	F19-S20	S20-F20	S19-F20	S19-S20	F19-F20
Seabright sites	1.64	26.00	4.88	31.02	28.07	26.10
Long Branch sites	-1.79	-4.39	25.34	19.25	-6.21	19.86
New Deal sites	7.49	-7.15	1.40	0.78	0.35	-6.67
AVERAGE for ALL SITES	2.78	3.52	2.10	7.69	6.19	4.80
Average for the oceanfront beaches	2.59	3.44	2.10	7.43	5.93	4.70
Phase II sites	3.52	1.30	-7.99	-3.71	4.53	-5.99

TABLE 2						
MOMOUTH COUNTY						
SEASONAL; OVERALL; ANNUAL SPRING & FALL SHORELINE CHANGES						
PROFILE SITE LOCATION	Survey & Time Period					
	Seasonal			Overall	Annual Spring & Fall	
	58 - 59	59 - 60	60 - 61	58 - 61	58 - 60	59 - 61
	S19-F19	F19-S20	S20-F20	S19-F20	S19-S20	F19-F20
	Shoreline Change (feet)					
187: Cliffwood Beach, Beach Park	-4.75	-10.25	3.00	-12.00	-15.00	-7.25
286: Union Beach, Beach Street	-3.25	-0.50	2.75	-1.00	-3.75	2.25
185: Port Monmouth, Spy House	28.25	38.75	-3.00	64.00	67.00	35.75
385: Sandy Hook, North Beach	-46.50	-20.00	-18.00	-84.50	-66.50	-38.00
285: Sandy Hook, Gunnison Beach	0.34	-7.25	1.25	-5.66	-6.91	-6.00
28401: Sandy Hook, Area F Rd.	22.25	30.50	24.50	77.25	52.75	55.00
284: Sandy Hook, Parking Lot E	-43.50	32.00	39.25	27.75	-11.50	71.25
18401: Sandy Hook, Parking Lot C	24.75	-33.50	-24.75	-33.50	-8.75	-58.25
184: Sandy Hook, Highlands Beach	-48.50	12.75	27.00	-8.75	-35.75	39.75
183: Sea Bright, Via Ripa Street	62.50	-85.25	28.75	6.00	-22.75	-56.50
28202: Sea Bright, 300 Ocean Ave.	20.75	41.75	-6.75	55.75	62.50	35.00
28201: Sea Bright, 436 Ocean Ave.	-54.50	12.50	-35.50	-77.50	-42.00	-23.00
282: Sea Bright, Shrewsbury Way	4.43	-7.25	7.00	4.18	-2.82	-0.25
18202: Sea Bright, 678 Ocean Ave.	0.00	-33.00	50.00	17.00	-33.00	17.00
18201: Sea Bright, 801 Ocean Ave.	1.00	-5.50	-25.75	-30.25	-4.50	-31.25
182: Sea Bright, Public Beach Lot	79.75	-31.00	-7.00	41.75	48.75	-38.00
181: Sea Bright, Municipal Lot	33.25	9.25	-26.75	15.75	42.50	-17.50
18003: Sea Bright, 1201 Ocean Ave	0.75	-44.50	41.50	-2.25	-43.75	-3.00
18002: Sea Bright, 15 Tradewinds Ln.	48.50	152.50	-158.75	42.25	201.00	-6.25
18001: Sea Bright, 1485 Ocean Ave.	23.00	41.25	-37.25	27.00	64.25	4.00
180: Sea Bright, Sunset Court	36.00	-6.75	-22.25	7.00	29.25	-29.00
17901: Monmouth Beach, 122 Ocean Ave.	-50.75	-70.00	48.75	-72.00	-120.75	-21.25
179: Monmouth Beach, Cottage Road	6.00	97.25	49.00	152.25	103.25	146.25
17801: Monmouth Beach, 65 Ocean Ave.	-21.25	43.25	-45.50	-23.50	22.00	-2.25
178: Monmouth Beach, Monmouth Beach Club	48.25	-44.75	-48.25	-44.75	3.50	-93.00
17701: Monmouth Beach, 9 Ocean Ave.	-5.25	3.50	-0.25	-2.00	-1.75	3.25
177: Long Branch, Ocean Avenue	5.25	-14.00	-9.00	-17.75	-8.75	-23.00
17601: Long Branch, 300 Ocean Ave North	33.25	-39.25	11.25	5.25	-6.00	-28.00
176: Long Branch, Seven Presidents Park	-17.50	-3.25	52.75	32.00	-20.75	49.50
17501: Long Branch, Ocean Terr.	2.75	9.25	142.00	154.00	12.00	151.25
175: Long Branch, Broadway Avenue	12.75	6.25	0.25	19.25	19.00	6.50
17402: Long Branch, 45 Ocean Ave.	1.25	-7.00	0.00	-5.75	-5.75	-7.00
17401: Long Branch, N. Morris Ave.	-17.75	19.75	-42.00	-40.00	2.00	-22.25
174: Long Branch, S. Morris Avenue	-23.50	5.75	3.75	-14.00	-17.75	9.50
17303: Long Branch, 276 Ocean Ave.	-8.75	-7.50	29.75	13.50	-16.25	22.25
17302: Long Branch, 378 Ocean Ave.	24.50	-66.50	23.75	-18.25	-42.00	-42.75
17301: Long Branch, Wooley Ct.	-30.75	-33.25	34.25	-29.75	-64.00	1.00
173: Long Branch, West End Avenue	3.50	18.00	28.25	49.75	21.50	46.25
27201: Long Branch, 717 Ocean Ave.	-26.00	4.25	76.50	54.75	-21.75	80.75
272: Long Branch, 805 Ocean Avenue	-6.00	-23.00	72.50	43.50	-29.00	49.50
17101: Long Branch, Plaza Ct.	-30.50	-26.75	123.75	66.50	-57.25	97.00
171: Elberon, Pullman Avenue	5.50	-34.00	118.75	90.25	-28.50	84.75
17005: Long Branch, 981 Ocean Ave.	-0.09	-1.02	22.85	21.74	-1.11	21.83
17004: Long Branch, 1115 Ocean Ave.	-14.25	-10.50	0.99	-23.76	-24.75	-9.51
17003: Long Branch, Ocean Ct.	-22.75	10.00	-3.68	-16.43	-12.75	6.32
17002: Long Branch, Garfield Rd.	-14.75	25.00	-58.25	-48.00	10.25	-33.25
17001: Deal, Jerome Ave.	26.50	-1.25	-7.00	18.25	25.25	-8.25
170: Deal, N. Roosevelt Avenue	-2.75	22.00	-26.50	-7.25	19.25	-4.50
16905: Deal, S. Roosevelt Ave.	-11.50	-17.25	30.00	1.25	-28.75	12.75
16904: Deal, 71 Ocean Ave.	2.50	-4.75	12.75	10.50	-2.25	8.00
16903: Deal, Ocean Ln.	8.75	-14.00	19.47	14.22	-5.25	5.47
16902: Deal, Brighton Ave.	-15.50	1.75	35.00	21.25	-13.75	36.75
16901: Deal, Wallace Rd.	4.00	-10.00	11.00	5.00	-6.00	1.00
169: Deal, Darlington Avenue	-29.00	-5.75	-7.75	-42.50	-34.75	-13.50
16802: Deal, Monmouth Dr.	-15.00	-1.75	30.75	14.00	-16.75	29.00
16801: Deal, Neptune Ave.	14.25	-41.75	46.75	19.25	-27.50	5.00

168: Allenhurst, Corlies Avenue	-52.25	17.75	-1.50	-36.00	-34.50	16.25
26703: Loch Arbour, Euclid Ave.	34.25	-44.50	35.50	25.25	-10.25	-9.00
26702: Loch Arbour, Edgemont Ave.	61.00	-64.75	62.50	58.75	-3.75	-2.25
26701: Asbury Park, 1740 Ocean Ave.	-9.50	12.50	21.75	24.75	3.00	34.25
267: Asbury Park, Seventh Avenue	-17.00	-7.00	25.00	1.00	-24.00	18.00
16701: Asbury Park, Sunset Ave.	-0.25	3.25	-27.00	-24.00	3.00	-23.75
167: Asbury Park, Third Avenue	-3.25	7.75	-13.00	-8.50	4.50	-5.25
16602: Asbury Park, Asbury Ave.	44.00	3.75	-47.75	0.00	47.75	-44.00
16601: Ocean Grove, Spray Ave.	-8.75	21.75	-16.00	-3.00	13.00	5.75
166: Ocean Grove, Ocean Pathway	-1.00	-12.25	2.25	-11.00	-13.25	-10.00
16502: Ocean Grove, Broadway	35.50	-37.00	24.50	23.00	-1.50	-12.50
16501: Bradley Beach, Cliff Ave.	11.00	-5.25	12.00	17.75	5.75	6.75
165: Bradley Beach, McCabe Avenue	-7.25	19.75	-25.25	-12.75	12.50	-5.50
16402: Bradley Beach, 4th Ave.	-21.50	19.75	-16.75	-18.50	-1.75	3.00
16401: Bradley Beach, 2nd Ave.	-6.50	-9.75	17.75	1.50	-16.25	8.00
164: Avon-By-The-Sea, Sylvania Avenue	41.00	1.50	11.00	53.50	42.50	12.50
16303: Avon-By-The-Sea, Garfield Ave.	27.50	-9.50	-24.25	-6.25	18.00	-33.75
16302: Avon-By-The-Sea, Washington Ave.	-4.00	20.25	28.50	44.75	16.25	48.75
16301: Belmar, 2nd Ave.	-24.75	8.50	23.75	7.50	-16.25	32.25
163: Belmar, 5 th Avenue	34.25	-16.50	3.00	20.75	17.75	-13.50
16202: Belmar, 8th Ave.	40.25	4.25	-23.00	21.50	44.50	-18.75
16201: Belmar, 14th Ave.	11.50	-0.25	-13.00	-1.75	11.25	-13.25
162: Belmar, 18 th Avenue	-9.00	20.00	-6.00	5.00	11.00	14.00
16104: Belmar, North Blvd.	5.00	-25.25	-2.00	-22.25	-20.25	-27.25
16103: Spring Lake, Remsen Ave.	5.50	-10.00	22.50	18.00	-4.50	12.50
16102: Spring Lake, Lorraine Ave.	-10.25	11.75	-6.00	-4.50	1.50	5.75
16101: Spring Lake, Tuttle Ave.	17.75	-8.25	19.75	29.25	9.50	11.50
161: Spring Lake, Brighton Avenue	-0.25	6.75	2.00	8.50	6.50	8.75
16004: Spring Lake, Madison Ave.	14.25	0.00	6.25	20.50	14.25	6.25
16003: Spring Lake, Morris Ave.	-9.25	2.25	-1.75	-8.75	-7.00	0.50
16002: Spring Lake, Mercer Ave.	0.50	6.00	2.50	9.00	6.50	8.50
16001: Spring Lake, Essex Ave.	17.75	-1.50	-0.75	15.50	16.25	-2.25
160: Spring Lake, Salem Avenue	0.25	16.00	23.25	39.50	16.25	39.25
15902: Spring Lake, Union Ave.	3.00	-1.25	10.50	12.25	1.75	9.25
15901: Spring Lake, Brown Ave.	20.25	-5.25	-27.25	-12.25	15.00	-32.50
159: Sea Girt, New York Avenue	-30.25	7.50	7.75	-15.00	-22.75	15.25
15801: Sea Girt , Crescent Park	-25.25	5.50	2.48	-17.27	-19.75	7.98
158: Sea Girt, Trenton Avenue	18.00	-25.00	14.50	7.50	-7.00	-10.50
15703: Sea Girt, Seaside Pl.	1.50	-13.25	0.75	-11.00	-11.75	-12.50
15702: Sea Girt, NGTC - North	14.50	2.75	-0.50	16.75	17.25	2.25
15701: Sea Girt, NGTC - South	9.75	-11.36	1.25	-0.36	-1.61	-10.11
157: Manasquan, Riddle Way	10.50	-18.00	8.00	0.50	-7.50	-10.00
25602: Manasquan, Main St.	12.50	-2.25	-3.00	7.25	10.25	-5.25
25601: Manasquan, Brielle Rd.	-30.00	-9.00	25.25	-13.75	-39.00	16.25
256: Manasquan, Pompano Avenue	57.75	-15.00	-12.75	30.00	42.75	-27.75
15601: Manasquan, Riverside Dr.	30.50	-15.25	6.00	21.25	15.25	-9.25
	S19-F19	F19-S20	S20-F20	S19-F20	S19-S20	F19-F20
Seabright sites	10.81	5.60	-4.53	11.88	16.41	1.07
Long Branch sites	-6.19	-8.39	31.42	16.84	-14.58	23.03
New Deal sites	-1.78	-7.28	14.45	5.40	-9.05	7.17
AVERAGE for ALL SITES	3.23	-2.68	7.73	8.28	0.55	5.06
Average for the oceanfront beaches	3.12	-3.04	7.94	8.02	0.08	4.90
Phase II sites	6.72	-3.22	3.32	6.82	3.50	0.10

TABLE 3

OCEAN COUNTY

SEASONAL; OVERALL; ANNUAL SPRING & FALL BEACH VOLUME CHANGES

	Survey & Time Period					
	Seasonal			Overall	Annual Spring & Fall	
	58 - 59	59 - 60	60 - 61	58 - 61	58 - 60	59 - 61
	S19-F19	F19-S20	S20-F20	S19-F20	S19-S20	F19-F20
PROFILE SITE LOCATION	Volume Change (cubic yards per foot)					
156: Point Pleasant, Water Street	-24.32	24.33	-4.46	-4.42	0.04	20.02
155: Point Pleasant, Maryland Avenue	125.05	-7.34	5.27	120.46	115.73	-2.15
154: Bay Head, Johnson Avenue	129.45	14.19	-1.01	135.66	138.08	12.72
153: Mantoloking, 1117 Ocean Avenue	3.94	-9.32	-15.51	-20.94	-5.33	-25.16
152: Brick Township, Public Beach #3	8.24	-7.7	12.51	12.55	0.65	4.07
151: Normandy Beach, 1 st Avenue	0.82	6.62	-17.22	-8.4	9.9	-9.8
150: Lavallette, White Avenue	-12.45	19.71	-15.36	-13.14	2.89	4.12
149: Ortlely Beach, 8 th Avenue	-11.99	11.18	-18.73	-19.39	-0.7	-7.49
248: Seaside Heights, Franklin Avenue	7.47	-26.12	-10.01	-27.69	-17.72	-36.14
148: Seaside Park, 4 th Avenue	13.38	4.56	-18.33	-1.31	16.84	-13.65
347: Midway Beach, 6 th Lane	22.28	-11.31	-20.37	-8.66	11.14	-32.16
247: Island Beach State Park, Gillikin Access	7.14	-8.93	-11.25	-12.27	-2.08	-19.95
246: Island Beach State Park, Parking Lot A7	19.47	33.19	-30.42	22	52.32	2.56
146: Island Beach State Park, South End	-15.74	-10.24	-19.65	-45.49	-25.53	-30.04
245: Barnegat Light, 10 th Street	-62.09	3.33	-11.72	-69.76	-58.96	-8.43
145: Barnegat Light, 26 th Street	68.45	-49.36	6.7	27.23	19.4	13.264
144: Loveladies, La Baia Street	5.223	0.476	0.32	7.504	4.71	0.747
143: Harvey Cedars, 73 rd Street	1.96	-14.97	-39.05	-51.42	-12.8	-52.83
142: Harvey Cedars, Tranquility Drive	-82.27	23.19	-13.3	-72.19	-59.52	9.85
241: Surf City, 20 th Street	-9.69	6.27	-2.76	-6.03	-3.13	3.73
141: Ship Bottom, 8 th Street	16.46	32.9	-24.46	25.31	48.12	9.66
140: Long Beach Township, 32 nd Street	4.66	-12.12	-5.12	-12.47	-7.49	-17.04
139: Long Beach Township, 81 st Street	1.64	-5.02	11.15	7.85	-4.28	6.28
138: Long Beach Township, Old Whaling Rd.	4.88	-2.19	7.47	9.55	2.5	5.13
137: Beach Haven, Taylor Avenue	-5.93	9.7	2.37	6.09	3.95	12.08
136: Beach Haven, Dolphin Avenue	-13.36	5.39	-19.3	-26.6	-7.47	-13.57
135: Long Beach Township, Webster Ave.	-2.621	5.625	2.808	2.173	2.82	3.196
234: Long Beach Township, Natural Area	25.39	45.26	-2.34	74.6	71.65	46.05
	S19-F19	F19-S20	S20-F20	S19-F20	S19-S20	F19-F20
AVERAGE COUNTY SURVEY	8.05	2.90	-8.99	1.81	10.56	-4.10

TABLE 4						
OCEAN COUNTY						
SEASONAL; OVERALL; ANNUAL SPRING & FALL SHORELINE CHANGES						
	Survey & Time Period					
	Seasonal			Overall	Annual Spring & Fall	
	58 - 59	59 - 60	60 - 61	58 - 61	58 - 60	59 - 61
PROFILE SITE LOCATION	S19-F19	F19-S20	S20-F20	S19-F20	S19-S20	F19-F20
	Shoreline Change (feet)					
156: Point Pleasant, Water Street	-20.25	23.00	-5.00	-2.25	2.75	18.00
155: Point Pleasant, Maryland Avenue	171.75	-67.50	8.25	112.50	104.25	-59.25
154: Bay Head, Johnson Avenue	73.00	-35.50	-4.75	32.75	37.50	-40.25
153: Mantoloking, 1117 Ocean Avenue	-16.25	-22.00	-24.25	-62.50	-38.25	-46.25
152: Brick Township, Public Beach #3	13.85	-24.50	4.00	-6.65	-10.65	-20.50
151: Normandy Beach, 1 st Avenue	-32.00	-19.25	10.25	-41.00	-51.25	-9.00
150: Lavallette, White Avenue	-58.25	-2.00	-15.25	-75.50	-60.25	-17.25
149: Ortley Beach, 8 th Avenue	-16.28	7.75	-12.00	-20.53	-8.53	-4.25
248: Seaside Heights, Franklin Avenue	5.75	-38.25	-14.75	-47.25	-32.50	-53.00
148: Seaside Park, 4 th Avenue	-15.75	-0.25	-14.00	-30.00	-16.00	-14.25
347: Midway Beach, 6 th Lane	-6.50	-17.00	-5.50	-29.00	-23.50	-22.50
247: Island Beach State Park, Gillikin Access	25.00	-18.25	15.25	22.00	6.75	-3.00
246: Island Beach State Park, Parking Lot A7	3.50	47.00	-38.25	12.25	50.50	8.75
146: Island Beach State Park, South End	-35.25	12.50	-16.00	-38.75	-22.75	-3.50
245: Barnegat Light, 10 th Street	-59.00	10.00	-18.50	-67.50	-49.00	-8.50
145: Barnegat Light, 26 th Street	38.75	-51.25	61.00	48.50	-12.50	9.80
144: Loveladies, La Baia Street	no data	15.48	3.74	no data	no data	19.23
143: Harvey Cedars, 73 rd Street	-13.25	-22.00	-36.75	-72.00	-35.25	-58.75
142: Harvey Cedars, Tranquility Drive	-90.50	25.00	-10.50	-76.00	-65.50	14.50
241: Surf City, 20 th Street	-22.00	-1.00	10.75	-12.25	-23.00	9.75
141: Ship Bottom, 8 th Street	9.25	41.25	-31.00	19.50	50.50	10.25
140: Long Beach Township, 32 nd Street	-0.25	2.00	-26.50	-24.75	1.75	-24.50
139: Long Beach Township, 81 st Street	-4.92	16.50	4.75	16.33	11.58	21.25
138: Long Beach Township, Old Whaling Rd.	5.00	3.25	7.50	15.75	8.25	10.75
137: Beach Haven, Taylor Avenue	-9.75	22.00	-2.50	9.75	12.25	19.50
136: Beach Haven, Dolphin Avenue	-30.75	4.50	-0.75	-27.00	-26.25	3.75
135: Long Beach Township, Webster Ave.	-15.50	20.00	-20.25	-15.75	4.50	-0.25
234: Long Beach Township, Natural Area	-23.25	269.00	-25.00	220.75	245.75	244.00
	S19-F19	F19-S20	S20-F20	S19-F20	S19-S20	F19-F20
AVERAGE COUNTY SURVEY	-4.59	7.16	-7.00	-5.13	2.26	0.16

TABLE 7

CAPE MAY COUNTY

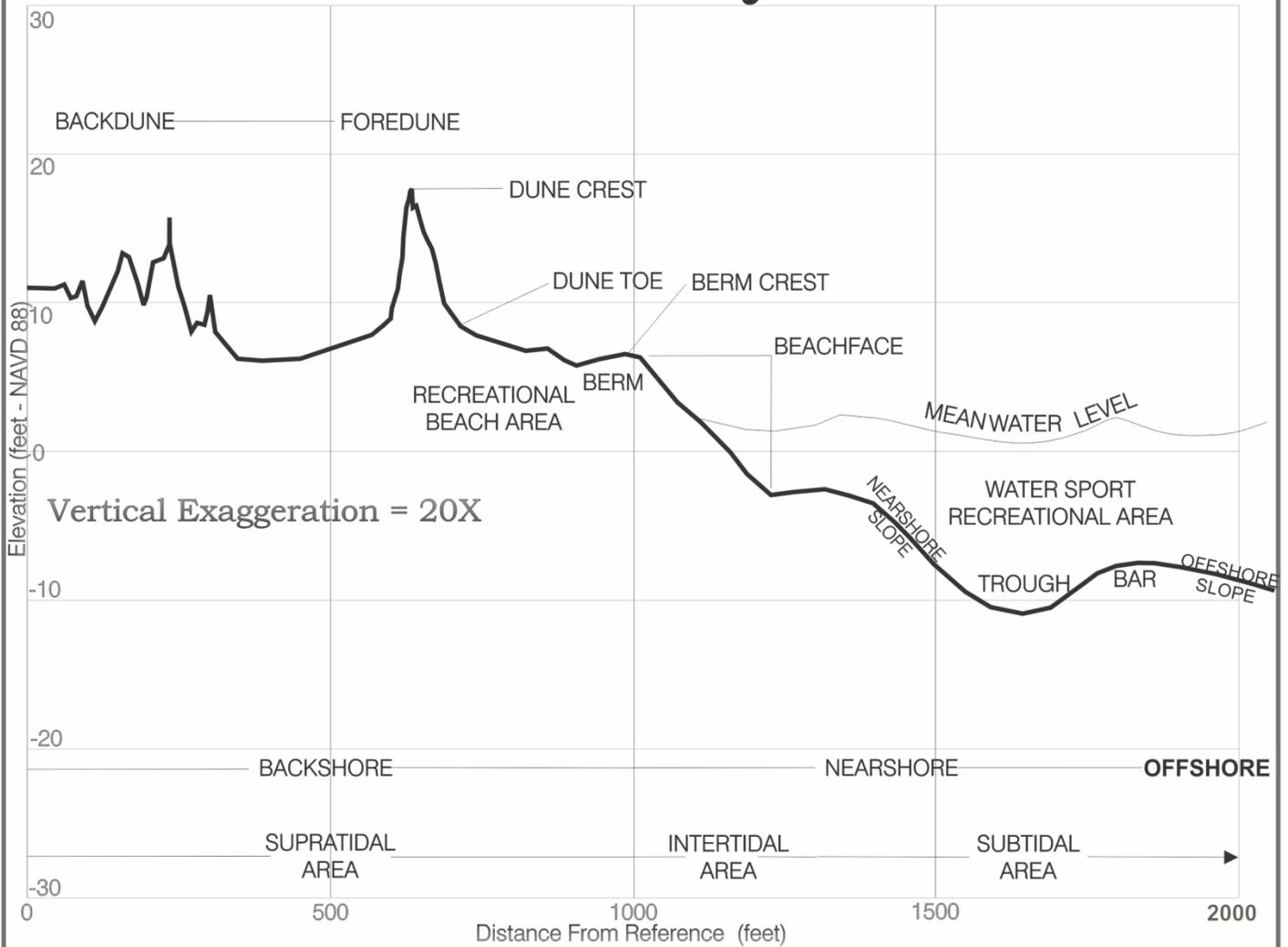
SEASONAL; OVERALL; ANNUAL SPRING & FALL SAND VOLUME CHANGES

	Survey & Time Period					
	Seasonal			Overall	Annual Spring & Fall	
	58 - 59	59 - 60	60 - 61	58 - 61	58 - 60	59 - 61
	S19-F19	F19-S20	S20-F20	S19-F20	S19-S20	F19-F20
PROFILE SITE LOCATION	Volume Change (cubic yards per foot)					
225: Ocean City, Gardens Road	8.81	-16.40	151.53	140.78	-9.25	135.16
125: Ocean City, 6 th Street	-34.80	-17.64	131.73	79.50	-52.15	114.34
124: Ocean City, 20 th Street	14.57	7.12	-15.20	5.63	21.66	-8.81
223: Ocean City, 34 th Street	12.99	-1.58	14.95	26.08	11.46	13.39
122: Ocean City, 56 th Street	-24.11	96.94	-27.19	46.69	70.04	69.77
222: Ocean City, 59 th Street	12.69	56.96	-1.65	72.20	68.00	55.81
221: Ocean City, Corson's Inlet Park	37.48	4.80	19.20	61.81	42.53	24.04
121: Strathmere, Williams Road	16.09	120.26	-32.25	103.64	136.46	87.41
120: Sea Isle City, 1 st Street	12.81	-16.58	14.20	7.65	-4.52	-5.35
119: Sea Isle City, 25 th Street	29.25	1.34	1.23	32.13	30.56	2.89
118: Sea Isle City, 57 th Street	-8.26	8.04	-12.87	-13.15	-0.35	-5.01
117: Sea Isle City, 80 th Street	-7.87	6.41	67.64	66.98	-1.24	74.16
216: Avalon, 9 th Street	-31.72	136.39	-51.12	53.54	104.79	85.32
116: Avalon, 23 rd Street	-5.68	19.39	7.14	19.37	12.09	24.66
115: Avalon, 35 th Street	18.63	10.90	-2.43	27.72	30.29	7.49
114: Avalon, 70 th Street	1.59	19.83	-4.51	17.57	22.31	15.63
113: Stone Harbor, 90 th Street	11.41	-7.59	-0.13	3.23	2.92	-8.09
212: Stone Harbor, South End	-10.21	22.02	-8.21	3.40	11.37	14.23
111: North Wildwood, 15 th Avenue	-18.51	-20.08	-0.99	-38.60	-38.77	-20.22
110: Wildwood, Cresse Avenue	2.45	5.07	26.70	34.14	7.47	31.70
109: Lower Township, Raleigh Ave.	16.31	7.71	7.78	31.81	24.29	15.50
208: Lower Township, Cape May NWR	1.17	11.61	-0.42	11.77	11.64	11.63
108: Cape May City, Cape May Beach Club	8.50	-18.56	0.41	-9.65	-10.06	-18.33
107: Cape May, Baltimore Ave.	2.20	2.37	-5.76	-1.05	4.91	-3.39
206: Cape May, Broadway Ave.	-16.64	9.37	-15.37	-22.37	-7.37	-6.06
105: Cape May, Nature Conservancy	-3.46	19.90	-0.53	15.93	16.44	19.32
104: Cape May Point, Lake Drive	9.74	-6.49	11.39	7.77	-2.67	4.38
103: Lower Township, Higbee Beach	-4.61	1.53	-1.55	-4.62	-3.09	-0.05
102: North Cape May, Whittier Ave.	0.66	11.42	-8.77	3.33	12.05	2.71
201: Lower Township, Pacific Avenue	3.18	1.63	0.03	4.88	4.86	1.66
100: Middle Township, Reeds Beach	0.85	3.50	-3.24	1.11	4.35	0.30
	S19-F19	F19-S20	S20-F20	S19-F20	S19-S20	F19-F20
AVERAGE for EACH SURVEY	1.79	15.47	8.44	25.46	16.81	23.75
Average for oceanfront beaches	1.76	18.00	10.15	29.88	19.44	27.97
Average for bayshore beaches	0.02	4.52	-3.38	1.18	4.54	1.16

TABLE 8						
CAPE MAY COUNTY						
SEASONAL; OVERALL; ANNUAL SPRING & FALL SHORELINE CHANGES						
	Survey & Time Period					
	Seasonal			Overall	Annual Spring & Fall	
	58 - 59	59 - 60	60 - 61	58 - 61	58 - 60	59 - 61
PROFILE SITE LOCATION	S19-F19	F19-S20	S20-F20	S19-F20	S19-S20	F19-F20
	Shoreline Change (feet)					
225: Ocean City, Gardens Road	29.25	-54.50	187.75	162.50	-25.25	133.25
125: Ocean City, 6 th Street	-14.50	-39.75	188.75	134.50	-54.25	149.00
124: Ocean City, 20 th Street	52.75	-18.50	-29.25	5.00	34.25	-47.75
223: Ocean City, 34 th Street	19.25	23.50	18.00	60.75	42.75	41.50
122: Ocean City, 56 th Street	-125.25	193.75	-65.25	3.25	68.50	128.50
222: Ocean City, 59 th Street	-58.00	105.25	-23.75	23.50	47.25	81.50
221: Ocean City, Corson's Inlet Park	77.75	-14.00	-8.75	55.00	63.75	-22.75
121: Strathmere, Williams Road	9.50	302.25	-45.00	266.75	311.75	257.25
120: Sea Isle City, 1 st Street	2.25	-22.25	-13.25	-33.25	-20.00	-35.50
119: Sea Isle City, 25 th Street	6.75	13.50	57.50	77.75	20.25	71.00
118: Sea Isle City, 57 th Street	-10.75	9.50	25.50	24.25	-1.25	35.00
117: Sea Isle City, 80 th Street	24.25	-43.00	116.50	97.75	-18.75	73.50
216: Avalon, 9 th Street	-55.00	208.75	-65.75	88.00	153.75	143.00
116: Avalon, 23 rd Street	-43.50	26.50	44.75	27.75	-17.00	71.25
115: Avalon, 35 th Street	-58.25	-2.75	14.75	-46.25	-61.00	12.00
114: Avalon, 70 th Street	10.25	34.25	24.00	68.50	44.50	58.25
113: Stone Harbor, 90 th Street	-1.75	17.00	0.50	15.75	15.25	17.50
212: Stone Harbor, South End	15.00	-8.50	-9.75	-3.25	6.50	-18.25
111: North Wildwood, 15 th Avenue	-33.50	-48.25	16.50	-65.25	-81.75	-31.75
110: Wildwood, Cresse Avenue	-14.00	-16.00	49.75	19.75	-30.00	33.75
109: Lower Township, Raleigh Ave.	31.73	-7.00	5.50	30.23	24.73	-1.50
208: Lower Township, Cape May NWR	-9.50	3.75	40.75	35.00	-5.75	44.50
108: Cape May City, Cape May Beach Club	24.25	-36.00	6.25	-5.50	-11.75	-29.75
107: Cape May, Baltimore Ave.	-4.00	4.00	-22.50	-22.50	0.00	-18.50
206: Cape May, Broadway Ave.	-41.85	20.50	-11.40	-32.75	-21.35	9.10
105: Cape May, Nature Conservancy	-10.75	21.50	11.00	21.75	10.75	32.50
104: Cape May Point, Lake Drive	10.50	-19.50	21.75	12.75	-9.00	2.25
103: Lower Township, Higbee Beach	-10.50	0.75	-8.50	-18.25	-9.75	-7.75
102: North Cape May, Whittier Ave.	6.00	-5.00	13.00	14.00	1.00	8.00
201: Lower Township, Pacific Avenue	0.50	0.50	-0.50	0.50	1.00	0.00
100: Middle Township, Reeds Beach	2.50	-1.00	2.50	4.00	1.50	1.50
	S19-F19	F19-S20	S20-F20	S19-F20	S19-S20	F19-F20
AVERAGE for EACH SURVEY	-5.44	20.94	17.46	32.97	15.50	38.41
Average for oceanfront beaches	▲ -6.83	▲ 25.90	▲ 19.73	▲ 38.81	▲ 19.07	▲ 45.64
Average for bayshore beaches	▲ -0.38	▲ -1.19	▲ 1.63	▲ 0.06	▲ -1.56	▲ 0.44

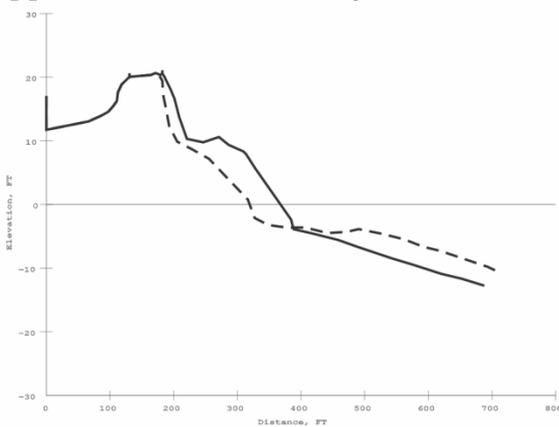


Typical Beach Profiles in New Jersey



Above is a typical beach profile with major features and zones labeled. No beach will show every aspect of this diagram at all times, but it illustrates all important features that appear on the New Jersey shoreline..

Seasonal Variations



The pair of profiles to the left show typical seasonal beach profile changes. The dashed line profile develops during a winter season, where wave conditions move material offshore. The solid line profile is generated during a summer season, where wave conditions move sand onshore, building a well developed berm and wider beach and adding to the dune. The winter wave conditions shift this beach material to the offshore region of the profile.



Coastal Research Center Glossary of Coastal Terms



Accretion - The addition of material to the beach cross section by natural processes.

Aeolian Accretion - Sand accumulation that results from wind driven processes.

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

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

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

Bulkhead - A structure that is built to retain or prevent the slumping of "earth" at the water's edge due to currents or wave action. Bulkheads are typically made of wood, steel, or plastic.

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

Current - The flow of water in a channel or at the shoreline.

Downdrift - The direction of movement of sediment parallel to the coastline.

Datum - A reference level from which elevations are measured.

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

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

Eddy - A circular current developed within or adjacent to the main current.

Erosion - The removal of material either vertically or horizontally by natural processes.

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

Geotube - A geo-textile fabric installation filled with sand, typically used to retain material or to dissipate wave energy.

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

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

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

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

Littoral Drift - Also known as longshore transport. Movement of material parallel to the shoreline resulting from waves arriving at the shore at any angle not 90 degrees to the shore.



Coastal Research Center Glossary of Coastal Terms



Longshore Transport - Also known as littoral drift. Movement of sand parallel to the coastline resulting from wave generated littoral currents.

NAVD - (the datum of 1988) New elevation reference developed to replace the 1929 engineering datum.

NGVD - (the datum of 1929) An elevation reference developed from a specific model of the Earth's surface.

Onshore - In the direction of the shoreline; landward.

Offshore - In the direction opposite of the shoreline; seaward.

Neap Tide - A tide reduced in total elevation ranges due to the orbital positions of the sun and moon. Neap tides occur at first and last quarter moon stages.

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

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

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

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

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

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

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

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

Seawall - Hard structure that separates the land and water.

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

Spring Tide - Tide with the highest elevation ranges due to the orbital positions of the sun and moon. Spring tides occur at new or full moon stages.

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

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

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

Updrift - In the direction opposite of the dominant direction of movement of sand driven by waves.

Wrack - Debris deposited on the beach by wave action.

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