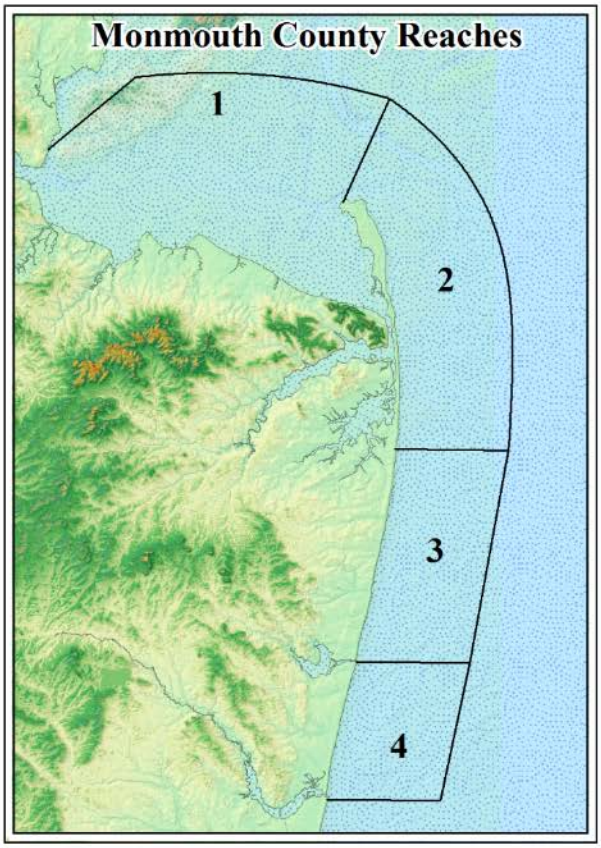
New Jersey Beach Profile Network

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.

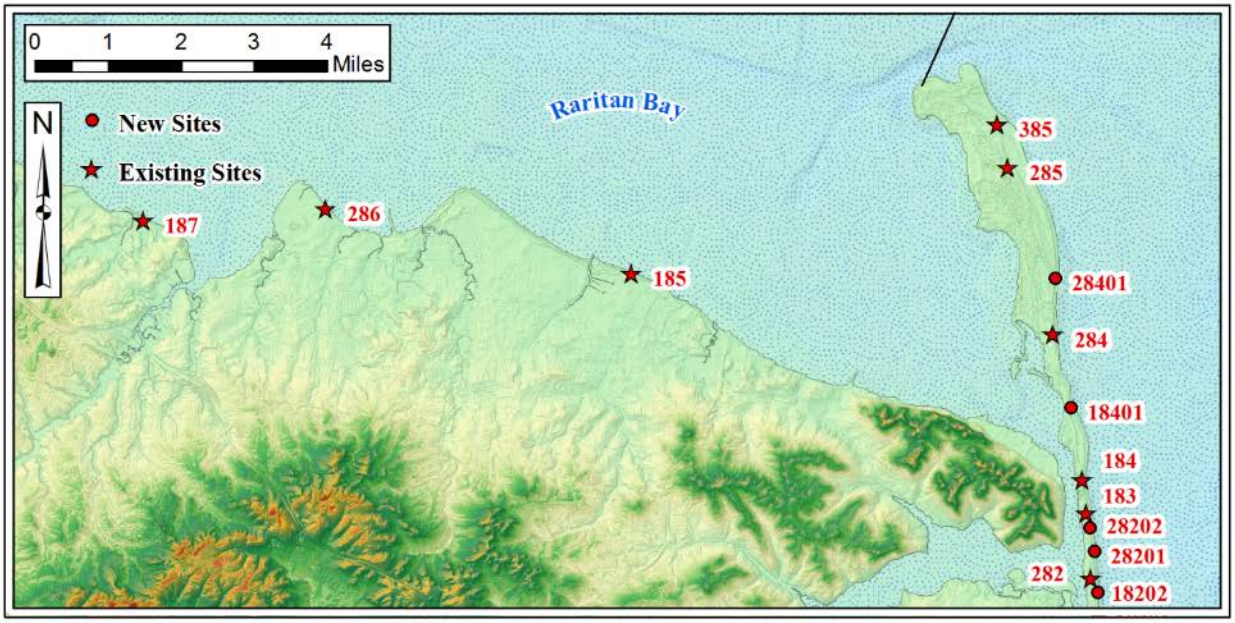


Figure 1a. Location Map for the four Monmouth County coastal reaches where the original and new survey sites are positioned along the Raritan Bay and oceanfront shorelines. The new sites have 5 diget ID numbers with the first three digits representing the original site immediately to the south, and the 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.

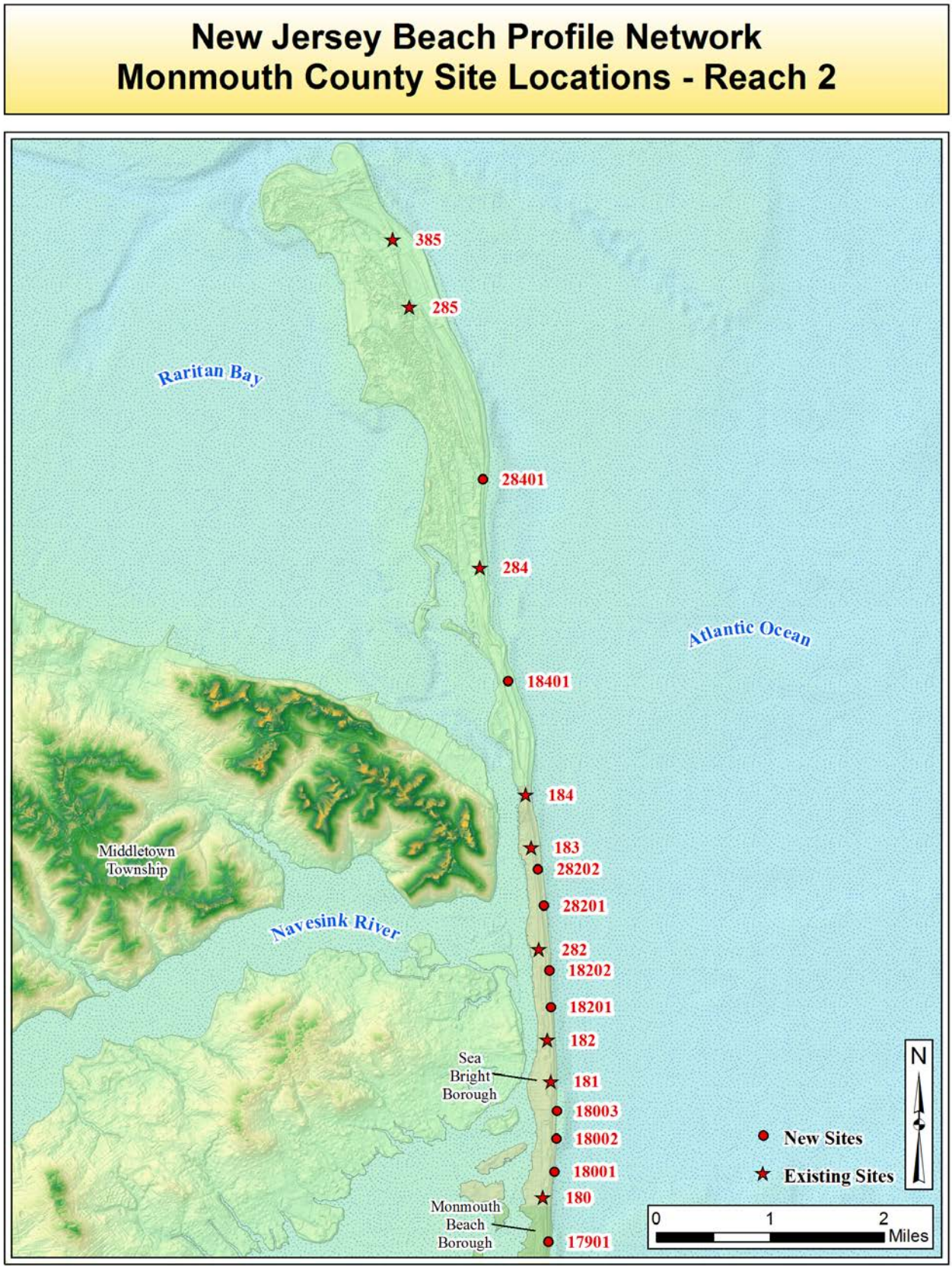


Figure 1b. Reach 2 showing Sandy Hook and Sea Bright survey site locations. The USACE NY District sites added in the fall of 2017 have 5 digits as location numbers. Site #385 was added spring 2017 to extend the Sandy Hook oceanfront beach coverage closer to the tip of the spit to gain better information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

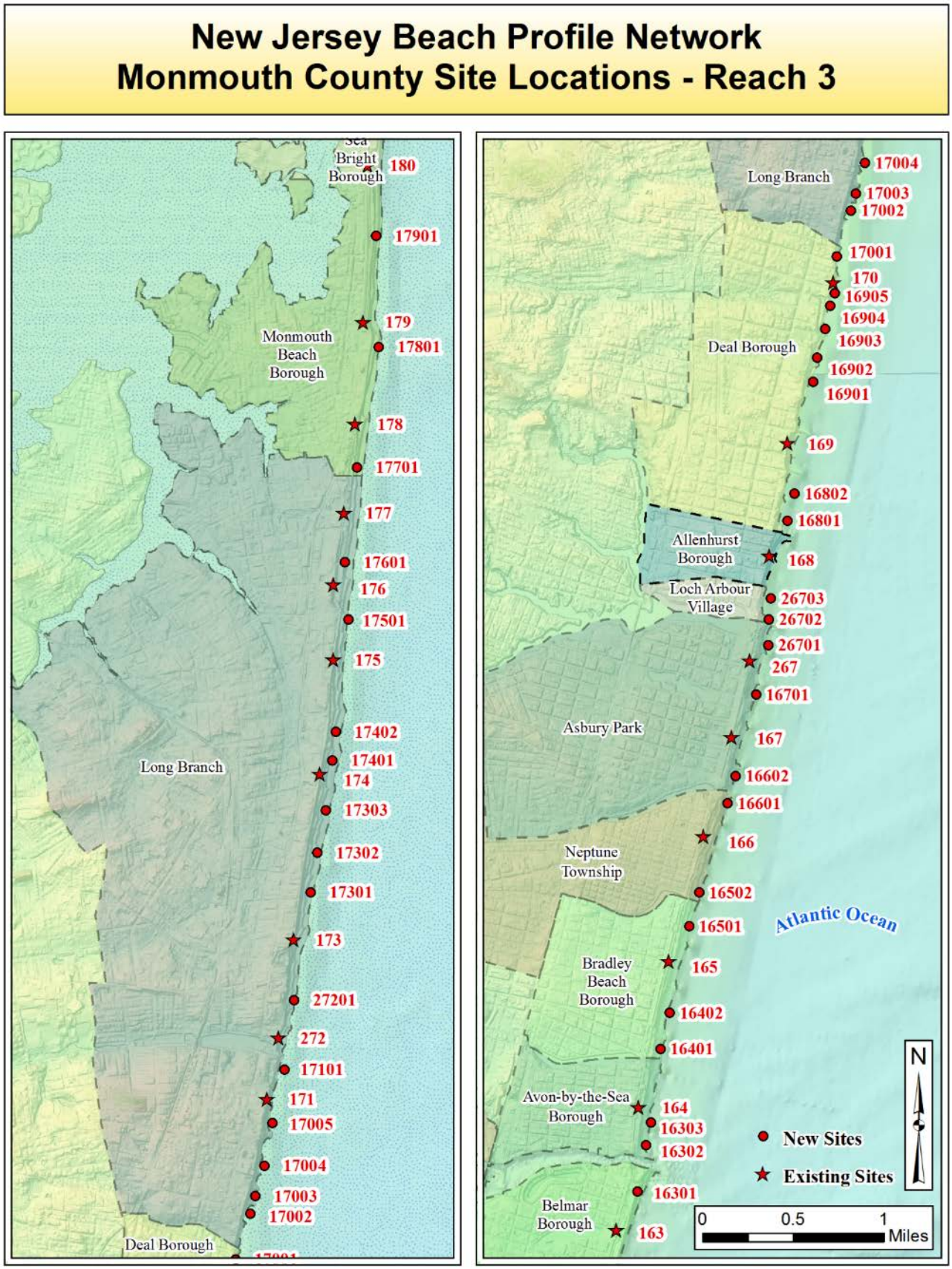


Figure 1c. Reach Three extends from Monmouth Beach south to Belmar Borough along the Monmouth County shoreline. A new location just north of Lake Takanassee was added (#272) in 2010 as Phase III of the federal beach project went to construction to better document the transition between the Phase I and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

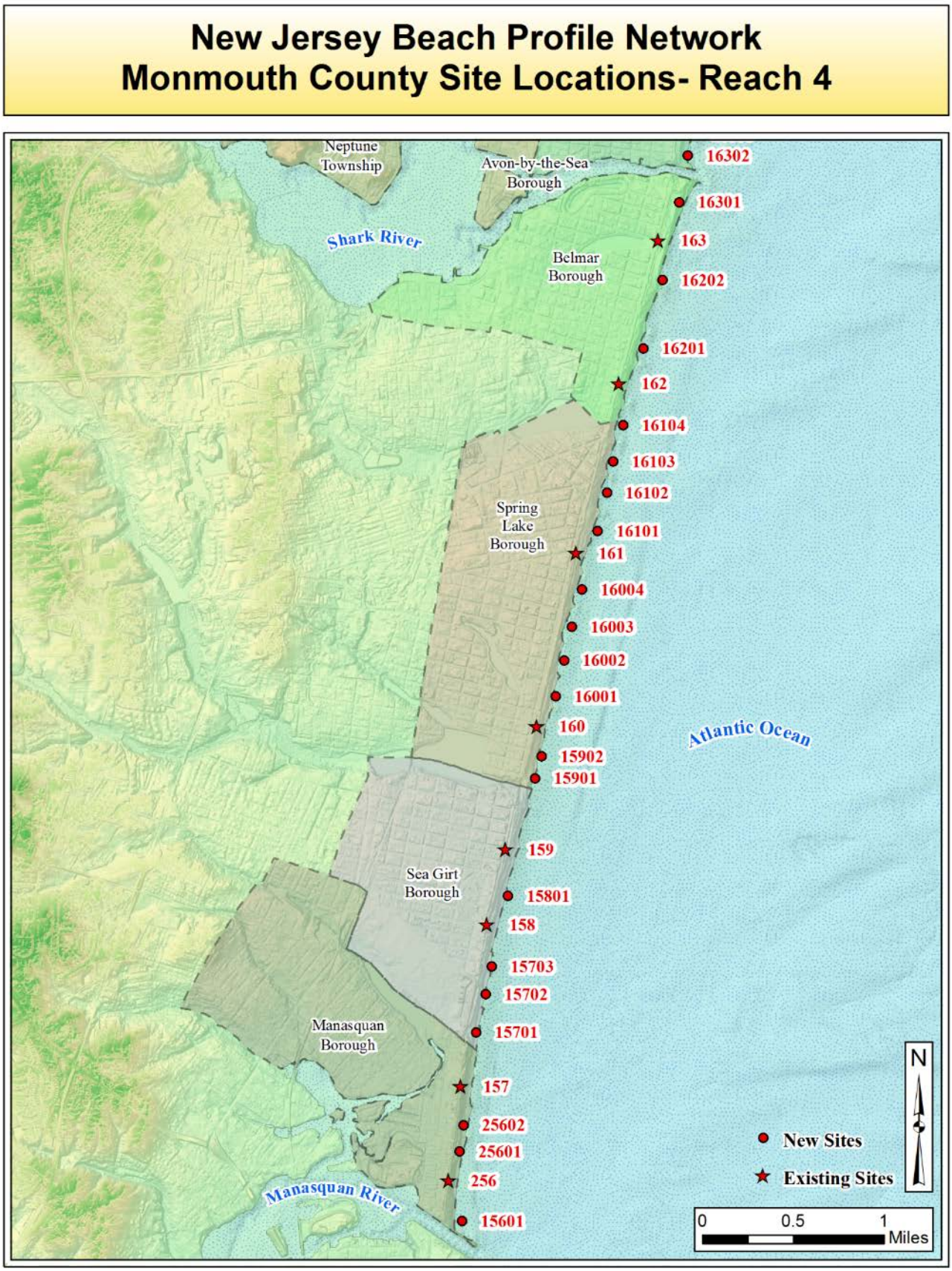


Figure 1d. The fourth reach extends to the Manasquan Inlet, the southern limit of the Monmouth County oceanfront and the NY Corps District project jurisdiction.

Individual Site Descriptions:

During 2015, Phase III of the Monmouth County shore protection project got underway with the placement of sand along the Loch Arbor, Allenhurst and Deal shoreline. Work was completed into Long Branch through the Elberon section (3.5 miles) leading to Lake Takanassee and a linking-up with Phase I project beaches extending north from West End Avenue (4.45 million cu. yds., $38 million dollars). Work 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).

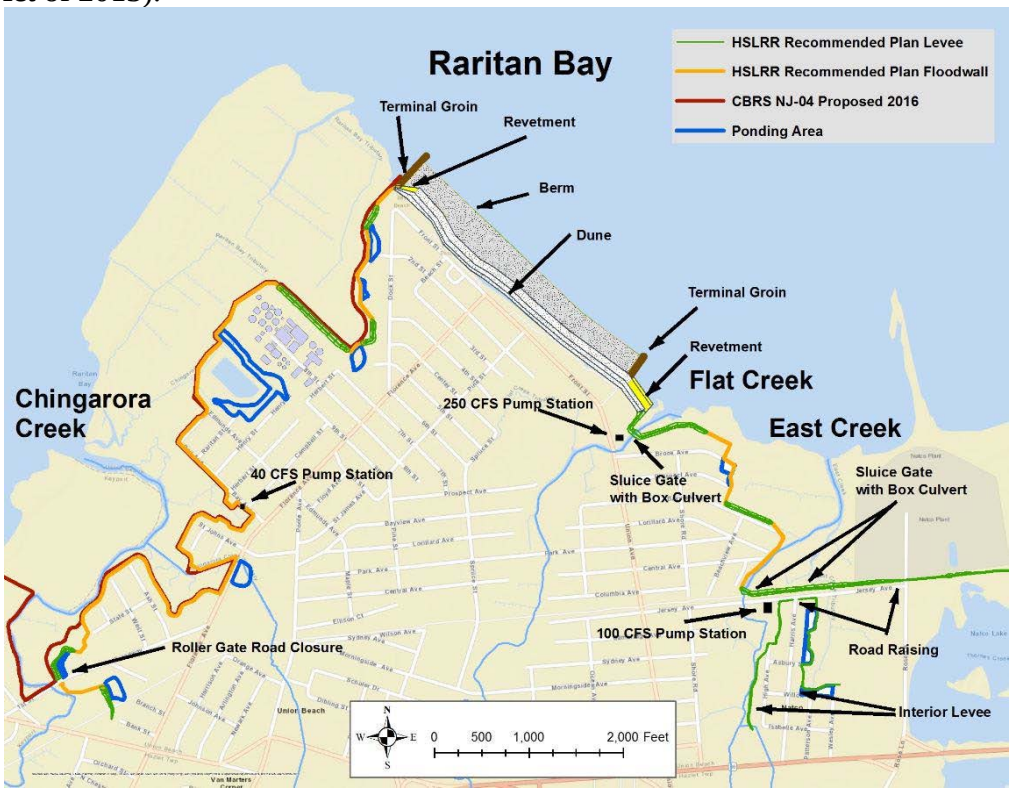


Figure 2. Design plan for Union Beach coastal resilience features reproduced from the January 2017 USACE Union Beach, NJ Hurricane Sandy Limited Reevaluation Report for Coastal Risk Management.

Cliffwood Park, Aberdeen; #187

This site is located 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. The shoreline has continued a slow, relatively consistent retreat over the past 18 months. The beachface slope to the bay floor surface has lost material as a thin wedge that fades out toward the toe of the dune. Offshore, no change in bayfloor elevation has been observed over 34 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. The berm diminished in elevation and dry beach width between surveys 56 and 58 with very minor loss seen over the summer of 2019. The Raritan Bay floor simply does not change in elevation because the wave climate is fetch-limited to wave periods between 2 and 4 seconds. These short period waves have minimal impact on the bottom in water depths greater than 1.04 feet for the 2-second wave period and 4.1 feet for the 4-second wave period. The latter of which is a rare event limited to strong northeast storms or prolonged northwest cold front winds across the bay.

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 yds^3/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 yds^3/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 extremely 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 yds^3/ft. in four years (17.3%) accompanied by a shoreline retreat of 25.4 feet. This represents a 2% loss percentage improvement since 2018.

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 an additional 4,000 feet of curving shoreline into Raritan Bay, but profile maintenance and access is difficult. Minor sand volumes were added to the outer 500 feet of dry beach while the berm and beachface advanced seaward between each of the four surveys for a total of 66 feet in shoreline advance and a sand volume gain of 46.53 yds^3/ft.

Gunnison Beach, Sandy Hook National Seashore; #285

Gunnison Beach, originally the northernmost site on Sandy Hook National Seashore actually lost sand volume during the past 18 months (-21.94 yds^3/ft.) accompanied by a 93-foot shoreline retreat. This represents an abnormal study interval in that this site, normally accretional, saw nearly a 100-foot shoreline retreat.

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. There is a wide dune with an extended slope seaward to the beach and a significant offshore bar. The coordinates given for the cross section's starting point and alignment put a large concrete foundation relic directly on the survey line. Therefore, this line was moved 70.2 feet south of the given coordinates for the start point to avoid the obstacle. The ruins are likely related to WW I or WW II military defense installations. The site gained sand between fall 2018 and spring 2019 (11.56 yds^3/ft.) and lost material in the spring 2019 to fall 2019 period (-9.29 yds^3/ft.). The shoreline changes for each interval were advances seaward of 6 and 22 feet respectively.

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 beach and berm width increased as the site gained 53.54 yds^3/ft. in new sand producing a 9-foot shoreline advance (spring 2018 to fall 2019).

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. The profile is quite steep, but offshore there is a bar system extending 350 feet seaward at 7-foot depths prior to dropping into deeper water. The seasonal surveys saw minor sand volume gains followed by losses (1.85 yds^3/ft. and -27.50 yds^3/ft.). Shoreline changes were an advance seaward of 3 feet followed by a retreat of 44 feet during the summer of 2019.

Highlands Beach, Sandy Hook National Seashore; #184

This was initially the northern coastal site, 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 site remained stable between March 2019 and late Feb. 2019. Beach erosion produced a major shoreline retreat of 49 feet over the summer of 2019 combined with a 5.43 yds^3/ft. sand volume loss which argues for extensive cross shore migration of sand supplies. Offshore gains nearly balanced on-beach sand volume losses.

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. In 2015, the Army Corps project added 43.1 yds^3/ft. to the beach producing a shoreline position almost equal to pre-Sandy conditions. The March 2018 survey was followed by two subsequent surveys where the beach retreated (-43 and -17 feet) yielding sand losses of -0.87 yds^3/ft. and -17.20 yds^3/ft. The summer of 2019 saw a dramatic turn-around where the 63-foot shoreline advance was combined with a sand volume gain of 29.96 yds^3/ft. pushing the final shoreline position exactly back to the March 2018 position (+3.3 feet and +10.62 yds^3/ft. over the time interval of 18 months).

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 landward each successive survey. The net 18-month change was a loss of 24.75 yds^3/ft. during the summer of 2018 accompanied by a 41-foot shoreline retreat. The final survey cross section in Dec. 2019 lies midway between that of March 2018 and Feb. 2019.

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 and seaward between surveys. This site's shoreline advanced 1.4 feet by fall 2019, and the site gained 17.79 yds^3/ft. in sand volume.

Shrewsbury Way, Sea Bright; #282

This site accumulated sand to the point where the shoreline was 96 feet further seaward than prior to Hurricane Sandy. There exists a certain stability to this site that differs from most other Sea Bright locations. During the past 18 months an additional 9.72 yds^3/ft. in sand volume was added, but the shoreline retreated (-82 feet). The -75-foot shoreline shift between March and October 2019 is easily explained where the nearshore bar surveyed in March just above the zero-elevation position added to the beach by October generating a steep beachface into the water producing the shoreline retreat noted. Subsequent shoreline position shifts were below 10 feet.

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. Little material lies offshore as a bar however. Since the initial survey in May 2018, the site initially lost substantially across the entire profile (-25.12 yds^3/ft.) during the summer, however the 2018-19 winter season saw a gain of 30.65 yds^3/ft. as the shoreline retreated 13 feet. The 18-month change was a gain at 8.61 yds^3/ft., which is unusual to see high summer sand losses reversed by strong winter gains (30.65 yds^3/ft.). The shoreline retreated 84 feet in 18 months.

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 at the berm crest on a variable position berm beachfront that is 540 feet wide to the water's edge. An offshore bar system developed by April 2019 and moved landward by that fall. Very pronounced berm ridges appeared by October 2018 having 4 feet of relief on the landward slope. This site gained sand during the study period. The net change was +7.72 yds^3/ft. with a 37-foot shoreline retreat. This "retreat" was produced by the migration of the offshore bar ridge into the zero-elevation region which generated significant "shoreline" movements as calculated by the computer which checks the first dip below that value.

Sea Bright Public Beach, Sea Bright; #182

The next location south was obtained by NJ State purchase 35 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. There is no significant offshore bar system, but a deep nearshore trough developed in the April 2019 survey that filled in by fall 2019. The sand volume decreased by 2.57 yds^3/ft. over 18 months with a 7-foot shoreline retreat.

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 seaward of the seawall retreated at the berm crest, but not at the shoreline during the summer of 2018, then remained stable to accretional since. The 18-month changes were a loss of 35.32 yds^3/ft. as the shoreline retreated 17 feet. The sand volume loss was mostly due to the berm retreat in the 2018 summer.

1201 Ocean Avenue, Sea Bright; #18003

This new profile location includes a dune ridge seaward of the seawall but no horizontal dry beach, just a slope to the water's edge where large seasonal berms developed each summer. The dune continued to develop with added sand. The summer of 2018 resulted in a very large berm ridge generating a decent beach area. A smaller version was documented by Jan. 2020. No distinct offshore bar features have developed but the berm sand may have taken the material from the offshore terrace surface each summer. The site lost 21.91 yds^3/ft. and saw a shoreline retreat of 20 feet in the past 18 months.

15 Tradewinds Lane, Sea Bright; #18002

This new profile site has two dune ridges with the larger one seaward, and a similar structure to the beach seaward as seen at site 18003 where by Jan. 2020 a huge berm feature had been deposited. The beach has lost sand volume but had a shoreline position advance since May 2018 (-11.79 yds^3/ft. and +15 feet for 18 months).

1485 Ocean Avenue, Sea Bright; #18001

Positioned at the base of the seawall, this new profile site shows a narrow beach, a seasonally developed berm, but no offshore bar system. The surveys during 2019 saw the most successful berm development of the study period. The beach lost 7.07 yds^3/ft. while the shoreline position shifted 16 feet seaward.

Sunset Court, Sea Bright; #180

The location north of Cottage Road maintained the majority of the initial sand volume placed in 1999. The repeated deposition of maintenance material at Cottage Road moved north through this location. A small dune has developed seaward of the rock wall with a narrow dry beach that ended the study period with a decent sized berm. Sand appeared offshore and migrated onto the lower beachface by Dec. 2019. Over the past 18 months the sand volume decreased (-11.16 yds^3/ft.) but the shoreline advanced 16 feet.

122 Ocean Avenue, Monmouth Beach; #17901

This NY USACE site is located north of Cottage Road and contains no dune at the seawall, but a relatively decent width beach sloping into the sea without an offshore bar system. The widest beach was documented after the winter with the April 2019 survey showing an advance of 37 feet in the shoreline and a 16.39 yds^3/ft. sand volume increase. This shifted to a 32.16 yds^3/ft. sand volume loss by the fall of 2019. At the end of the study interval, the sand volume declined by 10.29 yds^3/ft. but the shoreline advanced 12 feet.

Cottage Road, Monmouth Beach; #179

The Cottage Road location has been the "Hot Spot" erosion area in an otherwise very successful Federal beach restoration project. Immediately south of this site, a massive stone groin was privately built decades ago and 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. There was only a narrow, dry beach that gets wet to the rocks under normal wave action at high tide. 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. There is no dune at the seawall, but a narrow berm remains in place. The recent four surveys document continued loss offshore until the spring of 2019 with the beach remaining constant. The summer produced significant beach

loss with dune erosion into the toe, but sand deposited offshore restoring the surface elevations between 400 and 600 feet from the reference location to that seen May 2018. These 18 months produced a 37.22 yds^3/ft. sand volume loss with a 10-foot shoreline retreat.

65 Ocean Avenue, Monmouth Beach; #17801

This new profile location includes a 14-foot elevation dune that lies at the landward edge. The beach is about 150 feet wide to the second berm crest and then slopes into the water without any bar system present. This site is on the up-drift side of the groin producing the serious erosion hot spot at Cottage Road (site #179). During the past 18 months this location gained 2.78 yds^3/ft. along with a 14-foot shoreline retreat.

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. There was a very large ridge of sand pushed up on the beach that also generated a deep trough immediately landward as of the Jan. 2019 survey. This activity was as a result of the NJDEP working on the rock seawall and excavating material for access. The work concluded by June 2019 and the beach returned to near normal but without evidence for an offshore bar. The 18 months of survey showed 31.23 yds^3/ft. in sand volume increase accompanied with a 40-foot shoreline advance seaward.

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, which became less pronounced at each of the two subsequent surveys. The sand volume decreased by 0.51 yds^3/ft. as the shoreline position retreated 19 feet by January 2020.

Ocean Avenue Long Branch; #177

Presently, this site is part of the Seven-Presidents Park system belonging to Monmouth County. This site saw severe erosion during Sandy, followed by further losses offshore as some sand moved landward by March 2013. Restored by the USACOE, the site did lose beach width over the 2018-19 winter. These losses were a 14.12 yds^3/ft. beach volume loss and a 31-foot shoreline retreat. The recent study interval produced a shoreline change of -51 feet with a -28.85 yds^3/ft. loss in sand volume.

300 Ocean Avenue, North Long Branch; #17601

This new profile location includes a long slope up to the dune crest, a straight line drawn between the reference mark 400 feet landward of the crest and the top of the dune. The beach is about 220 feet wide, but slopes steeply into a trough present during three of the four surveys. This trough represents a bar system approaching the base of the beachface most notable in the Dec. 2019 survey. The berm retreated over the summer of 2018 reaching the most landward location by April 2019, then advancing back to exactly the November 2018 position by fall 2019. Sand volume declined by 55.50 yds^3/ft. over the study interval and the shoreline retreated 63 feet.

Seven Presidents Park, Long Branch; #176

This site was converted into open parkland space 40 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 last 18 months of surveys show that the berm advanced seaward for surveys 57 and

58, then retreated to the March 2018 position again by fall 2019. The sand volume increased by 6.76 yds^3/ft. and the shoreline advanced 12 feet.

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 slope continued as a terrace in March 2018, then transformed into a gradually increasing in size offshore bar system that was quite dramatically different by Dec. 2019. The beach remained relatively constant over the study interval. The 18 month interval produced a +19.97 yds^3/ft. sand volume change with a 7-foot shoreline advance.

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. The beachface started and finished the 18-month study interval at the same location so sand volume changes (+9.21 yds^3/ft.) and shoreline shifts were small (+0.8 feet).

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 200 feet wide with a milder slope into the ocean. No offshore bar system is present. The berm grew in elevation and prominence during 2019. Minor losses were documented at the base of the beachface and immediately offshore. The net change was a sand volume gain of 3.35 yds^3/ft. and a 5-foot shoreline advance.

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 300 feet wide with a significant berm developed high up on the beachface slope by Jan. 2020. Offshore small bar systems appeared and gradually moved landward. The sand volume declined by 0.81 yds^3/ft. and the shoreline advanced 6 feet over the study period.

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. Minor berm retreat occurred between surveys 58 and 59 with little change on the beach or further seaward from the near shore water. In the recent survey interval, the site lost -7.90 yds^3/ft. in sand volume with a 17-foot shoreline retreat.

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 two early surveys with little change then a marked retreat in the berm position by April 2019, followed by a minor berm enhancement by Jan. 2020. The sand volume change was -18.44 yds^3/ft. with a 56-foot shoreline retreat largely from the winter 2018-19 berm retreat (39 feet).

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, with an offshore bar deposit. Few changes occurred at the site yielding a small shoreline advance (15.0 feet) and a +6.87 yds^3/ft. gain in sand volume.

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. The berm moved seaward over the 2018 summer, remained in place until April 2019 and then retreated back to the May 2018 position by Jan. 2020. The net site change over 18 months was a shoreline advance of 14 feet and a sand volume increase of 8.81 yds^3/ft.

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. A significant retreat in the beach berm occurred between surveys 57 and 58 generating a 57-foot shoreline shift landward. Over the past 18 months -35.20 yds^3/ft. in sand volume loss were combined with an 71-foot shoreline retreat.

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 300-foot wide beach seaward of the bulkhead. No dune exists at the site, but there is an offshore terrace at the -4-foot elevation of about 200 feet in width. No bar exists on the initial survey. This site replaced a site originally established in 1986 (#172) and abandoned due to development. The year since the first survey saw -8.35 yds^3/ft. in sand volume loss combined with a -35-foot shoreline retreat. The beachface retreat was constant among the three surveys thus far, but the summer 2018 season saw a large wedge of sand accumulate just offshore mitigating the total site sand loss.

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. The major sand placement took place between May and December of 2016 as the Phase III portion of the USACE project was completed. That sand volume was 217.10 yds^3/ft. with a 322-foot shoreline advance seaward. A new freshwater drainage system was completed to allow lake water to discharge into the ocean from Lake Takanassee. The most recent series of surveys show slow, but continuous retreat in the berm with no significant offshore bar system developing. The net change was a 43-foot shoreline retreat as a result of a sand volume loss of 20.78 yds^3/ft.

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 May 2018 survey showed over a one hundred foot beach remaining that eroded back to the timber structures by Dec. 2018. Further retreat occurred each of the two successive surveys leading to the Jan. 2020 profile. The loss rate seemed indifferent to seasonal benefit with the series of sand volume losses at -24.39 yds^3/ft. (S18 to F18); -47.31 yds^3/ft. (F18 to S19); and -9.88 yds^3/ft. (S19 to F19) producing a total of -80.18 yds^3/ft. The shoreline retreated 19, then 60, and finally 31 feet at each interval for a total retreat of 110 feet.

Pullman Avenue, Elberon; #171

The May 2016 survey was the last of pre-project cross sections and is the basis for a dramatic comparison with the Phase III sand placement (271.99 yds^3/ft., with a 418-foot shoreline advance). Losses were substantial by May 2017 (-100.86 yds^3/ft., and -189 feet of shoreline retreat). Loss continued during the summer of 2017 (-40.66 yds^3/ft., and -57 feet of additional retreat). The net change since May 2016 was a loss of 137.40 yds^3/ft. and a shoreline retreat of 173 feet (41.4% of the placement shoreline advance). Conditions at this site have not improved between May 2017 and December 2018. Beach retreat rates have consumed the remainder of the USACE deposit (-57; -46; and -48 feet between the three surveys totaling 150.5 feet of retreat). Sand volume losses were almost as consistent totaling -98.02 yds^3/ft. As of May 2018, the site retains just 13.4% of the sand initially placed here in 2016. The May 2018 survey still showed a flat dry beach surface about 80 feet wide which eroded into a steep slope from the bulkhead to the water line by December 2018. Even that beach retreated to the timber and rocks of the shore protection hard structure and remained constant through the summer of 2019 to Jan. 2020. The sand volume loss since May 2018 was -54.43 yds^3/ft. with a 78-foot additional shoreline retreat.

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 extended seaward at elevation 10.0 for 100 feet before descending on a steep slope to an offshore trough. This beach retreated 53 feet by Dec. 2018 and changed slope gradient over the next 12 months producing small shoreline advances as the upper part of the slope continued to retreat. Offshore, the modest bar present in May 2018 moved slowly landward by Dec. 2018, then radically further landward by April 2019. It returned seaward to the May 2018 location by Jan. 2020 without providing any direct deposition on the beach. Sand loss was 53.63 yds^3/ft. and the shoreline retreated 40 feet during the study period.

1115 Ocean Avenue, Long Branch; #17004

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 done here out to the dramatic shift in bar sediments between April 2019 and January 2020. The 18-month sand volume change was a gain (+2.56 yds^3/ft.) with a small shoreline advance of 5 feet.

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. The most change occurred between April 2019 and Jan. 2020 because the April survey was the most accretional on the beach. Offshore the Jan. 2020 bar was much further seaward than the April feature. The sand volume change was a loss of 7.49 yds^3/ft. and the shoreline retreated 12 feet.

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 as shoreline erosion took place. The offshore bar was present for three of the four surveys essentially in the same location and elevation. The site shed 25.42 yds^3/ft. in sand volume over the 18 months of study, which included a -21-foot shoreline retreat.

Jerome Avenue, Deal; #17001

Located just south of the Deal municipal boundary, this new profile starts at a vertical bulkhead and initially extended for 160 feet at elevation 10.0 to the berm crest. Shoreline erosion took a few feet from the project

beach width, but sand accumulated offshore by Jan. 2020 as a generous terrace slope into deeper water. The shoreline retreat was 9 feet during the 18 months, with a 2.30 yds^3/ft. sand volume gain.

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 yds^3/ft. and a 311-foot shoreline advance. Since the shore protection work was completed, the beach has retreated to a point by Dec. 2018 where stability occurred until Jan. 2020. Small bars appeared twice in 18 months, but at the end of the interval there was a sloping terrace seaward from the beach. The interval sand volume change was a small gain of 4.51 yds^3/ft. and a 35-foot shoreline retreat, mostly in the spring 2018 to fall 2018 survey (34.5 feet).

South Roosevelt Avenue, Deal; #16905

This new profile site is just 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 a long, long time. 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. Some retreat in the beach berm occurred over the 18-month survey period with just the first of the series of surveys showing an offshore bar. Since May 2018, the offshore has been a sloping terrace surface. Over the study interval the shoreline retreated 32 feet while the sand volume dropped by 0.97 yds^3/ft.

71 Ocean Avenue, Deal; #16904

Starting at a vertical bulkhead, this new profile location showed an initial trough below offshore that slowly added to the beach by April 2019. The berm retreated somewhat during the study period. The beach became steeper producing a shoreline retreat of 18 feet. The sand volume loss was -3.57 yds^3/ft.

Ocean Lane, Deal; #16903

This new profile starts at a rock revetment and reaches the beach at elevation 10.0, which extends seaward for 300 feet to the berm crest. Sand added offshore generating a sloping terrace by Jan. 2020. The shoreline advanced 9 feet as the sand volume increased by 19.10 yds^3/ft.

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 9.5 descending steeply to a lower slope gradient terrace offshore. There were sand ridges pushed up present on the May and Dec. 2018 surveys, not present subsequently. The study interval found a beach volume change of -9.30 yds^3/ft. accompanied with a shoreline retreat of 22 feet.

Wallace Road, Deal; #16901

Positioned at a tall bulkhead and rock revetment that reaches the bluff crest at 30 feet elevation, this new profile location includes a beach that is 180 feet wide at elevation 10.0. The beach slopes to the ocean at similar gradients to others in the area, but has a wide low-gradient terrace offshore. No bar system was present on any of the four surveys. Minor sand losses occurred on the beachface, but sand was added offshore raising the terrace elevation considerably. The 18-month change was a +14.25 yds^3/ft. increase in sand volume with a 5-foot shoreline retreat. The sand volume increase was dominated by the additions offshore.

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". The beach varied little over time. Individual owners repaired the extensive damage to their bluff protection once again concealing the sedimentary deposits from inspection. This site did gain sand as the federal project got underway with 241.39 yds^3/ft. added during the spring to fall 2015 interval. The net change was a sand volume gain of 231.44 yds^3/ft. accompanied by a 350-foot shoreline advance. The recent study interval produced a 10.06 yds^3/ft. sand volume loss accompanied with a 31-foot shoreline retreat. These changes were confined to the retreat in the beachface between surveys 58 and 59. The bluff and upper dry beach changed very little. A small bar appeared offshore in the Jan. 2020 survey.

Monmouth Drive, Deal; #16802

This new profile site has a 130-foot wide beach at elevation 10.0 with a steep slope on the beachface to the zero-datum elevation. Erosion produced a gradual shoreline retreat along with the entire beachface, while offshore minimal change occurred beyond the immediate offshore region. plus sand transfer offshore occurred the first winter of study at this site. The 2018 summer saw the most sand extracted from the beachface and from the bar trough offshore. The sand volume decreased by 26.49 yds^3/ft. as the shoreline retreated 39 feet.

Neptune Avenue, Deal; #16801

From the bluff elevation, this new profile descends to the beach at the 10.0-foot elevation. The May 2018 survey found that a nearshore trough had developed which flattened out by December 2018, became deeper by April 2019, then accumulated sand volume exceeding that present in the May 2018 survey. The beach retreated until April 2019, then advanced nearly to the May 2018 position. The sand volume increased by 13.87 yds^3/ft., but the shoreline retreated 16 feet during the 18 months of study.

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 yds^3/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 two spikes on the cross sections are sand ridges pushed up by the municipality as added storm protection. The initial survey of this 18-month series shows a beach that received additional sand by Dec. 2018 which remained in place through the winter to the April 2019 survey. Shoreline retreat ensued during the summer leaving the March 2020 survey showing the beach at the April 2018 position and a sizable bar present offshores, not present in any scale previously. The sand volume change was 3.71 yds^3/ft. over 18 months in spite of a summer 2019 loss of 25.24 yds^3/ft. Shoreline changes consisted of 44 feet of advance seaward between April 2018 and April 2019 followed by a 52-foot retreat by March 2020.

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. The Dec. 2018 survey showed a tall spike of a dune that was not present in May 2018 and was a storm protection ridge pushed up for the winter season. The narrow beach slopes steeply into the ocean. The low-gradient terrace offshore appeared at the April 2019 survey interval, but a bar and trough system was present on the other occasions. The sand volume change was a gain of 66.51 yds^3/ft. over the 18-month study. The shoreline advanced 67 feet.

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. Offshore there was a terrace extending at a gentle slope for another 220 feet seaward. This beach eroded between May and Dec. 2018 with the May 2019 profile developing a large berm and very steep beachface that flattened out as a wide terrace before dropping into deep water well offshore. The terrace vanished by Feb. 2020, but the beach gained sand both on the upper beach and the lower zone advancing the shoreline. 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 scout will produce huge "gains" or "losses" at the site of the scour. The feature can be seen in Google Earth air photographs. There were man-made ridges of sand put in place as added storm protection. The sand volume gain was 15.36 yds^3/ft. as the shoreline advanced 38 feet. With only the May 2019 survey extending 1,100 feet seaward, neither possible comparison included the changes from 625 to the 1,100-foot distance as sand volume changes.

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. The beachface slope is steep with a lower gradient terrace offshore. This terrace was a trough and bar system in May 2018 and grew more pronounced by December 2018. The terrace slope returned by Jan. 2020. The sand volume change was +6.64 yds^3/ft. and the shoreline shifted just 1 foot landward.

Seventh Avenue, Asbury Park; #267

The Federal project beach in Asbury Park had no dune, but the sand was ramped up to the elevation of the boardwalk. In 2014, the USACE provided an additional 92.68 yds^3/ft. generating a 115-foot shoreline advance. In the past study interval, the site gained 14.45 yds^3/ft. as the shoreline advanced 17 feet. The May 2018 profile had the most sand present on the beach with the widest cross section. Subsequent retreat produced a 29-foot narrower beach as sand was taken from the berm and beachface. It also appears that extensive beachfront construction has removed the boardwalk at this site and for 4-5 blocks to the south. The 18 months of evaluation produced a 29-foot shoreline retreat accompanied by a 31.75 yds^3/ft. sand loss volume.

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 earlier three surveys. The beach berm retreated to the Jan. 2020 position with sand loss since May 2018. The sand volume change was -58.40 yds^3/ft. as the shoreline retreated 63 feet from the initial position surveyed in 2018.

Third Avenue, Asbury Park; #167

At site #167 on Third Avenue, there was a beach gain of 4.66 yds^3/ft. with a 9-foot shoreline retreat and sand moved offshore raising the surface elevation near the beach. There is a man-made dune ridge pushed up in the late November 2018 profile.

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. The April 2018 beachface retreated for 12 months to the May 2019 survey, then advanced substantially at the Jan. 2020 survey. The sand volume increased by 33.12 yds^3/ft. as the shoreline advanced 24 feet seaward. The small dune ridge present Dec. 2018 was man-made for the winter season's storms.

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 steep beachface slope ends at -2.0-foot elevations in the water. The low-gradient terrace present in the initial survey remains approximately at the same elevation with a small bar present as of Jan. 2020. The April 2018 survey displayed the widest beach, with retreat following that summer. A minor advance occurred over the 2018 to 2019 winter that was again followed by a summer berm retreat. The sand volume declined by 0.73 yds^3/ft. and the shoreline retreated 20 feet.

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 recent study interval produced a sand volume gain of 4.34 yds^3/ft. with a 11-foot shoreline retreat. Ocean Grove added a man-made beach ridge for winter storm protection in 2018 but not in 2019.

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. Sand was pushed up for added storm protection for both the winter of 2017 and 2018, but not for 2019. The beachface retreated from the May 2018 position, then recovered to a point twice the initial retreat distance including a new offshore bar of greater proportions than any previously present. The initial retreat was 15 feet which was reversed with a 36-foot advance during the summer of 2019. The 18-month sand volume increased (+9.62 yds^3/ft.) with the shoreline advancing 19 feet as the net value.

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 160 feet seaward of the dune before descending into the water at elevation -4.0. The terrace present as of April 2018 has been replaced by an offshore bar system that added

sand volume to the distal portion of the profile line. The beach/dune portion changed very little over the study interval. The sand volume increased by 53.20 yds^3/ft. with the majority of the increase contained in the offshore bar, while the shoreline position advanced 10 feet.

McCabe Avenue, Bradley Beach; #165

This site originally was surveyed with a timber boardwalk seaward of the promenade. The boardwalk was removed following the Dec. 1992 northeast storm to gain dry beach width and move the pedestrian path to the grass strip between the beach and Ocean Avenue. During the past 18 months of study, there were fluctuations in the berm and beachface, sand added to the back beach and dune and modest changes occurred offshore as bar migration was minimal. The sand volume decreased by 0.33 yds^3/ft. and the shoreline retreated by 15 feet during the past 18 months.

4th Avenue, Bradley Beach; #16402

This new profile site is situated at the Bradley Beach bluff promenade and dune complex. The original beach width decreased but then a new berm developed by Nov. 2019 in conjunction with a large ridge of sand poised in the nearshore zone ready to attach to the beach slope. The sand volume increased by 0.71 yds^3/ft., but the shoreline retreated 6 feet landward.

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 dune gained sand and minor fluctuations occurred in the offshore. The sand volume increased by 5.80 yds^3/ft. as the shoreline retreated 53 feet landward largely due to a steeper beachface slope in Nov. 2019 as compared to April 2018.

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. This width was dramatically increased by almost 100 feet as of the Oct. 2019 survey showing an addition to the berm of significance. There were no bars present following the spring 2018 survey. Beachface accretion was the dominant theme. The sand volume increased by 3.12 yds^3/ft. and the shoreline retreated 18 feet because the new berm developed a steeper slope than the June 2018 beachface slope.

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

This new profile site includes a tiny dune seaward of the boardwalk that became a slope to the beach elevation from the boardwalk by Oct. 2019. The beach extends about 150 feet further seaward at a 10-foot elevation. The bar terrace offshore became much deeper as a trough and bar system took its place by spring 2018. The beach retreated slightly then advanced back to the initial position by Oct. 2019. The sand volume increased 3.04 yds^3/ft. largely offshore as the bar moved landward into the trough. The shoreline change was +0.5 feet.

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 April 2018. The situation shifted to a steeper beach with a series of small bars located offshore which changed individual locations over the next 14 months. This resulted in an 86-foot relative shoreline retreat largely due to the change in slope on

the beachface. The sand volume decreased as well because of the large cut at the shoreline between the April 2018 and Oct. 2019 profile configuration (-53.30 yds^3/ft.)

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 two successive shoreline advances followed by the Dec. 2019 retreat. The sand volume increased by 42.18 yds^3/ft. due to the gains offshore. The shoreline moved 42 feet seaward.

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 majority of the changes in the past 18 months have been variations in the position of the beach berm. The April 2019 situation was the most erosional and was followed by the Dec. 2019 survey where the shoreline was the most accretional. Back at the boardwalk a tiny dune appears to have started as of survey 59. The sand volume change was a gain of 14.15 yds^3/ft. with a shoreline change of +9 feet.

8th Avenue, Belmar; #16202

At this new profile site, the boardwalk is just seaward of Ocean Avenue and the beach extends 230 feet further seaward at the 10.0-foot elevation. The first three surveys in this interval showed little change at the beach with some variation offshore. This was followed by an extensive accumulation of sand on the beachface advancing the shoreline by 40 feet between April and Dec. 2019. The steep beachface that continues offshore abruptly transitions into a bar system that has gradually moved landward since Oct. 2018. The sand volume increased by 30.44 yds^3/ft. and the shoreline advanced 42 feet.

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. The 10-foot elevation beach extends 240 feet seaward with a man-made ridge of sand pushed up in the Oct. 2018 survey. Minor changes took place on the beach and offshore during the past 18 months. Sand volume increased by 2.06 yds^3/ft. as the shoreline retreated 1 foot.

18th Avenue, Belmar; #162

The City generated a sand ridge on the beach to protect against northeast storms because there was no dune system during 2017 and 2018. The Dec. 2019 survey found a small dune closer to the boardwalk than the pushed-up ridges, so the procedure stopped. The sand volume decreased by 2.32 yds^3/ft. and the shoreline retreated 12 feet.

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. Sub-bottom studies for an offshore breakwater system installed in the 1990’s found lagoonal sediments under a 3-foot thick sand layer approximately at the 600-foot horizontal distance seaward from the water’s edge. This deposition was residual from past conditions where the shoreline was significantly seaward of today’s location. The October 2018 cross section was the most accretional, especially since the other three surveys were relatively similar in the beachface position. Following Hurricane Sandy the Lake

Como ocean discharge pipeline was replaced with a much larger diameter structure. The large ridge on the October profile was pushed up and the unique October 2018 cross section was the result of additional sand placement. The berm added some of that material by December 2019, while the bar accumulated other quantities. The accretional interval involved adding 37.62 yds^3/ft. by fall 2018, followed by the loss of 29.59 yds^3/ft. as of the spring 2019 survey, yielding a net change of +18.22 yds^3/ft. The shoreline shifts followed the same pattern (+49.3 feet, fall 2018; -49.0 feet, spring 2019; and +5.0 feet as of fall 2019 producing a net shift of +5.3 feet over the 18 months.

Remsen Avenue, Spring Lake; #16103

The new profile at the Spring Lake boardwalk lies seaward of the dune system with a 210-foot wide beach at elevation 10.0 feet. The April 2018 survey showed a man-made sand ridge pushed up. By Dec. 2019 a small dune had appeared at the base of the bulkhead. Offshore the variation was accretional by the end of 2019. The sand volume change was +2.88 yds^3/ft. with a 6-foot shoreline advance.

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. The April 2018 survey retained the pushed-up ridge of sand but was the last survey to show such activity. The beach berm varied in elevation and position with the Dec. 2019 profile showing the most elevation at a point somewhat landward of other locations seen earlier. The sand volume declined by 5.92 yds^3/ft. with a 3-foot shoreline advance.

Tuttle Avenue, Spring Lake; #16101

This fourth new profile site in Spring Lake maintains the same configuration as the northern three with the pushed up ridge on the beach as of April 2018 as the last such event. The elevation of the beach was at 10.0 feet (NAVD88) across 250 feet of width, and a generous berm deposit by fall 2019. Minor bar development does appear to provide a cross-shore sediment supply based on the Dec. 2019 survey showing a ridge near the zero-elevation position. The 18-month beach volume change was +3.97 yds^3/ft. with a 9-ft. shoreline advance.

Brighton Avenue, Spring Lake; #161

By the end of 2014, the boardwalk was rebuilt on its original concrete supports and the USACE provided 40.47 yds^3/ft. in new sand at Brighton Ave. with a 76-foot shoreline advance seaward. Man-made storm ridges were employed up to the 2018 winter season but not done recently. Sand has appeared as a generous berm during the 2019 surveys with offshore deposition exceeding that present as of April 2018. The site gained 7.50 yds^3/ft. in added sand volume. The shoreline advanced 9 feet as well.

Madison Avenue, Spring Lake; #16004

This new profile site includes a dune, then the boardwalk, followed by a pushed-up ridge of sand as of April 2018. Variations in the berm position and offshore bar location shifts dominated the study interval. The sand volume lost was 12.33 yds^3/ft. and the shoreline advanced 6 feet. Sand accumulated at the seaward edge of the boardwalk raising the surface elevation. This ramp of deposition makes the boardwalk increasingly vulnerable to storm damage because when waves rush up under the structure they have no where to go but upward when they encounter the dune toe at the landward edge of the walkway, the lifting forces successfully lift entire sections of the boardwalk off the concrete piers. This was the Irene and Sandy experience in Spring Lake.

Morris Avenue, Spring Lake; #16003

This new profile location includes a dune, then the boardwalk, and a pushed-up sand ridge as of April 2018. Little horizontal beach remains seaward of the boardwalk. The beachface as of Dec. 2019 slopes consistently downward into the water where the offshore bar position lies 80 feet seaward of the beachface toe. Offshore, the bar arrangement progressed steadily landward between Nov. 2018 and the Dec. 2019 surveys. A sand volume loss of 2.52 yds^3/ft. was accompanied by a 3-foot shoreline advance.

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. Bar shifts offshore at this site appear to be in the initial phase of bar accumulation about 500 feet from the profile reference location. The sand volume change was +8.52 yds^3/ft. with a 17-foot shoreline advance.

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. The April 2018 sand ridge was the last time this process was seen. Sand ramped up to the level of the boardwalk surface at this location adding elevation to the uppermost beach. The berm as of Dec. 2019 was the most accretive of this series of surveys. There was a bar well offshore from the base of the beachface by fall 2019. An earlier bar seen on the April 2019 cross section appears to have attached to the beach over the summer providing the berm accretion seen in Dec. 2019. Sand volume gain was 12.71 yds^3/ft. with a +8-foot shoreline advance.

Salem Avenue, Spring Lake; #160

For some reason, Salem Avenue did not see sand ridges pushed up. The volume added to the berm between April 2018 and Dec. 2019 is quite significant. The rise in elevation is approximately 3 feet from the dune toe, under the boardwalk and across 125 feet of berm width. This sand likely came from the low-gradient beachface slope present in the April 2018 survey as waves pushed it landward over two summer seasons. The sand volume change was -16.41 yds^3/ft. with a 29-foot shoreline retreat all due to the landward migration of the beachface and nearby offshore sediment. Losses offshore exceeded the gains on the beach; the beach gained 13.61 yds^3/ft. as the immediate zone offshore lost 15.63 yds^3/ft. that was mostly transferred onto the beach. The most distal segment of these two surveys lost 23.25 yds^3/ft. between the 700-foot and 912-foot distances from the reference point, some of which was transferred to the new offshore bar crest (8.87 yds^3/ft.).

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 beach. No sand ridges have been present. Material deposited in the nearshore zone appears to have added to the beach berm by Dec. 2019 making that survey's berm condition the most accretional of the four surveys. Offshore a distal bar was present instead of the shallower trough area between the new bar and the beachface toe. The site lost 15.59 yds^3/ft. in sand volume with an 18-foot shoreline retreat.

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 100 feet at elevation 10 feet. This site lies just north of Wreck Pond, recently the site of extensive reconstruction of the flume box guiding freshwater from this "estuary lake" to the sea. Sand was lost offshore in quantity (-30.30 yds^3/ft.) while the shoreline advanced 1.3 feet seaward.

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). This dune has grown incrementally since. Sand was transferred onto the berm crest by Dec. 2019, but at the expense of the offshore region with an absence of bar formation or migration. The sand volume amounted to a loss of 11.63 yds^3/ft. and a shoreline retreat of 28 feet in the past 18 months.

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 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. The dry beach accumulated a berm by fall 2019 at the expense of the offshore region. The steep beachface descends into the water at a 5-foot depth before becoming a low-gradient terrace seaward as of Jan. 2020. The sand volume was a miniscule gain of 0.07 yds^3/ft. with a 4-foot shoreline retreat.

Trenton Avenue, Sea Girt; #158

The southern Sea Girt site at Trenton Avenue typifies the coastal bluff with single family homes and a wide, high dune landward of the boardwalk deposited on the bluff that minimized Sandy erosion and kept the overwash out of the street ends. The 2014 USACE effort added 94.20 yds^3/ft. and pushed the zero elevation shoreline 121 feet further seaward as the shore protection project was restored. A variety of berm and offshore configurations occurred in the past 18 months all with nearly the same exact shoreline position. The net sand volume change was +11.12 yds^3/ft. and the shoreline variation ranged from -19 to +18 feet yielding a -1 foot retreat over 18 months.

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, the beach with a steep beachface. Offshore is a terrace with a low amplitude bar system that held various positions over the study interval. This beach stayed particularly constant in shoreline position between the spring of 2018 and the fall of 2019 surveys. The net sand volume loss was 1.07 yds^3/ft. and a 5-foot shoreline retreat.

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 150-foot wide beach at 10.0-foot elevation leading to an offshore terrace with a bar present well offshore on the four surveys. A pronounced berm appeared on the Jan. 2020 survey making that profile the most depositional at the beach. Offshore losses dominated the 18-months of site changes. The sand volume change was -15.23 yds^3/ft. with a 10-foot shoreline retreat.

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. There was an offshore bar close to the

beachface toe present at the March 2019 survey. A smaller bar was present by Jan. 2020. This profile site gained 3.30 yds^3/ft. and the shoreline retreated 5 feet seaward over the past 18 months.

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. Over the 7 years since Hurricane Sandy, this community has not developed a dune to replace that one lost to the storm. Instead they depend on sand ridges pushed up each fall with considerable variation in width and elevation. A tiny dune exists at the seaward edge of the community asphalt promenade fronting the development that is situated on the original primary dunes. The Nov. 2019 survey was the most accretional on the beach with a well-defined offshore bar present about 125 feet from the beachface toe. Here the sand volume increased by 27.29 yds^3/ft. and the shoreline advanced 23 feet.

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 dune toe. Offshore bar formation appears to provide sand to the beach periodically. A well-defined bar was present in Nov. 2019. A pushed-up sand ridge appears on survey 58. The sand volume increased by 2.18 yds^3/ft. and the shoreline retreated 13 feet due to the bar trough and steeper beach.

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 each winter season, into the water at a steep slope. A well-defined offshore bar was present as of Nov. 2019 indicating sand transport landward seasonally. The sand volume amounted to +3.19 yds^3/ft. with the bar moving onto the nearshore terrace as the trough got deeper between April and Nov. 2019. The shoreline shift was -6 feet over the study interval of 18 months.

Pompano Avenue, Manasquan; #256

At the Pompano Avenue site (#256) the dune was removed by Sandy as well as the entire promenade with most of the sand transported inland. The Army Corps placed 82.26 yds^3/ft. at this site generating a 113-foot shoreline advance, but there is no significant dune present along the rebuilt promenade. A tiny feature exists but the municipality depends on ridges of sand pushed up each season. Only a meager ridge existed on the Nov. 2019 profile. The berm was enhanced at the Nov. 2019 survey as a result of nearshore sand moving onto the beachface during the summer. A new bar feature was present well offshore. The sand volume increased by 3.72 yds^3/ft., but the shoreline shifted landward by 2 feet since spring 2018.

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. A large deposit of sand occurred at the beachface by Nov. 2019 essentially duplicating that present in the April 2018 survey. The maximum retreat in the beachface slope occurred between April 2018 and April 2019 (92 feet). The 18-month condition changes for sand volume were a change of -36.15 yds^3/ft. in sand lost from the offshore region after the April 2018 survey combined with the shoreline position moving 34 feet landward after 18 months (-75 feet by fall 2018, -17 feet by spring 2019, followed by an advance of 58 feet as of fall 2019).

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 5, 2018 at a particularly low tide revealing the fine sand composing the Raritan Bay floor. The right picture was taken October 11, 2019 and shows a higher tide stage, but a very similar beach and dune profile.

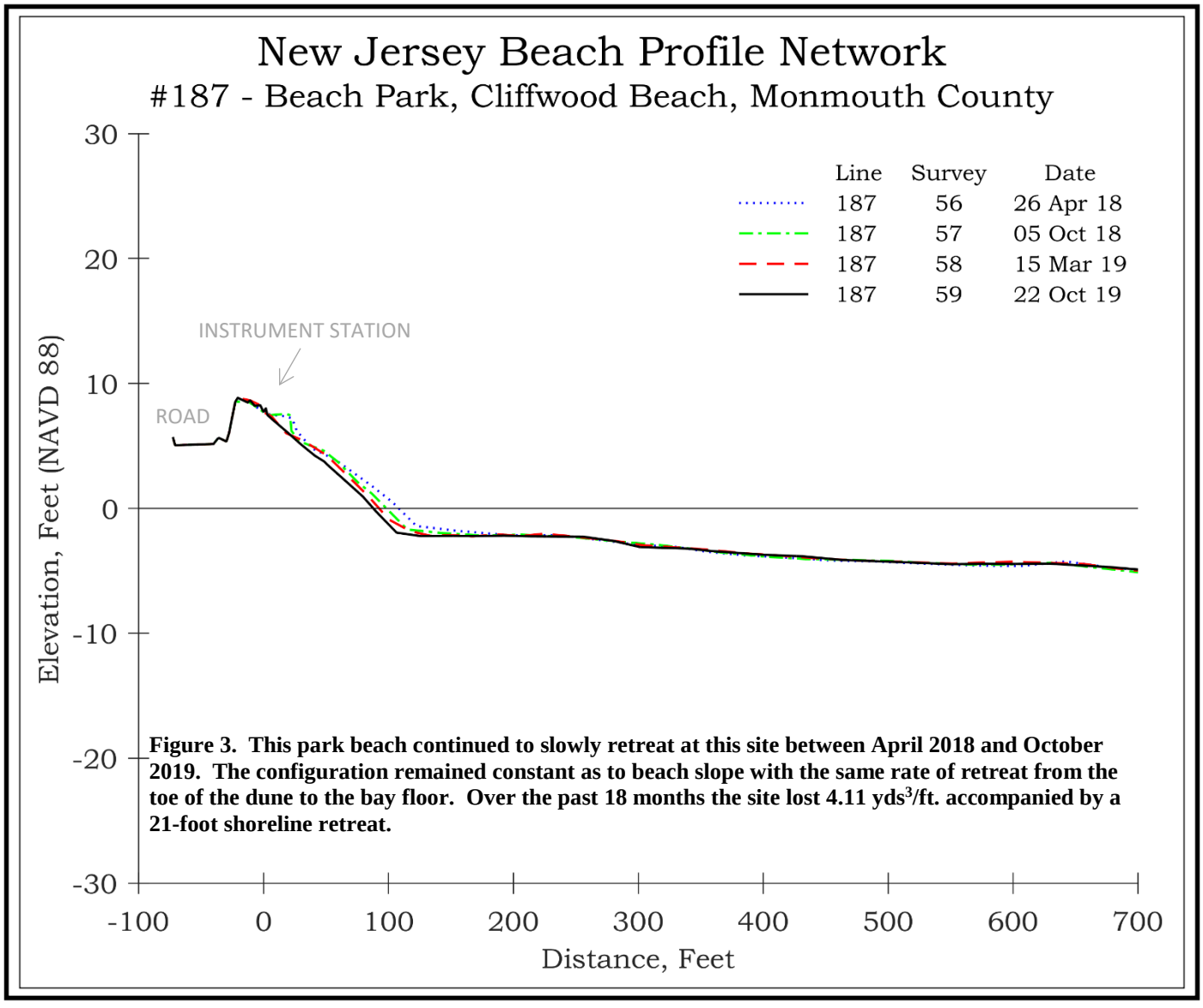


Figure 3. This park beach continued to slowly retreat at this site between April 2018 and October 2019. The configuration remained constant as to beach slope with the same rate of retreat from the toe of the dune to the bay floor. Over the past 18 months the site lost 4.11 yds^3/ft. accompanied by a 21-foot shoreline retreat.

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 5. 2018 with a ridge of sand pushed up as added storm protection. The photo on the right shows the beach width and berm on October 24, 2019 with a beach slope created by the bay wave action.

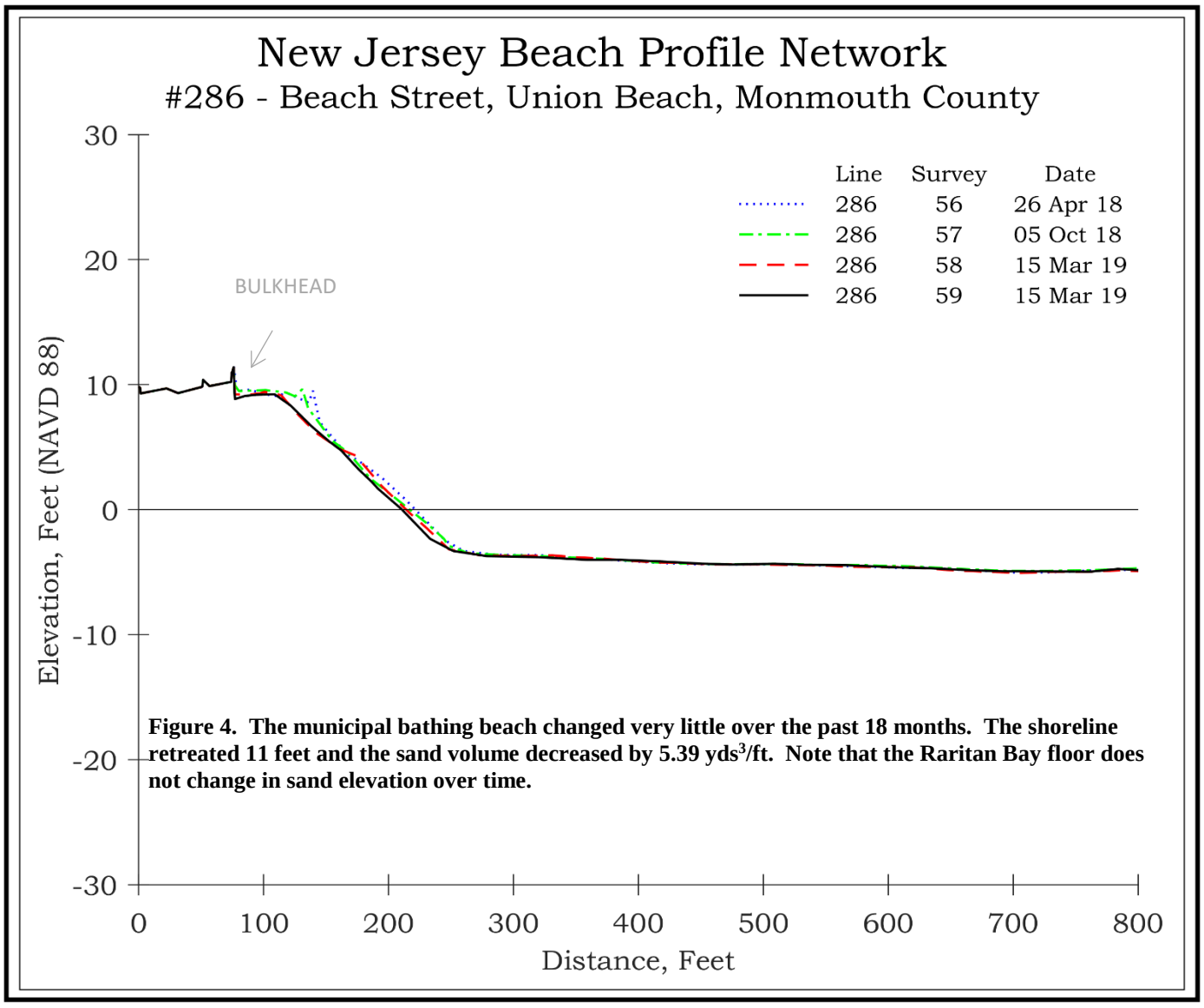


Figure 4. The municipal bathing beach changed very little over the past 18 months. The shoreline retreated 11 feet and the sand volume decreased by 5.39 yds^3/ft. Note that the Raritan Bay floor does not change in sand elevation over time.

NJBPN 185 – Bay Shore Waterfront Park, Port Monmouth

This site was greatly enhanced during 2014 by the NY USACE. The September 18, 2018 view on the left along the beach to the east shows the established profile and sand fence. The right picture was taken October 22, 2019 showing dune grass progressing out onto the upper dry beach beyond the fence.

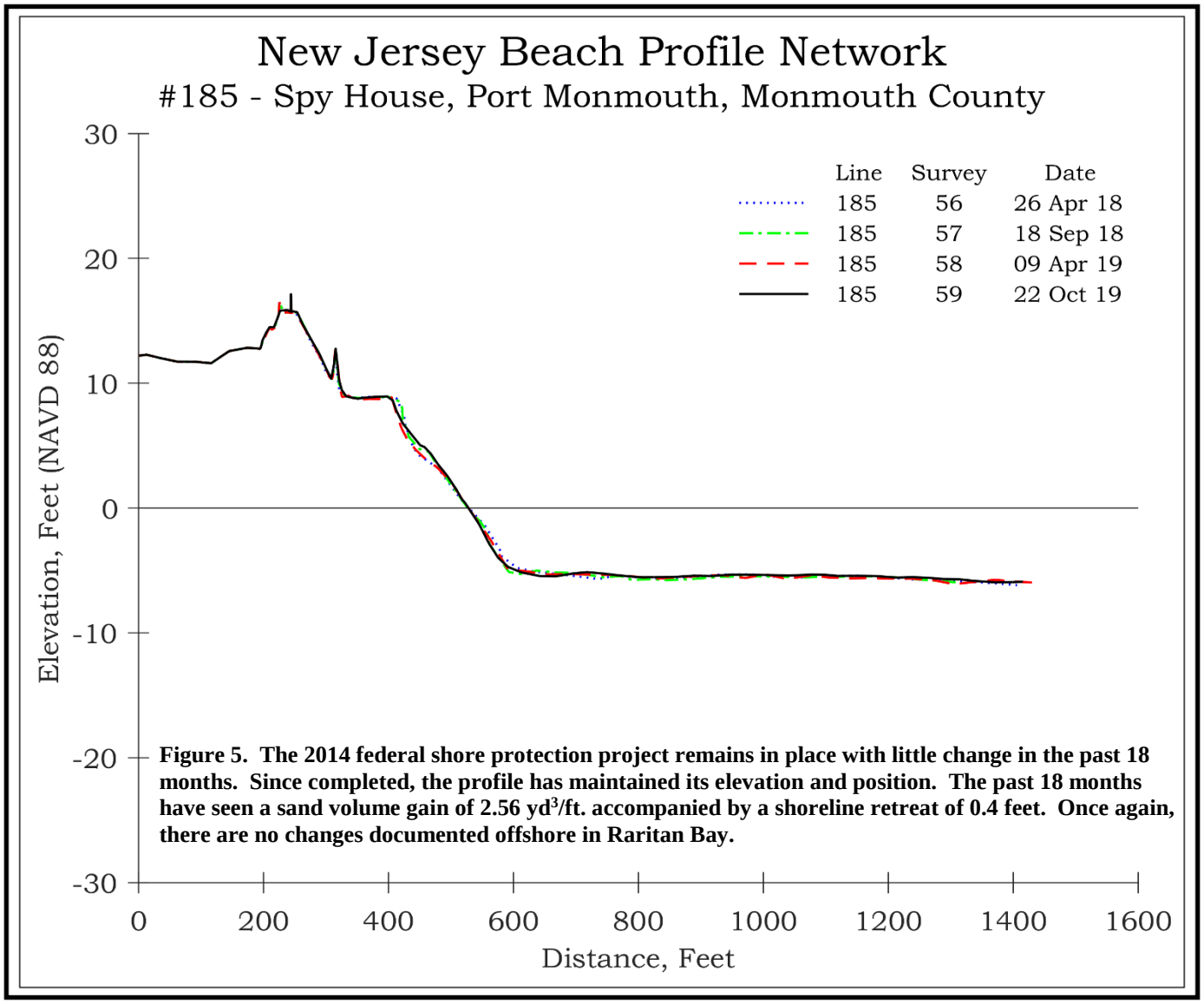


Figure 5. The 2014 federal shore protection project remains in place with little change in the past 18 months. Since completed, the profile has maintained its elevation and position. The past 18 months have seen a sand volume gain of 2.56 $yd^3/ft.$ accompanied by a shoreline retreat of 0.4 feet. Once again, there are no changes documented offshore in Raritan Bay.

NJBPN 385 - North Beach, Sandy Hook National Seashore

This Sandy Hook location was established in December 2016. The expanse of beach with the view to the left December 11, 2018 is looking south along the dune toe. A similar view taking November 22, 2019 shows the extensive expanse of dry sand making up the northern end of the Sandy Hook spit.

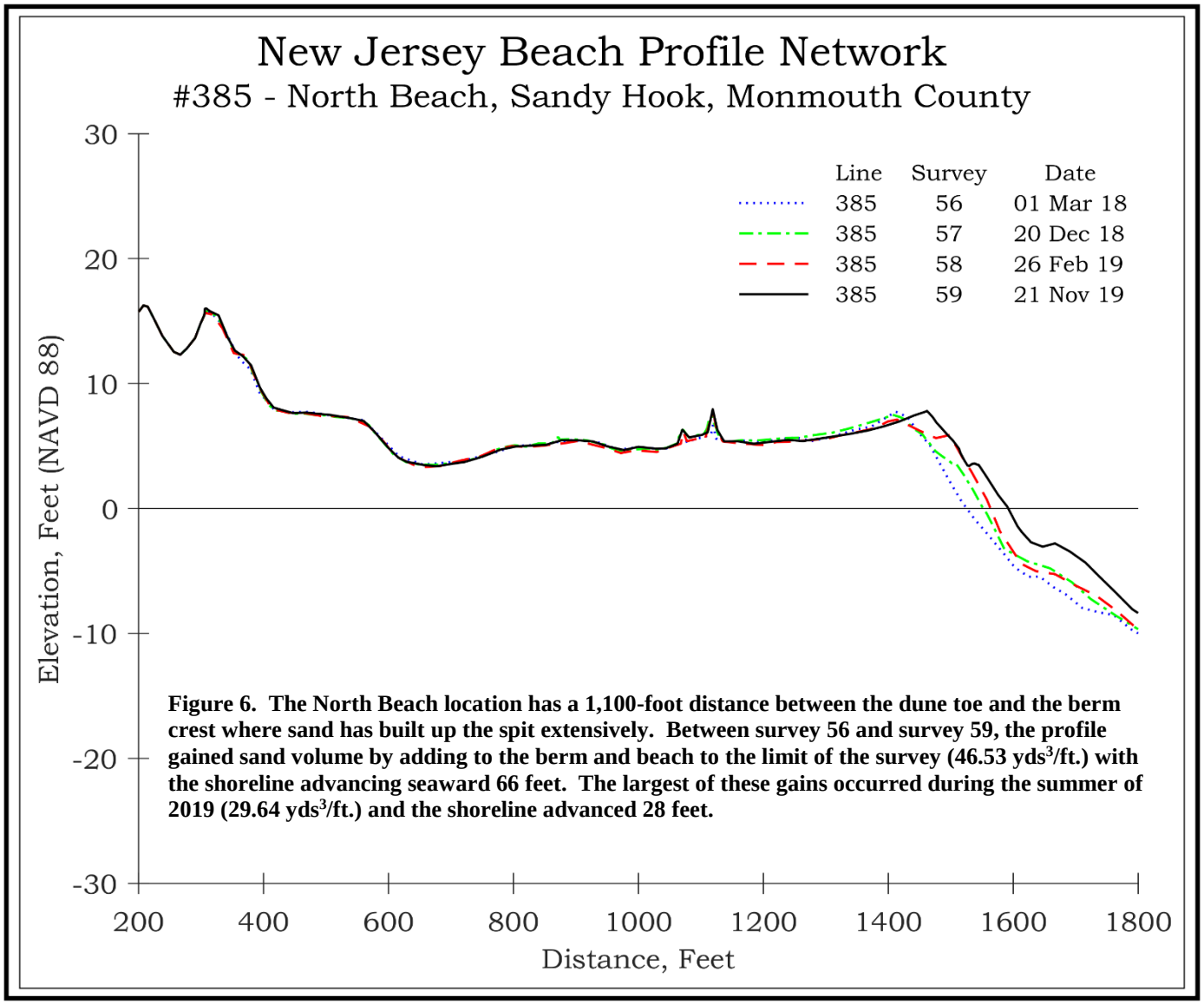


Figure 6. The North Beach location has a 1,100-foot distance between the dune toe and the berm crest where sand has built up the spit extensively. Between survey 56 and survey 59, the profile gained sand volume by adding to the berm and beach to the limit of the survey (46.53 yds^3/ft.) with the shoreline advancing seaward 66 feet. The largest of these gains occurred during the summer of 2019 (29.64 yds^3/ft.) and the shoreline advanced 28 feet.

NJBPN 285 – Gunnison Beach, Sandy Hook National Seashore

The photograph on the left shows the December 20, 2018 beach looking south along a sharp berm ridge with exceedingly fine plant debris placed on the high tide line by very low energy surf. On November 22, 2019 the berm presented a more common ridge with alternating patches of dark minerals separated by the swash. The expanse of beach to the right is enormous.

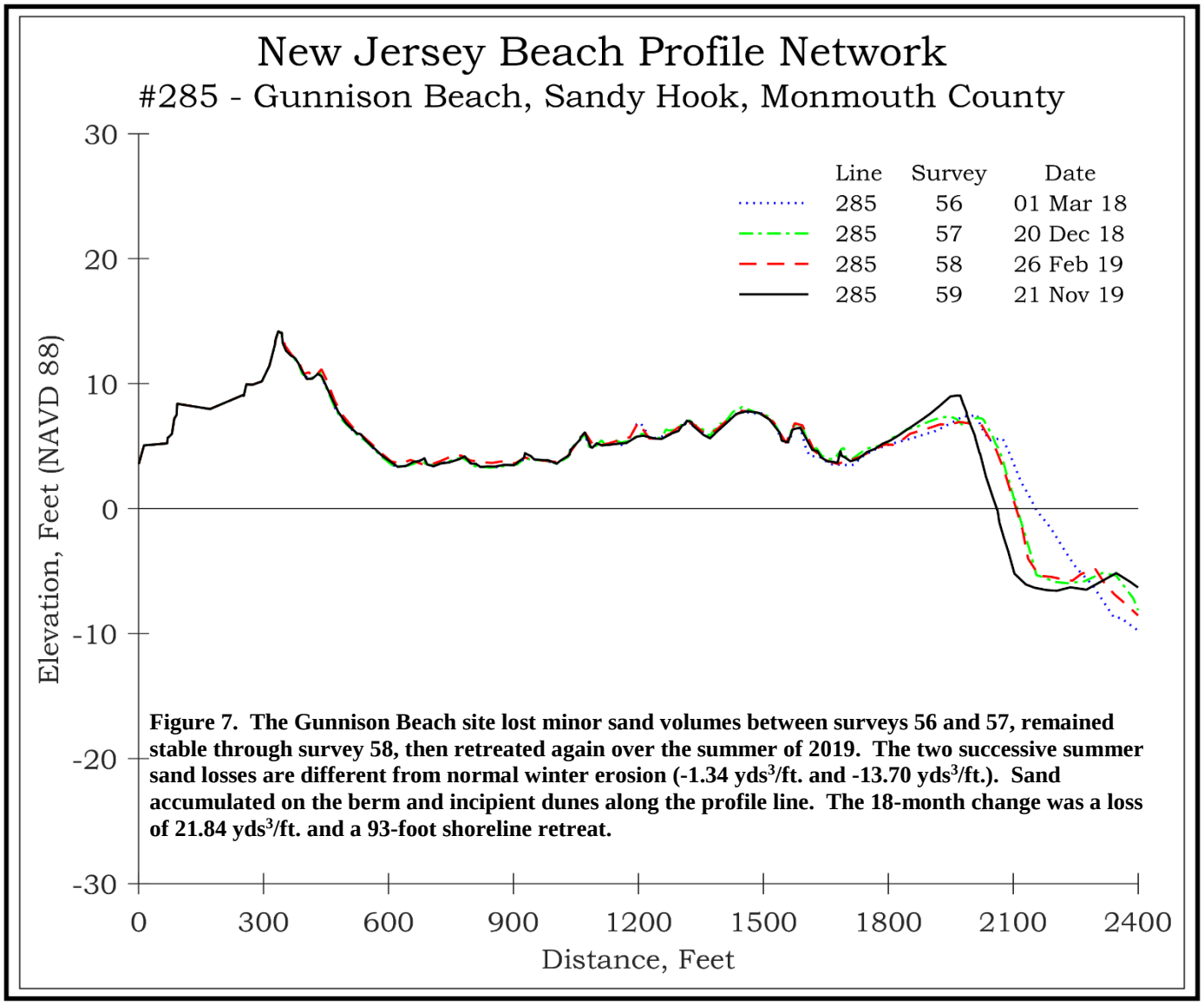


Figure 7. The Gunnison Beach site lost minor sand volumes between surveys 56 and 57, remained stable through survey 58, then retreated again over the summer of 2019. The two successive summer sand losses are different from normal winter erosion (-1.34 yds^3/ft. and -13.70 yds^3/ft.). Sand accumulated on the berm and incipient dunes along the profile line. The 18-month change was a loss of 21.84 yds^3/ft. and a 93-foot shoreline retreat.

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

The left view from December 20, 2018 is to the south along the dune crest shows vegetation on the dunes near the beach. The right-side photograph was taken November 22, 2019 with the beach at nearly the same slope and width and few changes in the dunes.

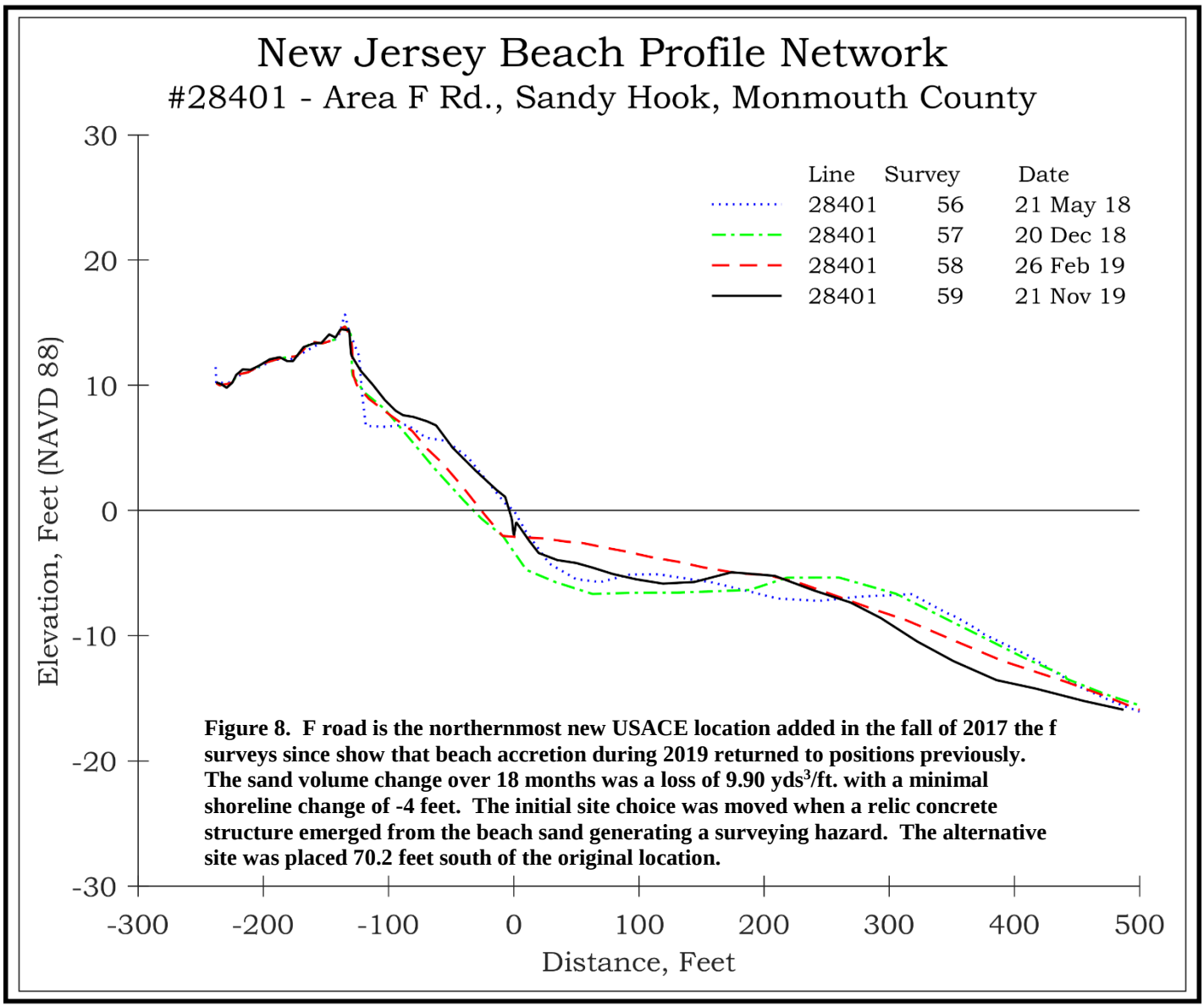


Figure 8. F road is the northernmost new USACE location added in the fall of 2017 the f surveys since show that beach accretion during 2019 returned to positions previously. The sand volume change over 18 months was a loss of 9.90 yds^3/ft. with a minimal shoreline change of -4 feet. The initial site choice was moved when a relic concrete structure emerged from the beach sand generating a surveying hazard. The alternative site was placed 70.2 feet south of the original location.

NJBPN 284 – Parking Lot E, Sandy Hook National Seashore

On the left is a beach picture from January 11, 2018 looking south along the dune toe. A similar perspective on November 26, 2019 shows the dune toe and a wide dry beach seaward of the dunes.

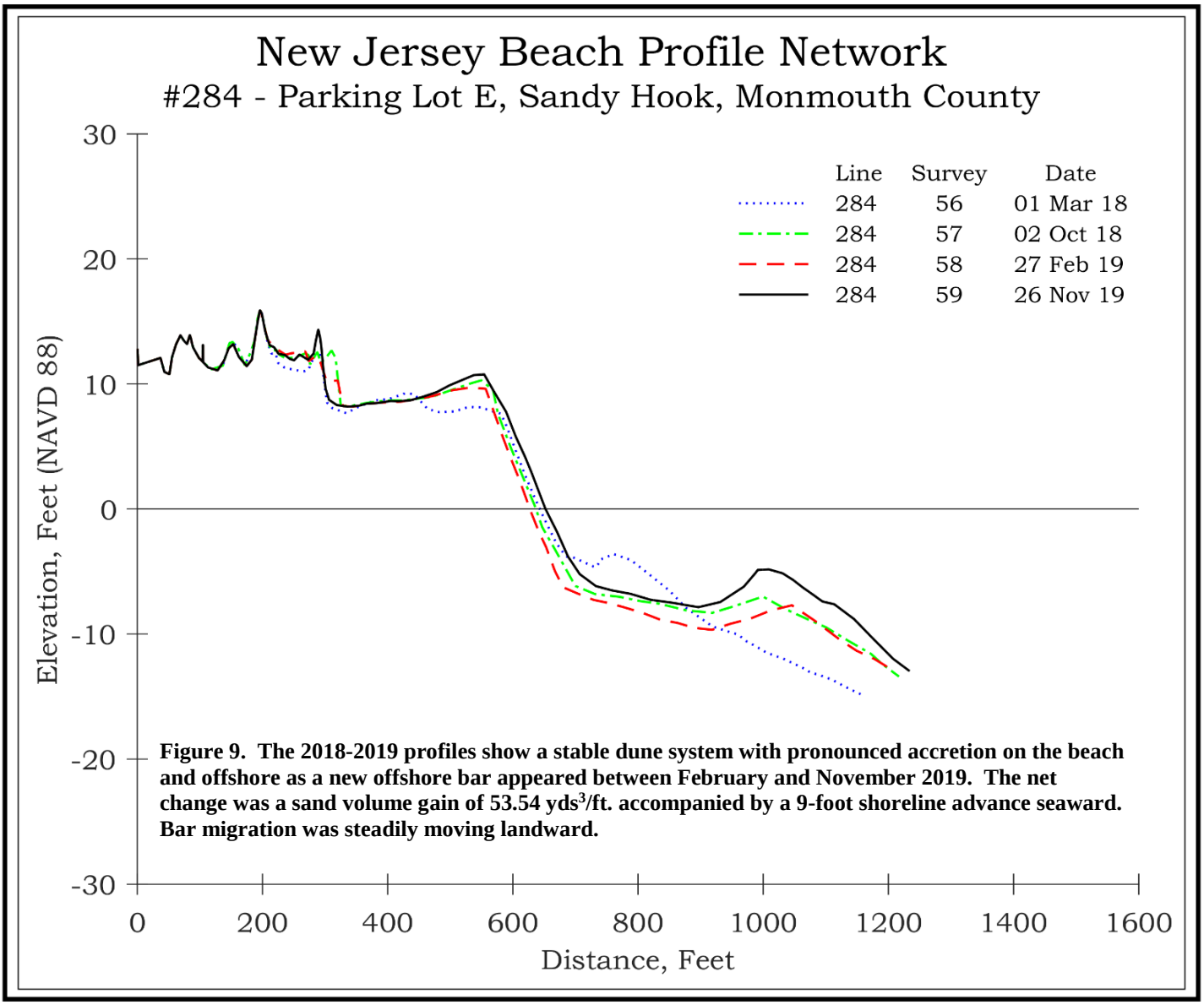


Figure 9. The 2018-2019 profiles show a stable dune system with pronounced accretion on the beach and offshore as a new offshore bar appeared between February and November 2019. The net change was a sand volume gain of 53.54 yds^3/ft. accompanied by a 9-foot shoreline advance seaward. Bar migration was steadily moving landward.

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

This new USACE site shows a wide area of new dune growth as of October 2, 2018. A similar view on the right shows that the beach has narrowed at the groin by November 26, 2019. The site is located at parking lot C along the National Seashore.

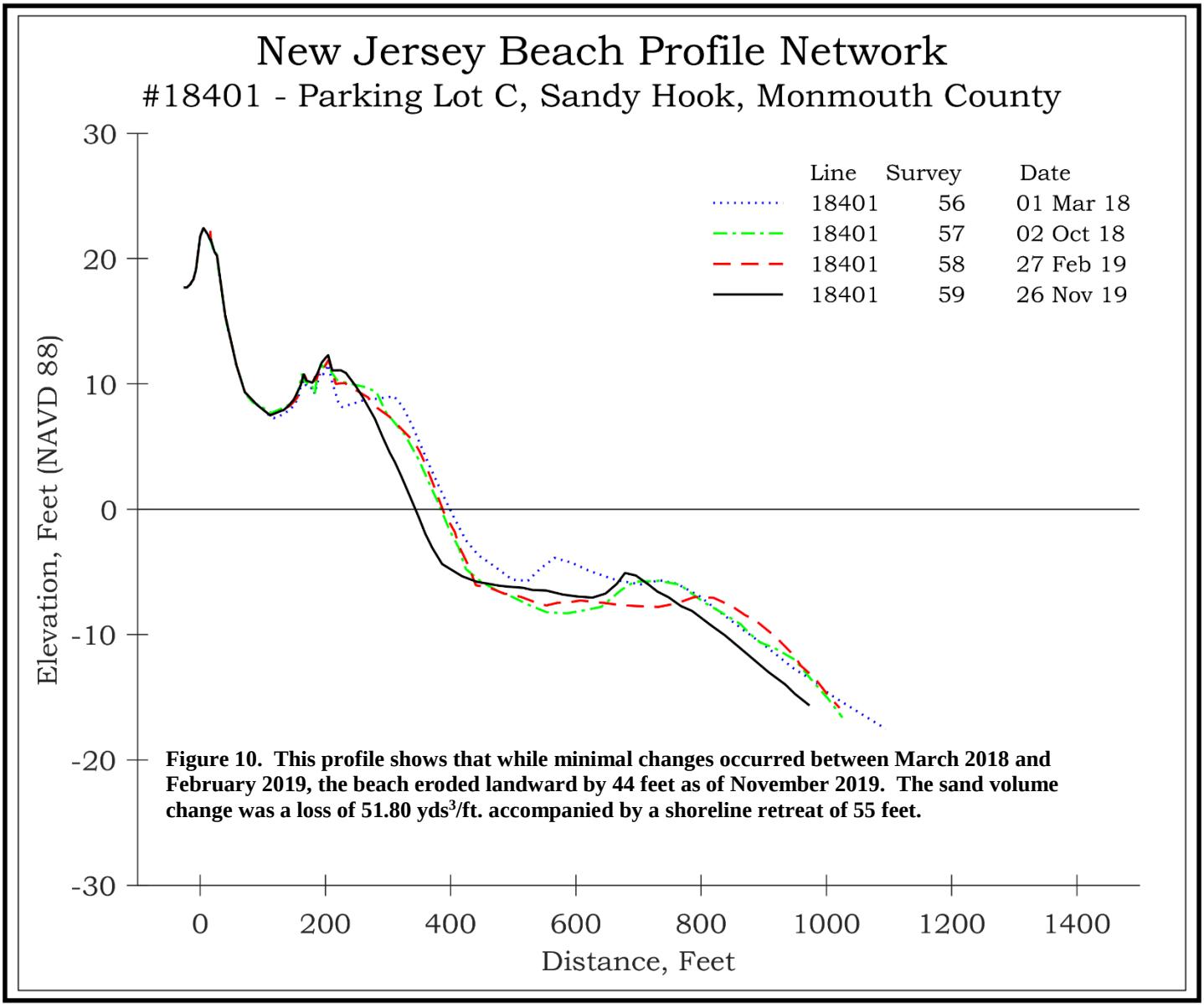


Figure 10. This profile shows that while minimal changes occurred between March 2018 and February 2019, the beach eroded landward by 44 feet as of November 2019. The sand volume change was a loss of 51.80 yds^3/ft. accompanied by a shoreline retreat of 55 feet.

NJBPN 184 – Highlands Beach, Sandy Hook National Seashore

This southern Sandy Hook site is located near the entrance to the park. The left view was taken Oct. 1, 2018. The beach and bar system were separated by over 100 feet. As of November 26, 2019 the view south from the rock seawall shows the dune system and the beach and offshore bar system.

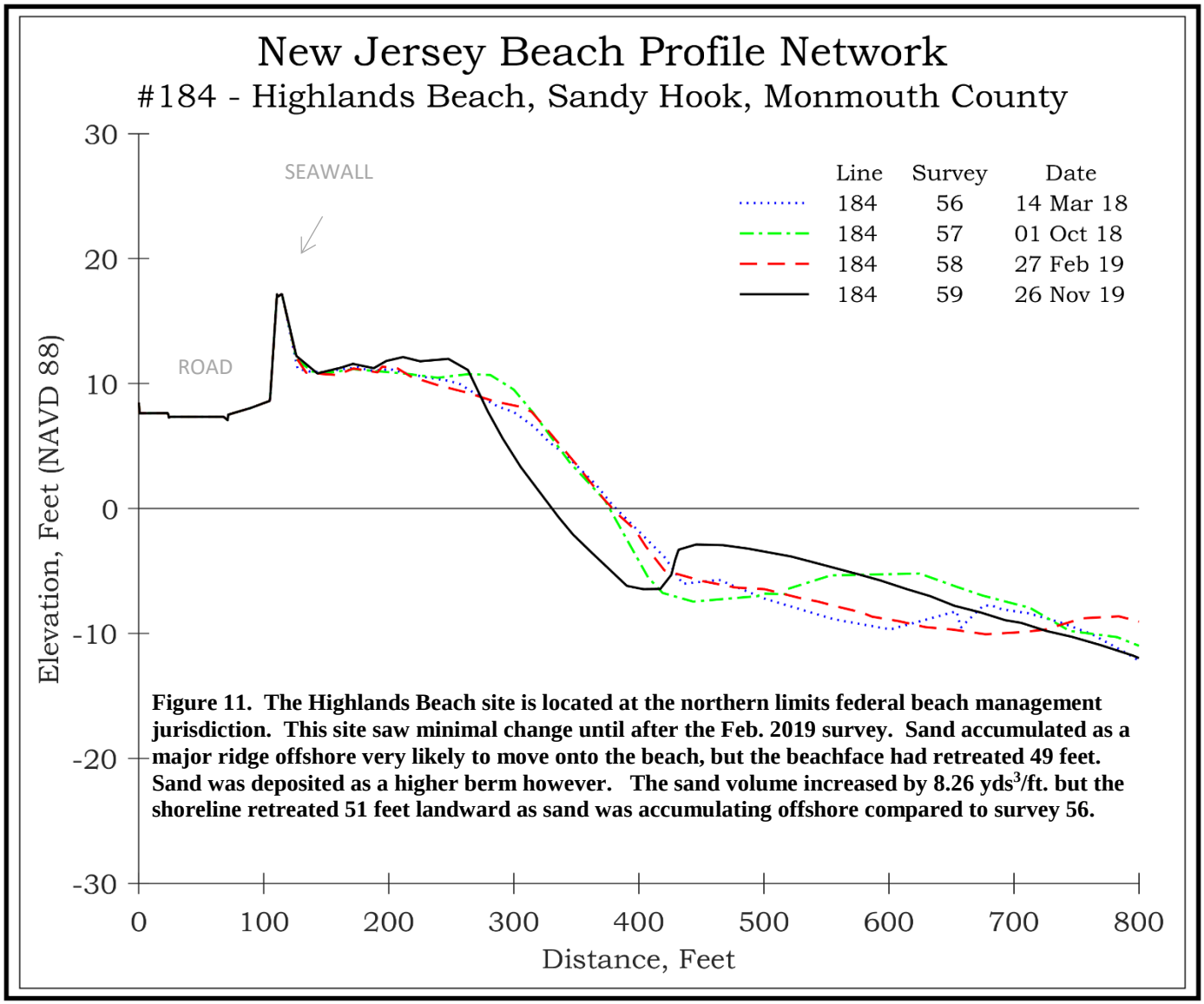


Figure 11. The Highlands Beach site is located at the northern limits federal beach management jurisdiction. This site saw minimal change until after the Feb. 2019 survey. Sand accumulated as a major ridge offshore very likely to move onto the beach, but the beachface had retreated 49 feet. Sand was deposited as a higher berm however. The sand volume increased by 8.26 $yds^3/ft.$ but the shoreline retreated 51 feet landward as sand was accumulating offshore compared to survey 56.

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 Oct. 1, 2018, while the right photo (Dec. 20, 2019) shows the beach from the dune crest.

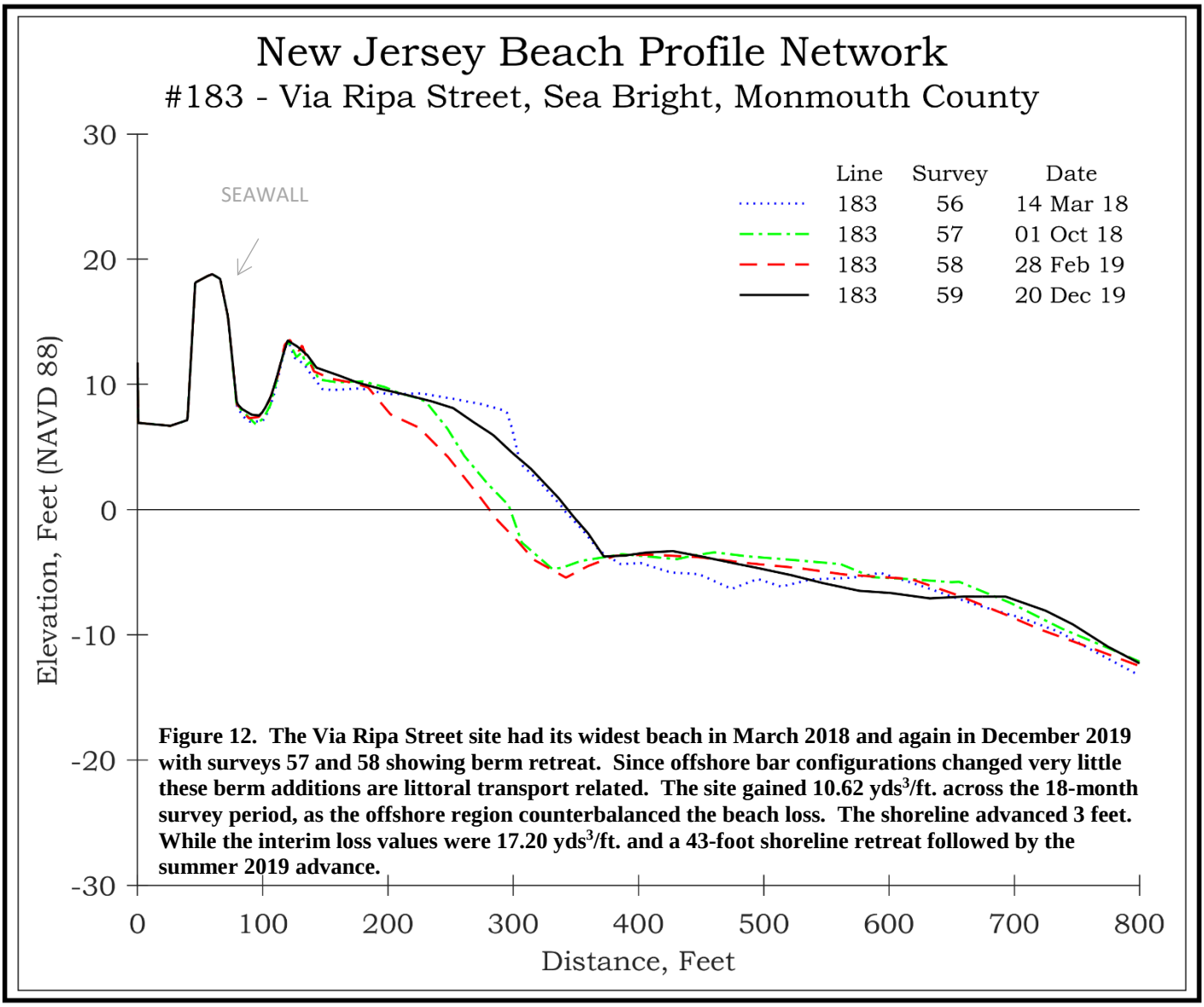
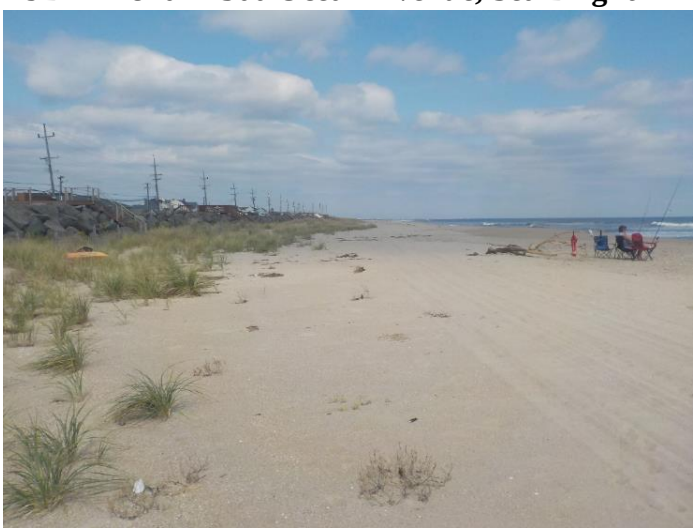


Figure 12. The Via Ripa Street site had its widest beach in March 2018 and again in December 2019 with surveys 57 and 58 showing berm retreat. Since offshore bar configurations changed very little these berm additions are littoral transport related. The site gained 10.62 yds^3/ft. across the 18-month survey period, as the offshore region counterbalanced the beach loss. The shoreline advanced 3 feet. While the interim loss values were 17.20 yds^3/ft. and a 43-foot shoreline retreat followed by the summer 2019 advance.

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 (Oct. 1, 2018). The right hand photograph was taken Dec. 20, 2019 at the seaward edge of the dune grass and appears to show minor growth.

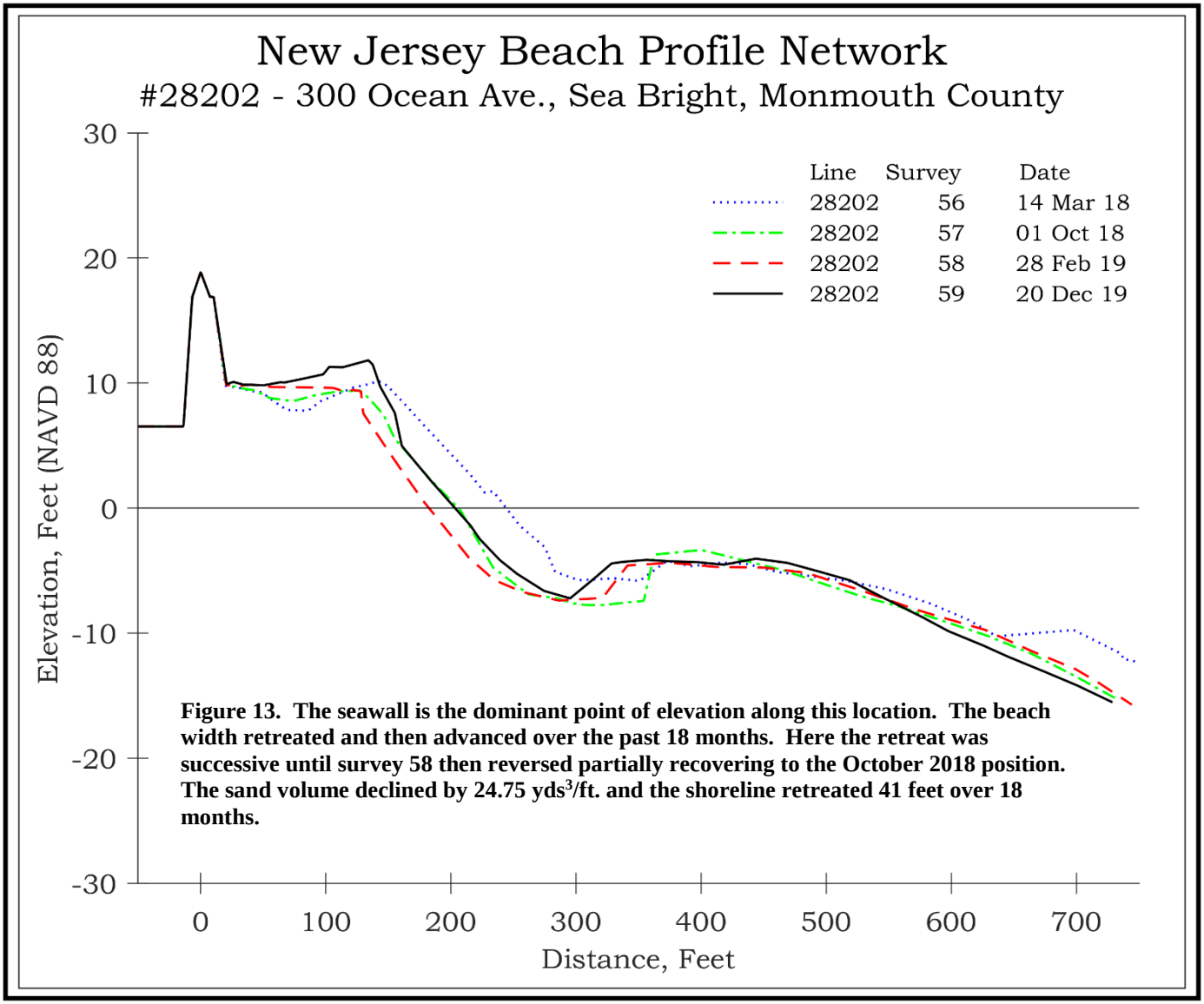


Figure 13. The seawall is the dominant point of elevation along this location. The beach width retreated and then advanced over the past 18 months. Here the retreat was successive until survey 58 then reversed partially recovering to the October 2018 position. The sand volume declined by 24.75 yds^3/ft. and the shoreline retreated 41 feet over 18 months.

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 (Oct. 3, 2018). By December 20, 2019 (on right) the grass remained consistent with minimal change to the beach.

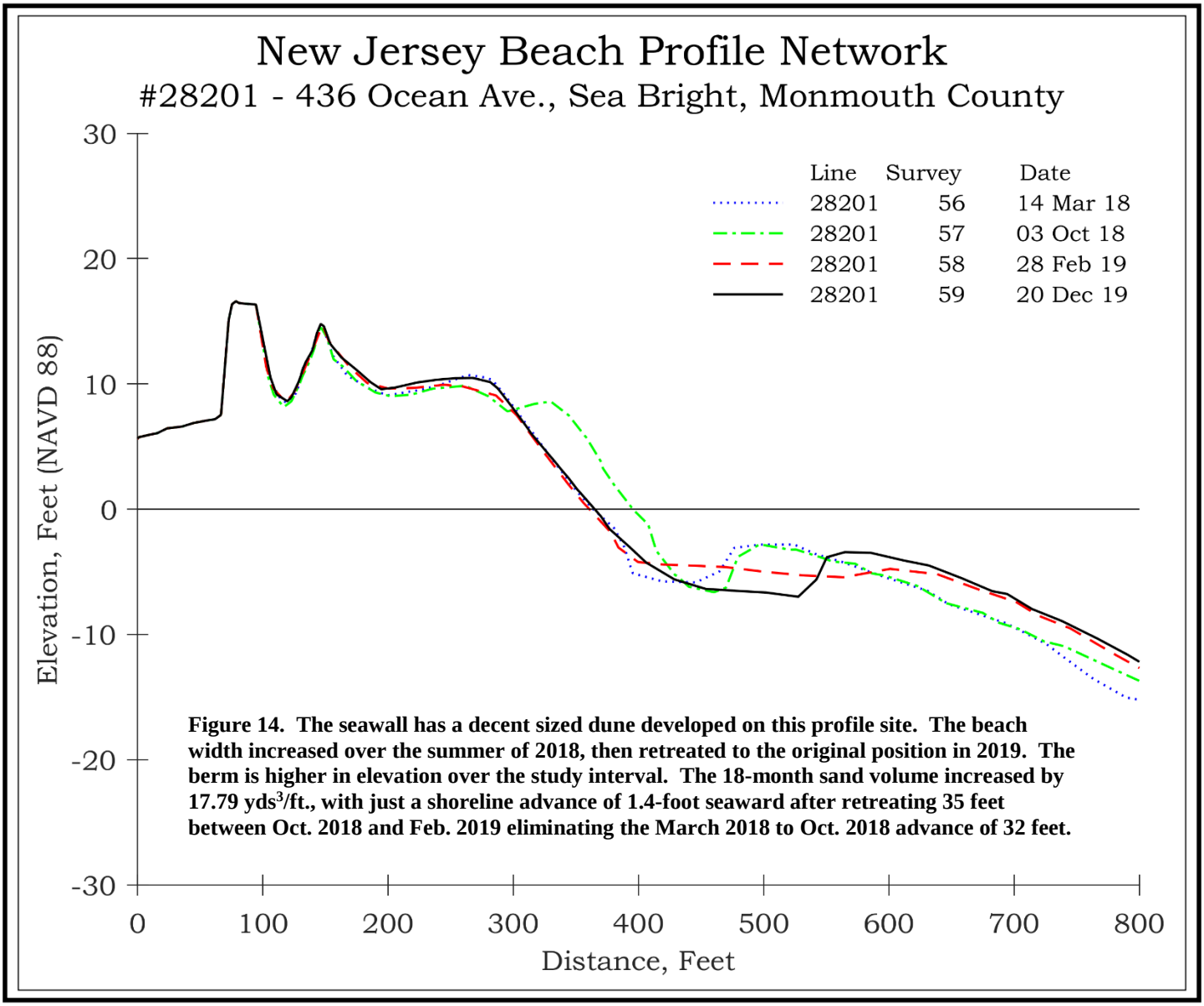


Figure 14. The seawall has a decent sized dune developed on this profile site. The beach width increased over the summer of 2018, then retreated to the original position in 2019. The berm is higher in elevation over the study interval. The 18-month sand volume increased by 17.79 yds^3/ft., with just a shoreline advance of 1.4-foot seaward after retreating 35 feet between Oct. 2018 and Feb. 2019 eliminating the March 2018 to Oct. 2018 advance of 32 feet.

NJBPN 282 – Shrewsbury Way, Sea Bright

The left view shows the federal project from the seaward edge of the seawall on Oct 3, 2018 (view to north). The right photo, from the dune crest looking north, shows the dune and beach seaward of the rock seawall on Dec. 20, 2019.

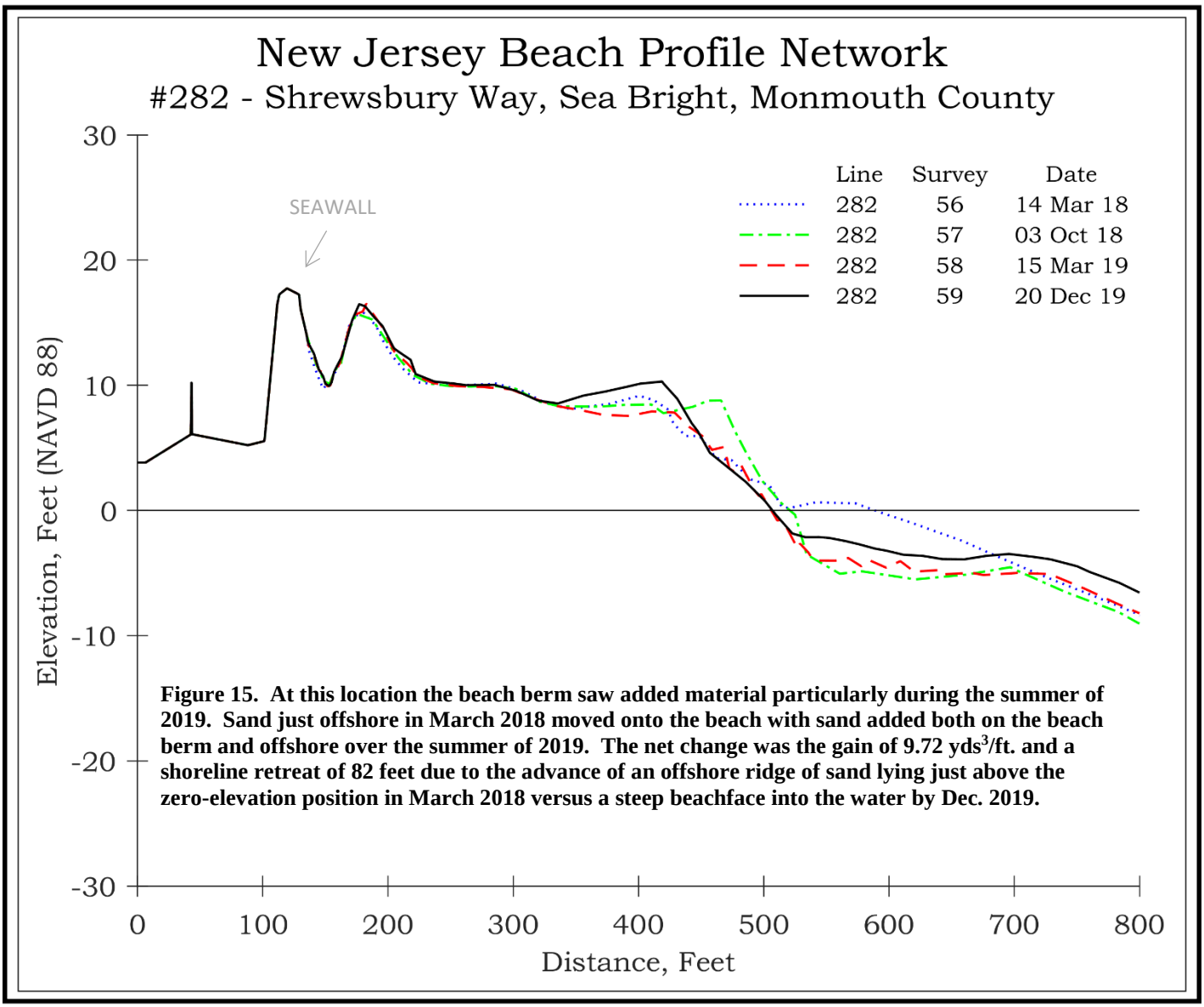


Figure 15. At this location the beach berm saw added material particularly during the summer of 2019. Sand just offshore in March 2018 moved onto the beach with sand added both on the beach berm and offshore over the summer of 2019. The net change was the gain of 9.72 yds^3/ft. and a shoreline retreat of 82 feet due to the advance of an offshore ridge of sand lying just above the zero-elevation position in March 2018 versus a steep beachface into the water by Dec. 2019.

NJBPN 18202 - 678 Ocean Avenue, Sea Bright

This site along the Sea Bright seawall shows the dune and wind deposited sand among the seaward facing rocks. The fence line showing in the photograph is the alignment that initiated sand deposition to create the dune system (Oct. 3, 2018). By December 20, 2019, (on right) the extent of grass propagation seaward is evident as a foredune development. There was no attempt along Sea Bright to actually build a dune system except place a line of fence seaward of the seawall.

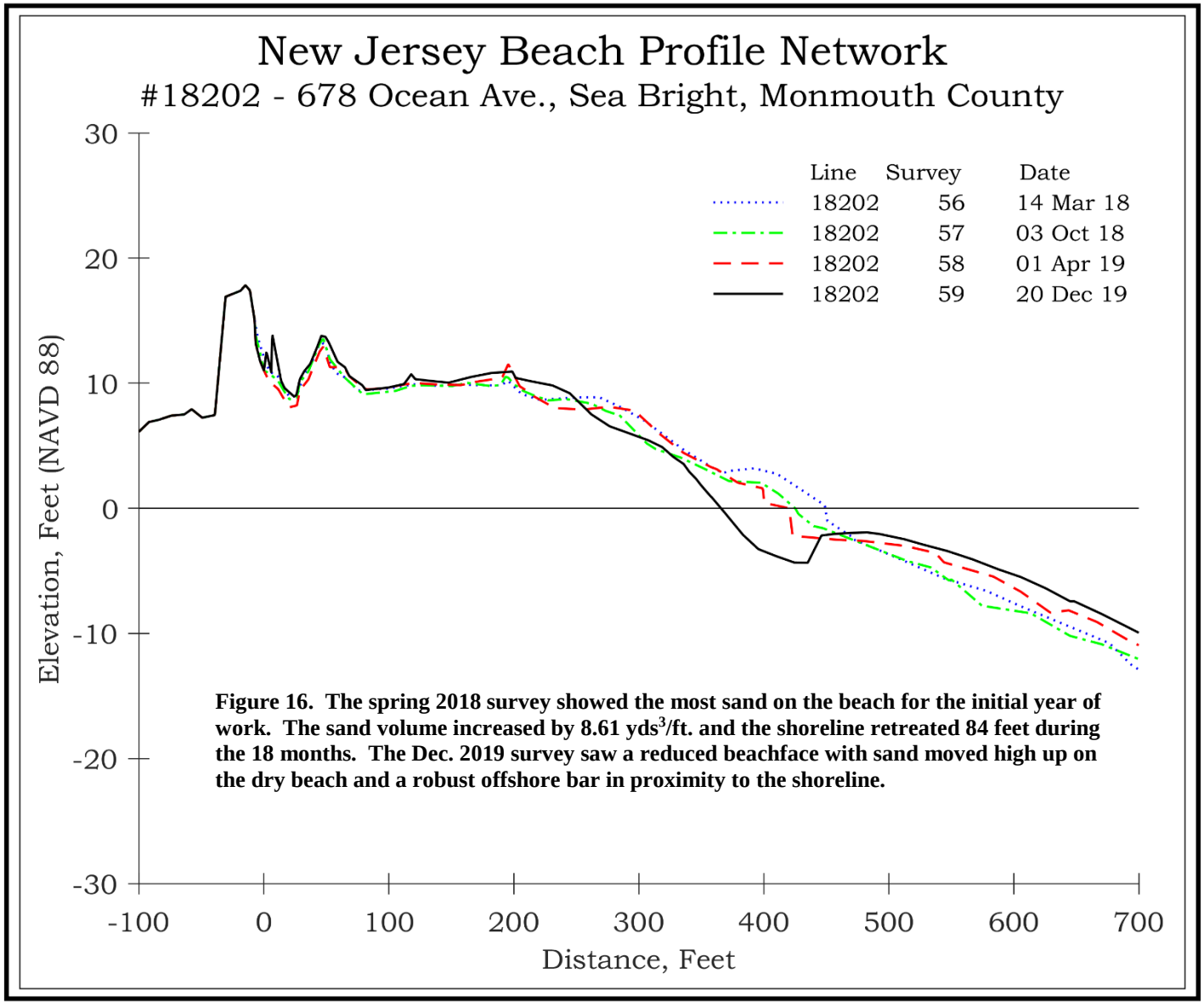


Figure 16. The spring 2018 survey showed the most sand on the beach for the initial year of work. The sand volume increased by 8.61 yds^3/ft. and the shoreline retreated 84 feet during the 18 months. The Dec. 2019 survey saw a reduced beachface with sand moved high up on the dry beach and a robust offshore bar in proximity to the shoreline.

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 a steep beachface drops into the water (Oct 3, 2018). By December 20, 2019 some beach retreat did occur, but no sand was added to the area normally the site for a dune.

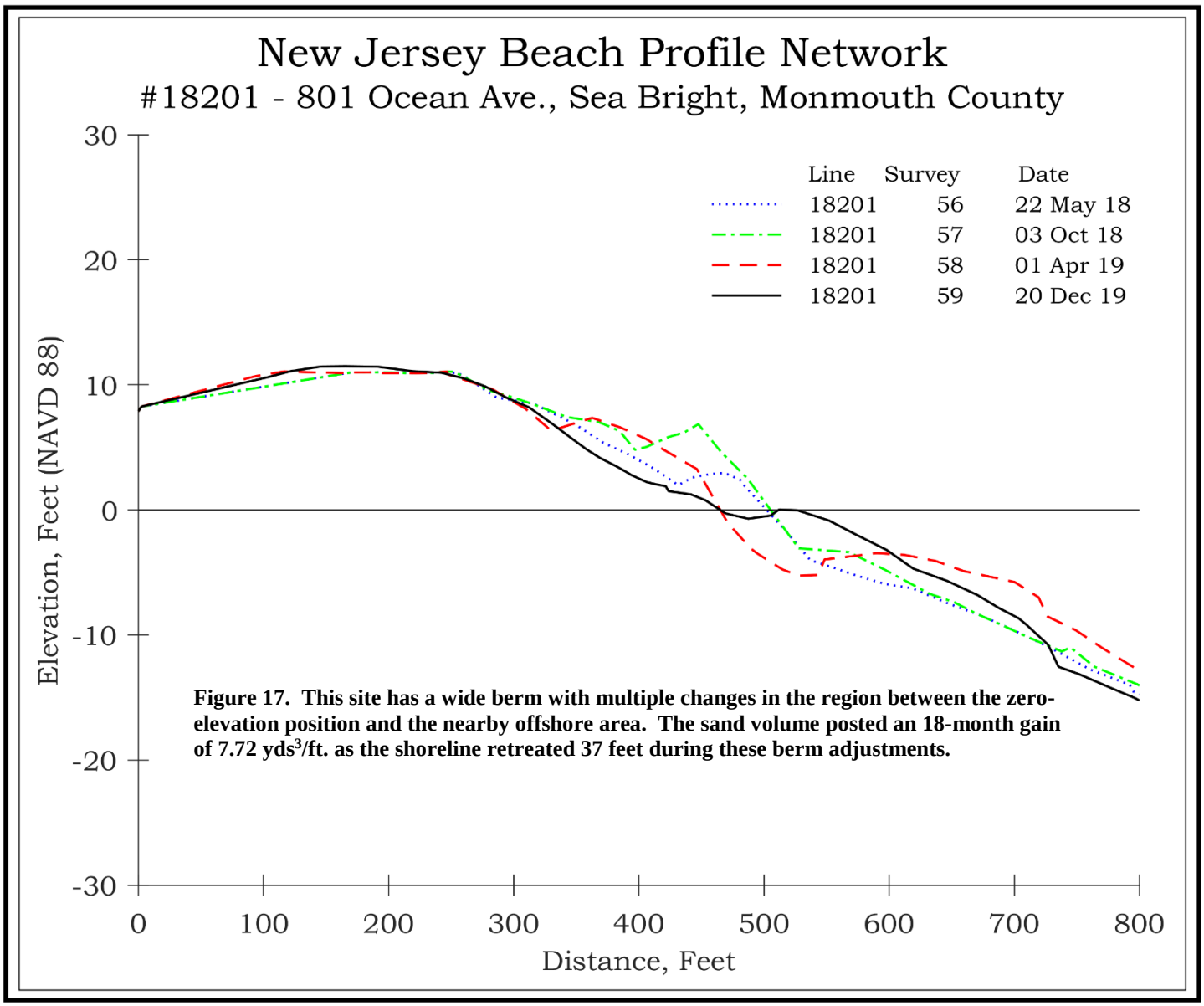


Figure 17. This site has a wide berm with multiple changes in the region between the zero-elevation position and the nearby offshore area. The sand volume posted an 18-month gain of 7.72 yds^3/ft. as the shoreline retreated 37 feet during these berm adjustments.

NJBPN 182 – Public Beach, Sea Bright

The Oct. 1, 2018 view on the left shows the berm sloping into a large runnel trough as the offshore bar migrated onto the beach at this site. The dunes exist to either side of the club, but not at the pedestrian entry paths. On the right, the December 20, 2019 view shows the expanse of dry beach seaward of the beach club.

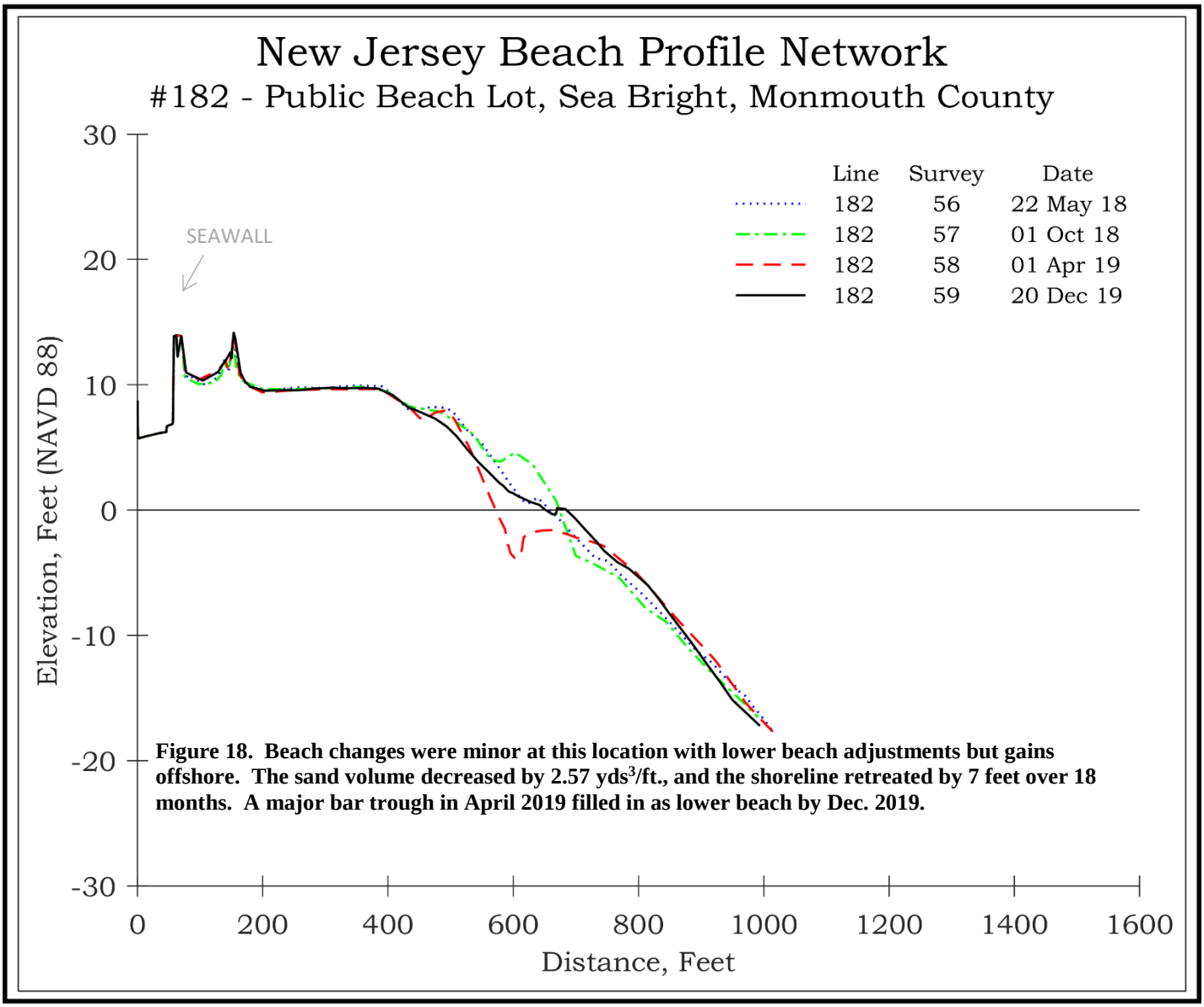


Figure 18. Beach changes were minor at this location with lower beach adjustments but gains offshore. The sand volume decreased by 2.57 yds^3/ft., and the shoreline retreated by 7 feet over 18 months. A major bar trough in April 2019 filled in as lower beach by Dec. 2019.

NJBPN 181 – Municipal Beach, Sea Bright

The December 20, 2018 view on the left side shows the berm crest following significant beach retreat. The December 22, 2019 view on the right seems to indicate that retreat slowed considerably based on the exposure of the distant rock groin.

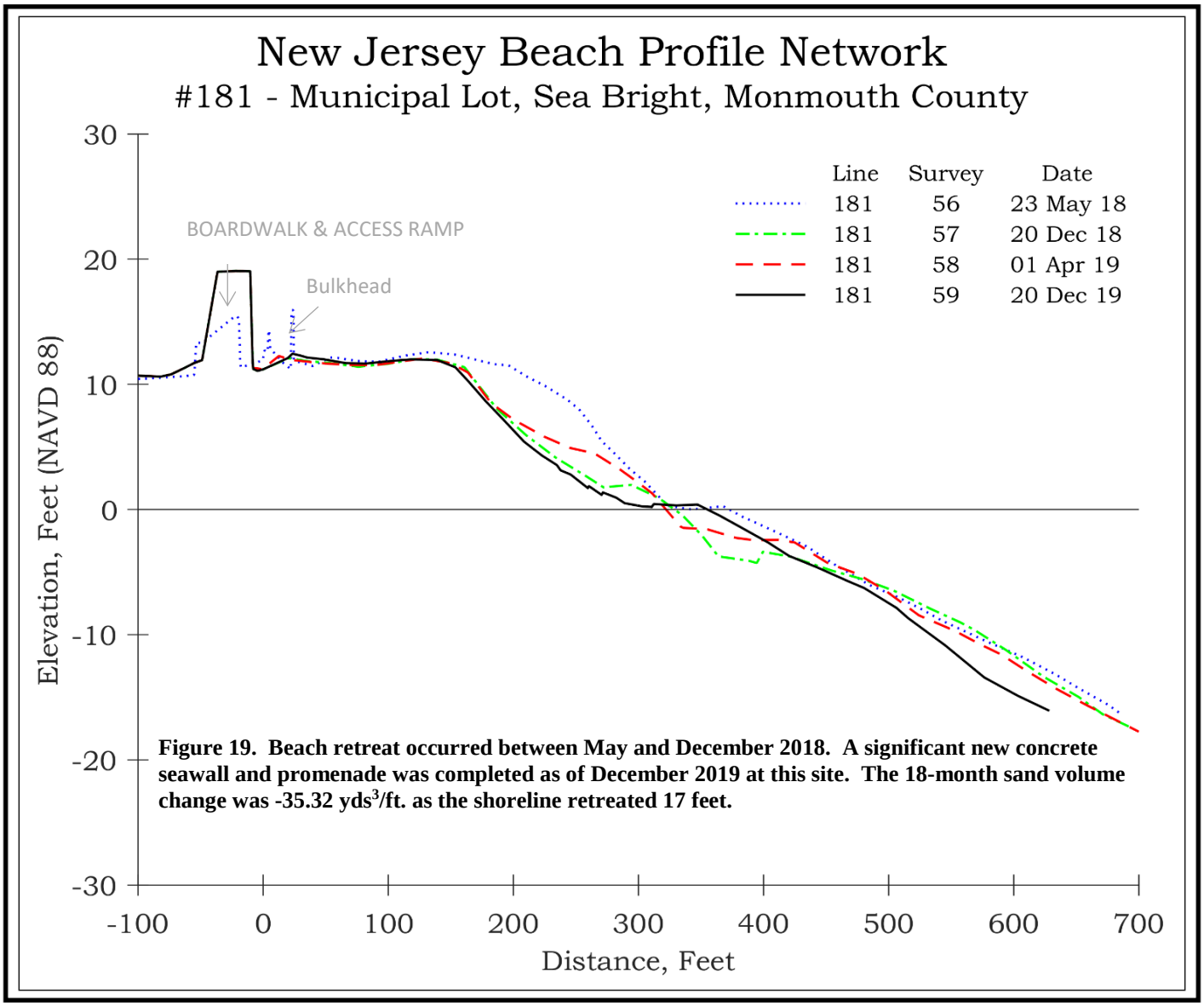
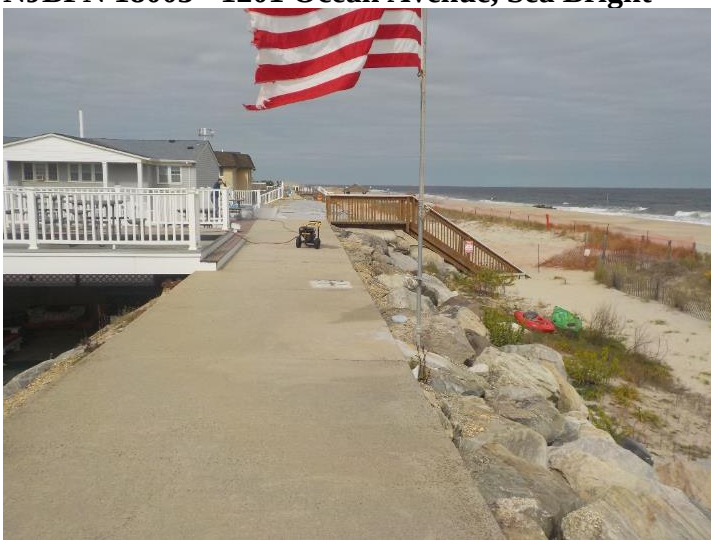


Figure 19. Beach retreat occurred between May and December 2018. A significant new concrete seawall and promenade was completed as of December 2019 at this site. The 18-month sand volume change was -35.32 yds^3/ft. as the shoreline retreated 17 feet.

NJBPN 18003 - 1201 Ocean Avenue, Sea Bright



This site starts at the rock seawall with a small dune present on the landward beach's first 100 feet of width (Oct. 5, 2018 on left). The Jan. 30, 2020 view on the right shows little change in the dune, but a narrower beach.

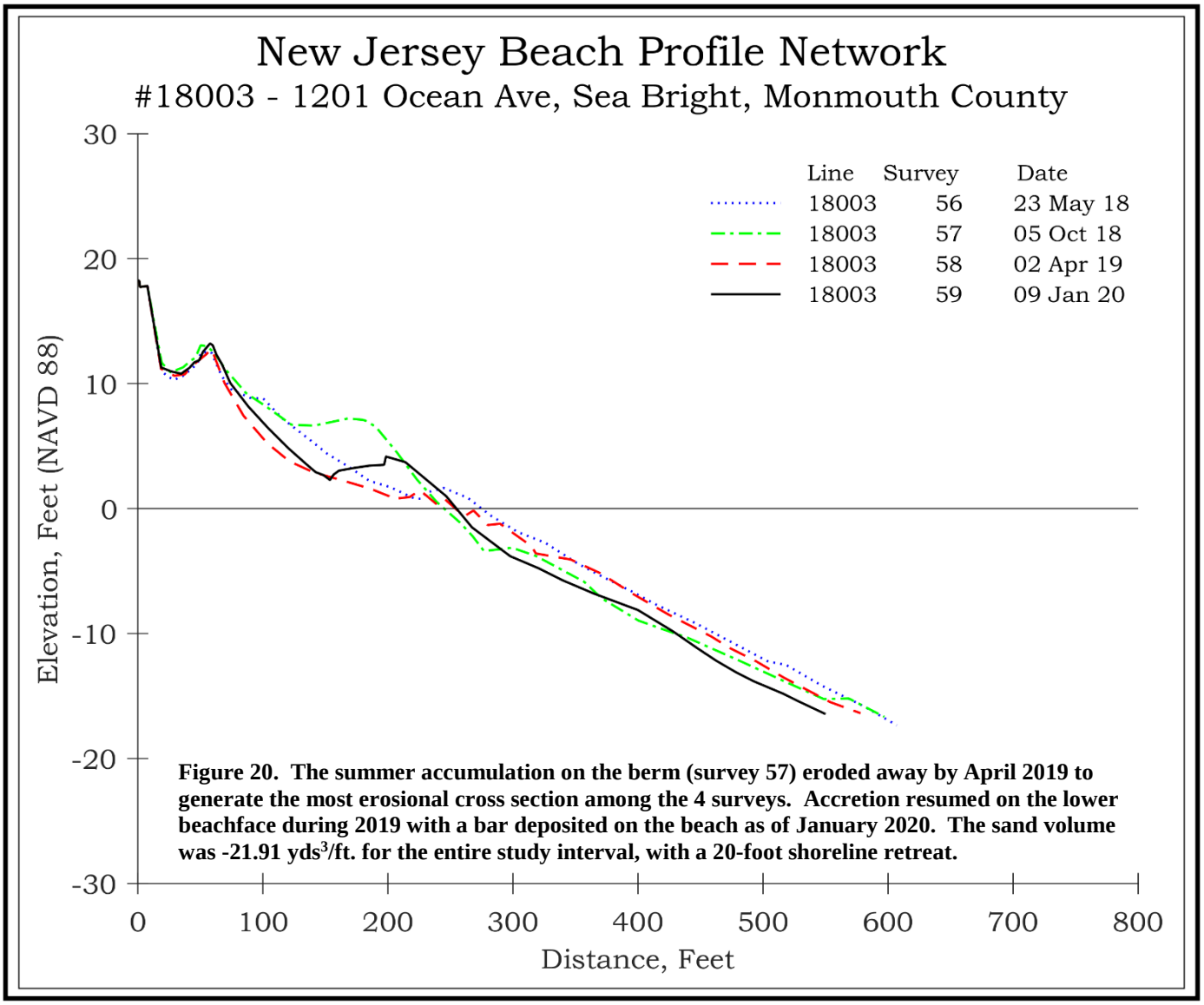


Figure 20. The summer accumulation on the berm (survey 57) eroded away by April 2019 to generate the most erosional cross section among the 4 surveys. Accretion resumed on the lower beachface during 2019 with a bar deposited on the beach as of January 2020. The sand volume was -21.91 yds^3/ft. for the entire study interval, with a 20-foot shoreline retreat.

NJBPN 18002 - 15 Tradewinds Ln., Sea Bright

The dune at this location has developed along the single row of fencing. The beach width here has declined since Jan. 2018. The December 2018 view shows minimal beach seaward of the dune. By Jan. 30, 2020 some dune vegetation loss is evident, but sand has blown over the dune toward the rock wall.

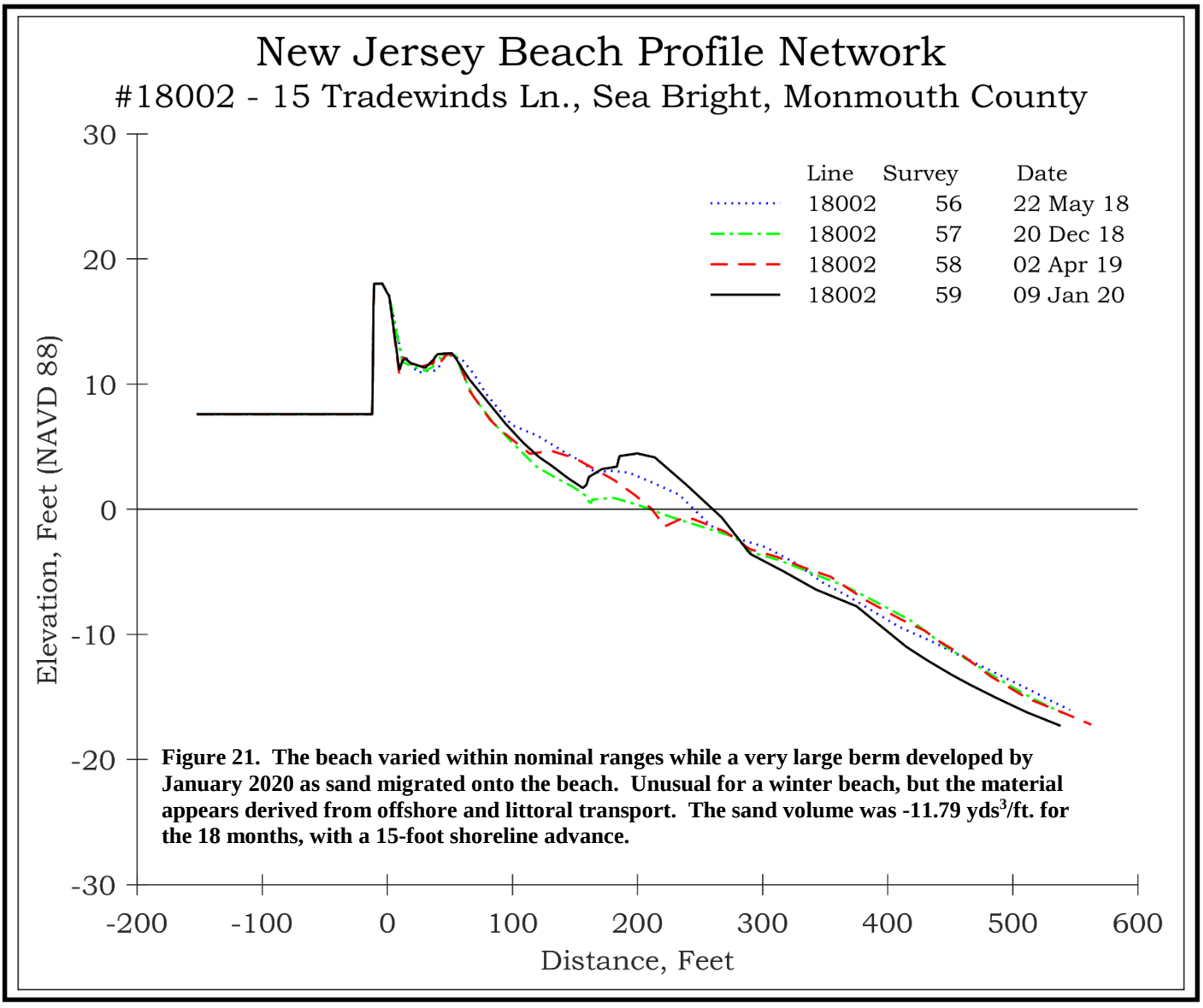


Figure 21. The beach varied within nominal ranges while a very large berm developed by January 2020 as sand migrated onto the beach. Unusual for a winter beach, but the material appears derived from offshore and littoral transport. The sand volume was -11.79 yds^3/ft. for the 18 months, with a 15-foot shoreline advance.

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, a fairly narrow beach that is losing sand (left view Jan. 9, 2019). As of Jan. 30, 2020, 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.

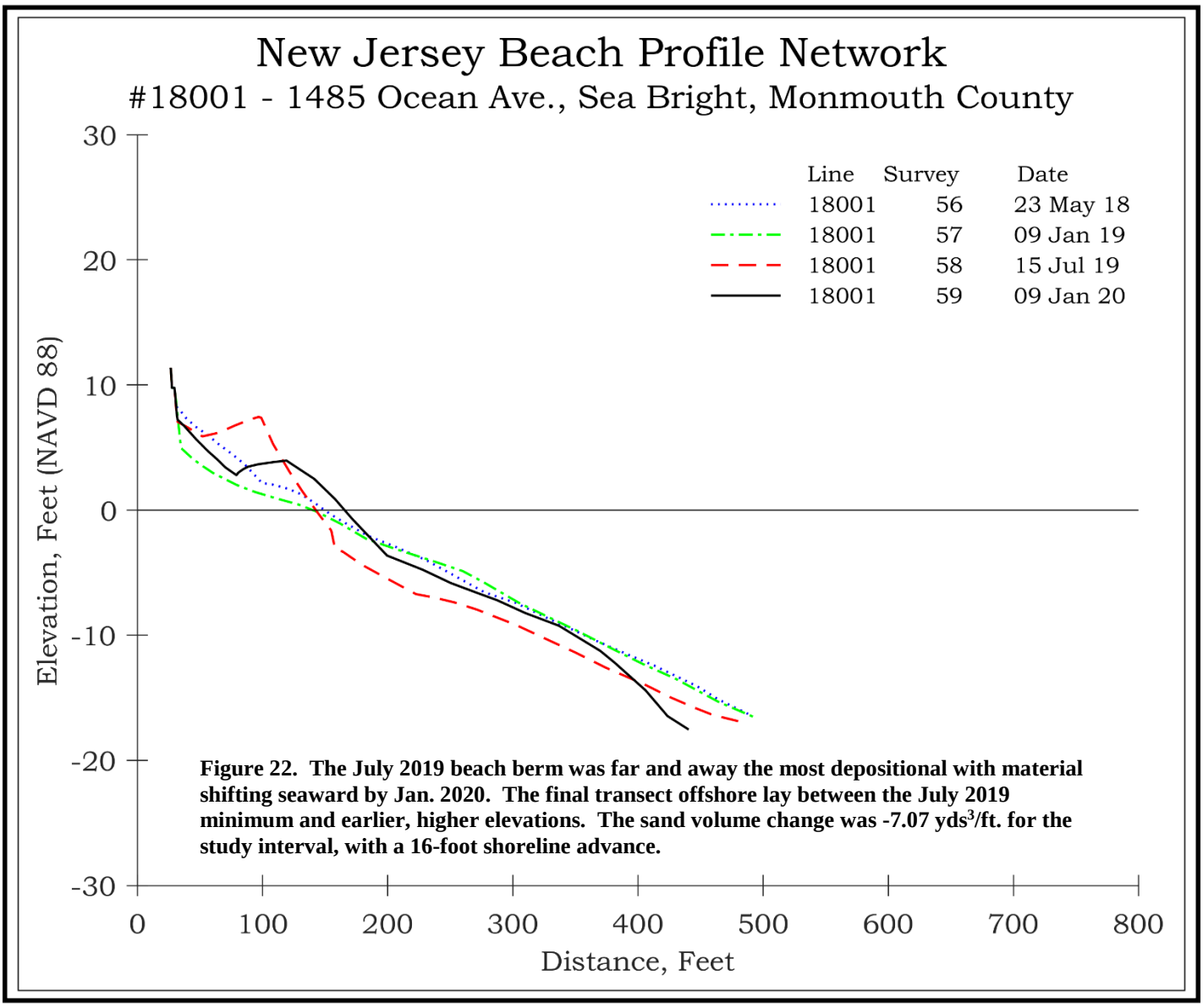


Figure 22. The July 2019 beach berm was far and away the most depositional with material shifting seaward by Jan. 2020. The final transect offshore lay between the July 2019 minimum and earlier, higher elevations. The sand volume change was -7.07 yds^3/ft. for the study interval, with a 16-foot shoreline advance.

NJBPN 180 – Sunset Court, Sea Bright

The view on the left taken Dec. 18, 2018 shows the sand build-up on the dune at the seaward slope (on left). By December 22, 2019 the fence area filled in with new grass and growth was extensive on the dune.

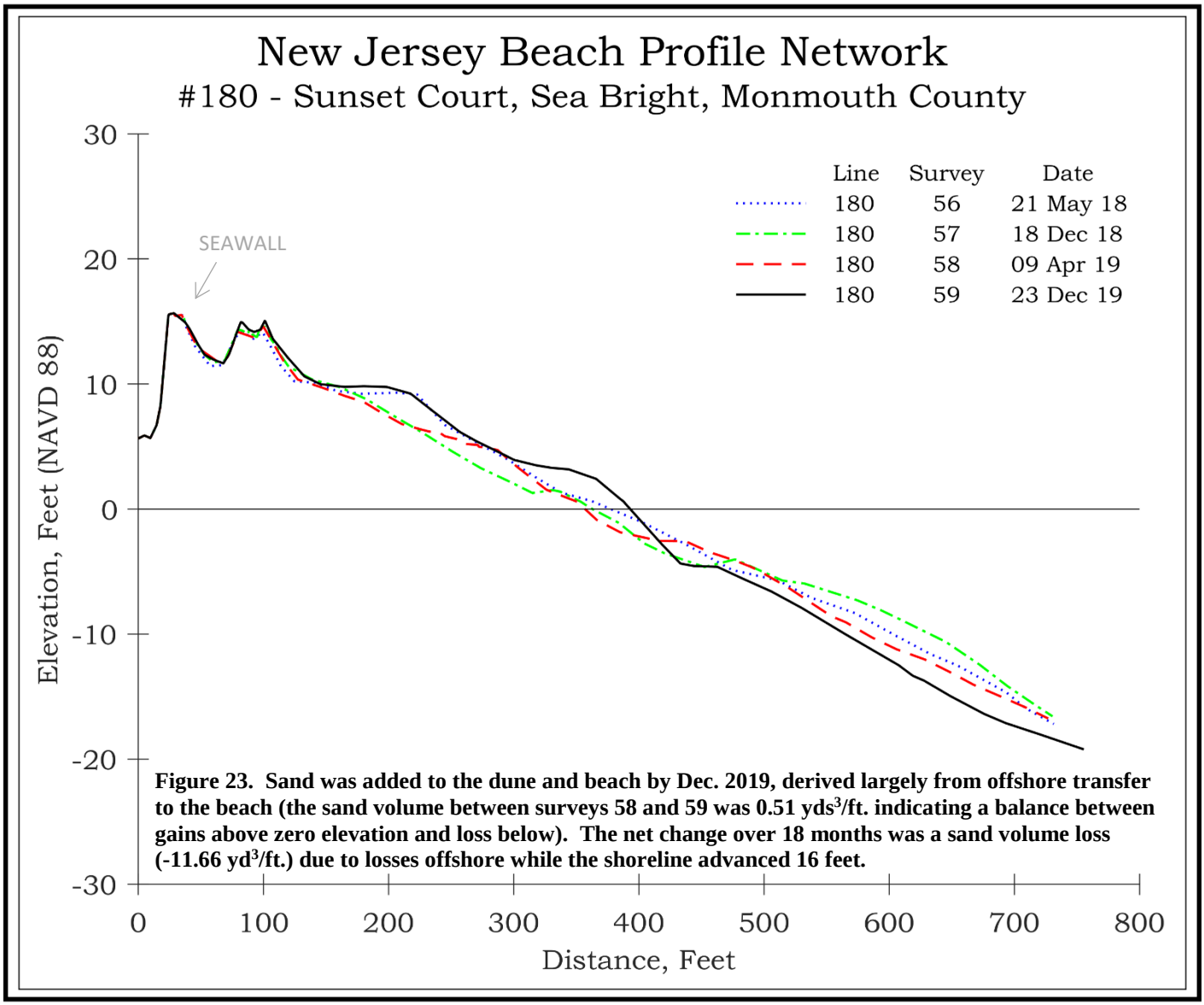


Figure 23. Sand was added to the dune and beach by Dec. 2019, derived largely from offshore transfer to the beach (the sand volume between surveys 58 and 59 was 0.51 yds^3/ft. indicating a balance between gains above zero elevation and loss below). The net change over 18 months was a sand volume loss (-11.66 yd^3/ft.) due to losses offshore while the shoreline advanced 16 feet.

NJBPN 17901 - 122 Ocean Avenue, Monmouth Beach

The left view from December 18, 2018 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 Dec. 23, 2019 and shows extensive grass growth with dune mounds appearing on the beach.

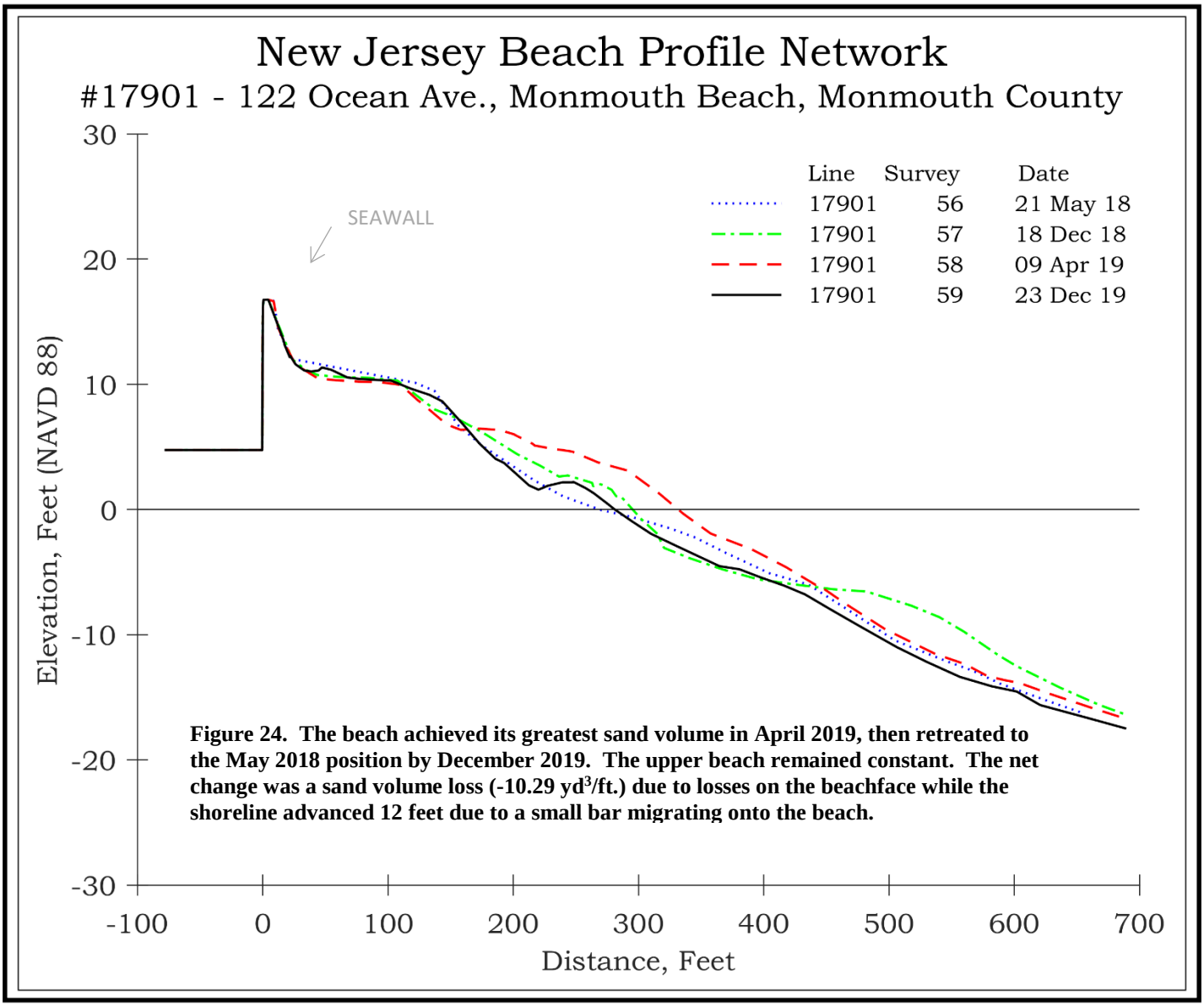


Figure 24. The beach achieved its greatest sand volume in April 2019, then retreated to the May 2018 position by December 2019. The upper beach remained constant. The net change was a sand volume loss (-10.29 $yd^3/ft.$) due to losses on the beachface while the shoreline advanced 12 feet due to a small bar migrating onto the beach.

NJBPN 179 – Cottage Road, Monmouth Beach

This site has been where the worst erosion occurs in Monmouth County. The left photograph December 20, 2018 shows the existing beach has narrowed the point where the dune becomes in jeopardy. The right-side view demonstrates that the erosion has chewed into the dunes by December 23, 2020.

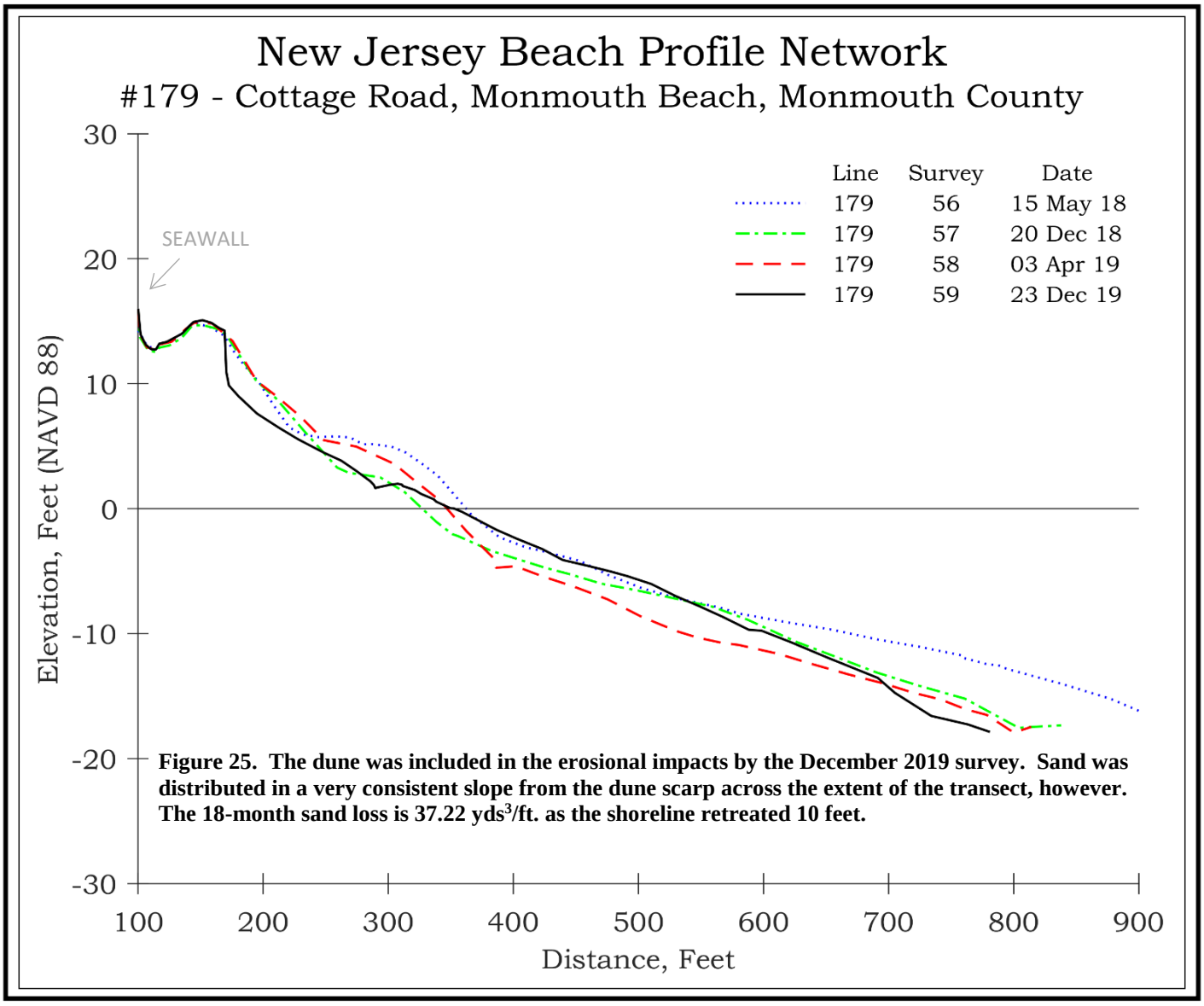


Figure 25. The dune was included in the erosional impacts by the December 2019 survey. Sand was distributed in a very consistent slope from the dune scarp across the extent of the transect, however. The 18-month sand loss is 37.22 yds^3/ft. as the shoreline retreated 10 feet.

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 20, 2018). The beach width has decreased on the right view (December 23, 2019) and the fencing has been removed allowing sand to blow up onto the promenade.

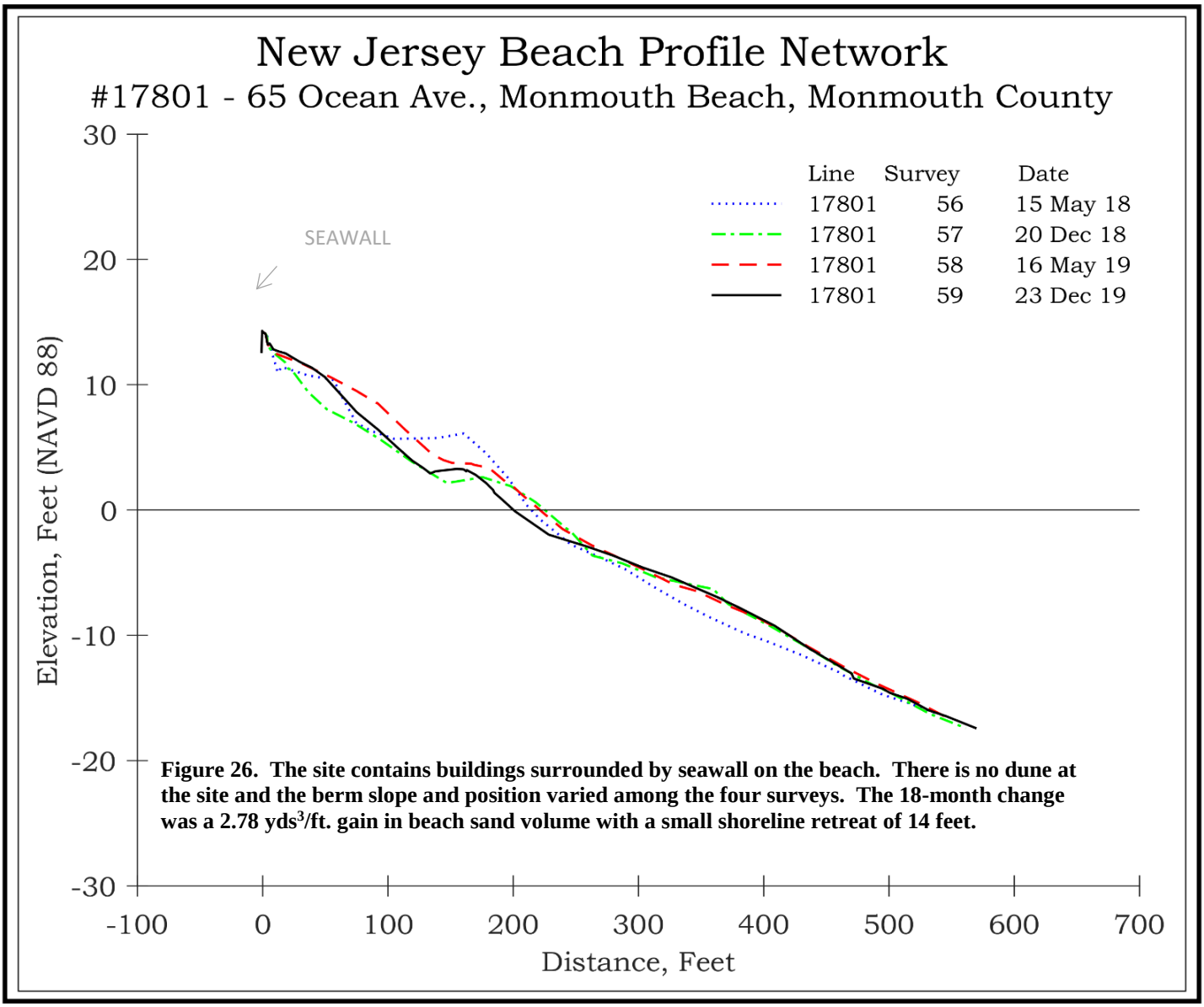


Figure 26. The site contains buildings surrounded by seawall on the beach. There is no dune at the site and the berm slope and position varied among the four surveys. The 18-month change was a 2.78 yds^3/ft. gain in beach sand volume with a small shoreline retreat of 14 feet.

NJBPN 178 – Monmouth Beach Club, Monmouth Beach

The left photo taken January 2, 2019 and shows the extensive seawall construction going on at the site establishing the rock barrier to the interior. As of December 23, 2019 the rock wall was complete and the sand pipeline was in place on the beach.

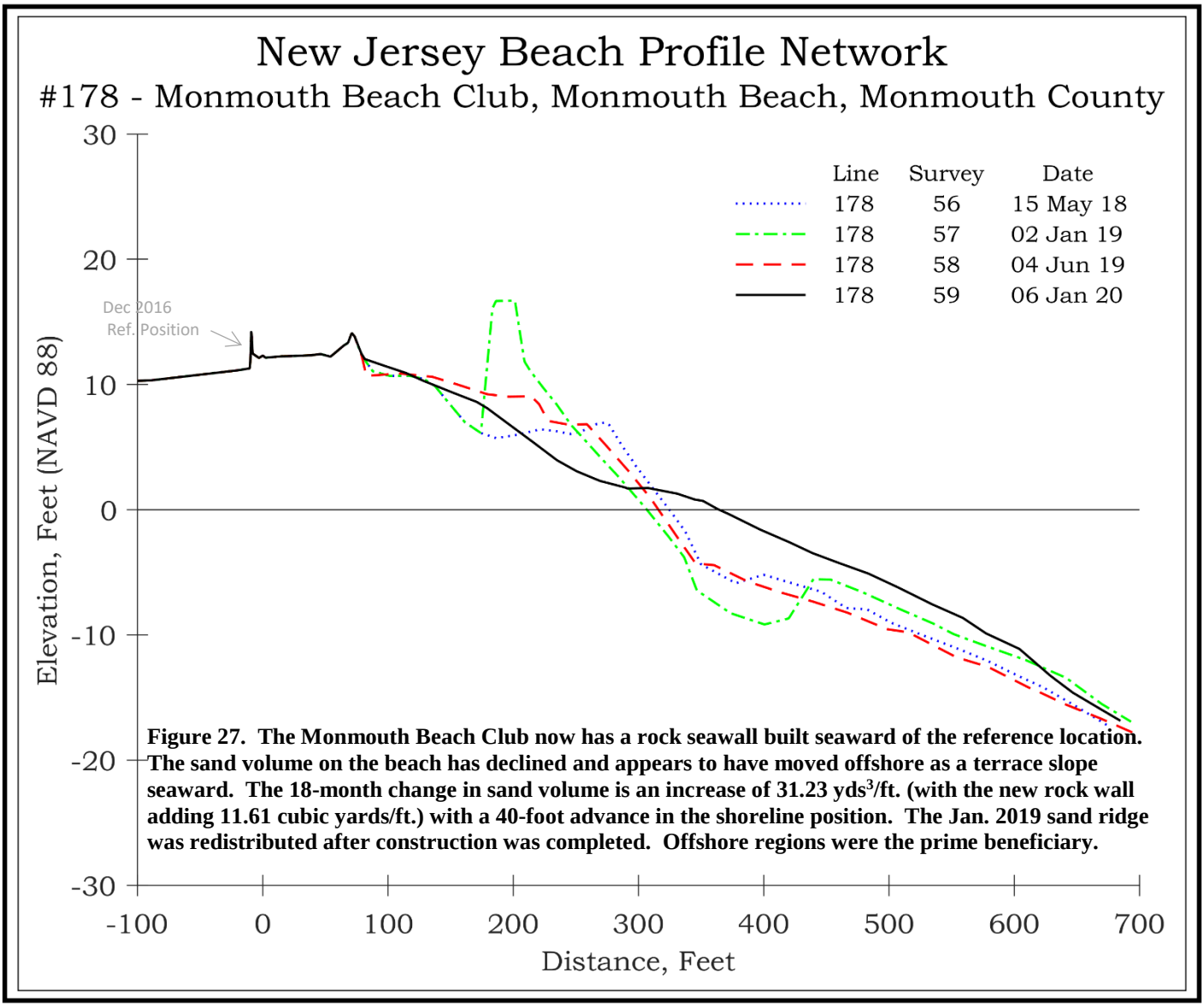


Figure 27. The Monmouth Beach Club now has a rock seawall built seaward of the reference location. The sand volume on the beach has declined and appears to have moved offshore as a terrace slope seaward. The 18-month change in sand volume is an increase of 31.23 yds^3/ft. (with the new rock wall adding 11.61 cubic yards/ft.) with a 40-foot advance in the shoreline position. The Jan. 2019 sand ridge was redistributed after construction was completed. Offshore regions were the prime beneficiary.

NJBPN 17701 - 9 Ocean Avenue, Monmouth Beach

This location has the seawall as the ultimate backstop, with a 270-foot wide beach seaward as of January 2, 2019. As of December 23, 2019, some added vegetation is evident with most of the construction activity to the north completed.

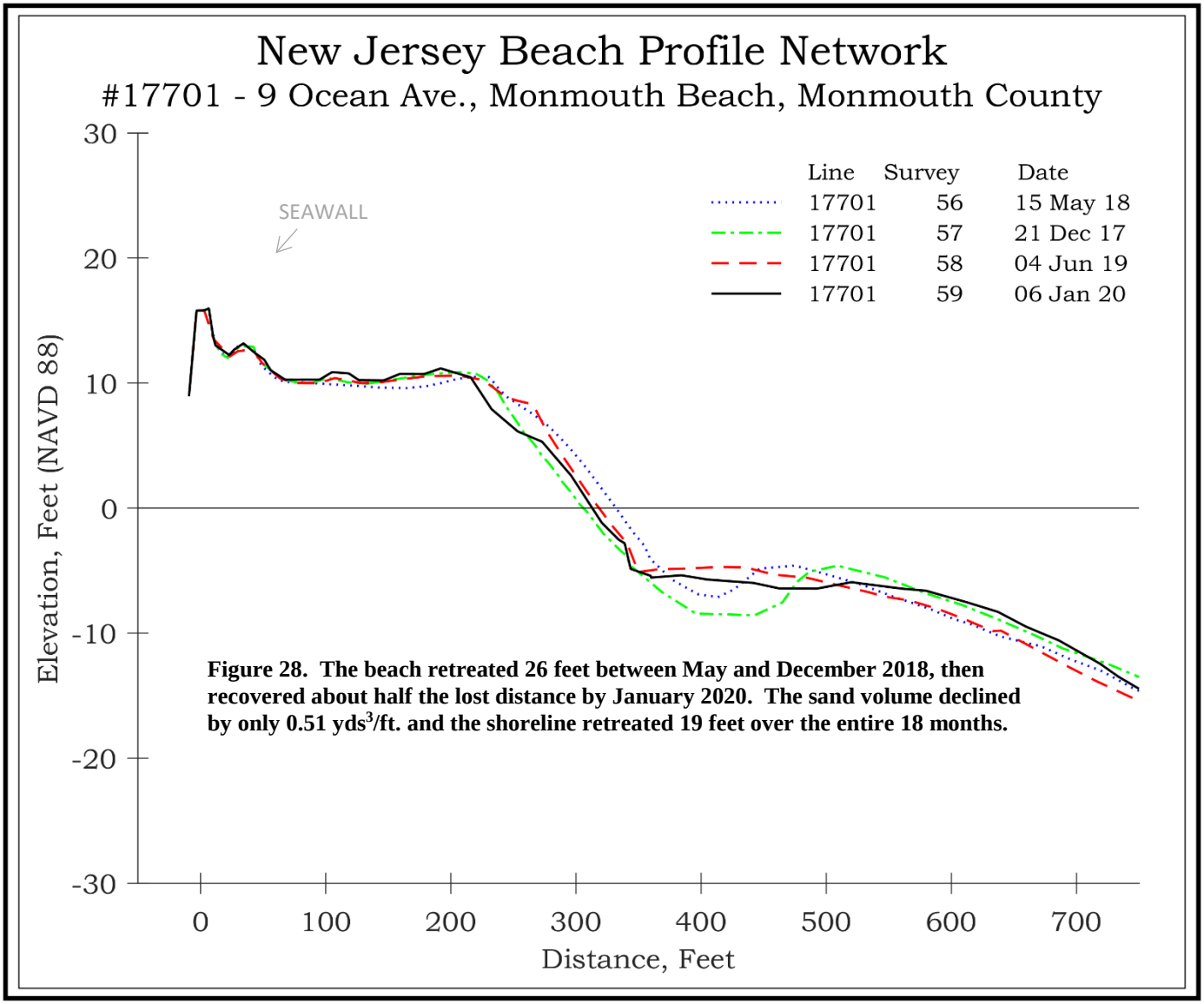
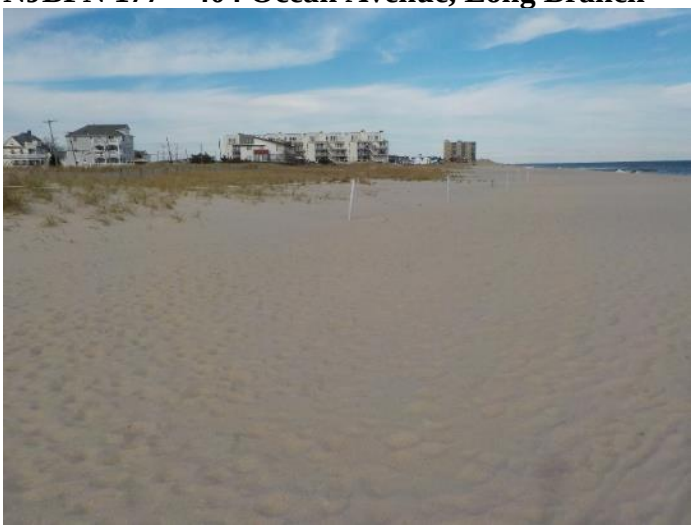


Figure 28. The beach retreated 26 feet between May and December 2018, then recovered about half the lost distance by January 2020. The sand volume declined by only 0.51 yds^3/ft. and the shoreline retreated 19 feet over the entire 18 months.

NJBPN 177 – 404 Ocean Avenue, Long Branch



The left photo was taken November 14, 2018 looking north along the dune toe. The right view along the foredune crest shows lush grass growth in the dunes, but the beach is obscured (Dec. 18, 2019).

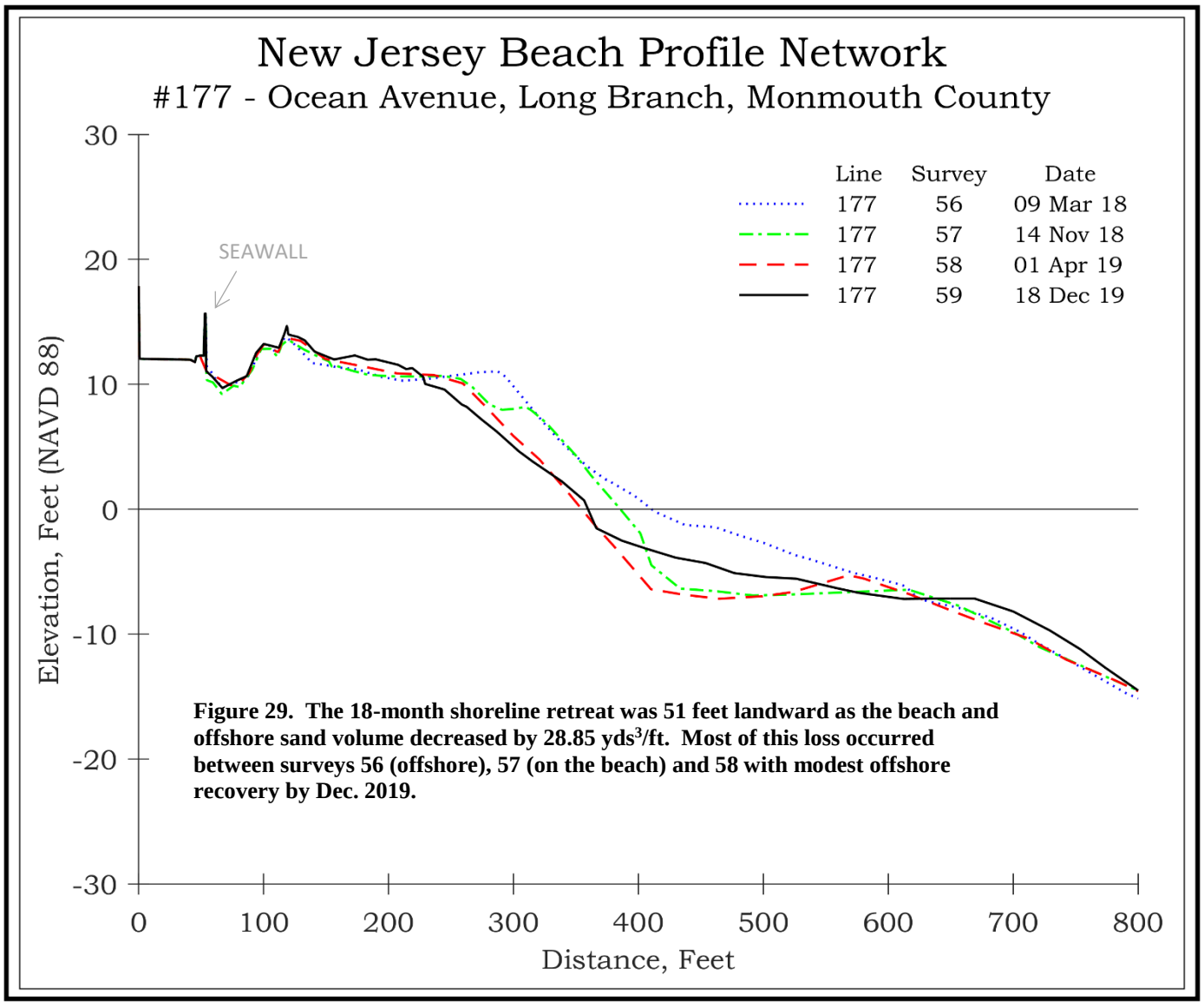


Figure 29. The 18-month shoreline retreat was 51 feet landward as the beach and offshore sand volume decreased by 28.85 yds^3/ft. Most of this loss occurred between surveys 56 (offshore), 57 (on the beach) and 58 with modest offshore recovery by Dec. 2019.

NJBPN 17601 – 300 Ocean Avenue North, Long Branch

The right view was taken Nov. 14. 2018 and shows the access pathway and the dunes with a wide beach. As of December 18, 2019 the grass had improved and fencing had been rearranged.

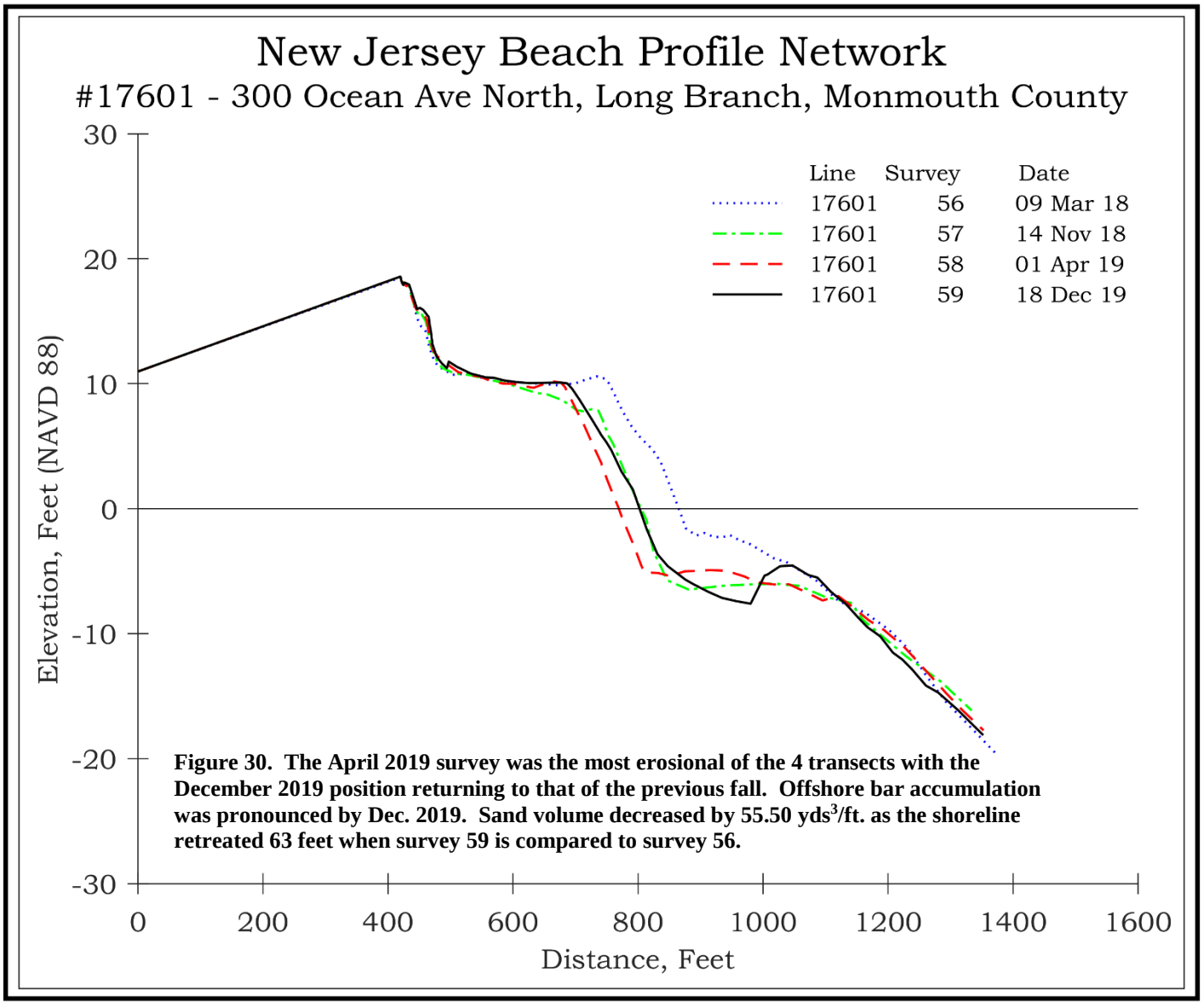


Figure 30. The April 2019 survey was the most erosional of the 4 transects with the December 2019 position returning to that of the previous fall. Offshore bar accumulation was pronounced by Dec. 2019. Sand volume decreased by 55.50 yds^3/ft. as the shoreline retreated 63 feet when survey 59 is compared to survey 56.

NJBPN 176 – Seven President's Park, Long Branch

This November 14, 2018 (left) photo shows the groin rocks were exposed with a south to north offset in the beach width. The same perspective on December 18, 2019 has the same offset with about the same level of rock exposed.

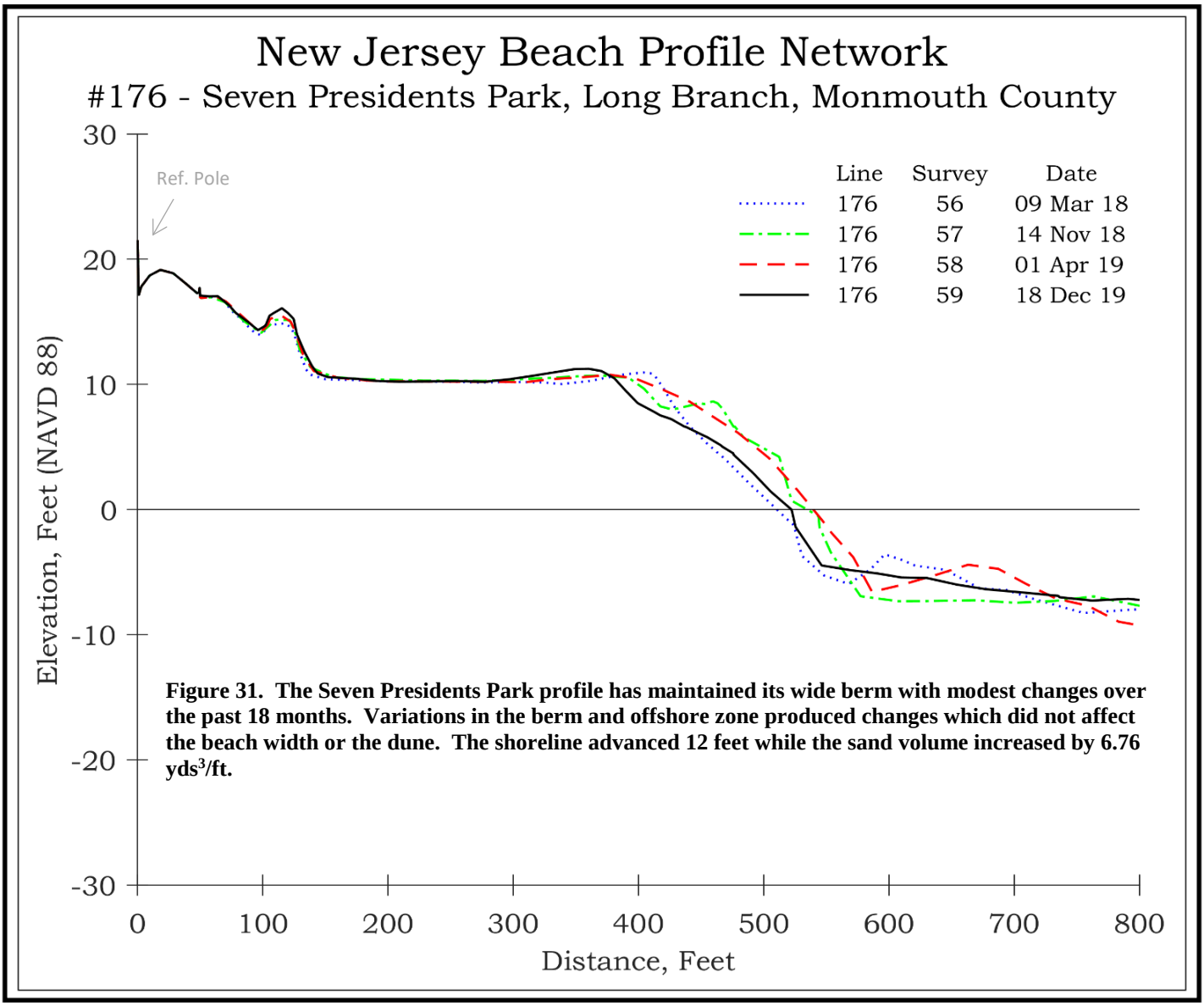
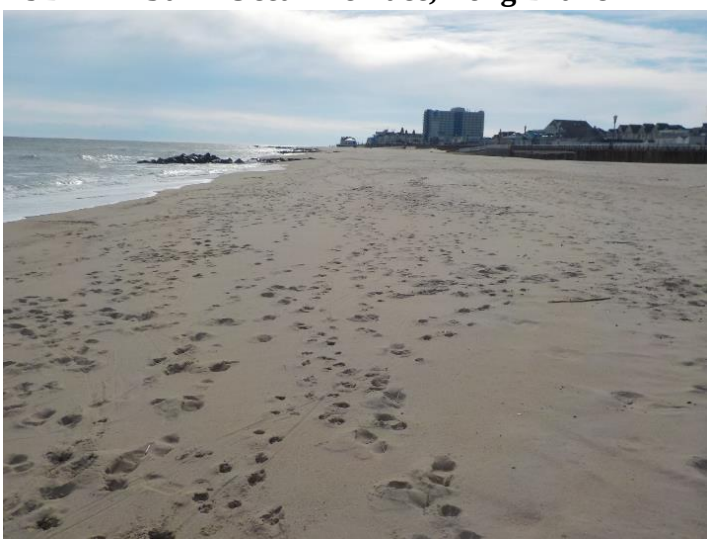


Figure 31. The Seven Presidents Park profile has maintained its wide berm with modest changes over the past 18 months. Variations in the berm and offshore zone produced changes which did not affect the beach width or the dune. The shoreline advanced 12 feet while the sand volume increased by 6.76 yds^3/ft.

NJBPN 17501 – Ocean Terrace, Long Branch



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 Nov. 14, 2018). On the right is a December 18, 2019 view in essentially the same location on the profile showing less of the groin in the distance exposed in the water, but few changes elsewhere.

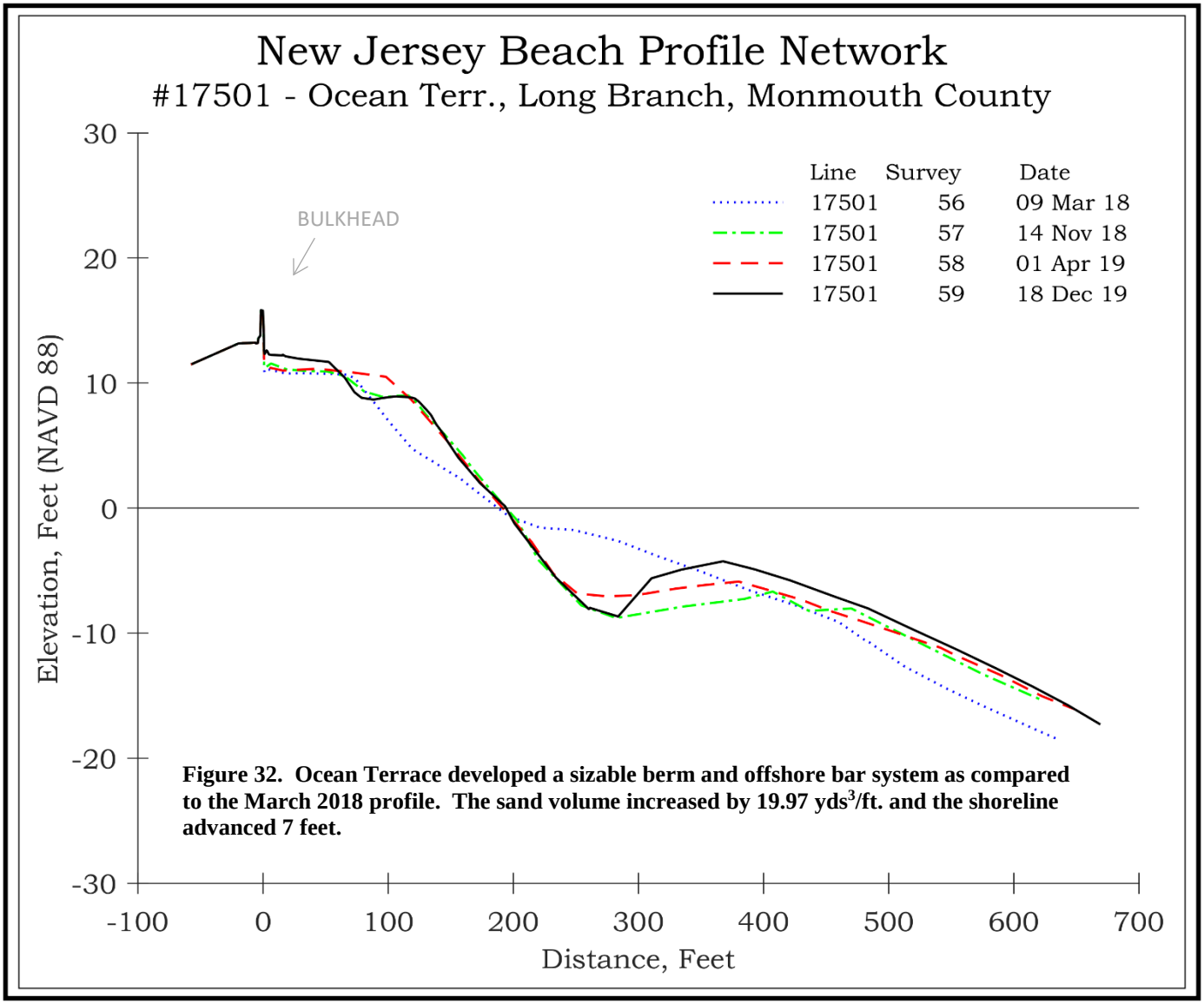
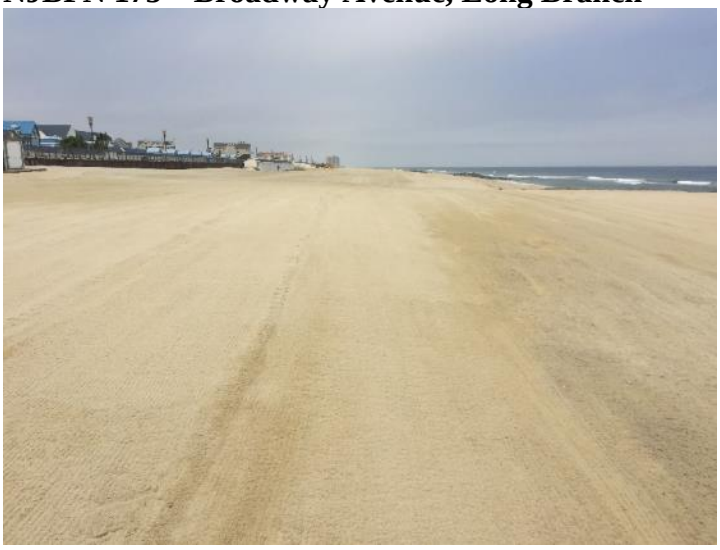


Figure 32. Ocean Terrace developed a sizable berm and offshore bar system as compared to the March 2018 profile. The sand volume increased by 19.97 yds^3/ft. and the shoreline advanced 7 feet.

NJBPN 175 – Broadway Avenue, Long Branch



The left photograph taken November 14, 2018 shows the berm in a robust condition. As of January 5, 2020 the beach was flatter with a few of the groin rocks exposed.

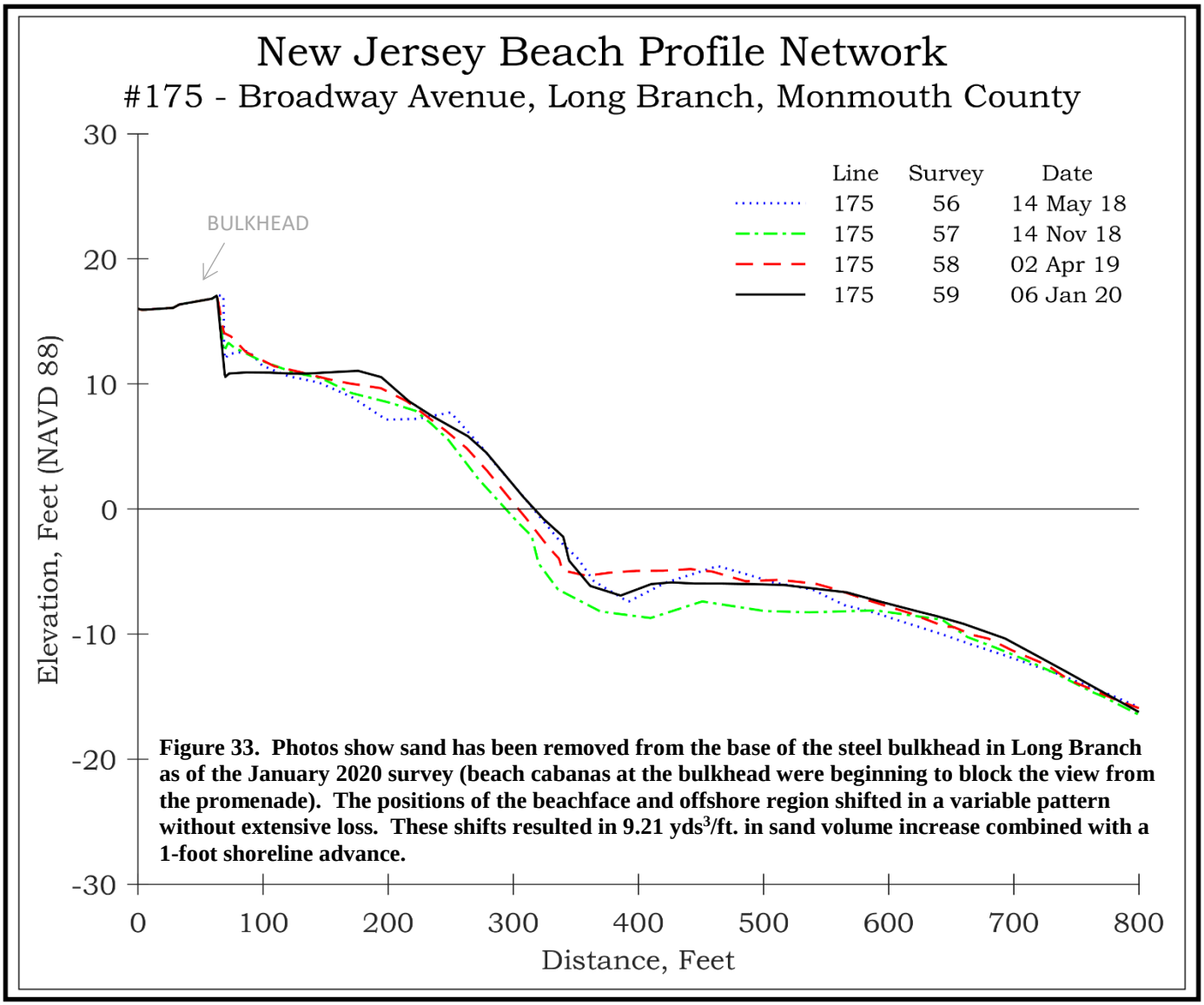


Figure 33. Photos show sand has been removed from the base of the steel bulkhead in Long Branch as of the January 2020 survey (beach cabanas at the bulkhead were beginning to block the view from the promenade). The positions of the beachface and offshore region shifted in a variable pattern without extensive loss. These shifts resulted in 9.21 yds^3/ft. in sand volume increase combined with a 1-foot shoreline advance.

NJBPN 17402 – 45 Ocean Avenue, Long Branch

The beach narrows to 150 feet without any bar system present by the fall (Nov. 27, 2018 on left). The beach remained relatively the same as of Jan. 6, 2020 if the distant groin rock exposure is compared (on right).

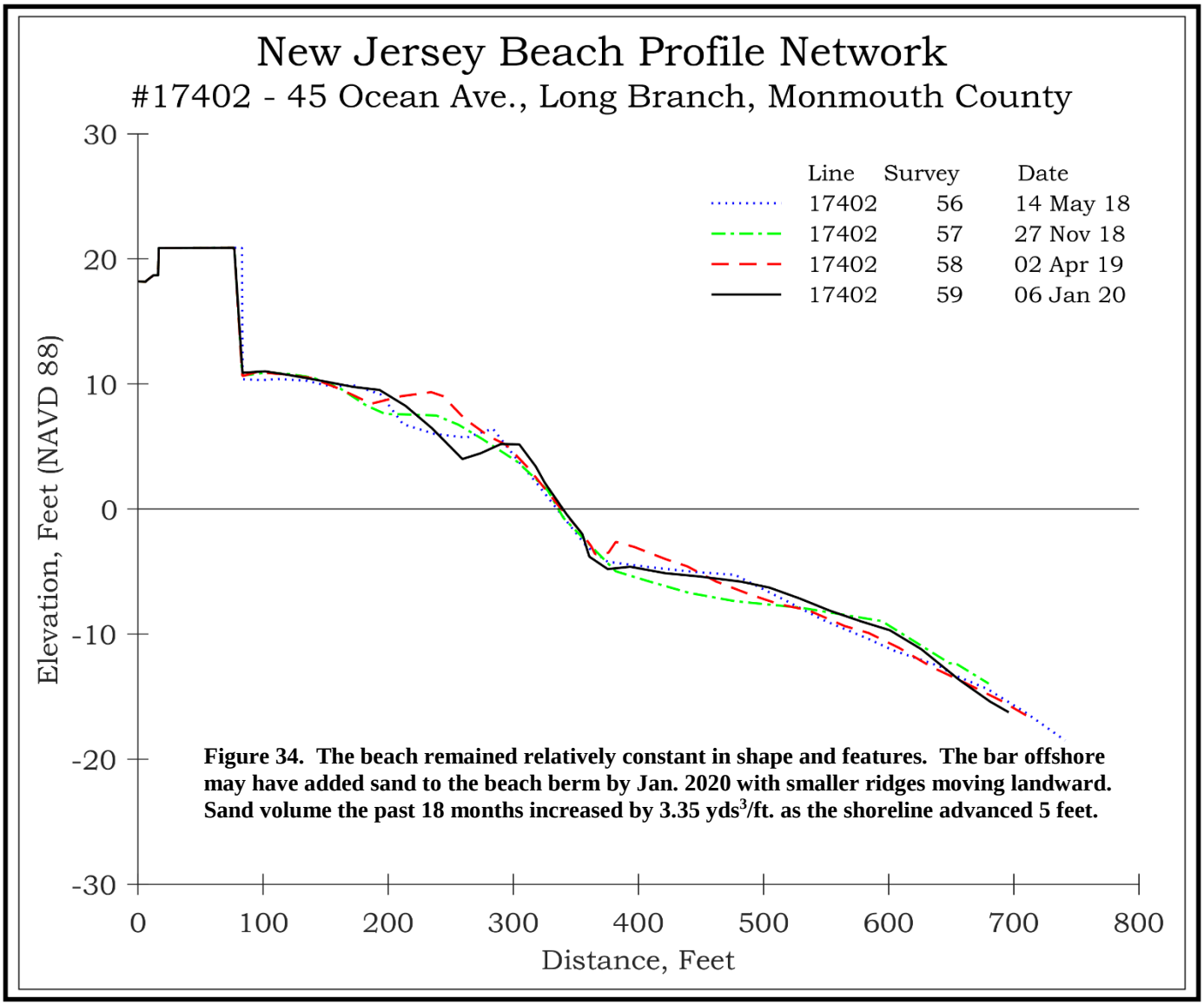


Figure 34. The beach remained relatively constant in shape and features. The bar offshore may have added sand to the beach berm by Jan. 2020 with smaller ridges moving landward. Sand volume the past 18 months increased by 3.35 yds^3/ft. as the shoreline advanced 5 feet.

NJBPN 17401 – North Morris Avenue, Long Branch

The left view is from Nov. 27, 2018 and shows the sand ramped up against the rock revetment protecting the beach bluff. The right view from Jan. 6, 2020 shows that grass did develop between rocks in that wind deposited sand.

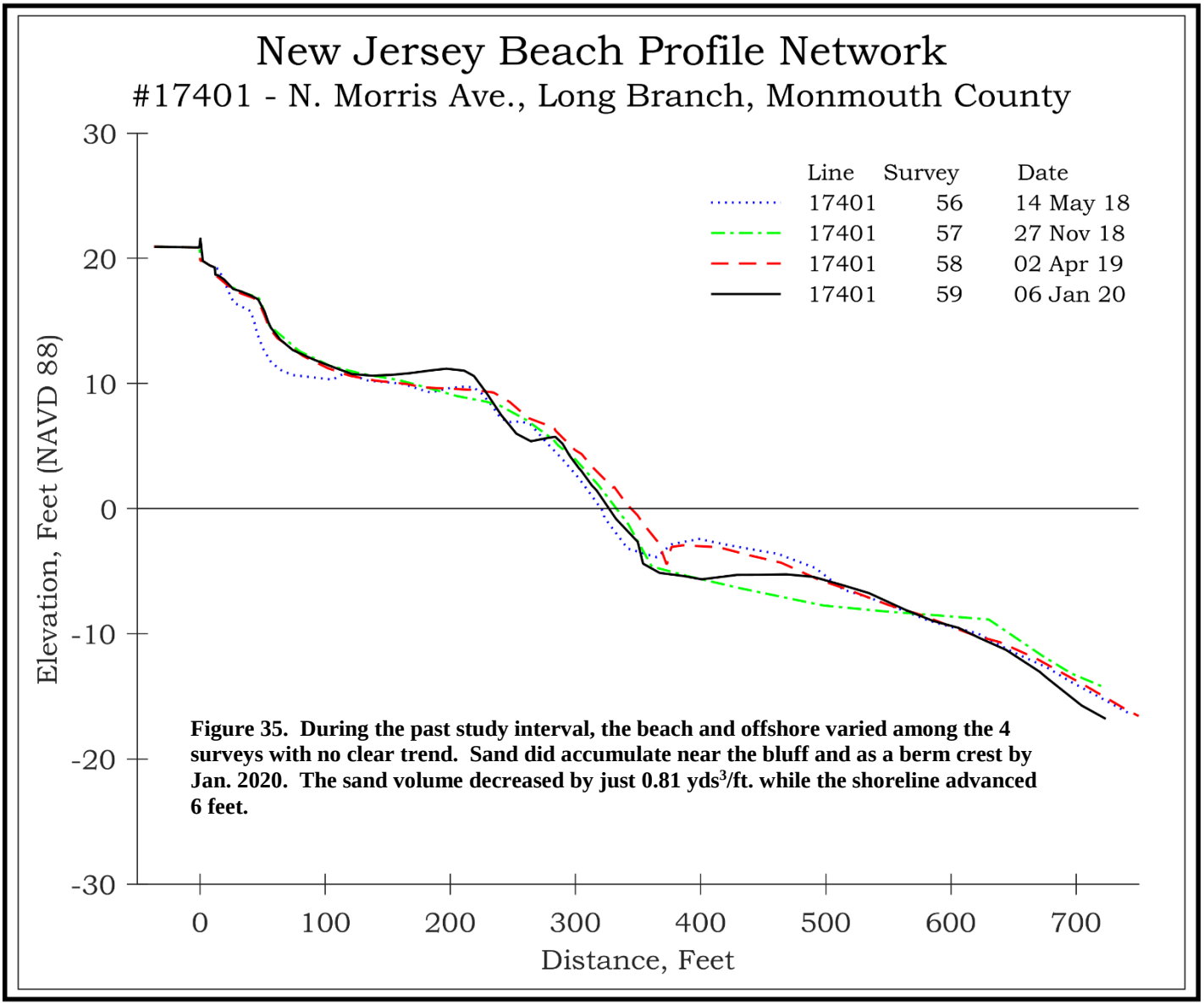
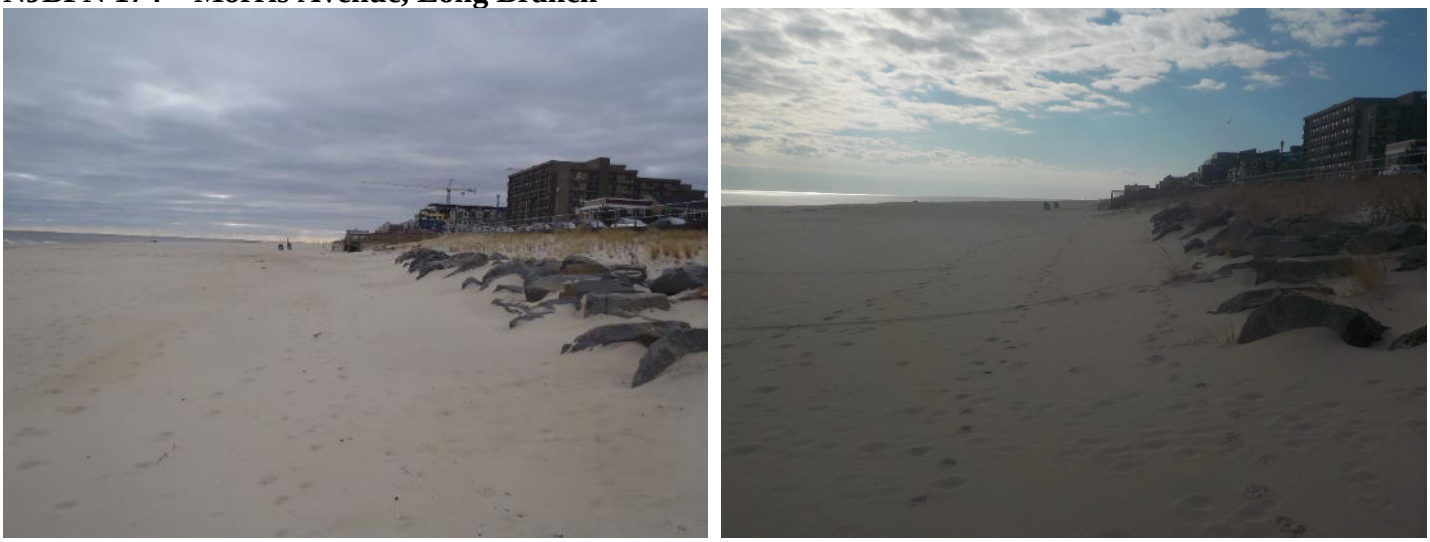


Figure 35. During the past study interval, the beach and offshore varied among the 4 surveys with no clear trend. Sand did accumulate near the bluff and as a berm crest by Jan. 2020. The sand volume decreased by just 0.81 yds^3/ft. while the shoreline advanced 6 feet.

NJBPN 174 – Morris Avenue, Long Branch



The left-side view, taken November 18, 2018 shows some grass growth above the rock toe on the beach as wind deposition placed sand up the bluff face. As of Jan. 6, 2020, the grass progressed, but does not appear to be extending onto the dry beach surface (right).

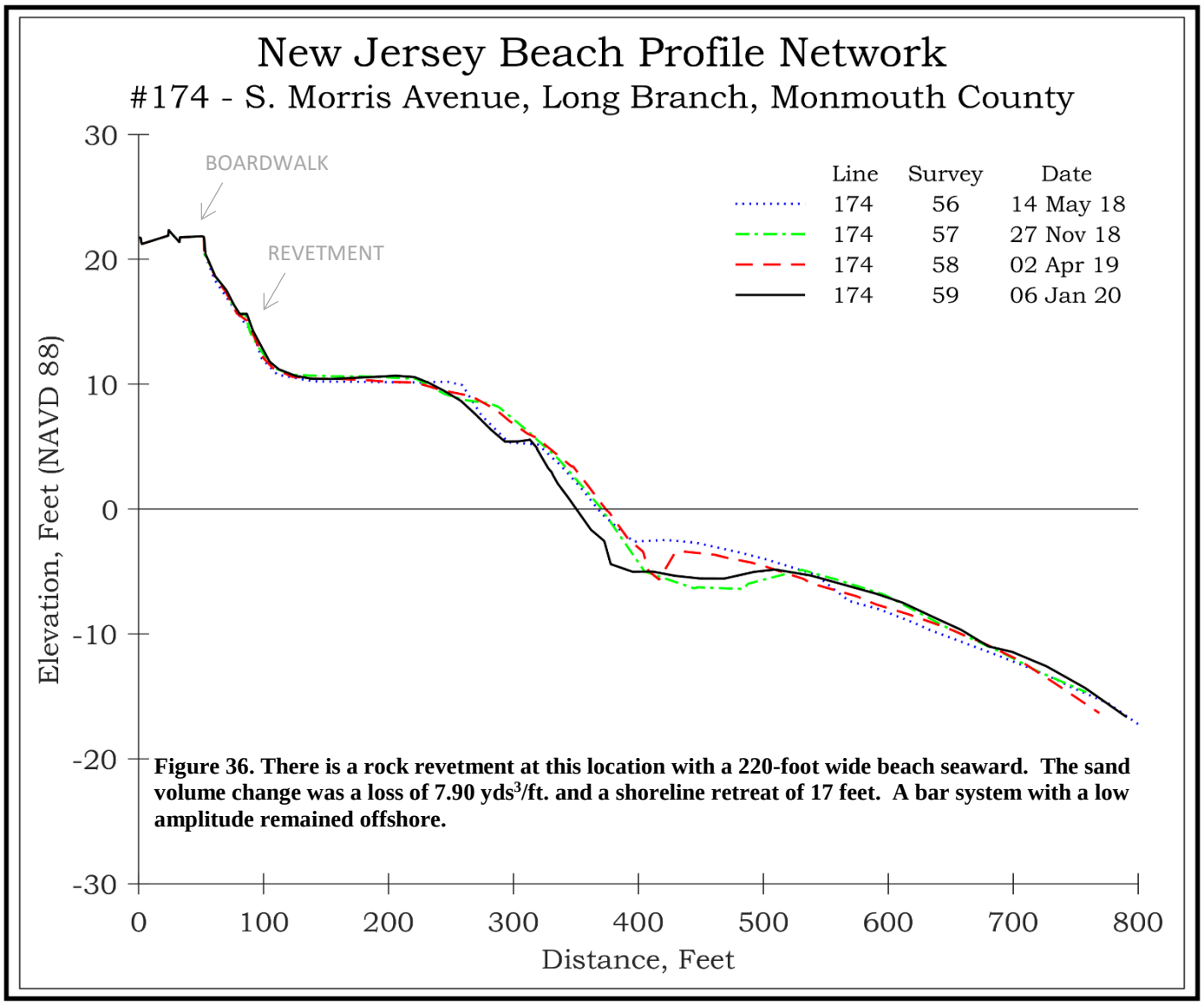
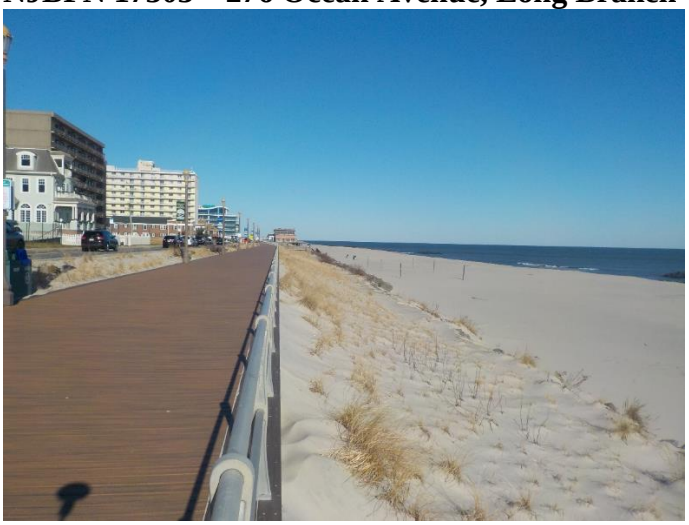


Figure 36. There is a rock revetment at this location with a 220-foot wide beach seaward. The sand volume change was a loss of 7.90 yds^3/ft. and a shoreline retreat of 17 feet. A bar system with a low amplitude remained offshore.

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 (Dec. 18, 2019). On the right on Jan. 6, 2020, the grass was a bit more pronounced among the rocks, but the beach was still devoid of vegetation.

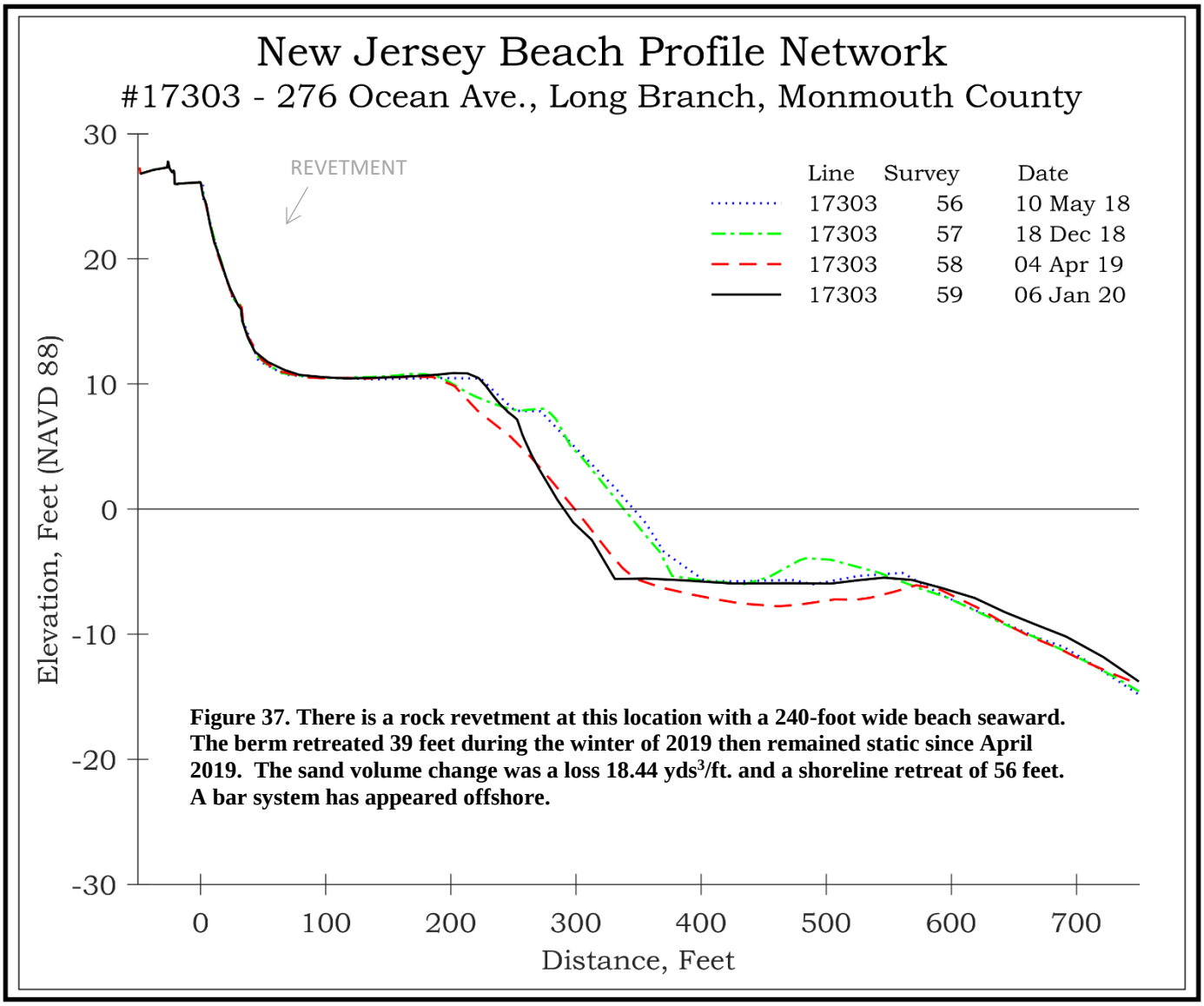


Figure 37. There is a rock revetment at this location with a 240-foot wide beach seaward. The berm retreated 39 feet during the winter of 2019 then remained static since April 2019. The sand volume change was a loss 18.44 yds^3/ft. and a shoreline retreat of 56 feet. A bar system has appeared offshore.

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. On the left as of Dec. 14, 2018 the wind had virtually covered the revetment rocks in a sand layer producing vegetation. As of Jan. 6, 2020, that vegetation had developed further. No dune exists at the foot of the revetment, but the beach width remained constant.

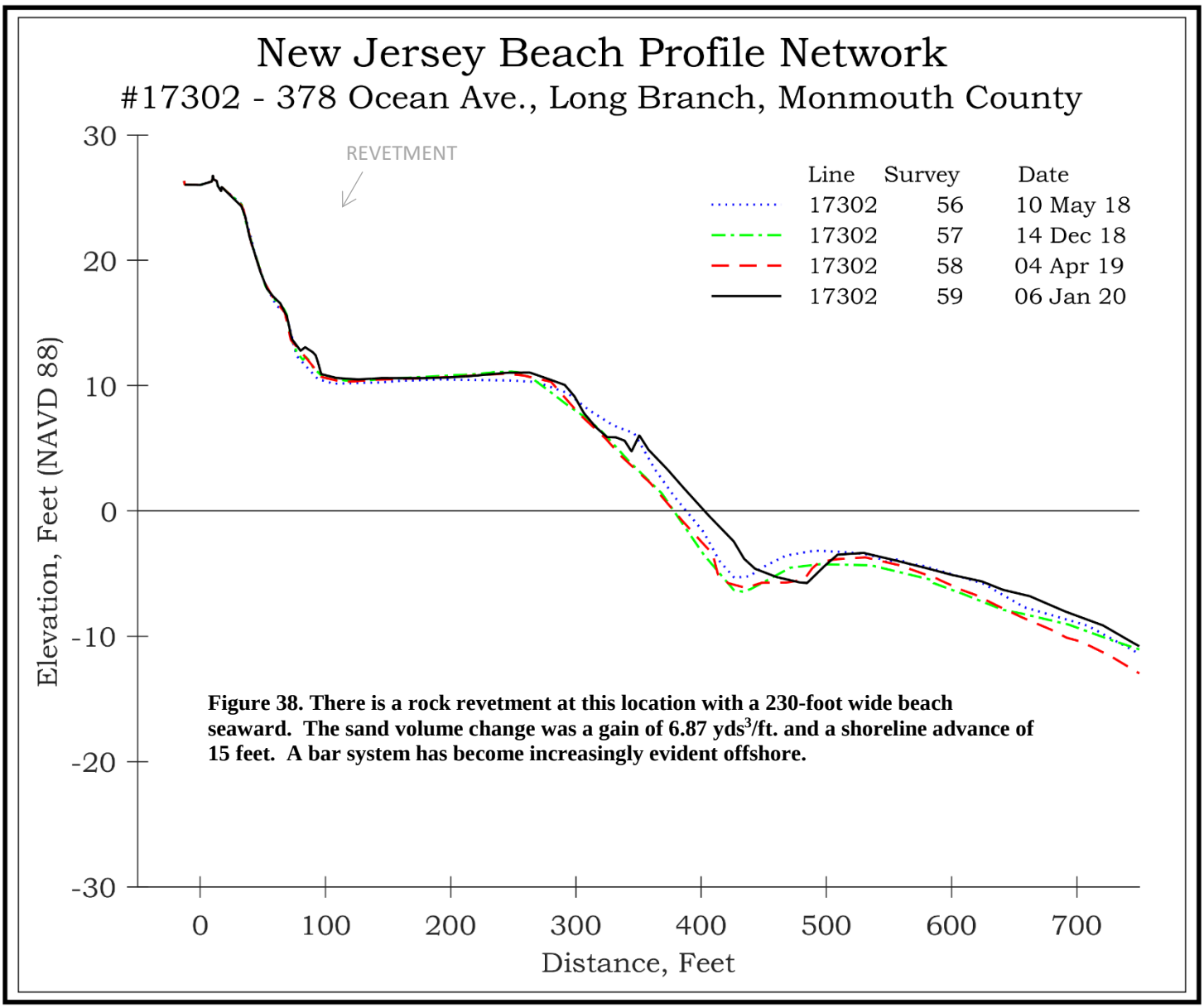


Figure 38. There is a rock revetment at this location with a 230-foot wide beach seaward. The sand volume change was a gain of 6.87 yds^3/ft. and a shoreline advance of 15 feet. A bar system has become increasingly evident offshore.

NJBPN 17301 – Wooley Court, Long Branch

The rock revetment on the left was photographed Dec. 14, 2018. On the right by Jan. 6, 2020, more grass in present among the rocks, exposed at the toe, but covered up-slope. The beach width remained constant.

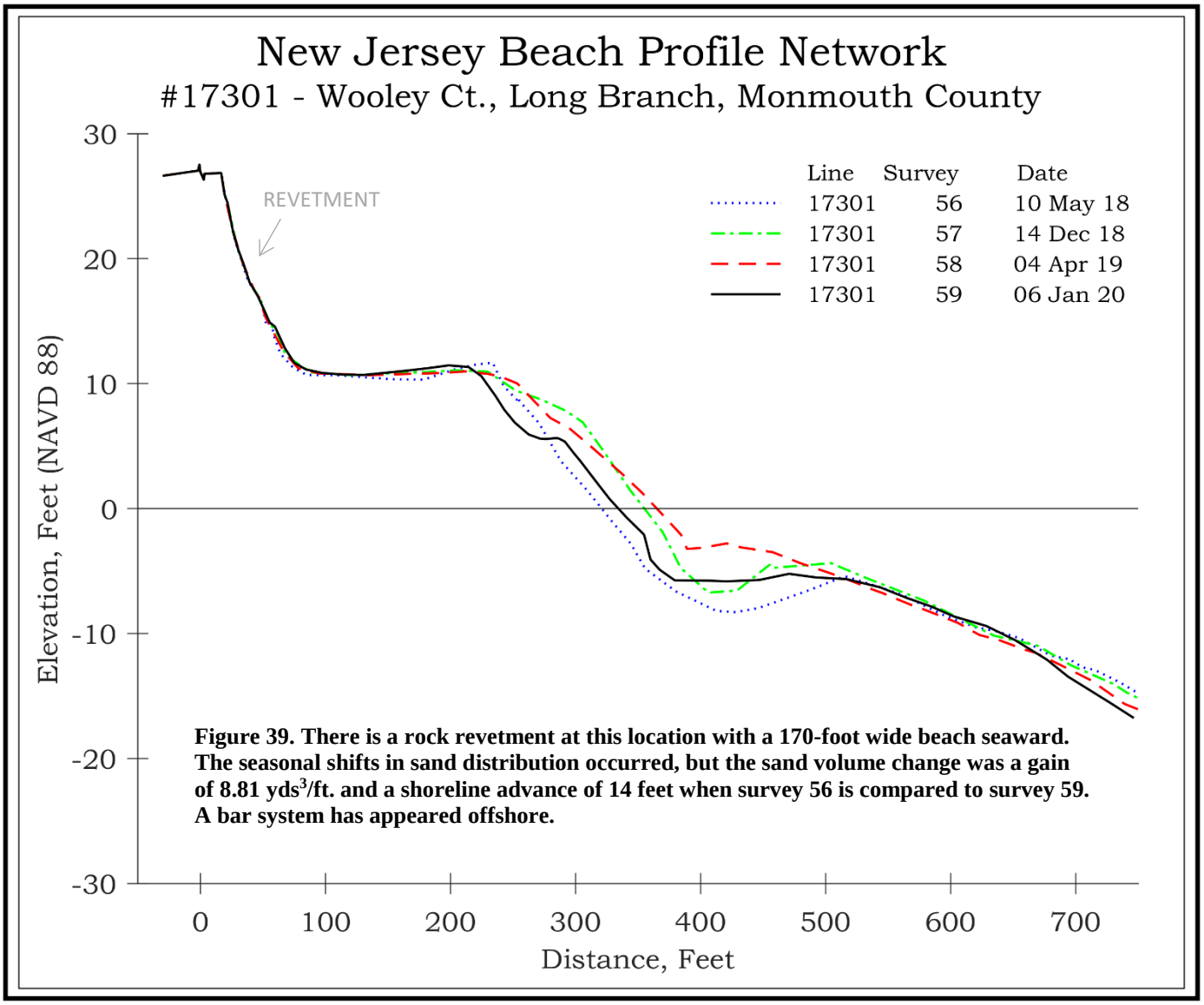
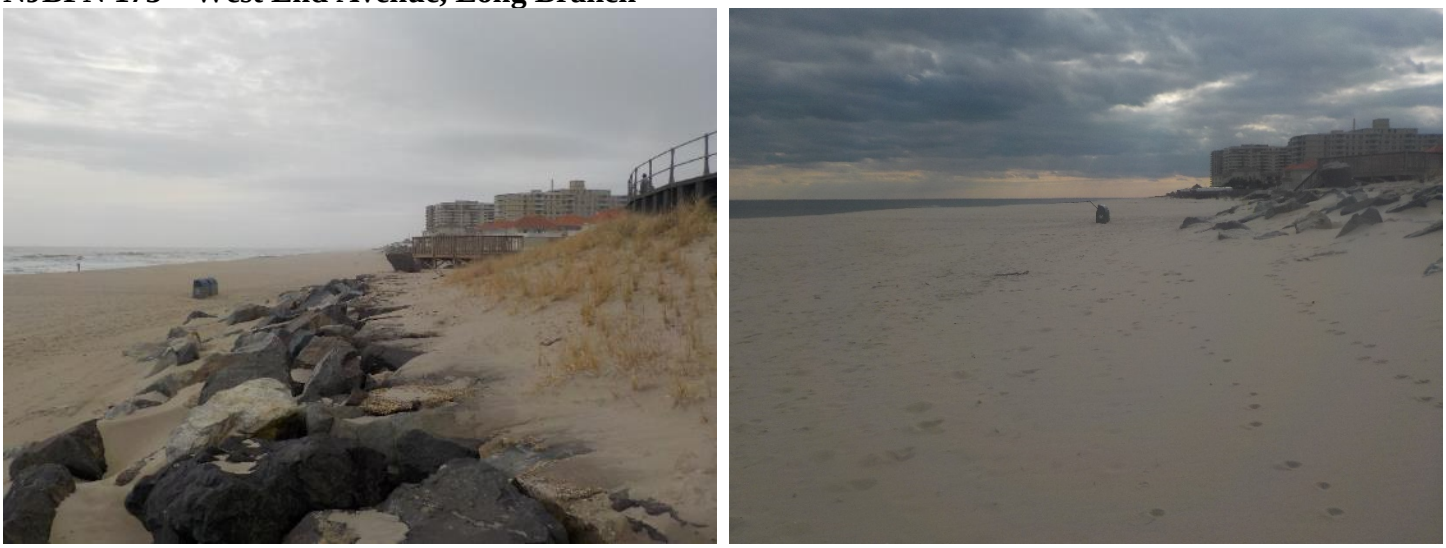


Figure 39. There is a rock revetment at this location with a 170-foot wide beach seaward. The seasonal shifts in sand distribution occurred, but the sand volume change was a gain of 8.81 yds^3/ft. and a shoreline advance of 14 feet when survey 56 is compared to survey 59. A bar system has appeared offshore.

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 and the beach was 200 feet wide (Dec 14, 2018). The right-hand view on Jan. 6, 2020 shows the rock toe of the revetment further buried in wind-deposited sand with the beach generally in the same conditions.

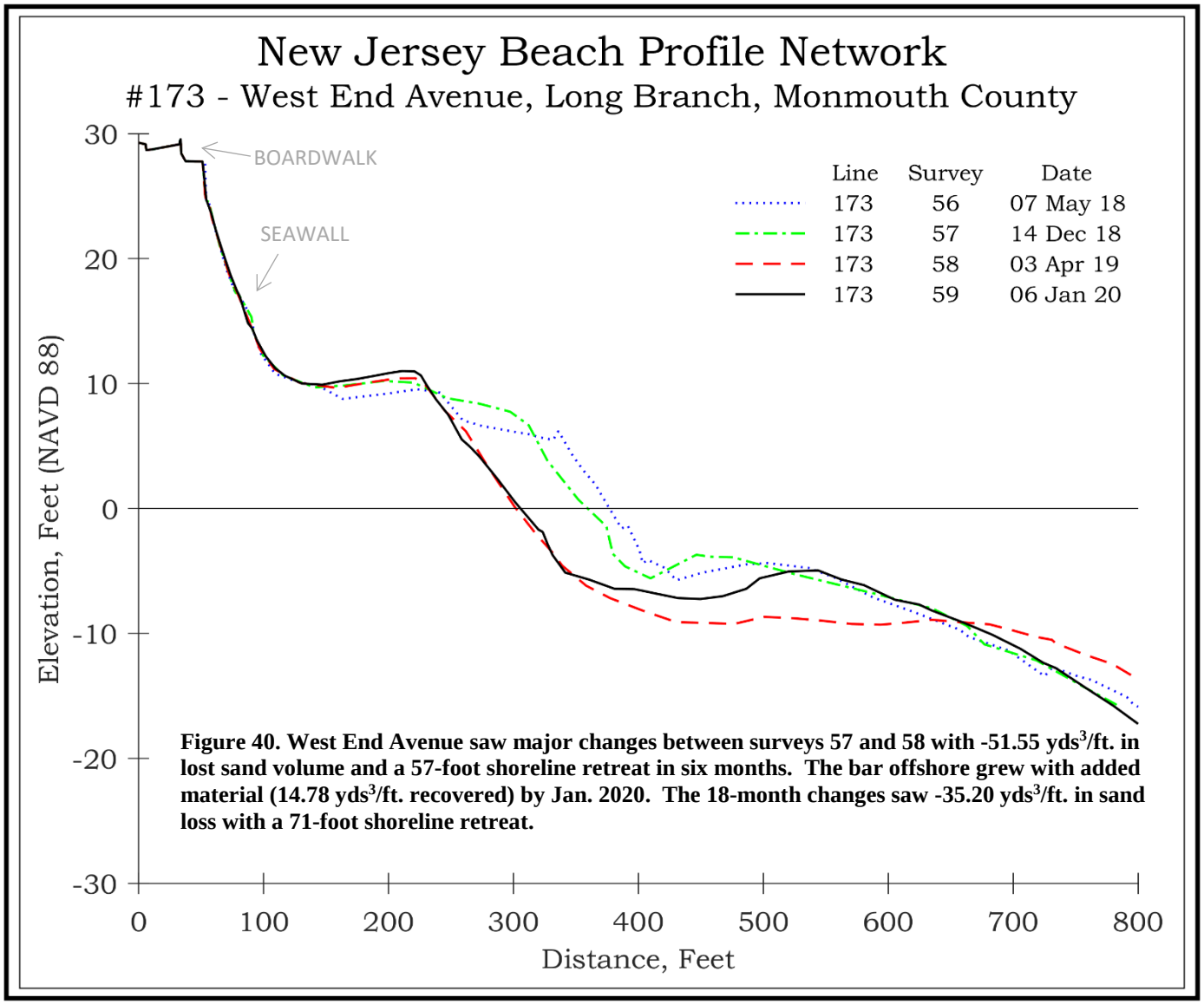
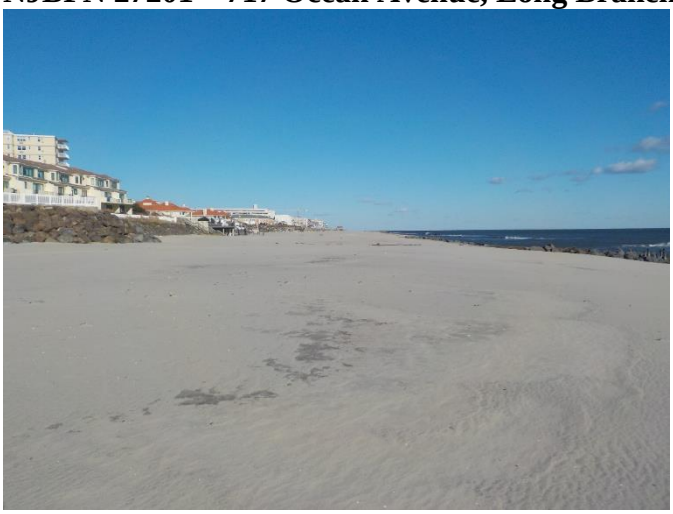


Figure 40. West End Avenue saw major changes between surveys 57 and 58 with -51.55 yds^3/ft. in lost sand volume and a 57-foot shoreline retreat in six months. The bar offshore grew with added material (14.78 yds^3/ft. recovered) by Jan. 2020. The 18-month changes saw -35.20 yds^3/ft. in sand loss with a 71-foot shoreline retreat.

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 Dec. 18, 2018 showing the rocks protecting the structures and the dry beach. As of Jan. 7, 2020 the beach was a bit wider, but no further deposition was seen at the rocks with developing dunes.

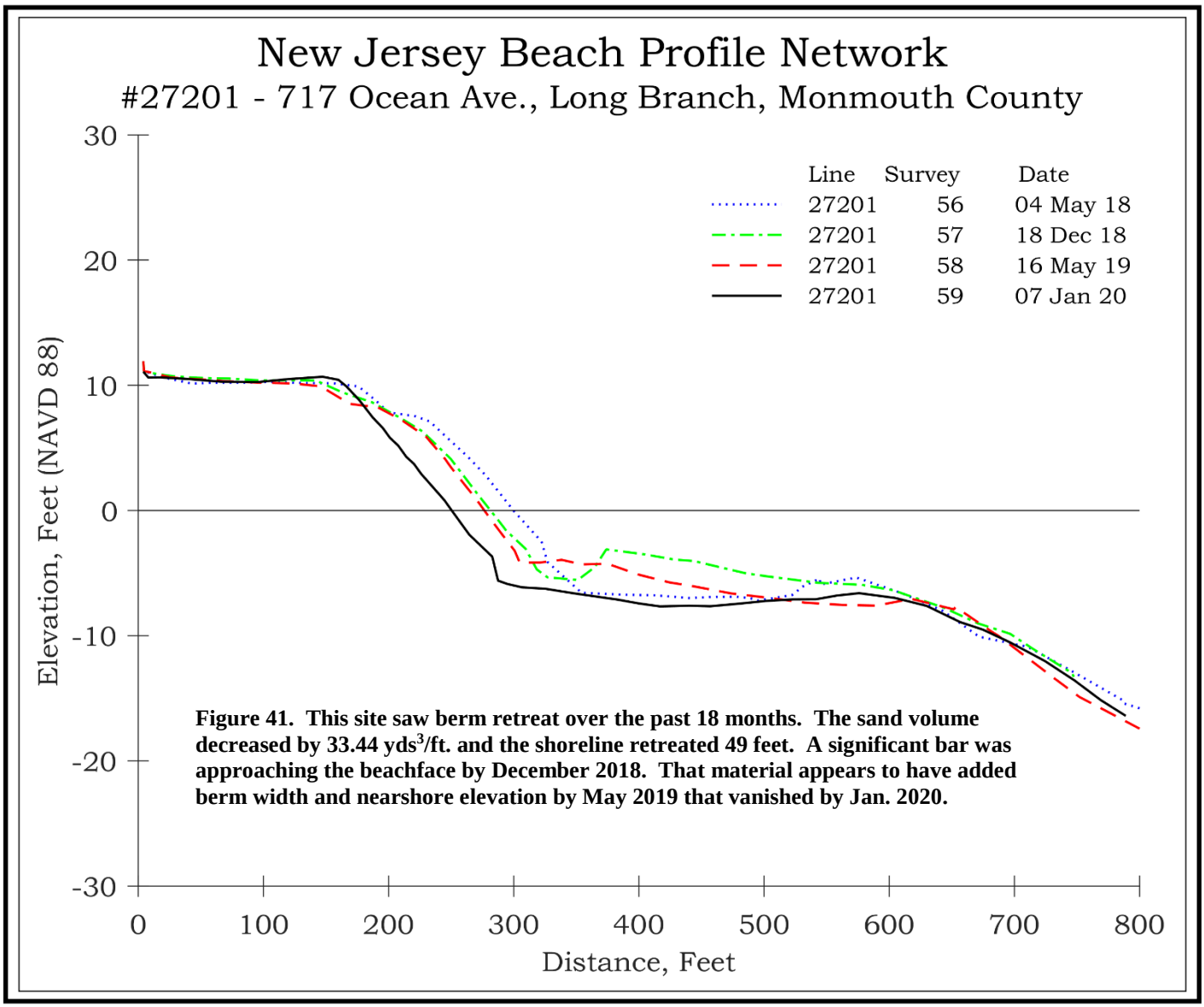


Figure 41. This site saw berm retreat over the past 18 months. The sand volume decreased by 33.44 yds^3/ft. and the shoreline retreated 49 feet. A significant bar was approaching the beachface by December 2018. That material appears to have added berm width and nearshore elevation by May 2019 that vanished by Jan. 2020.

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 December 18, 2018, shows retreat at the berm with rocks showing on the south groin. As of Jan. 7, 2020, more rocks have appeared along the rock groin indicating shoreline retreat.

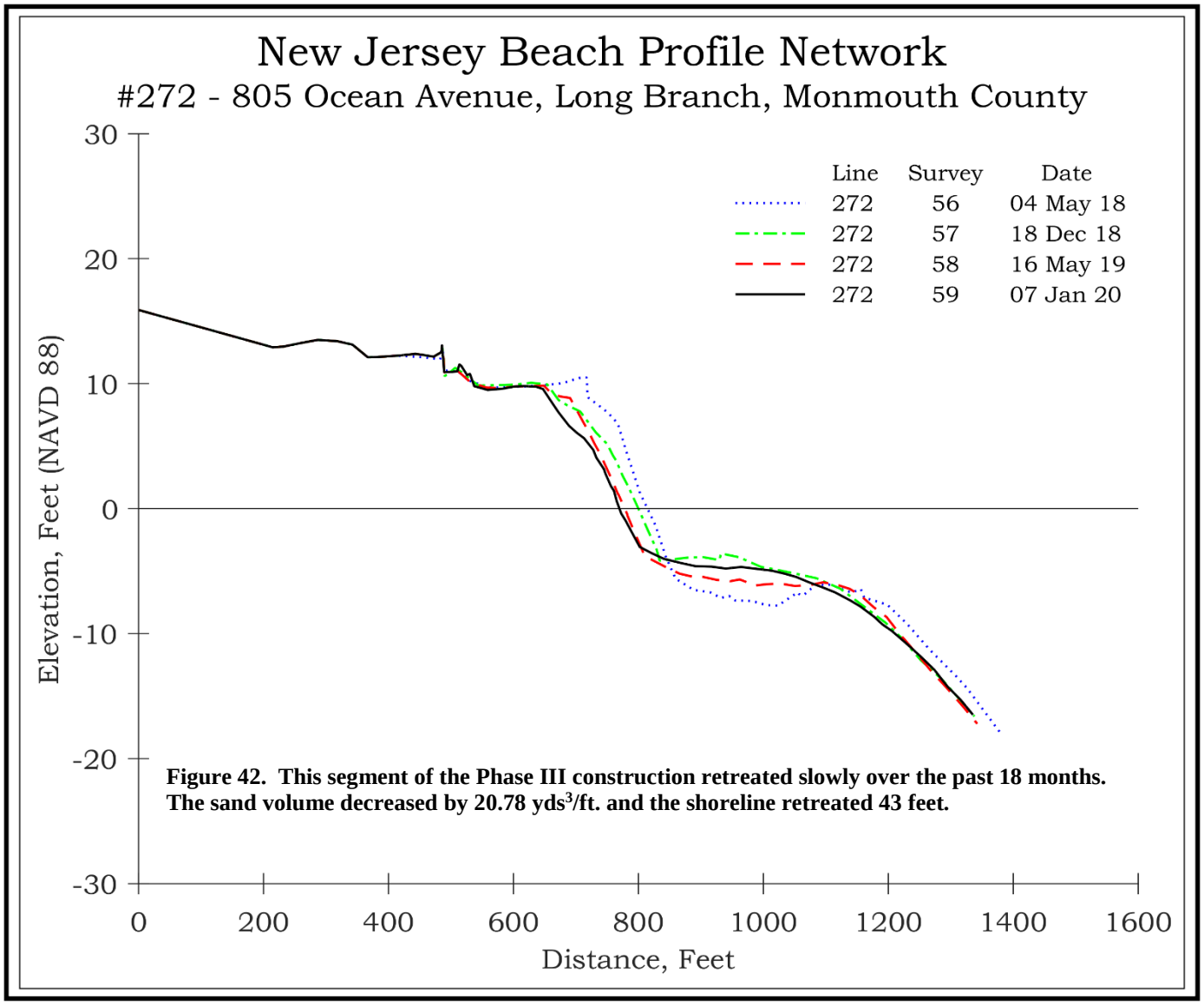


Figure 42. This segment of the Phase III construction retreated slowly over the past 18 months. The sand volume decreased by 20.78 yds^3/ft. and the shoreline retreated 43 feet.

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 De. 13, 2018 shows the rock groin exposed a year following project completion. By Jan. 7, 2020, erosion has taken a serious toll on the beach width with a scarp present and much more of the groin visible.

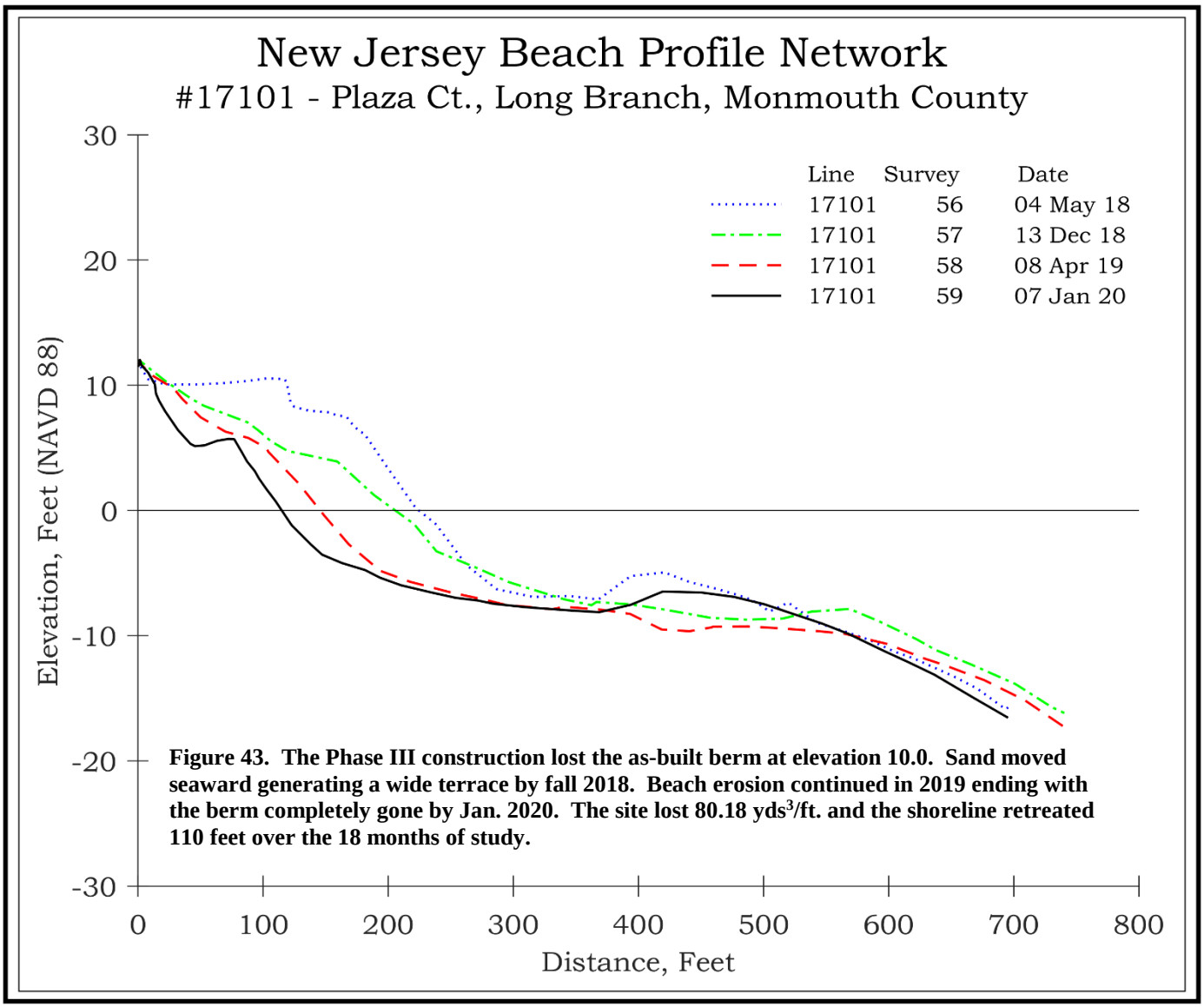
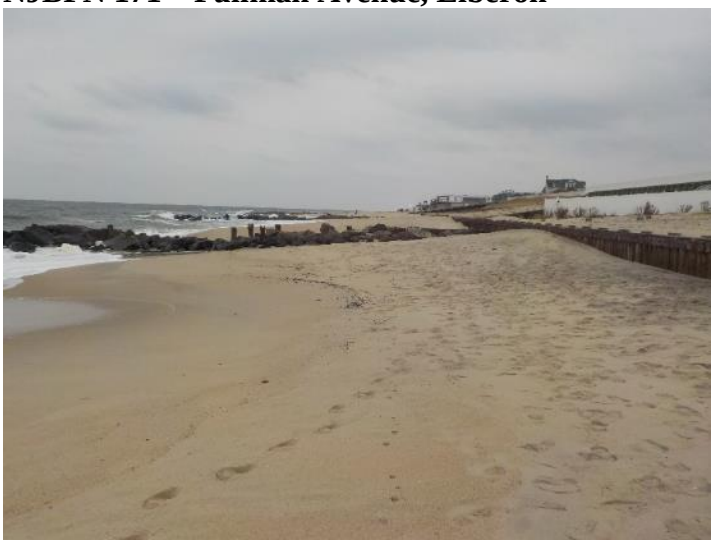


Figure 43. The Phase III construction lost the as-built berm at elevation 10.0. Sand moved seaward generating a wide terrace by fall 2018. Beach erosion continued in 2019 ending with the berm completely gone by Jan. 2020. The site lost 80.18 yds^3/ft. and the shoreline retreated 110 feet over the 18 months of study.

NJBPN 171 – Pullman Avenue, Elberon



This site is located on the highest point along the bluff shoreline. By December 13, 2018 the four pilings and a rock that barely were visible in 2017 are now fully exposed on the left view. As of Jan 7. 2020 further erosion has fully exposed the rock groin and pushed the beach berm nearly to the main shore-parallel bulkhead.

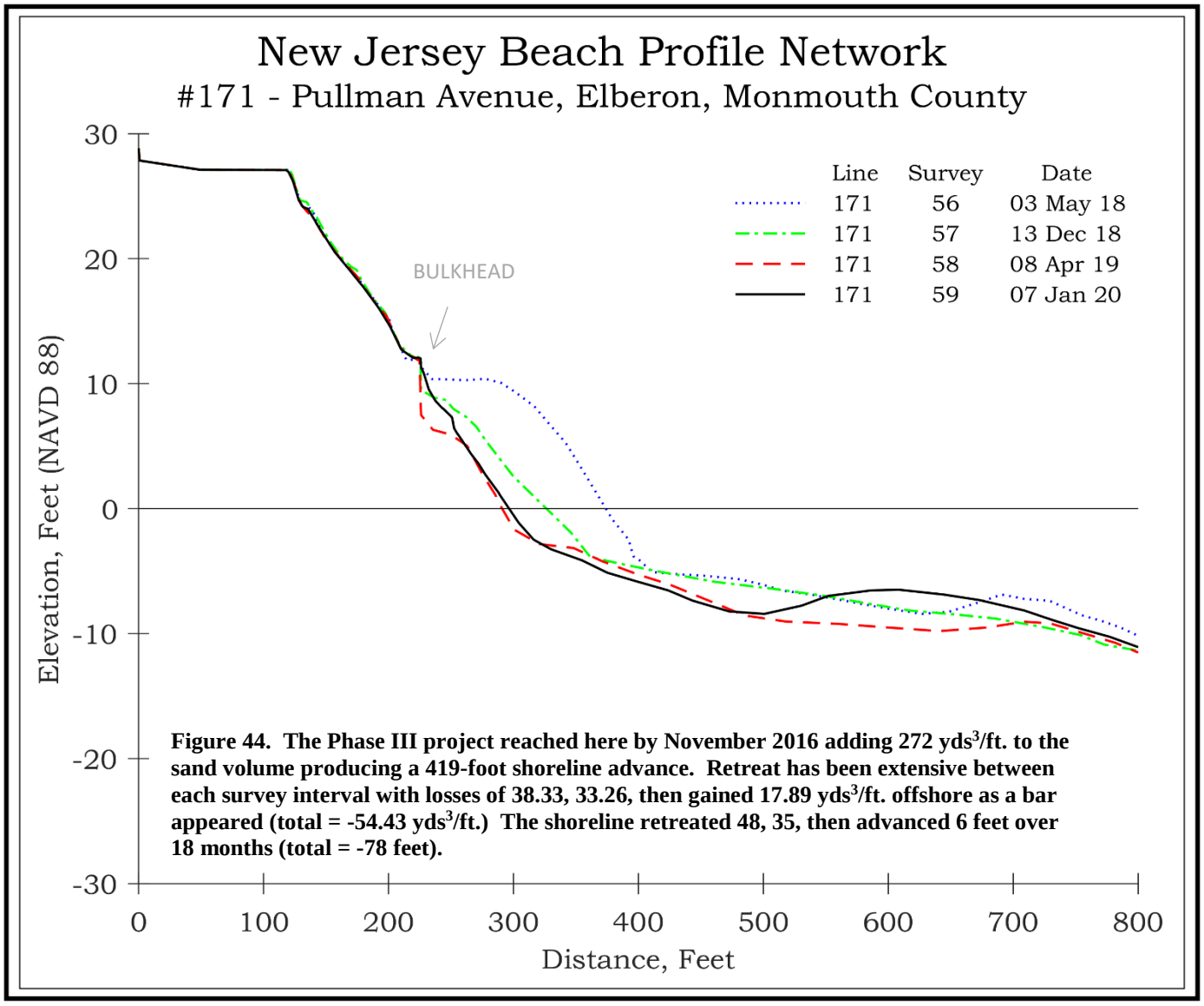
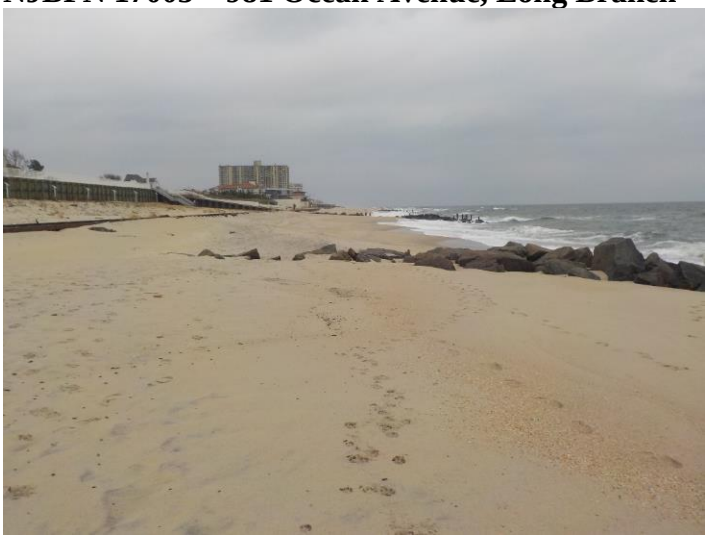


Figure 44. The Phase III project reached here by November 2016 adding 272 yds^3/ft. to the sand volume producing a 419-foot shoreline advance. Retreat has been extensive between each survey interval with losses of 38.33, 33.26, then gained 17.89 yds^3/ft. offshore as a bar appeared (total = -54.43 yds^3/ft.) The shoreline retreated 48, 35, then advanced 6 feet over 18 months (total = -78 feet).

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 Dec. 13, 2018. By Jan. 7, 2020 the beach was lower in elevation with the old timber bulkhead clearly visible on upper beach.

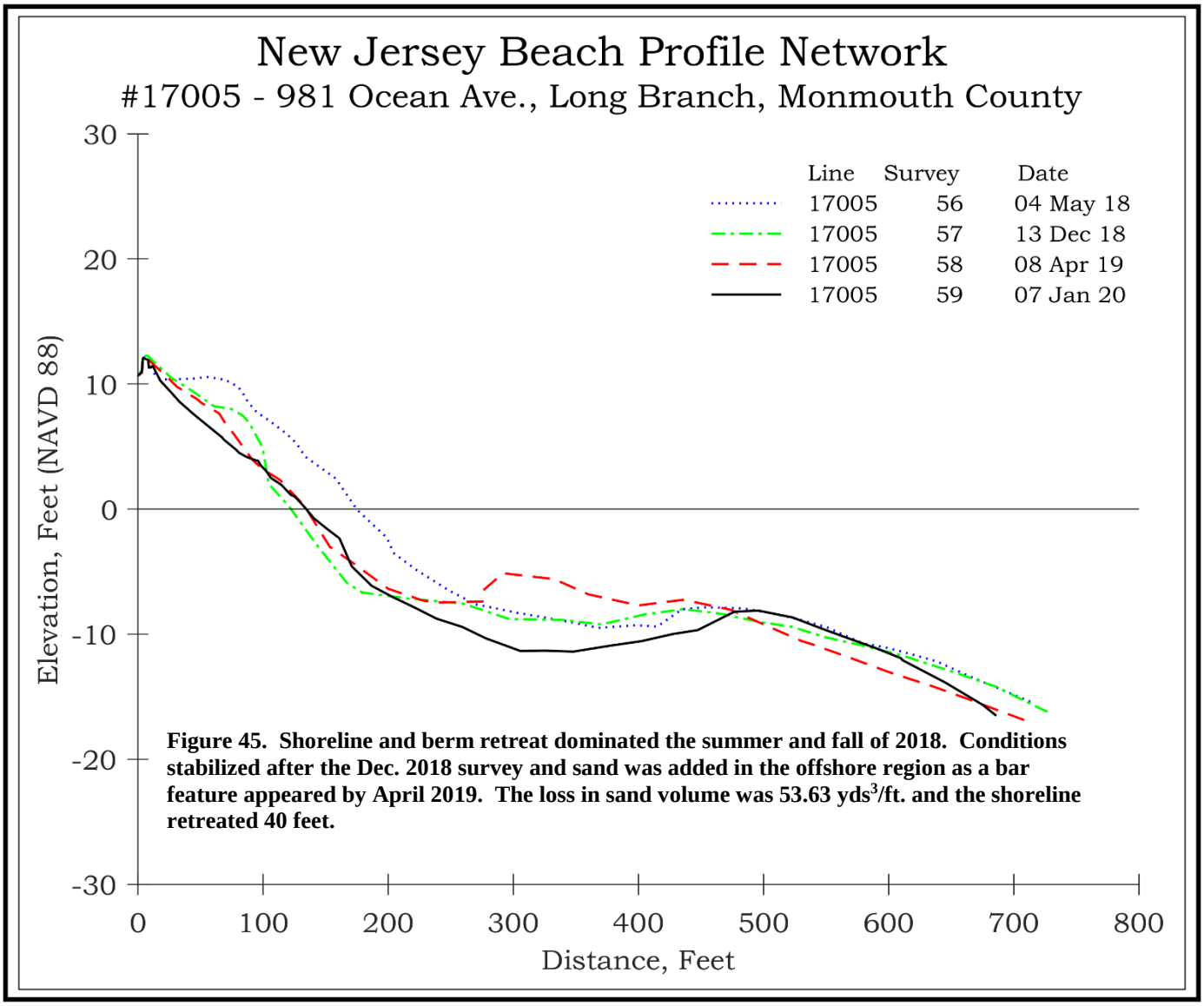


Figure 45. Shoreline and berm retreat dominated the summer and fall of 2018. Conditions stabilized after the Dec. 2018 survey and sand was added in the offshore region as a bar feature appeared by April 2019. The loss in sand volume was 53.63 yds^3/ft. and the shoreline retreated 40 feet.

NJBPN 17004 – 1115 Ocean Avenue, Long Branch

This location is also within the Elberon groin field. The left view was on Dec. 13, 2018 and shows some rock exposure in the distance to the south. As of Jan. 9, 2020 the same perspective on the right shows about the same elevation to the beach at the structures landward with some additional rock groin exposure.

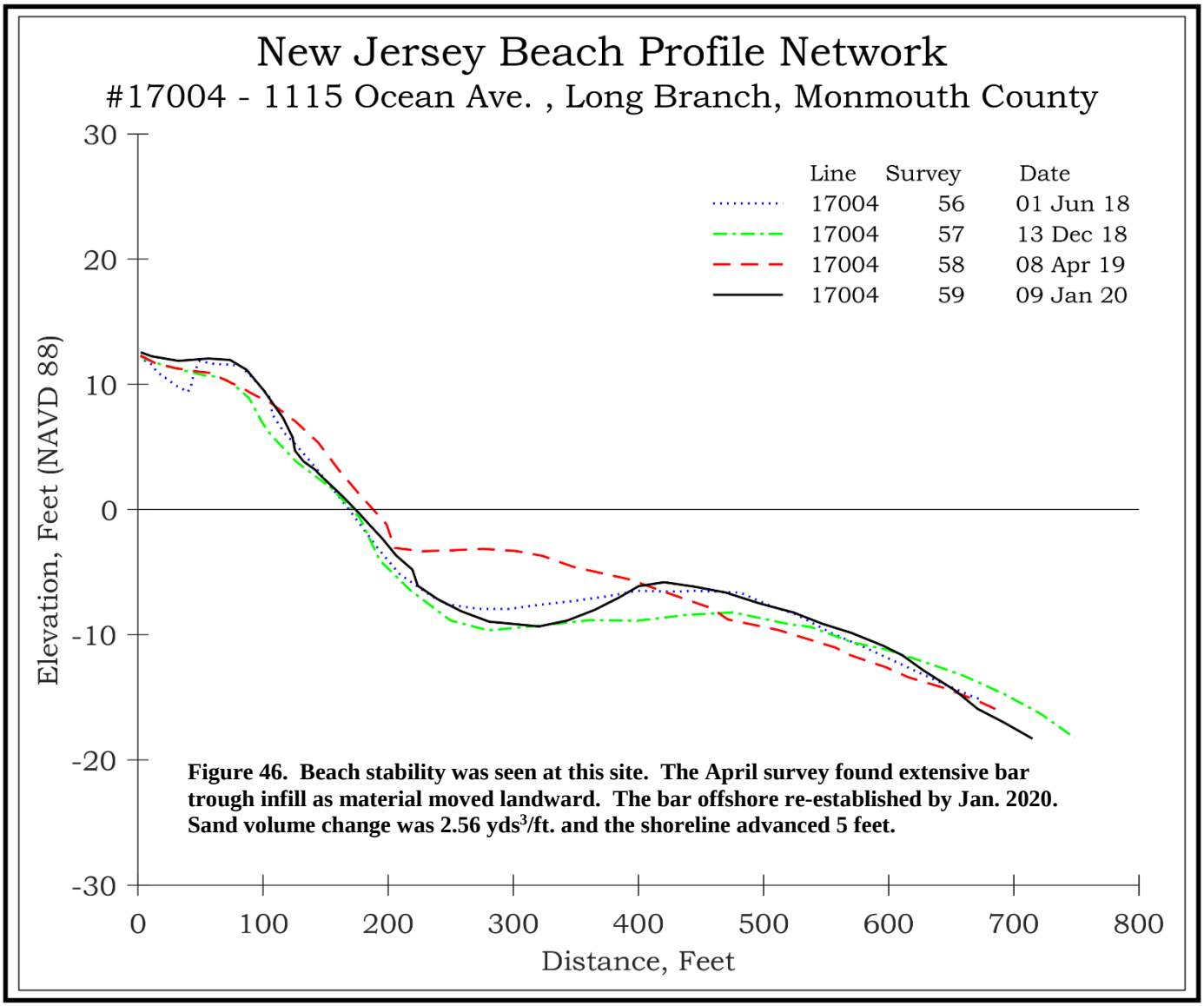


Figure 46. Beach stability was seen at this site. The April survey found extensive bar trough infill as material moved landward. The bar offshore re-established by Jan. 2020. Sand volume change was 2.56 yds^3/ft. and the shoreline advanced 5 feet.

NJBPN 17003 – Ocean Court, Long Branch

The left view was taken Dec. 13, 2018 and shows a wide beach with little dune development. The right view shows a similar beach configuration as of Jan. 9, 2020 with few changes.

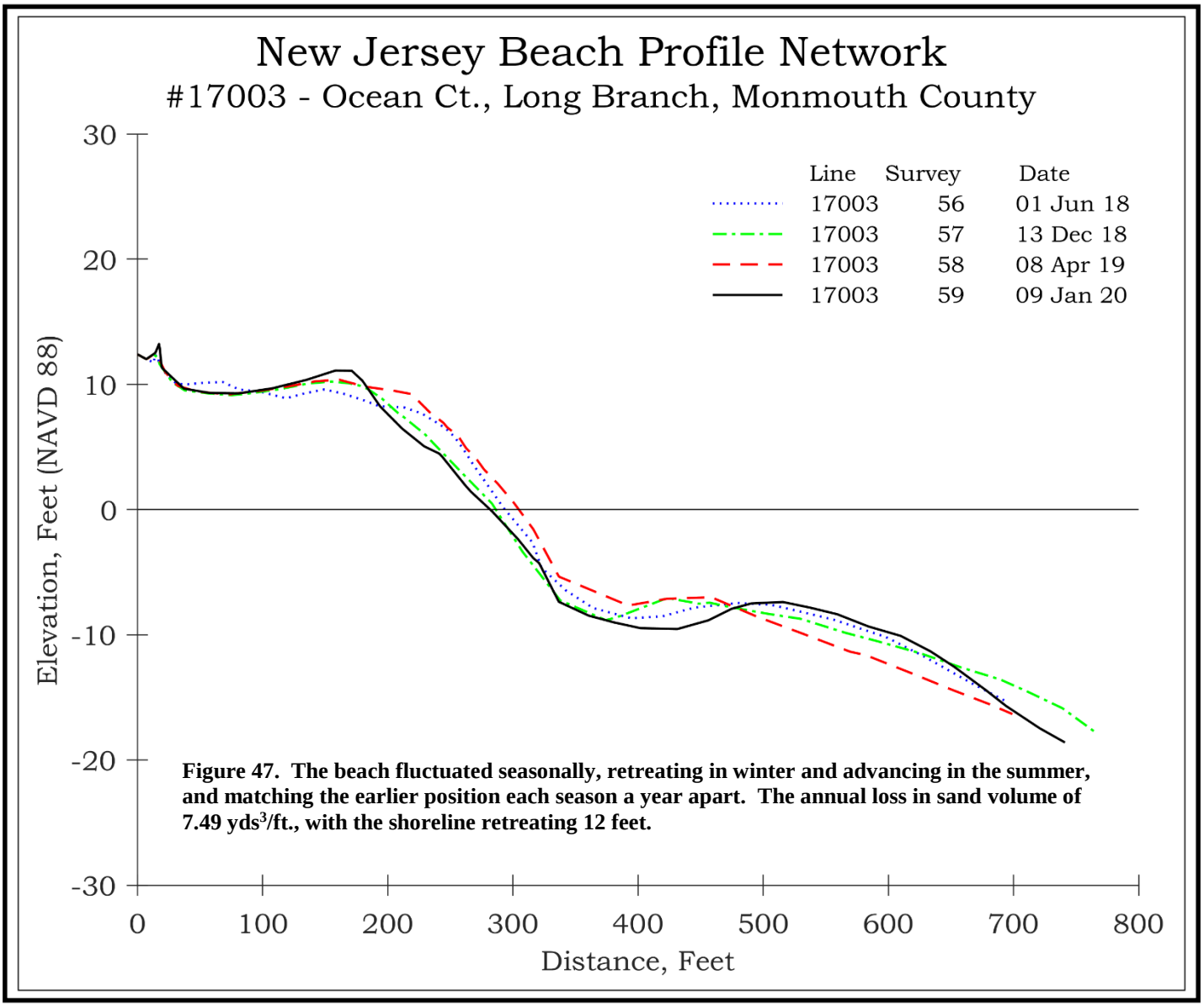


Figure 47. The beach fluctuated seasonally, retreating in winter and advancing in the summer, and matching the earlier position each season a year apart. The annual loss in sand volume of 7.49 yds^3/ft., with the shoreline retreating 12 feet.

NJBPN 17002 – Garfield Road, Long Branch

The left view on Dec. 13, 2018 shows a beach with some rock groin exposure, while the right view on Jan. 9, 2020 shows more of the rock groin exposed at the beachface, but otherwise a retained beach width.

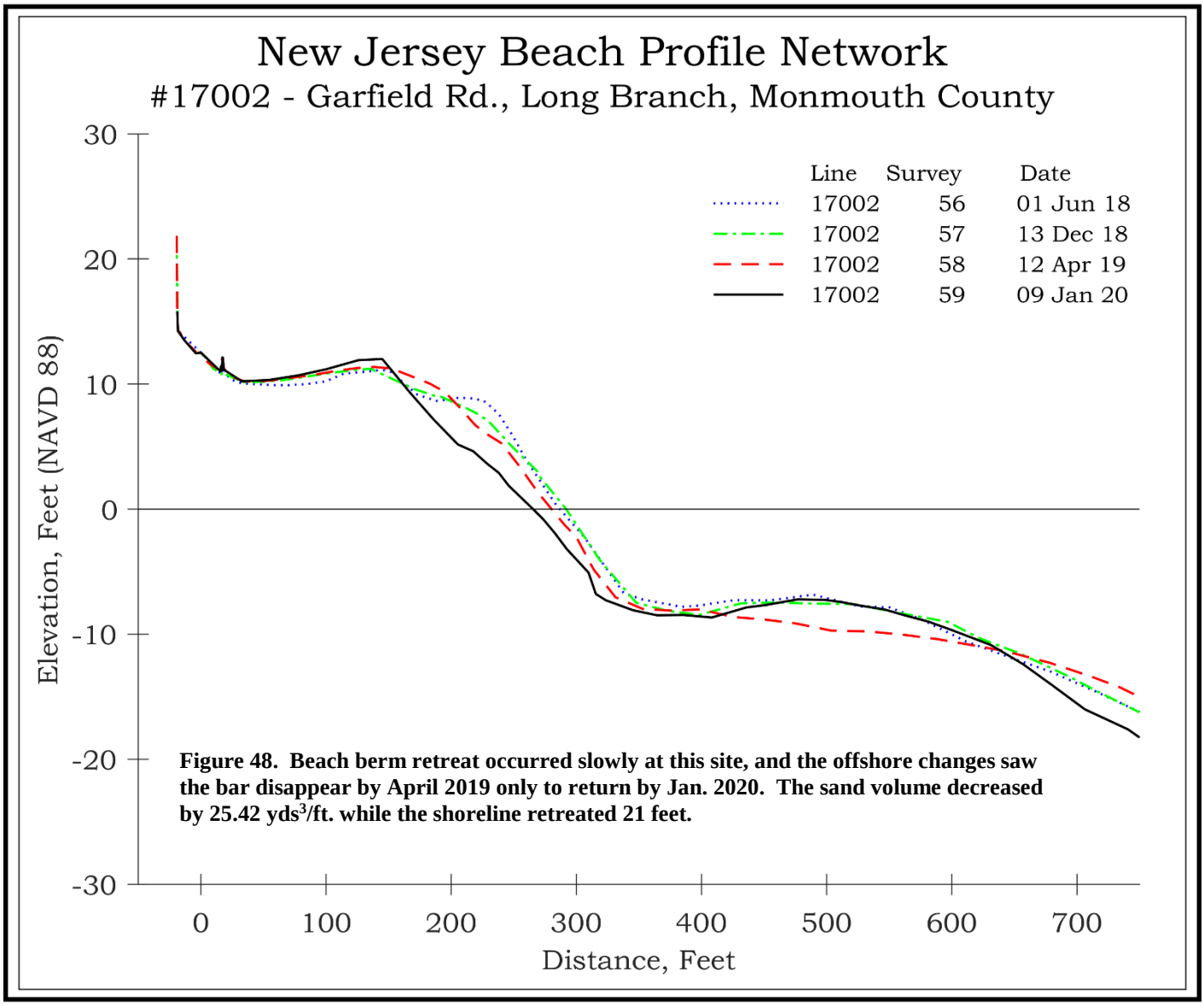
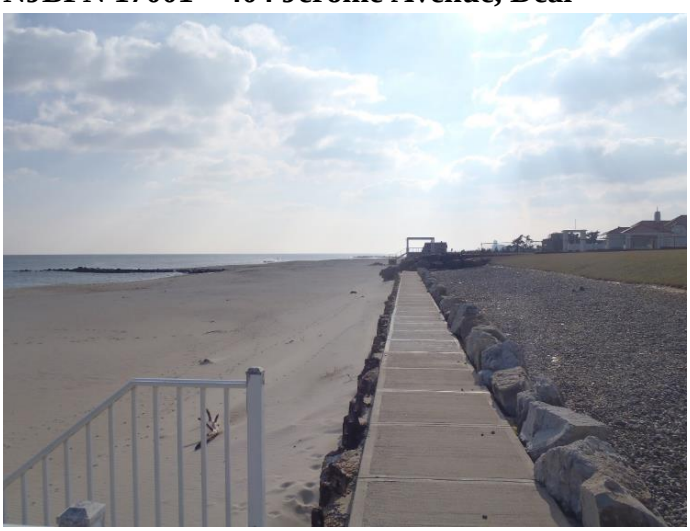


Figure 48. Beach berm retreat occurred slowly at this site, and the offshore changes saw the bar disappear by April 2019 only to return by Jan. 2020. The sand volume decreased by 25.42 yds^3/ft. while the shoreline retreated 21 feet.

NJBPN 17001 – 404 Jerome Avenue, Deal



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 incipiant dunes but with a fairly stable beach width.

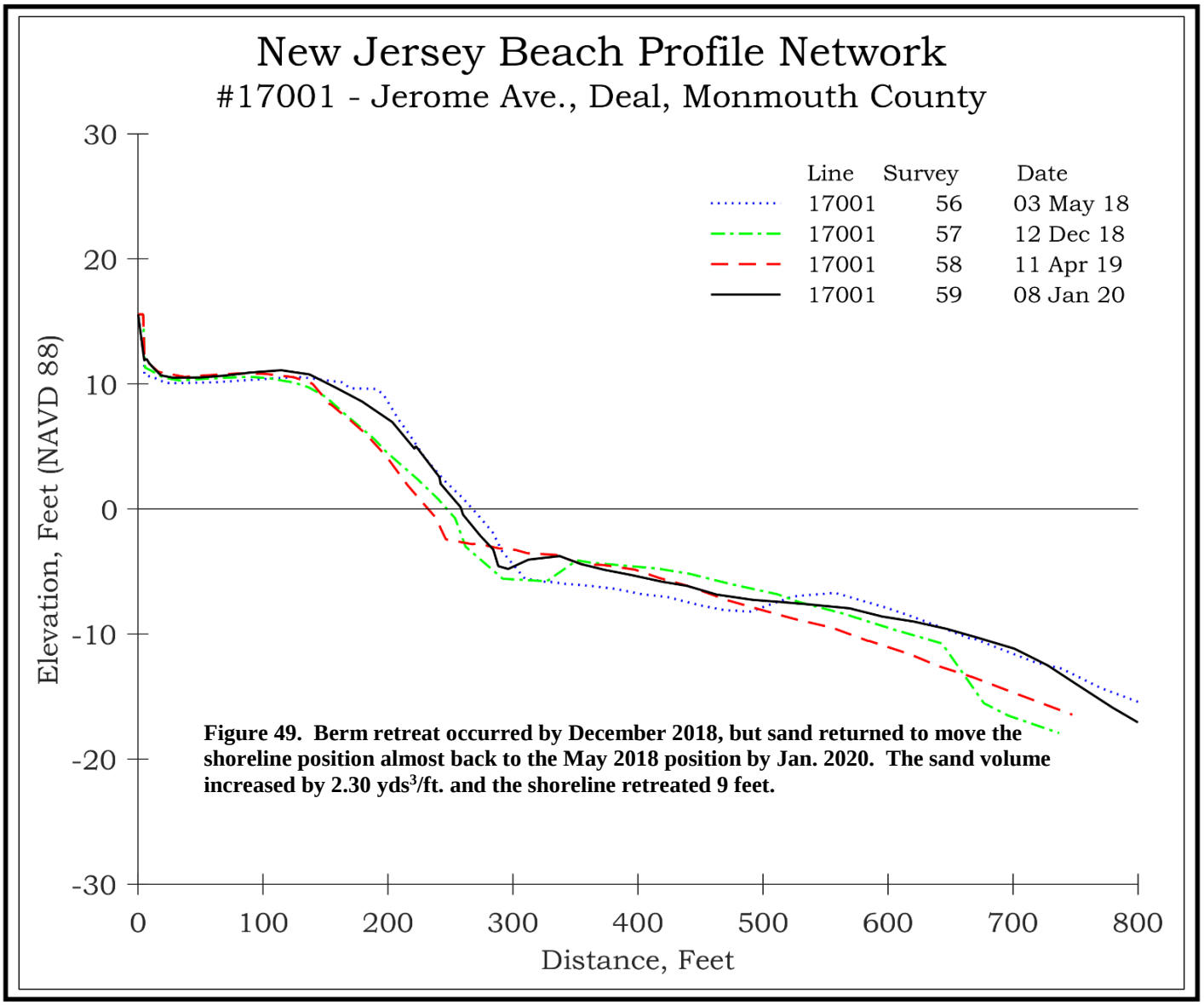


Figure 49. Berm retreat occurred by December 2018, but sand returned to move the shoreline position almost back to the May 2018 position by Jan. 2020. The sand volume increased by 2.30 yds^3/ft. and the shoreline retreated 9 feet.

NJBPN 170 – Roosevelt Avenue, Deal

By December 11, 2017 the project was complete. The left view was taken a year later on Dec. 12, 2018 with some sand added at the base of the rocks by the wind. As of Jan. 8, 2020, the situation had changed very little at the rock revetment but with modest retreat of the beachface position.

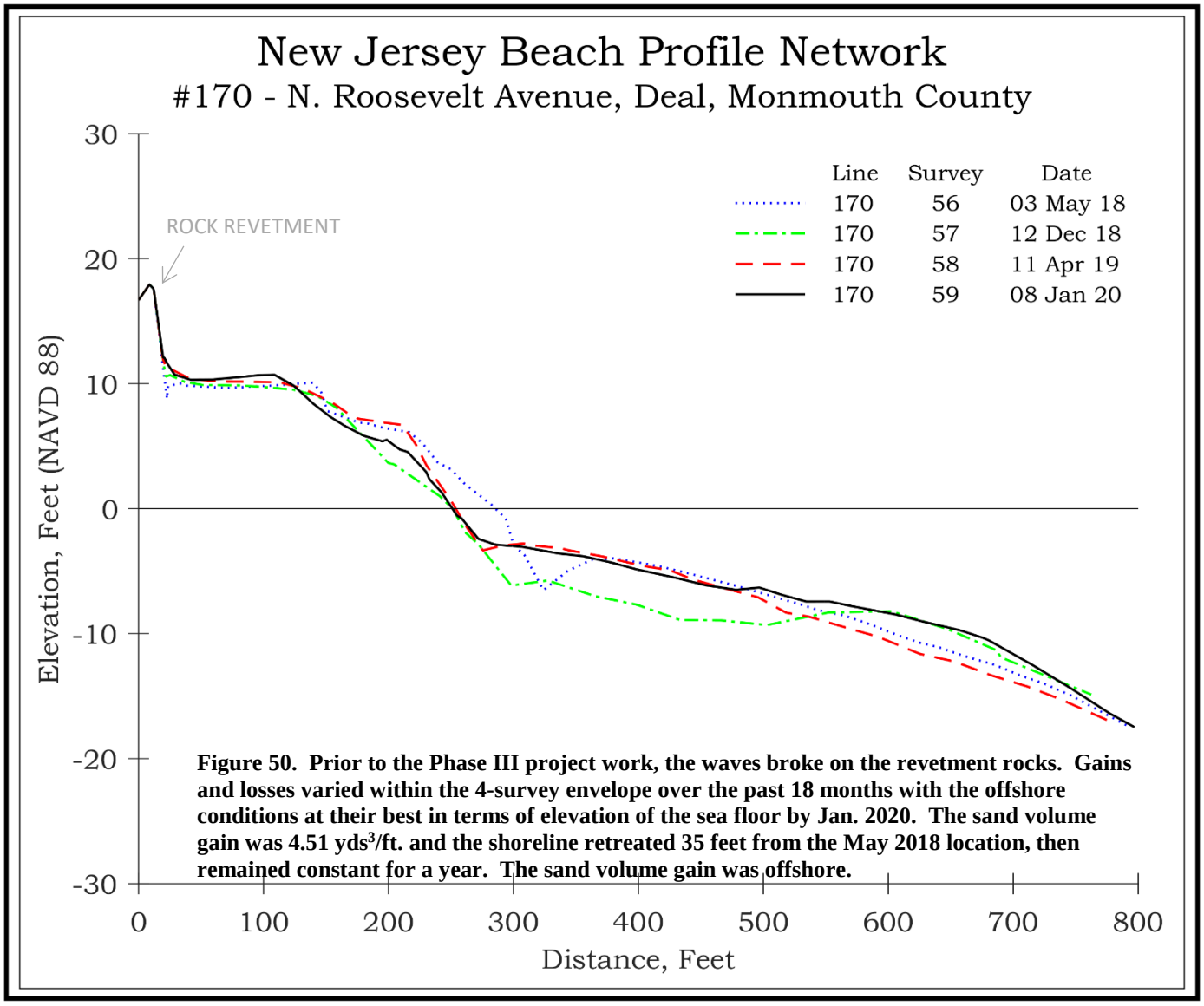


Figure 50. Prior to the Phase III project work, the waves broke on the revetment rocks. Gains and losses varied within the 4-survey envelope over the past 18 months with the offshore conditions at their best in terms of elevation of the sea floor by Jan. 2020. The sand volume gain was 4.51 yds^3/ft. and the shoreline retreated 35 feet from the May 2018 location, then remained constant for a year. The sand volume gain was offshore.

NJBPN 16905 – South Roosevelt Avenue, Deal

This new site is just south of Roosevelt Avenue in Deal. The beach on Dec. 12, 2018 was just exposing the rocks in the groin to the north. 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.

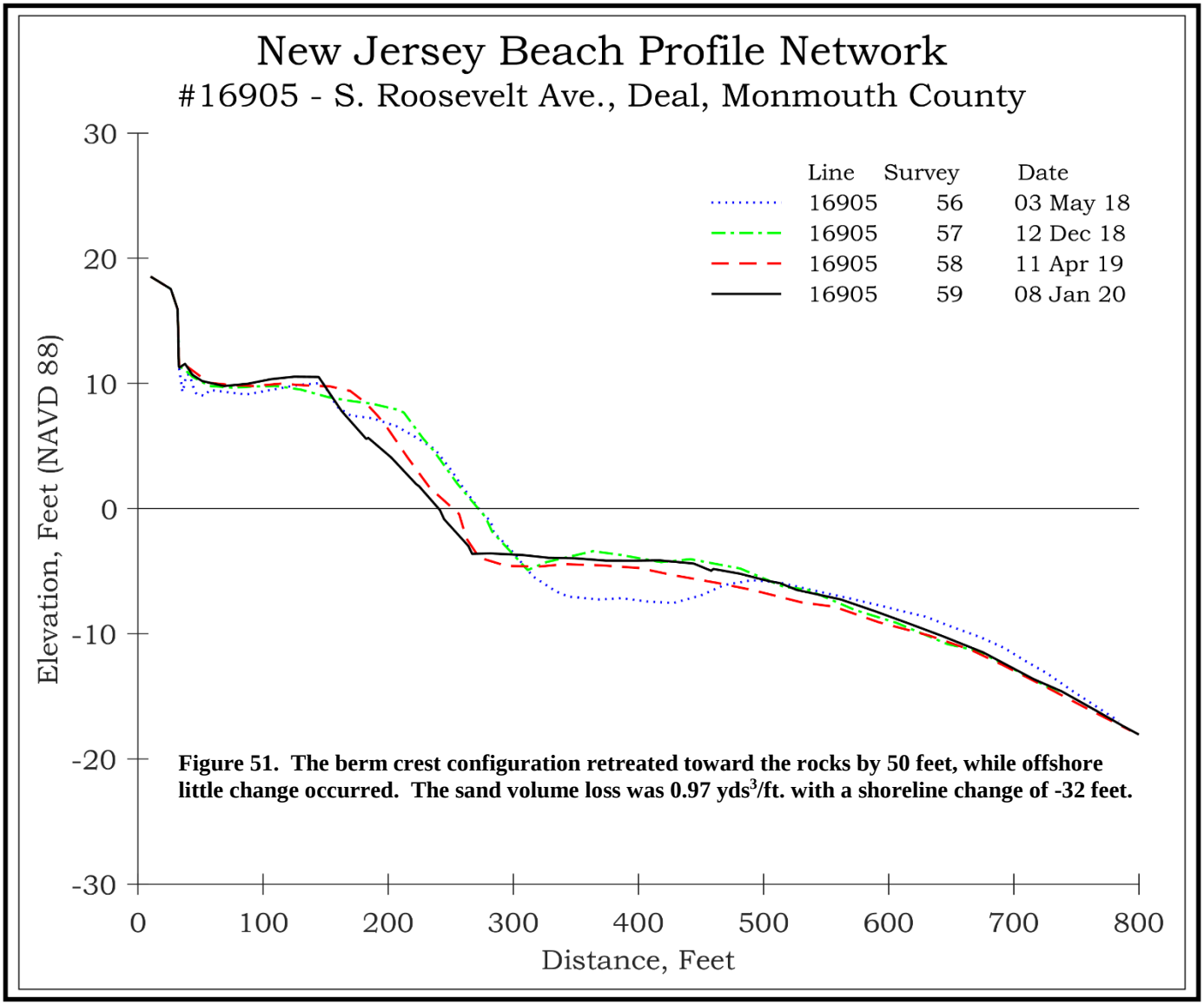


Figure 51. The berm crest configuration retreated toward the rocks by 50 feet, while offshore little change occurred. The sand volume loss was 0.97 yds^3/ft. with a shoreline change of -32 feet.

NJBPN 16904 – 71 Ocean Avenue, Deal

Located south of Poplar Brook, this site on December 12, 2018 remained essentially at the design width. As of Jan. 8, 2020 some beachface retreat has occurred (right view) with a beach still far wider than pre-project.

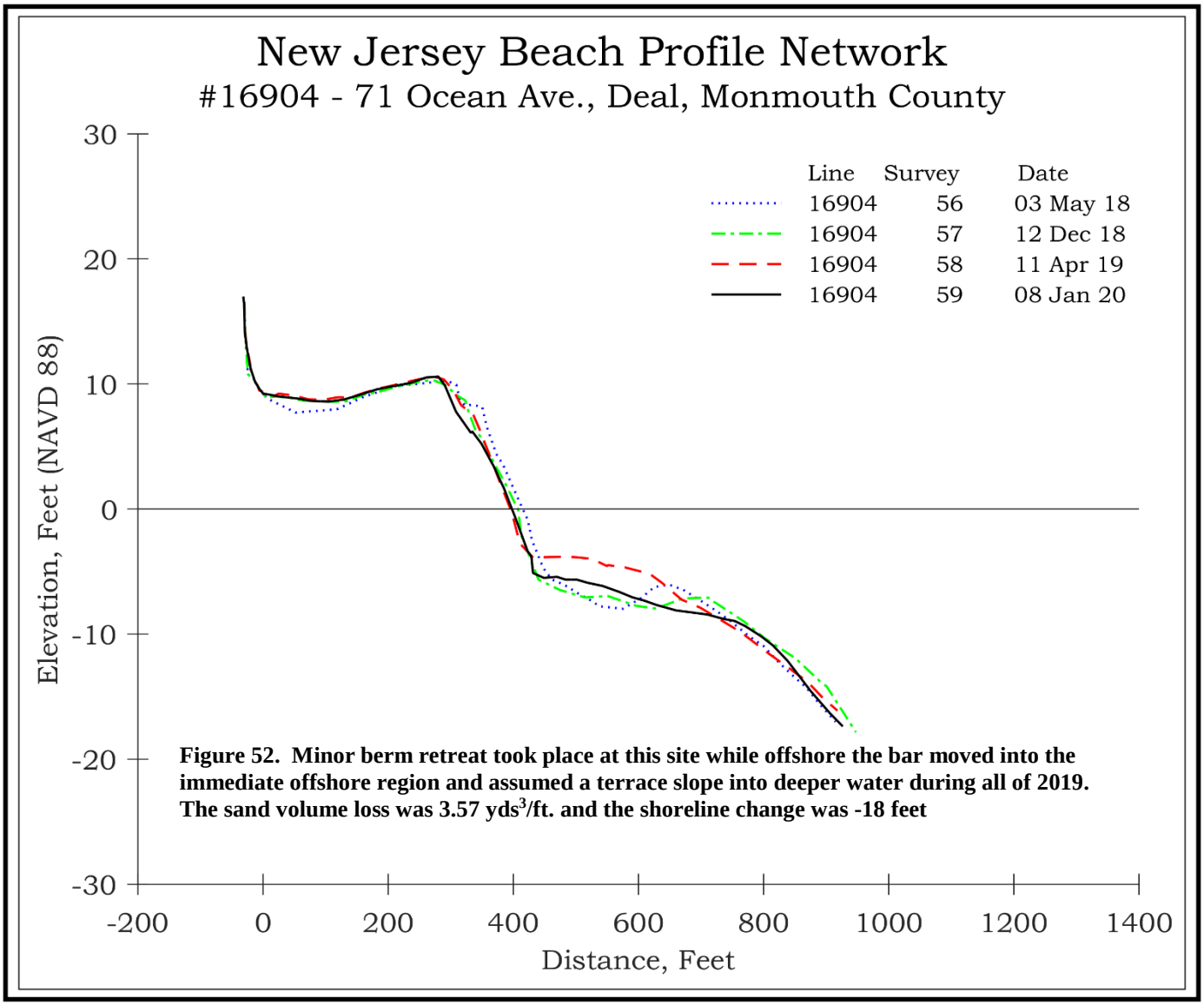


Figure 52. Minor berm retreat took place at this site while offshore the bar moved into the immediate offshore region and assumed a terrace slope into deeper water during all of 2019. The sand volume loss was 3.57 yds^3/ft. and the shoreline change was -18 feet

NJBPN 16903 – Ocean Lane, Deal

This site is in proximity to Phillips Avenue bathing pavillion, severely damaged by Hurricane Sandy. The Dec. 12. 2018 view on the left shows the toe of the dunes where wind deposition has added material. The right side shows the beach as of Jan. 8, 2020 with more wind deposition.

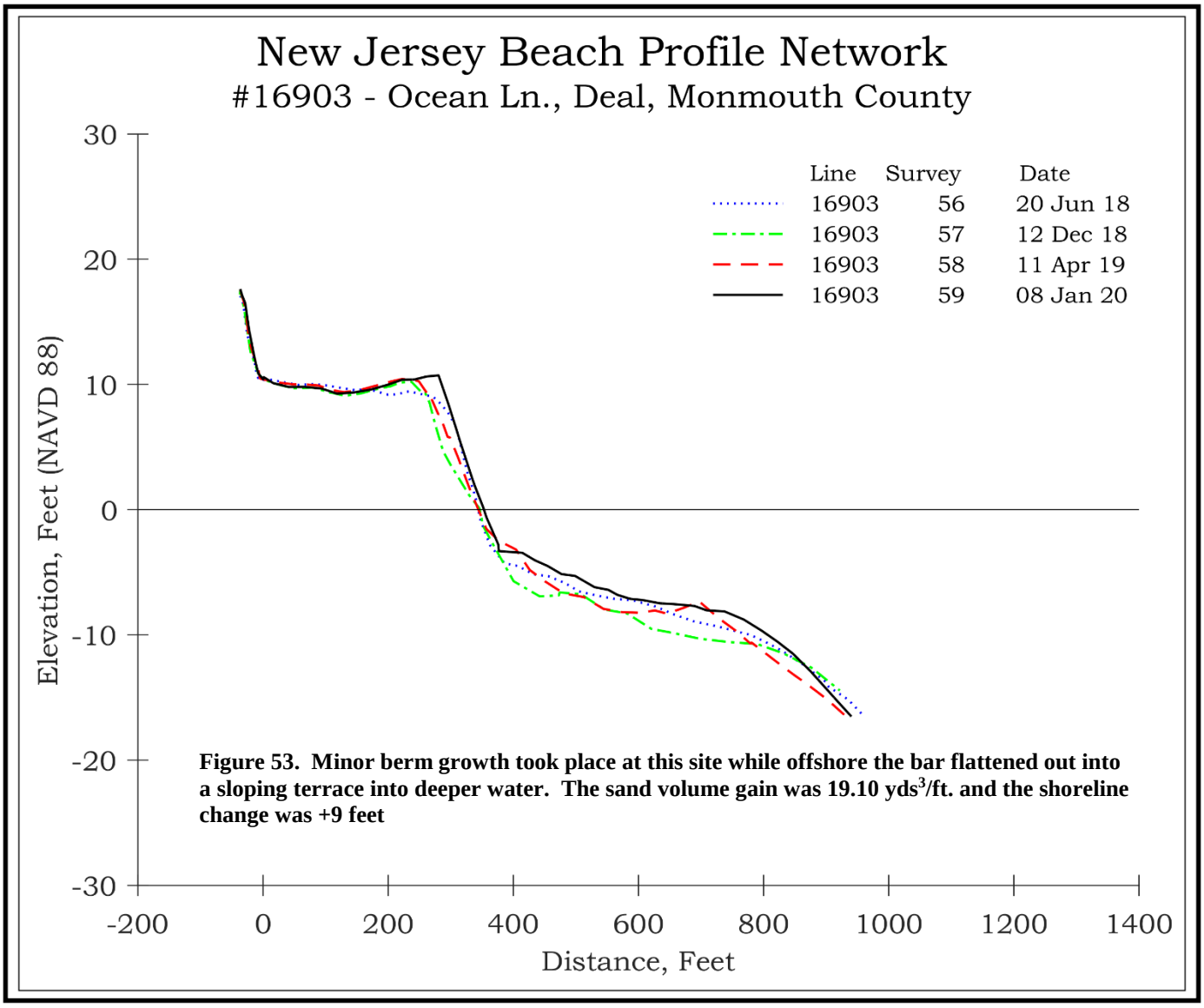


Figure 53. Minor berm growth took place at this site while offshore the bar flattened out into a sloping terrace into deeper water. The sand volume gain was 19.10 yds^3/ft. and the shoreline change was +9 feet

NJBPN 16902 – Brighton Avenue, Deal

The Deal Casino bathing complex is the site of this cross section. The extensive disturbance seen December 2018 (left) was to create a sand ridge on the beach for storm defense that winter. As of Jan. 7, 2020 the ridge was not present and sand has deposited on the small dune growing at the fence line on the beach.

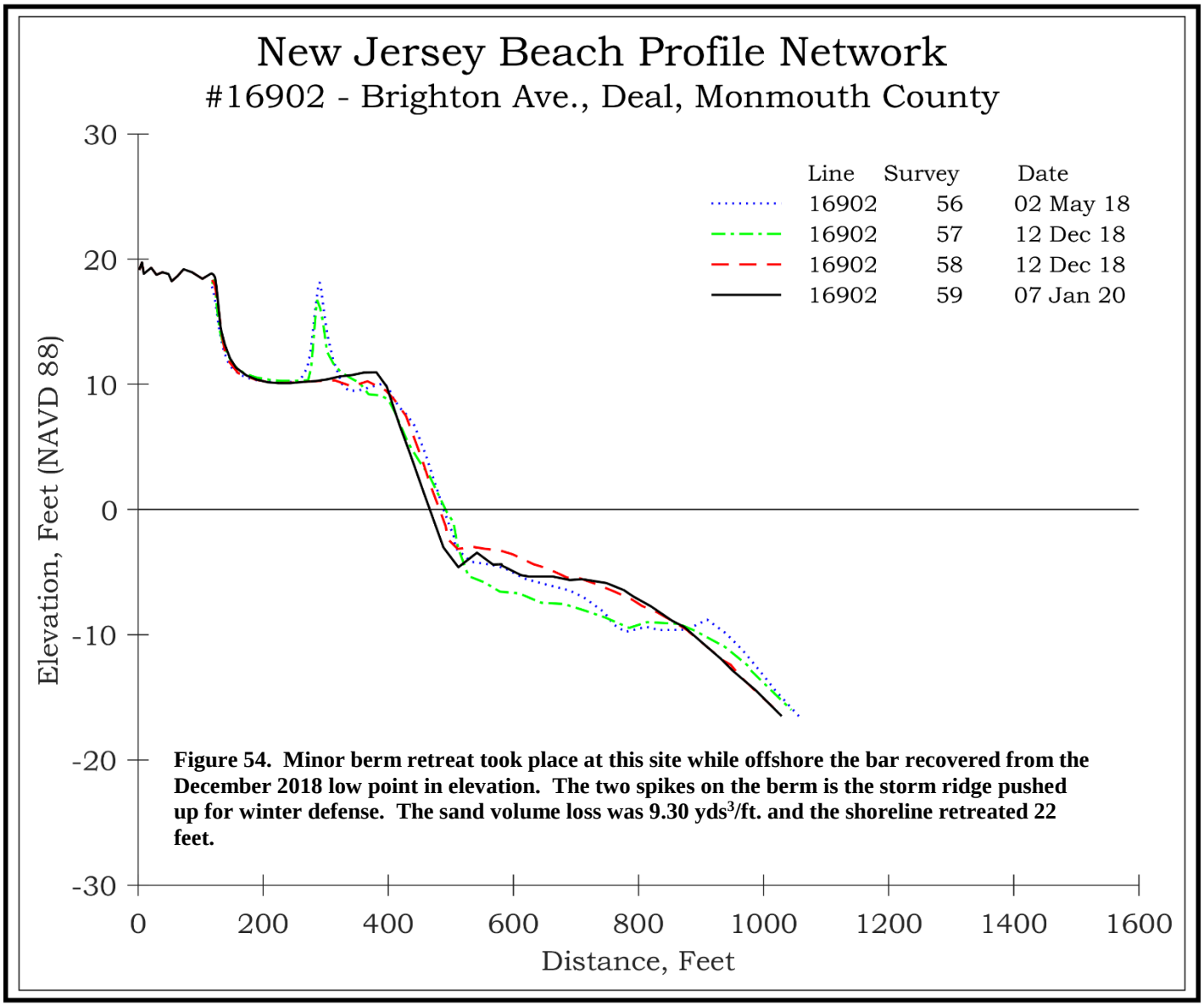
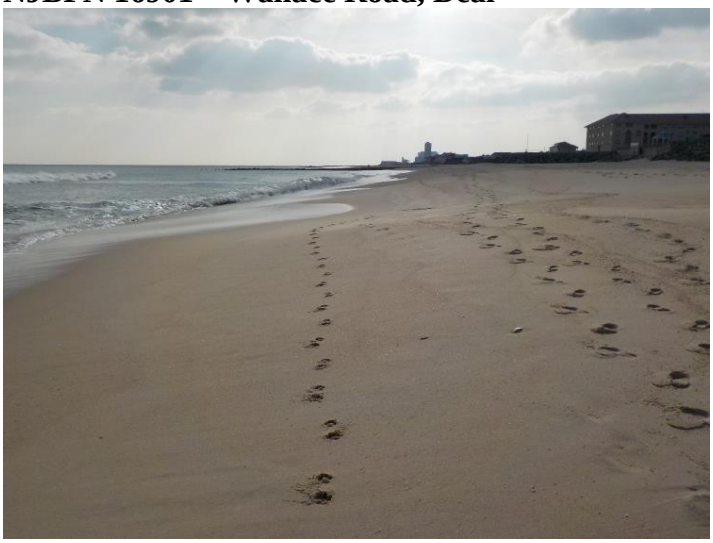


Figure 54. Minor berm retreat took place at this site while offshore the bar recovered from the December 2018 low point in elevation. The two spikes on the berm is the storm ridge pushed up for winter defense. The sand volume loss was 9.30 yds^3/ft. and the shoreline retreated 22 feet.

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 Dec. 12, 2018 view south on the left was taken at the beachface while the Jan. 7, 2020 view was shot at the toe of the rock revetments built post-Sandy at the site with some wind deposition generating an incipient dune (right view). The 4-foot high fence has been buried.

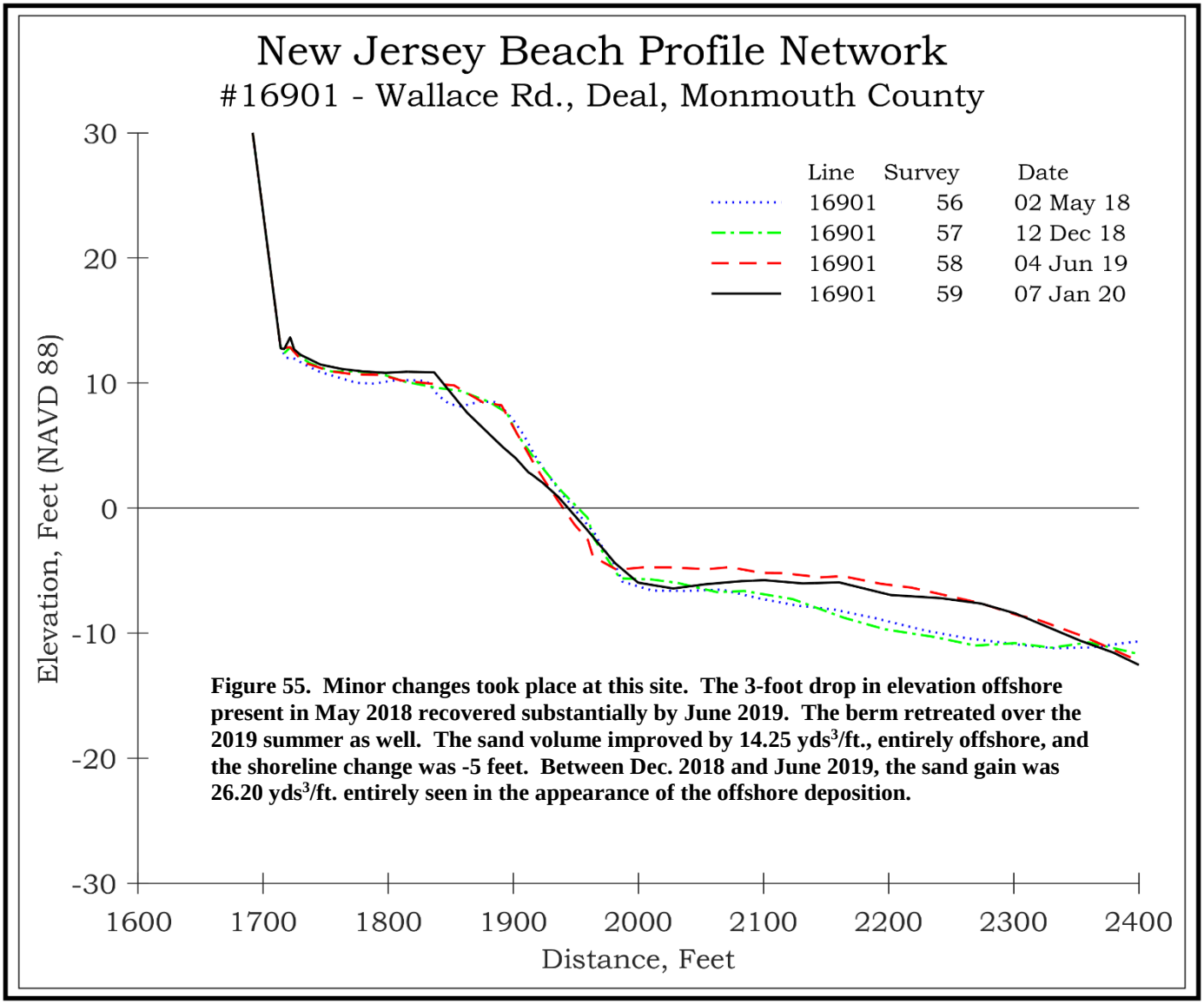
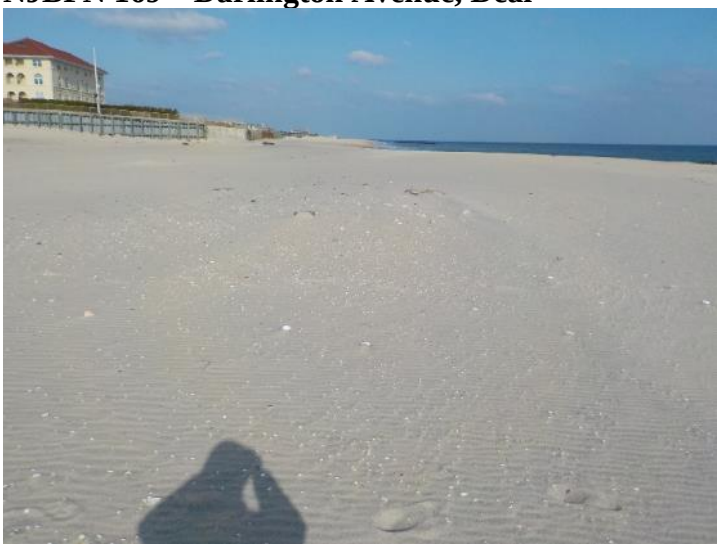


Figure 55. Minor changes took place at this site. The 3-foot drop in elevation offshore present in May 2018 recovered substantially by June 2019. The berm retreated over the 2019 summer as well. The sand volume improved by 14.25 yds^3/ft., entirely offshore, and the shoreline change was -5 feet. Between Dec. 2018 and June 2019, the sand gain was 26.20 yds^3/ft. entirely seen in the appearance of the offshore deposition.

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 December 12, 2018 view shows the beach width quite well (left side) and the Jan. 7, 2020 view on the right shows the berm and beachface at the outer part of the dry sand beach.

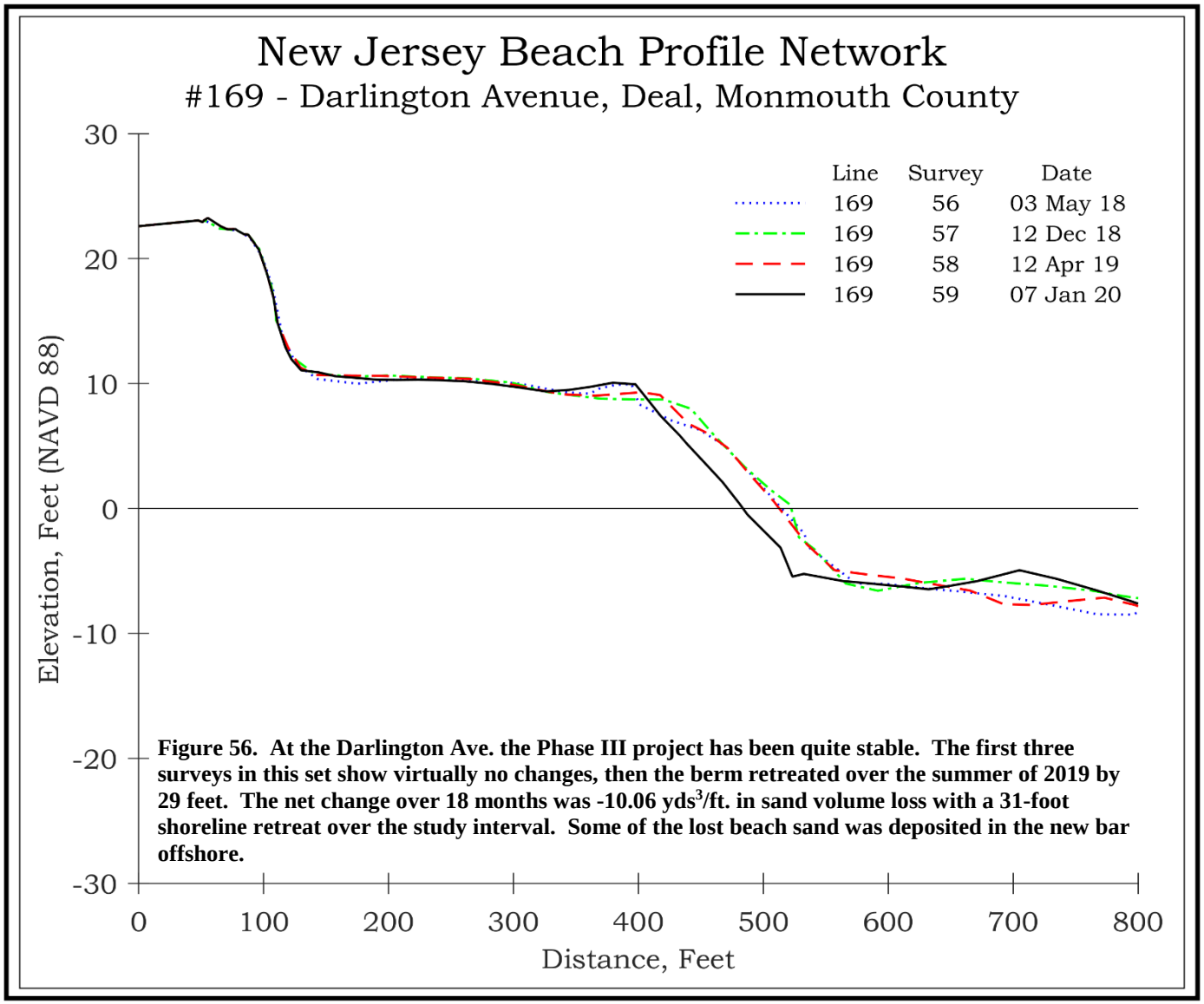


Figure 56. At the Darlington Ave. the Phase III project has been quite stable. The first three surveys in this set show virtually no changes, then the berm retreated over the summer of 2019 by 29 feet. The net change over 18 months was -10.06 yds^3/ft. in sand volume loss with a 31-foot shoreline retreat over the study interval. Some of the lost beach sand was deposited in the new bar offshore.

NJBPN 16802 – Monmouth Drive, Deal

This site fronts a private home at the bluff. No dune exists and the beach measured 150 feet wide on Dec. 11, 2018 on left. 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 right side view.

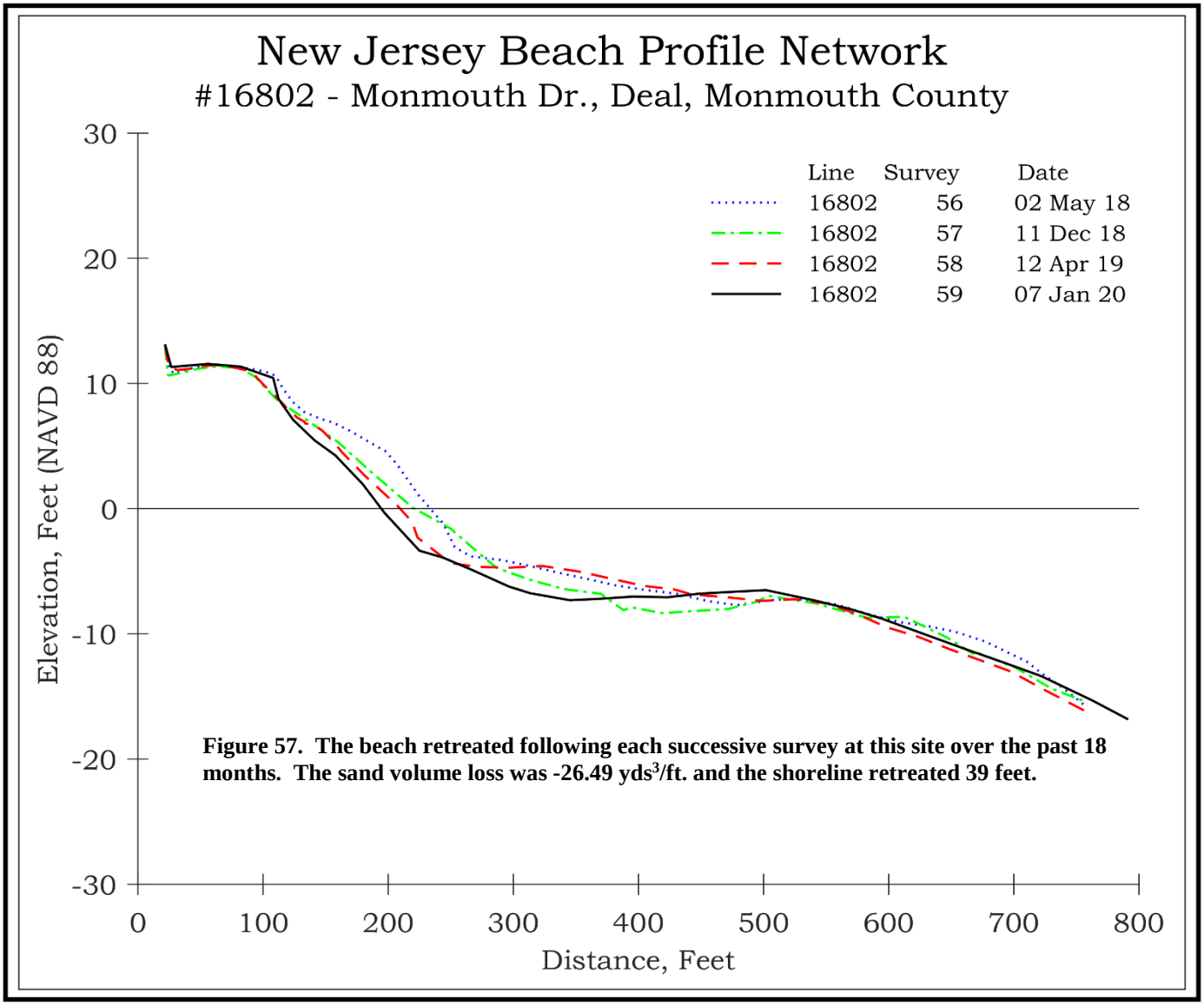


Figure 57. The beach retreated following each successive survey at this site over the past 18 months. The sand volume loss was -26.49 yds^3/ft. and the shoreline retreated 39 feet.

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 years ago. The sediment may not reside here terribly long, but the past two years show some stability. The left view was taken Dec. 11, 2018 and the right side was taken Jan. 3, 2020.

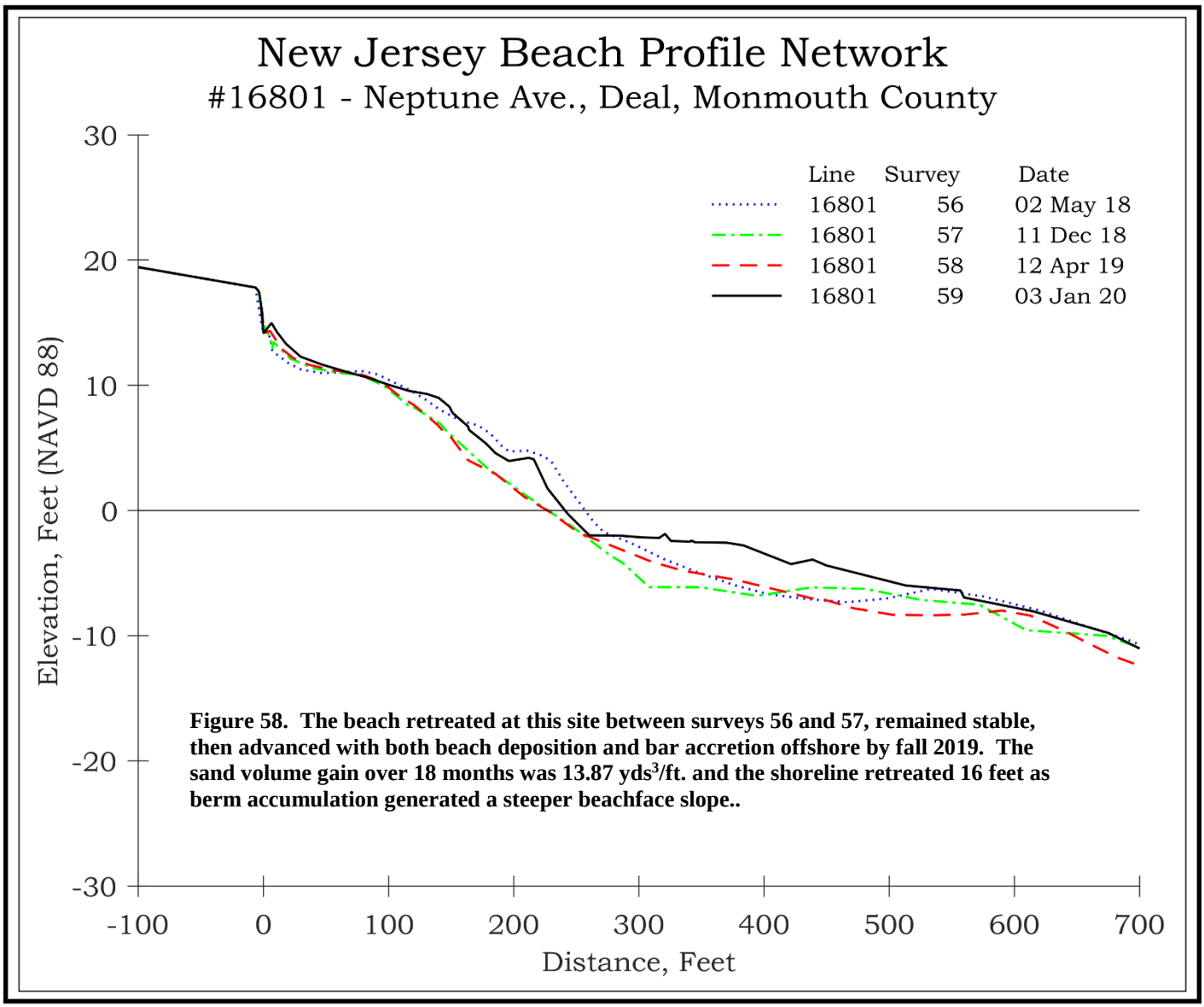


Figure 58. The beach retreated at this site between surveys 56 and 57, remained stable, then advanced with both beach deposition and bar accretion offshore by fall 2019. The sand volume gain over 18 months was 13.87 yds^3/ft. and the shoreline retreated 16 feet as berm accumulation generated a steeper beachface slope..

NJBPN 168 – Corlies Avenue, Allenhurst

This site in Allenhurst was the starting point for Phase III USACE work in 2015. The left side view (Dec. 11, 2018) to the south includes Loch Arbor and, in the distance, Asbury Park. The winter storm ridge was not present in the Jan. 30, 2020 view on the right.

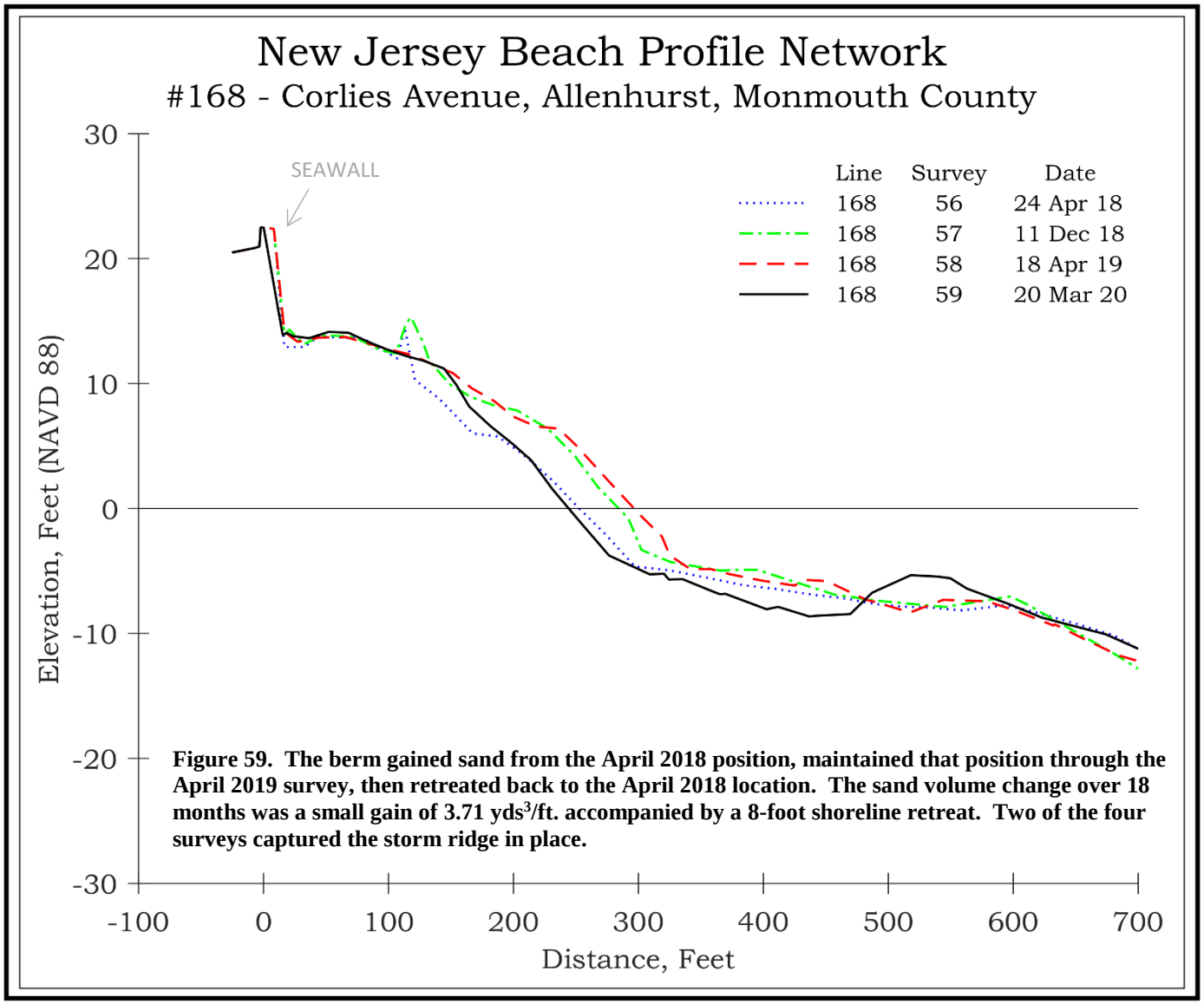


Figure 59. The berm gained sand from the April 2018 position, maintained that position through the April 2019 survey, then retreated back to the April 2018 location. The sand volume change over 18 months was a small gain of 3.71 yds^3/ft. accompanied by a 8-foot shoreline retreat. Two of the four surveys captured the storm ridge in place.

NJBPN 26703 – Euclid Avenue, Loch Arbor

This site is located on the public half of the Loch Arbor shoreline. The Dec. 12, 2018 view on the left shows the beach width in comparison with the Jan. 30, 2020 view on the right taken approximately in the same location on the transect.

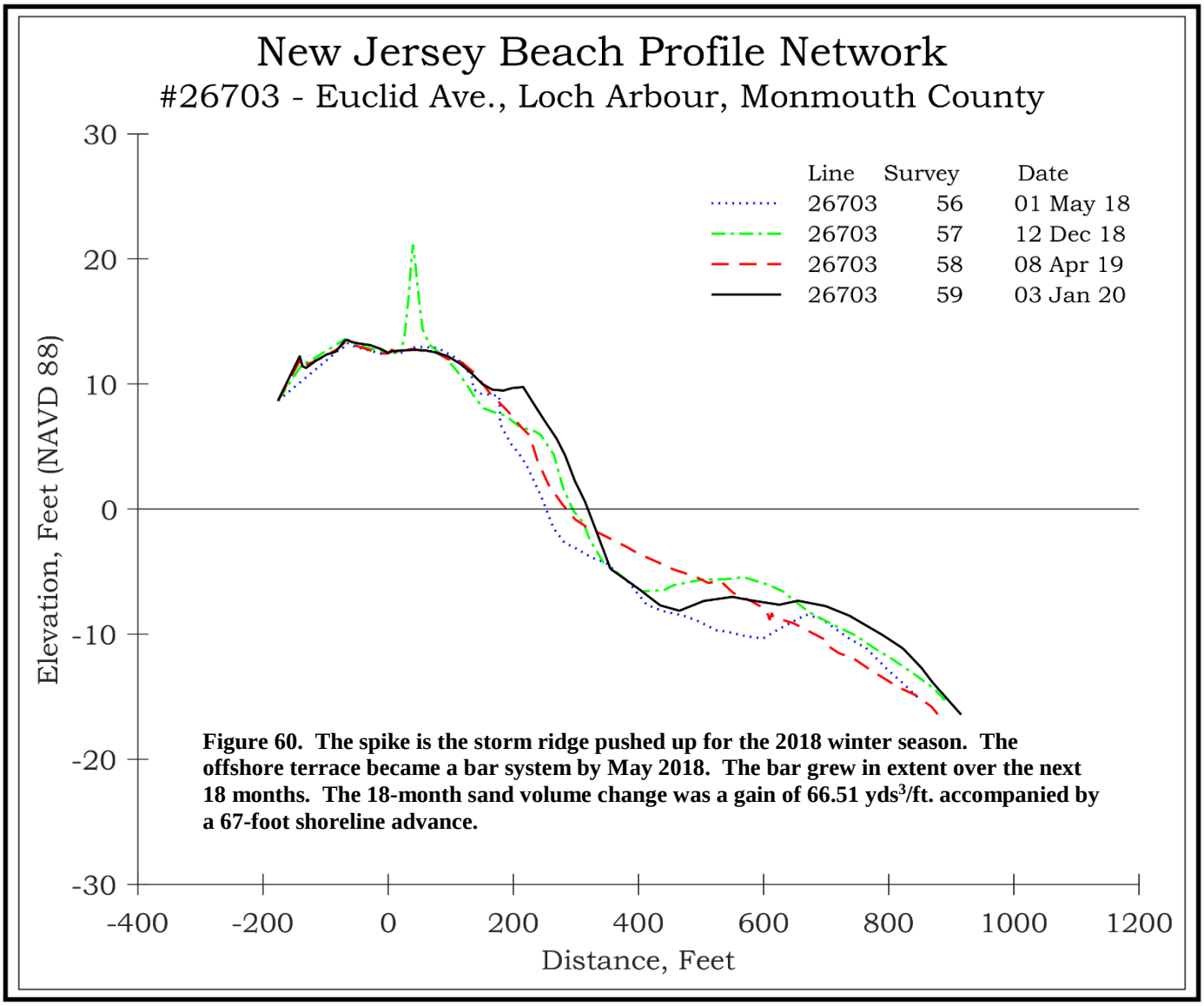


Figure 60. The spike is the storm ridge pushed up for the 2018 winter season. The offshore terrace became a bar system by May 2018. The bar grew in extent over the next 18 months. The 18-month sand volume change was a gain of 66.51 yds^3/ft. accompanied by a 67-foot shoreline advance.

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 left view taken Dec. 12, 2018 shows the beach with a series of ridges pushed up as added storm protection. The Jan. 30, 2020 view on the right shows the natural beach slope without sand pushed up.

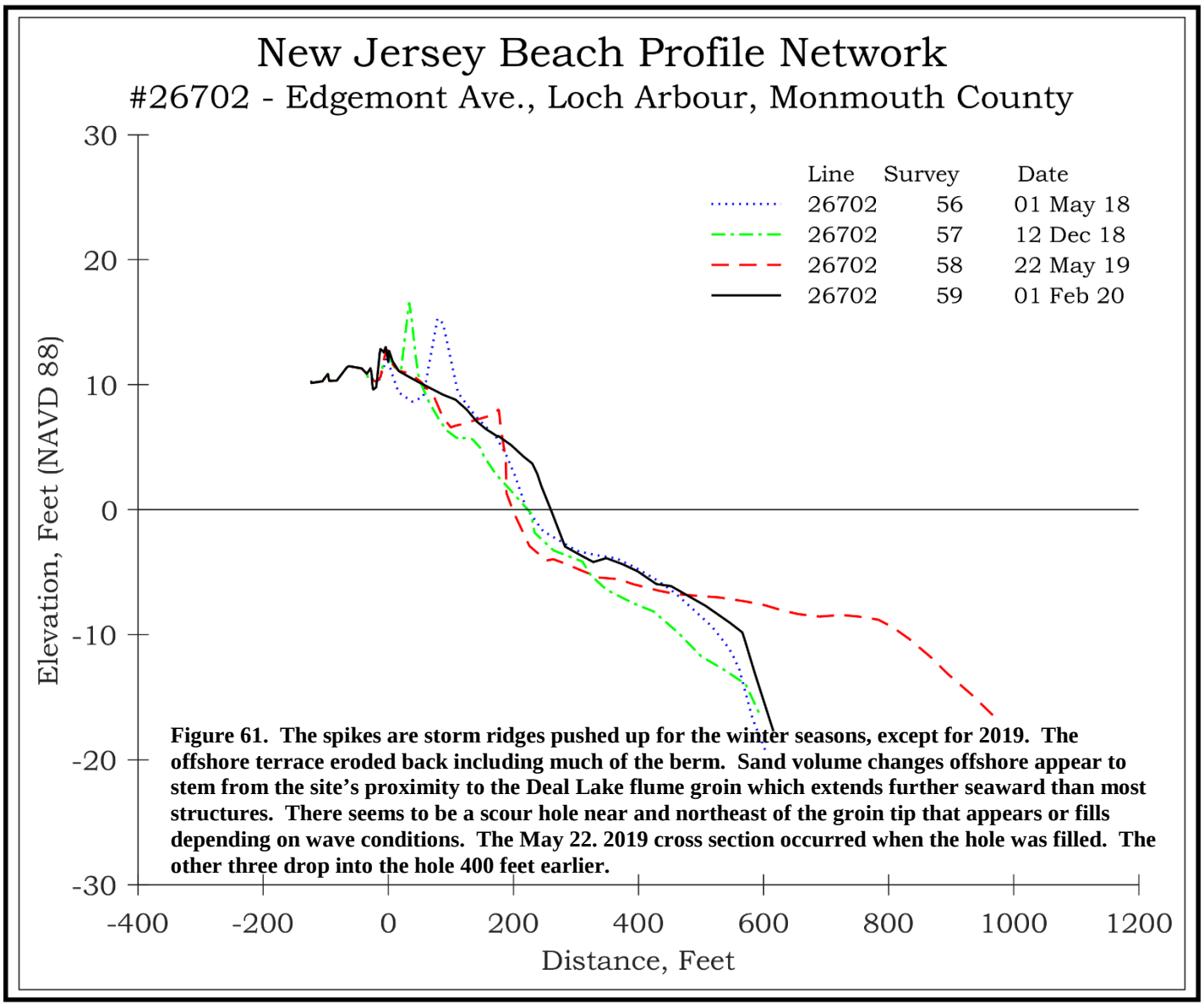


Figure 61. The spikes are storm ridges pushed up for the winter seasons, except for 2019. The offshore terrace eroded back including much of the berm. Sand volume changes offshore appear to stem from the site's proximity to the Deal Lake flume groin which extends further seaward than most structures. There seems to be a scour hole near and northeast of the groin tip that appears or fills depending on wave conditions. The May 22. 2019 cross section occurred when the hole was filled. The other three drop into the hole 400 feet earlier.

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 left view in Dec. 11, 2018 shows the beachface looking south with minimal groin exposure. By Jan. 30, 2020, the rocks were clearly exposed as the beach retreated.

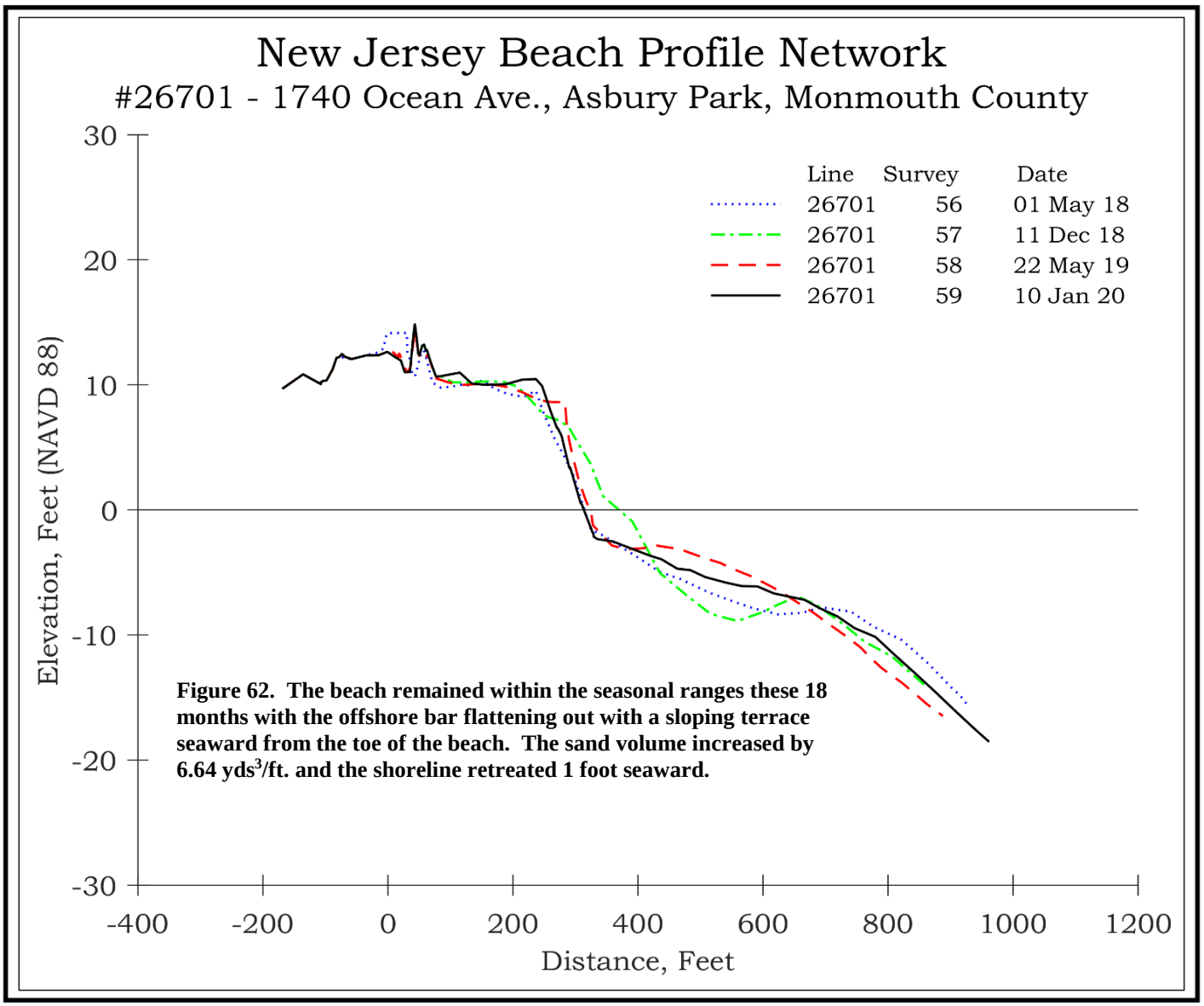


Figure 62. The beach remained within the seasonal ranges these 18 months with the offshore bar flattening out with a sloping terrace seaward from the toe of the beach. The sand volume increased by 6.64 yds^3/ft. and the shoreline retreated 1 foot seaward.

NJBPN 267 – 7th Avenue, Asbury Park

This site is the northernmost location in the Phase II part of the Monmouth County project. The left photo was taken Dec. 11, 2018 and shows the sand fence placed primarily to restrict access to the boardwalk reconstruction. The beachface view on Jan. 11, 2020 shows the rock groins with greater exposure indicating shoreline retreat.

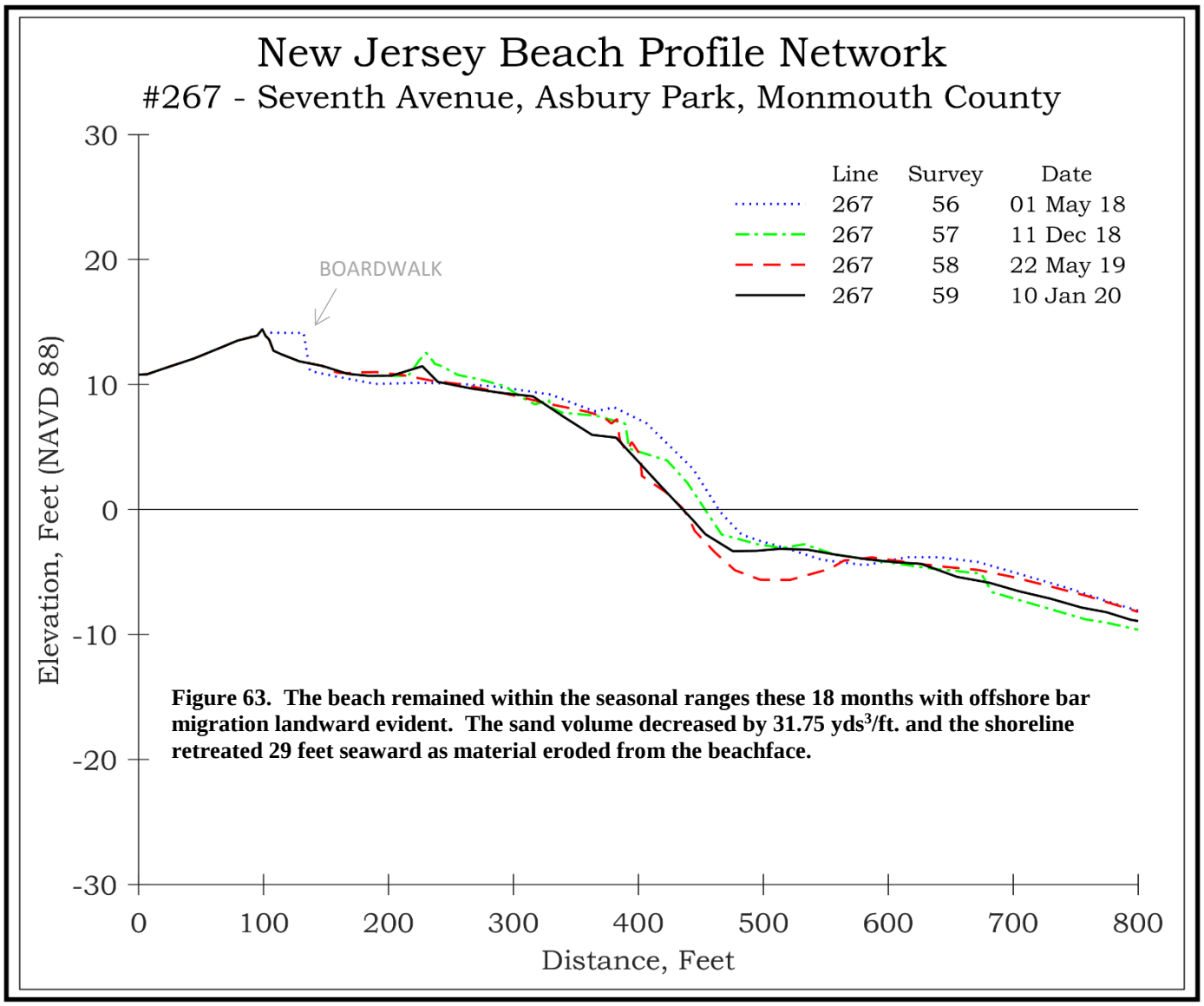
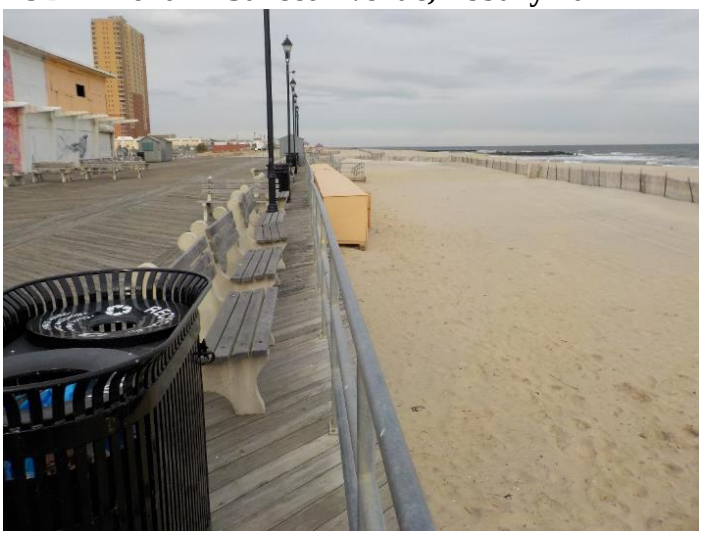


Figure 63. The beach remained within the seasonal ranges these 18 months with offshore bar migration landward evident. The sand volume decreased by 31.75 yds^3/ft. and the shoreline retreated 29 feet seaward as material eroded from the beachface.

NJBPN 16701 – Sunset Avenue, Asbury Park



The Dec. 5, 2018 view on the left shows the beach and fencing designed to restrict access to construction. The Jan. 10, 2020 view on the right shows the storage boxes completed next to the boardwalk with the beach essentially the same.

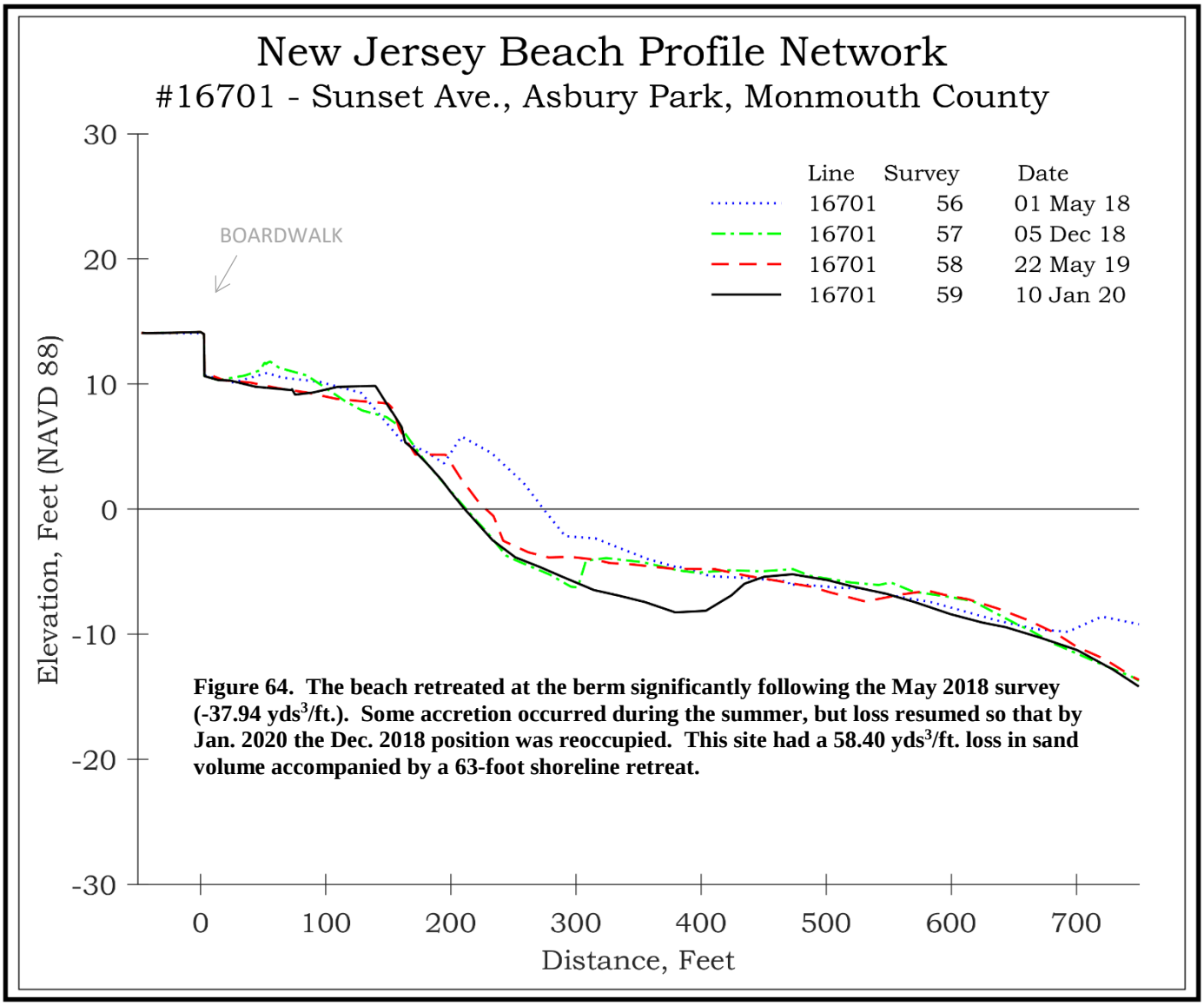


Figure 64. The beach retreated at the berm significantly following the May 2018 survey (-37.94 yds^3/ft.). Some accretion occurred during the summer, but loss resumed so that by Jan. 2020 the Dec. 2018 position was reoccupied. This site had a 58.40 yds^3/ft. loss in sand volume accompanied by a 63-foot shoreline retreat.

NJBPN 167 – 3rd Avenue, Asbury Park

The left view was taken November 30, 2018 on the dry beach looking north. The Jan. 11, 2020 view was at the berm crest showing the exposed groins and the relative beach with compared to the Asbury Park convention center building.

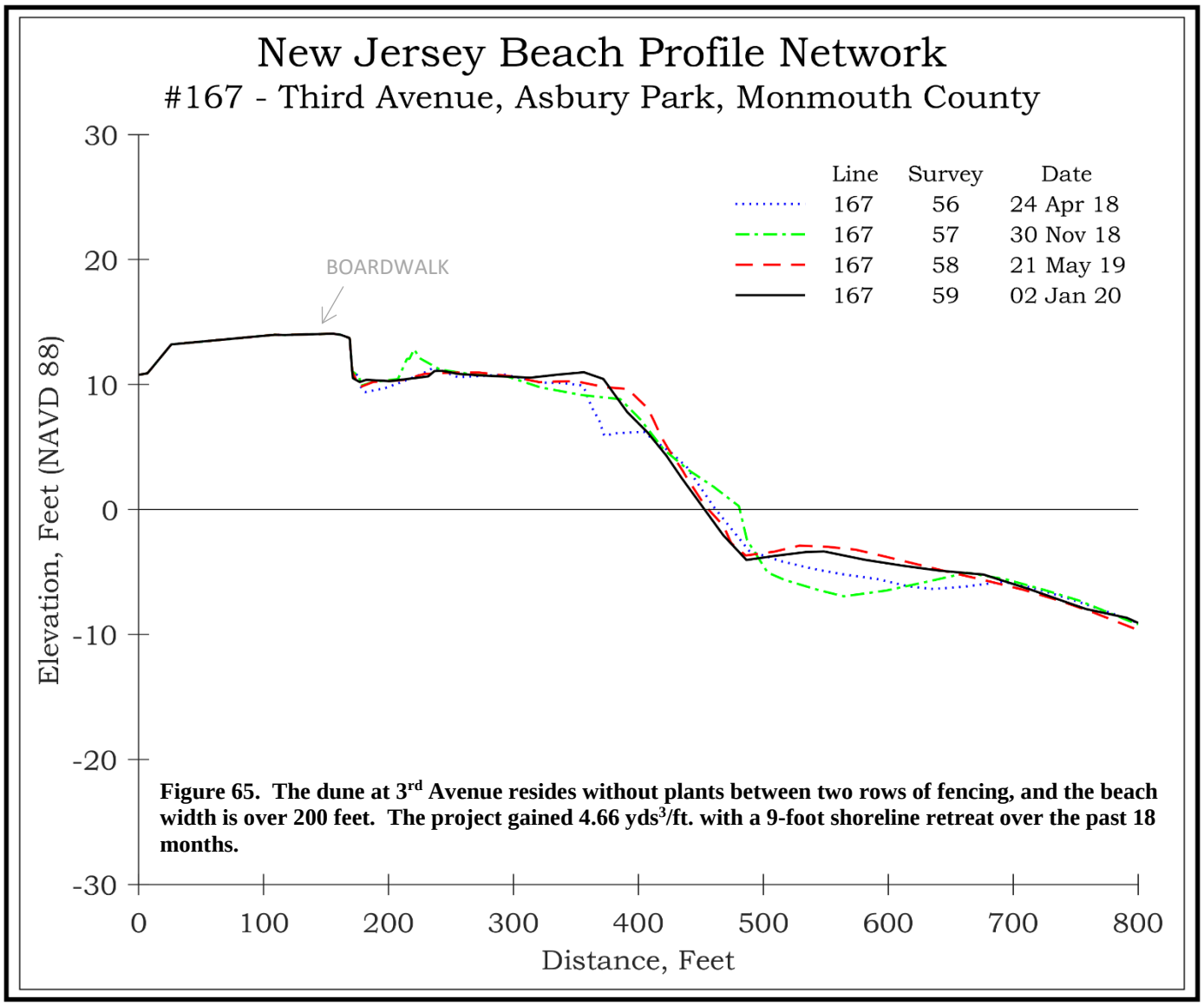
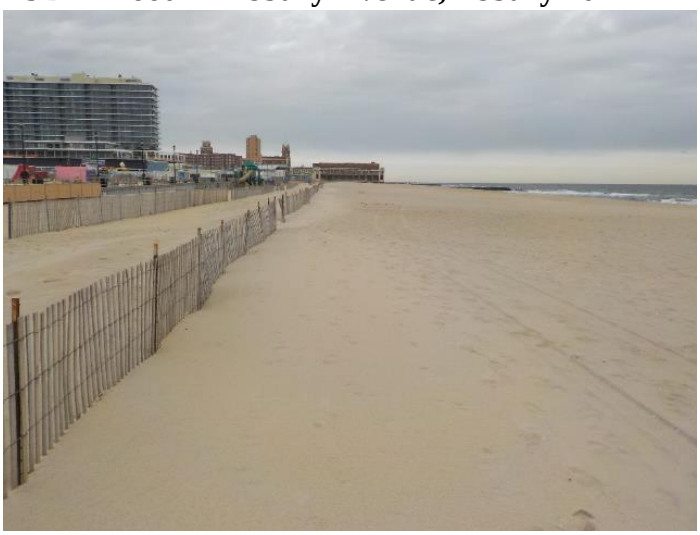


Figure 65. The dune at 3rd Avenue resides without plants between two rows of fencing, and the beach width is over 200 feet. The project gained 4.66 yds^3/ft. with a 9-foot shoreline retreat over the past 18 months.

NJBPN 16602 – Asbury Avenue, Asbury Park



The left view was taken seaward of a double row of sand fence on Dec. 5, 2018. The same view to the north was shot on Jan 2, 2020 between the rows of fence. Sand does collect here, but in minor amounts.

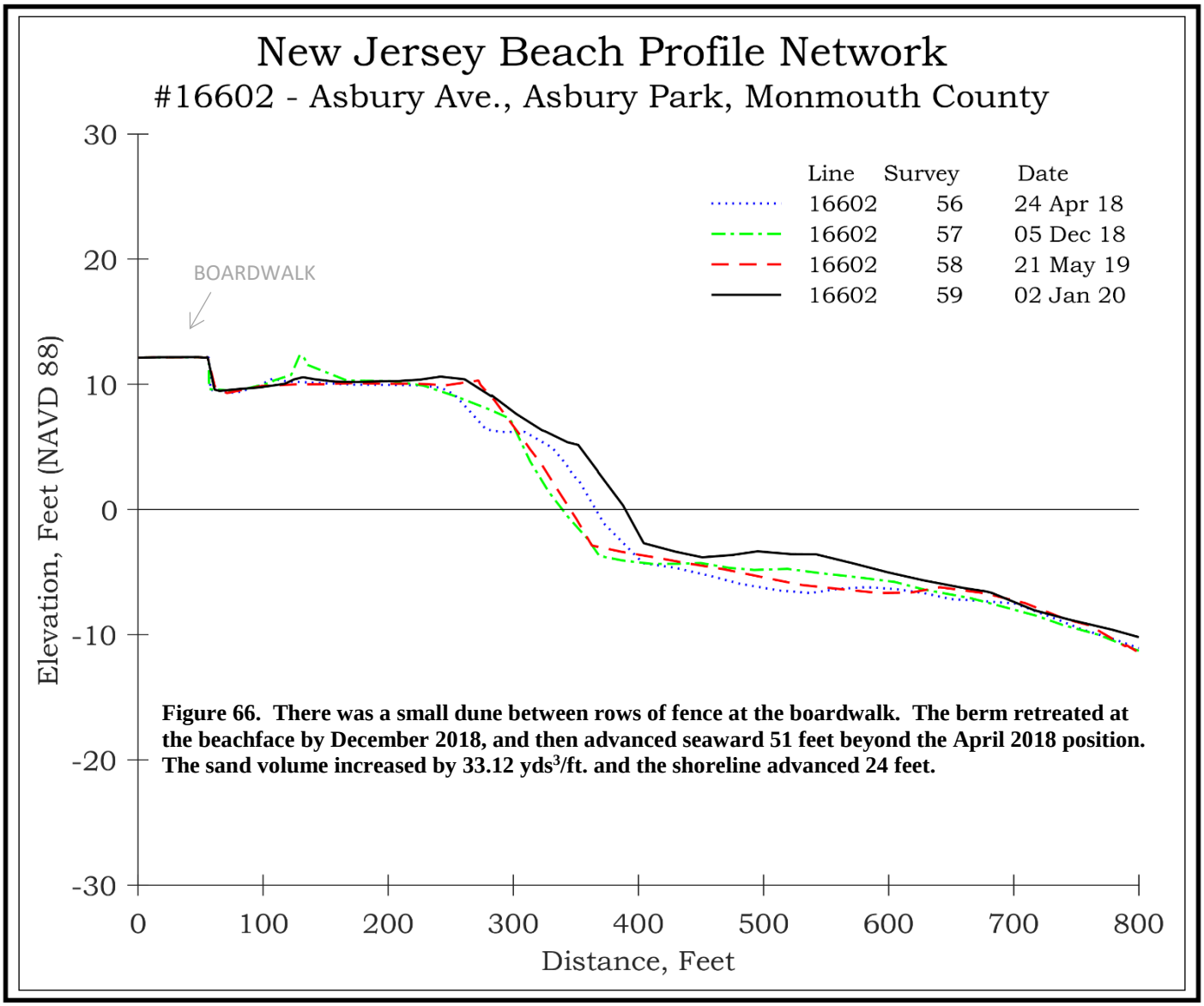


Figure 66. There was a small dune between rows of fence at the boardwalk. The berm retreated at the beachface by December 2018, and then advanced seaward 51 feet beyond the April 2018 position. The sand volume increased by 33.12 yds^3/ft. and the shoreline advanced 24 feet.

NJBPN 16601 – Spray Avenue, Ocean Grove

The view on the left is from Nov. 30, 2018 and shows the entire beach width. 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 Ocean Grove dunes.

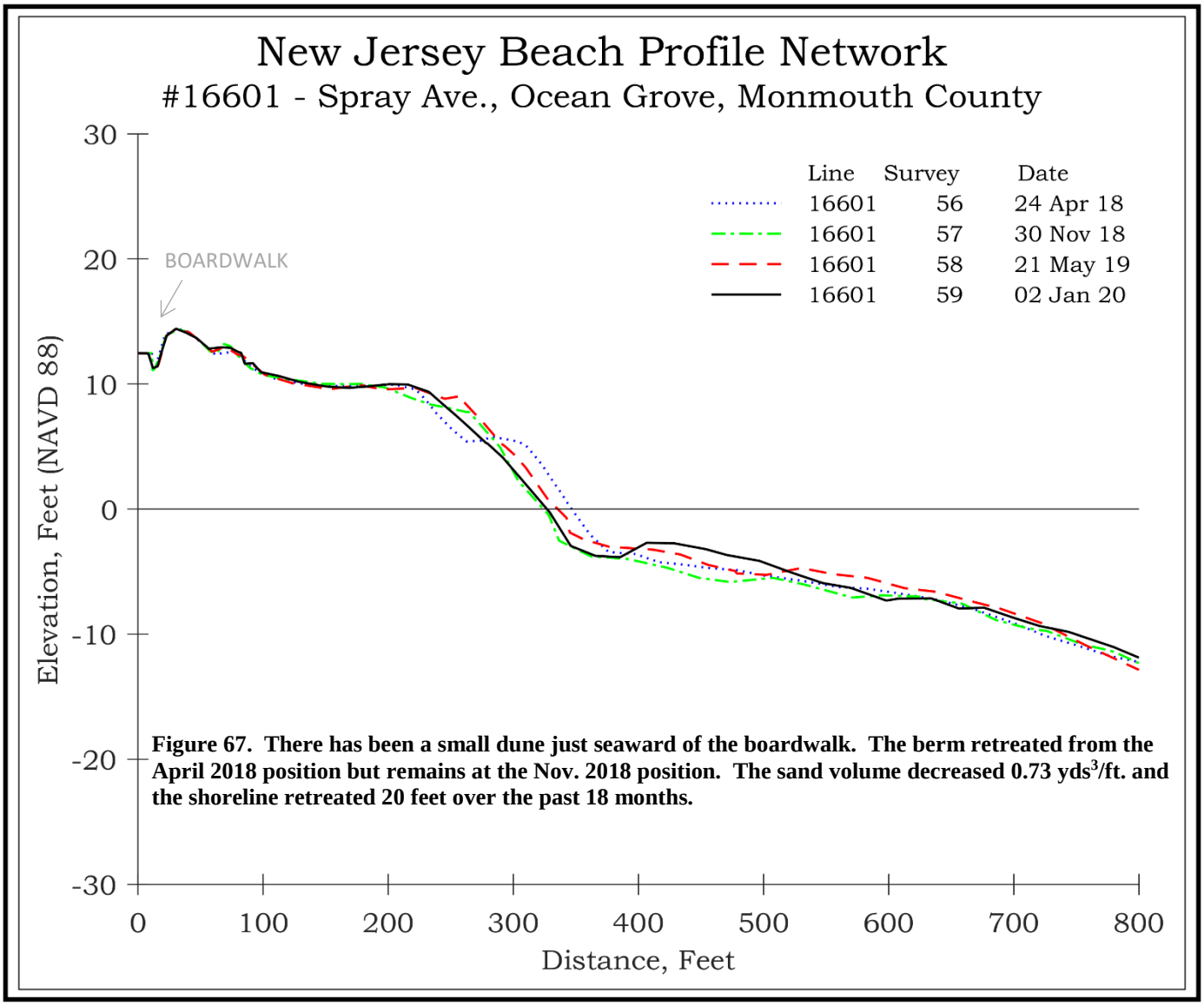


Figure 67. There has been a small dune just seaward of the boardwalk. The berm retreated from the April 2018 position but remains at the Nov. 2018 position. The sand volume decreased 0.73 yds^3/ft. and the shoreline retreated 20 feet over the past 18 months.

NJBPN 166 – Ocean Pathway, Ocean Grove

The Nov. 30, 2018 view to the left shows the sand ridge pushed up that year for added storm protection. The Jan. 2, 2020 view on the right shows the new service building put on the seaward dune toe and the dry beach width present at the time.

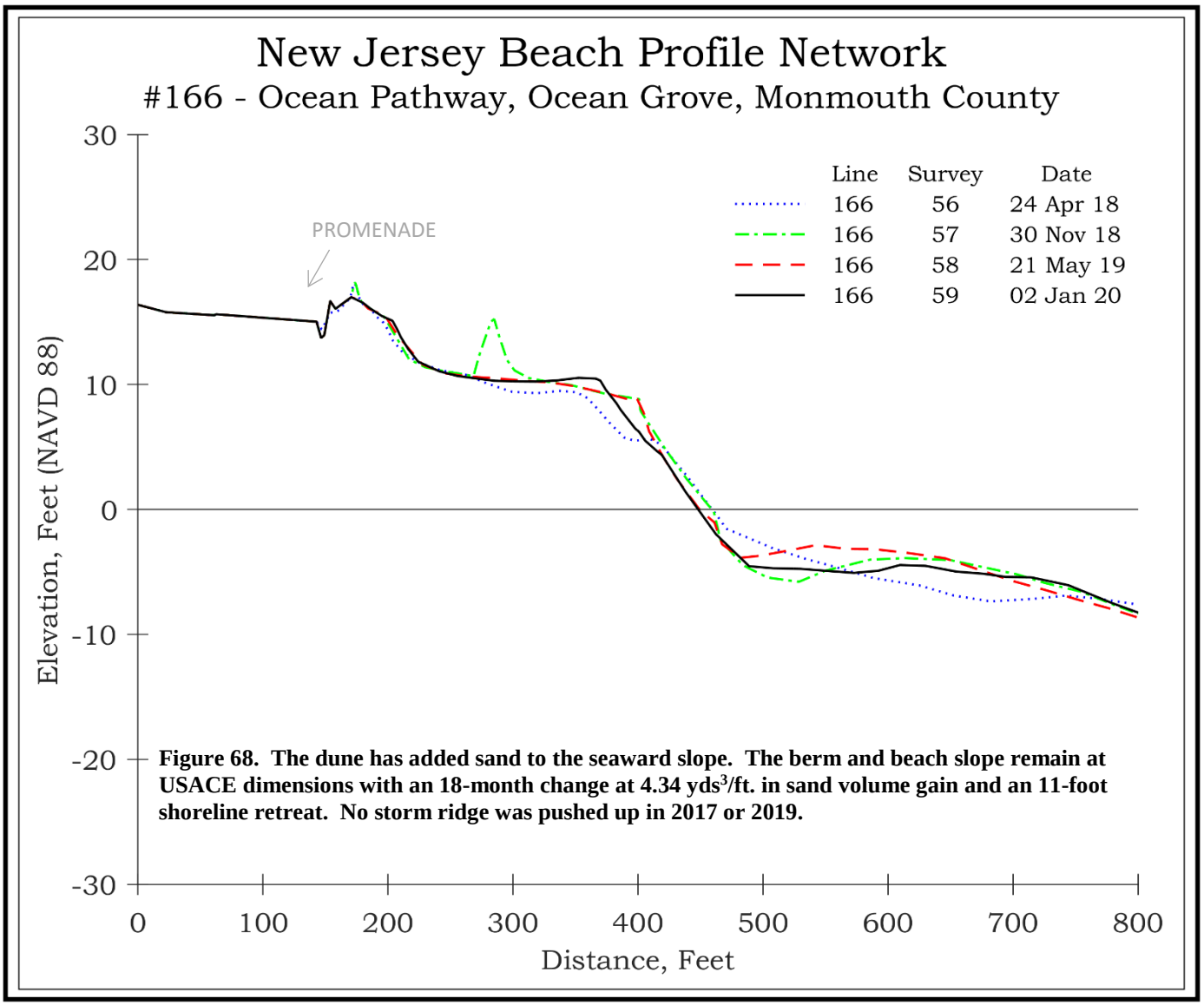


Figure 68. The dune has added sand to the seaward slope. The berm and beach slope remain at USACE dimensions with an 18-month change at 4.34 yds^3/ft. in sand volume gain and an 11-foot shoreline retreat. No storm ridge was pushed up in 2017 or 2019.

NJBPN 16502 – Broadway, Ocean Grove

The Nov. 30, 2018 view on the left shows the dune slope with a sand ridge added that year for storm protection. The right view from Jan. 2, 2020 shows the beach width and seaward dune slope without pushed up material.

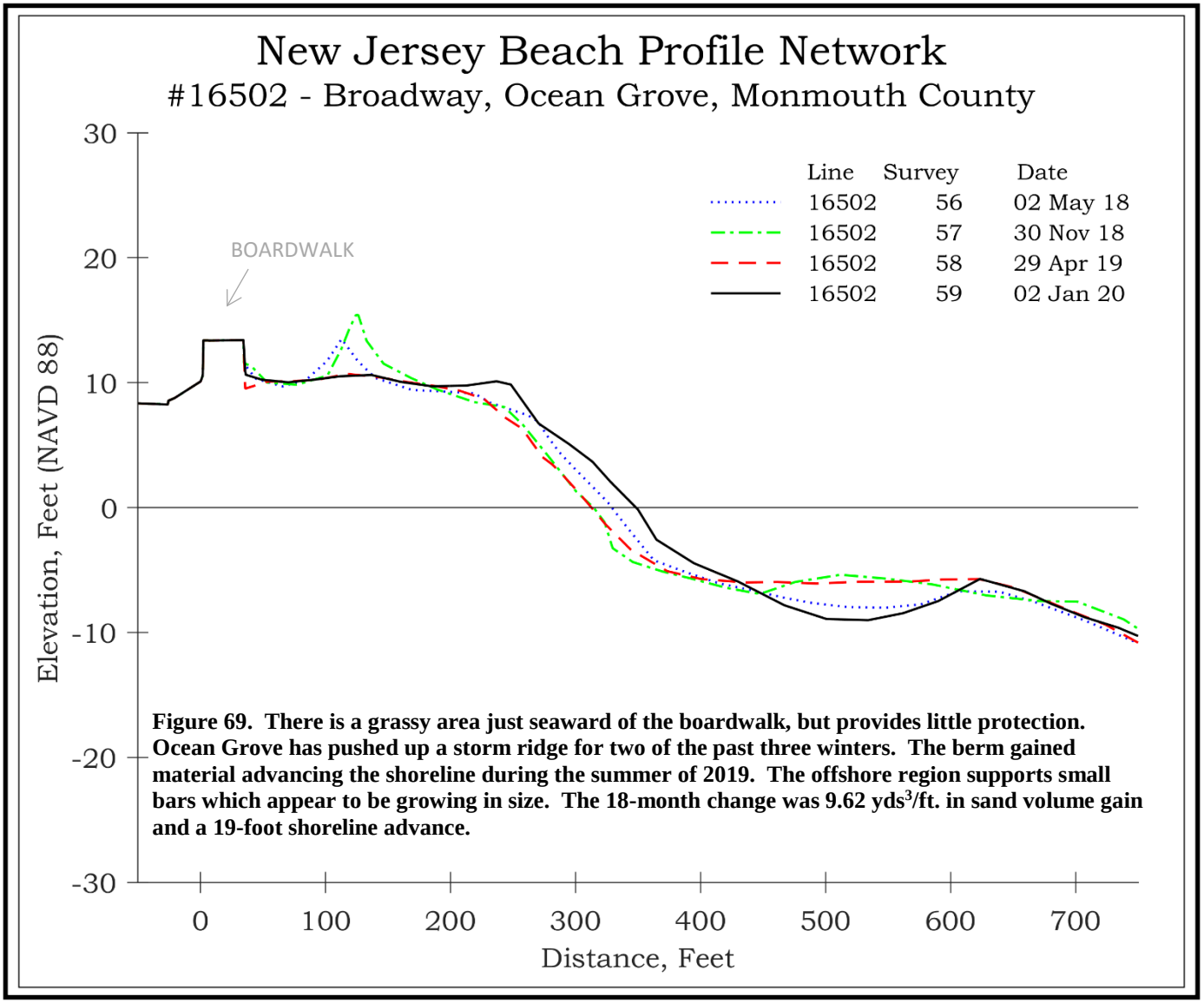


Figure 69. There is a grassy area just seaward of the boardwalk, but provides little protection. Ocean Grove has pushed up a storm ridge for two of the past three winters. The berm gained material advancing the shoreline during the summer of 2019. The offshore region supports small bars which appear to be growing in size. The 18-month change was 9.62 yds^3/ft. in sand volume gain and a 19-foot shoreline advance.

NJBPN 16501 – Cliff Avenue, Bradley Beach

The Nov. 29, 2018 view on the left is to the north seaward at the foredune toe on the beach, while 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.

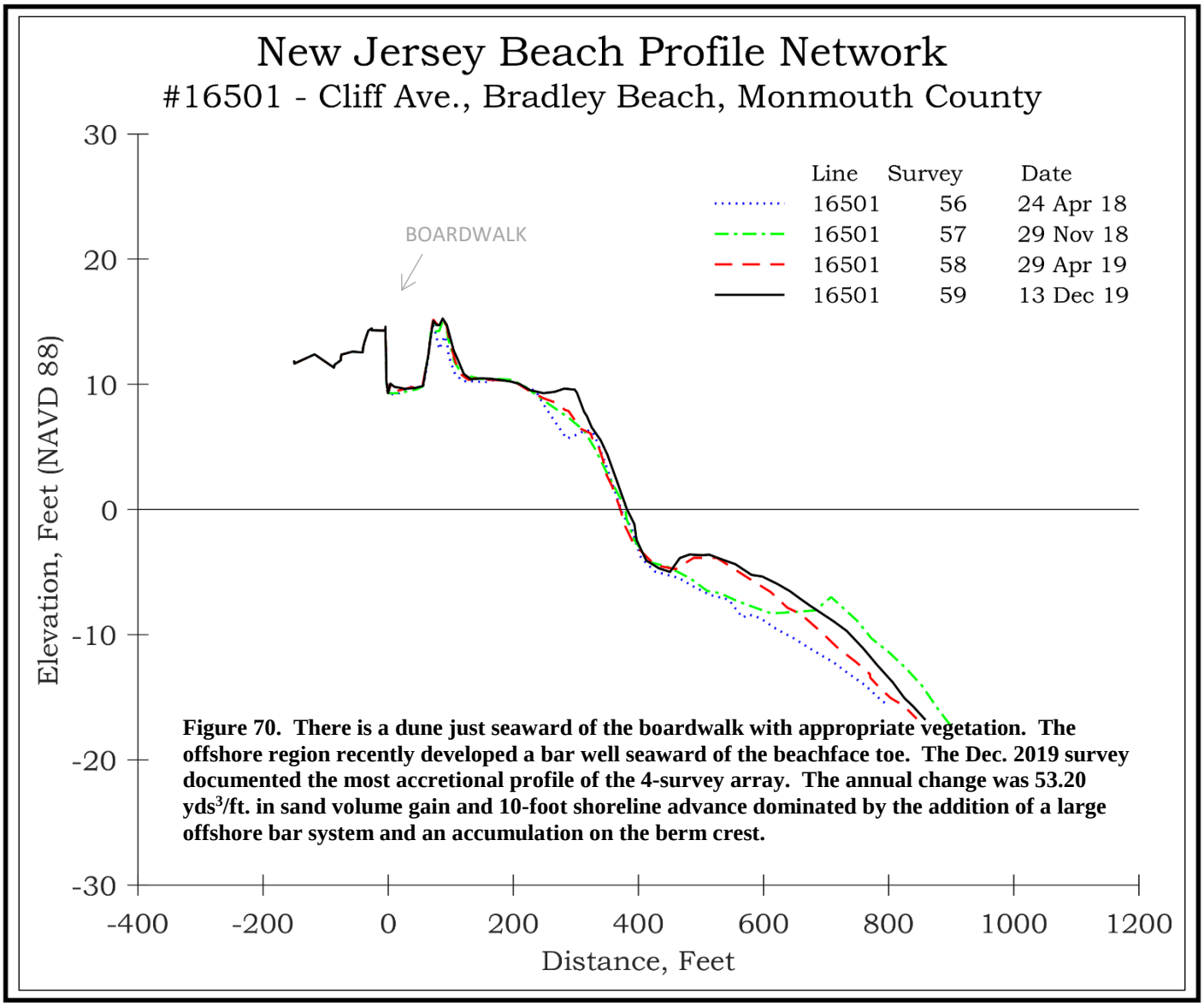


Figure 70. There is a dune just seaward of the boardwalk with appropriate vegetation. The offshore region recently developed a bar well seaward of the beachface toe. The Dec. 2019 survey documented the most accretional profile of the 4-survey array. The annual change was 53.20 yds^3/ft. in sand volume gain and 10-foot shoreline advance dominated by the addition of a large offshore bar system and an accumulation on the berm crest.

NJBPN 165 – McCabe Avenue, Bradley Beach

The November 29, 2018 view to the south shows the beach width (left photo) and dune crest with added sand deposited on the grass plants. The right view Nov. 22, 2019 shows the dunes and the dry beach with conditions appearing to be stable.

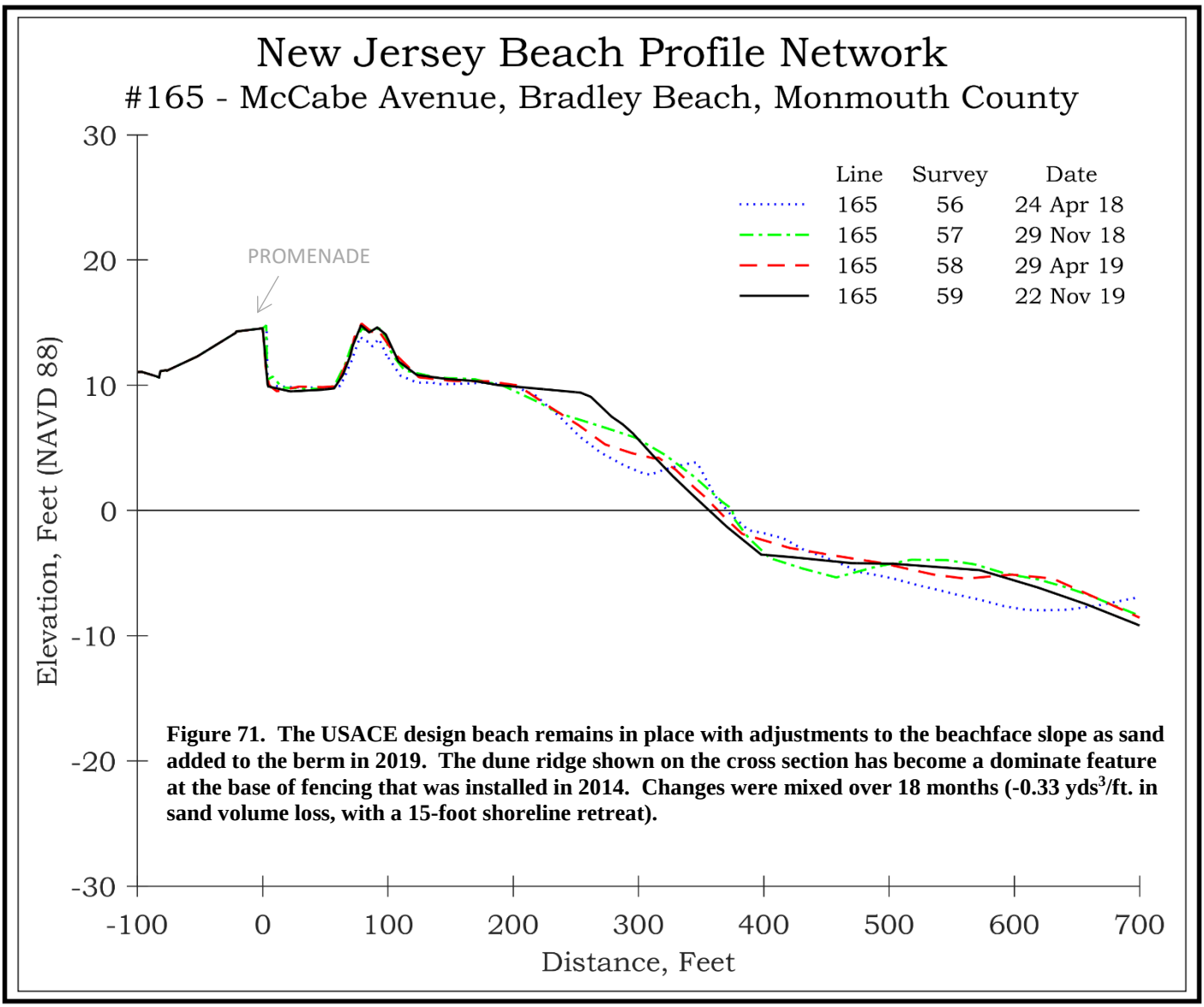


Figure 71. The USACE design beach remains in place with adjustments to the beachface slope as sand added to the berm in 2019. The dune ridge shown on the cross section has become a dominate feature at the base of fencing that was installed in 2014. Changes were mixed over 18 months (-0.33 yds^3/ft. in sand volume loss, with a 15-foot shoreline retreat).

NJBPN 16402 – 4th Avenue, Bradley Beach

A dune lies seaward of the promenade with a wide space between it and the boardwalk. The Nov. 28, 2018 view on the left was taken at the toe of the dunes while the Nov. 22, 2019 view on the right was taken from the dune crest showing both the beach and the promenade.

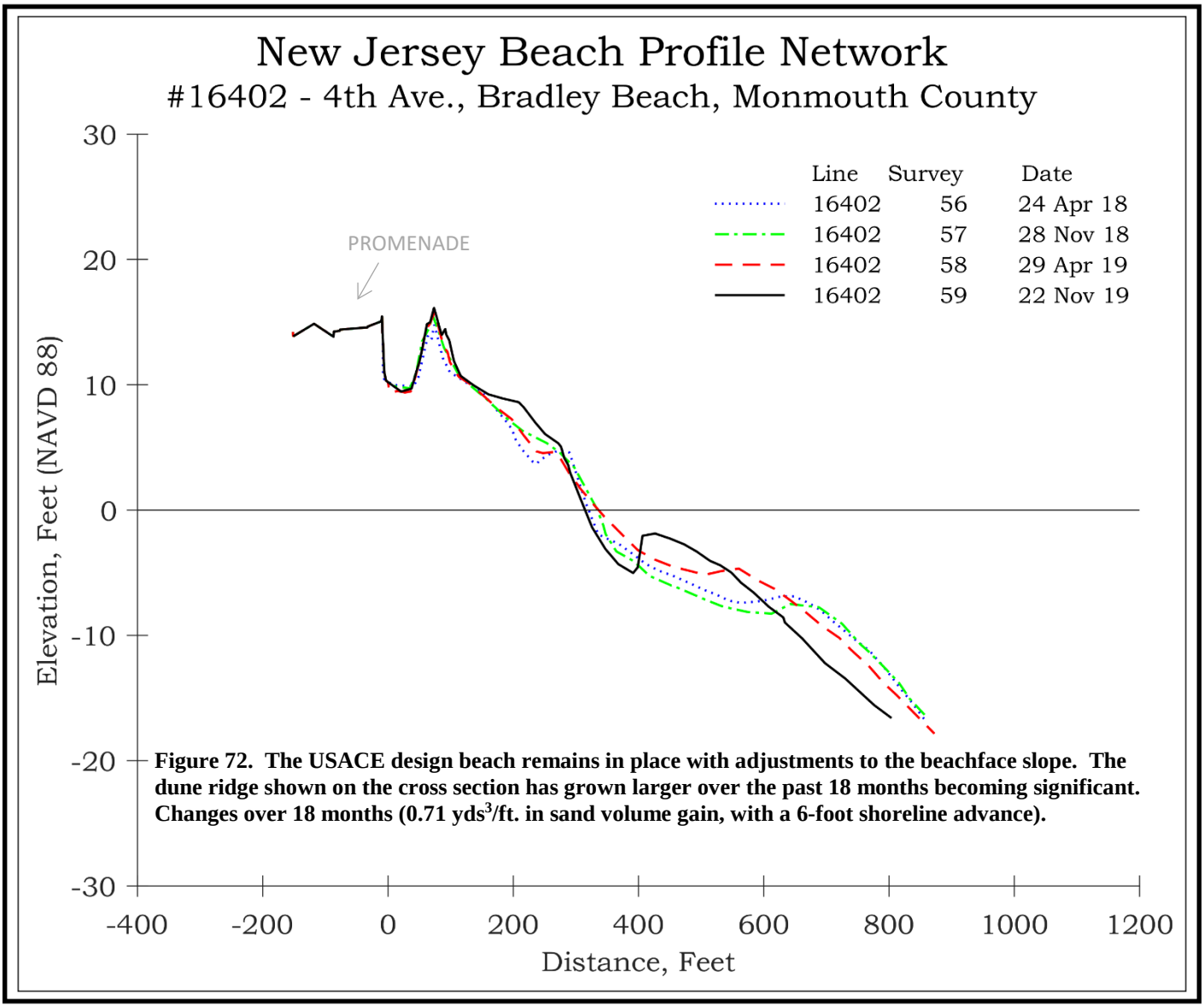
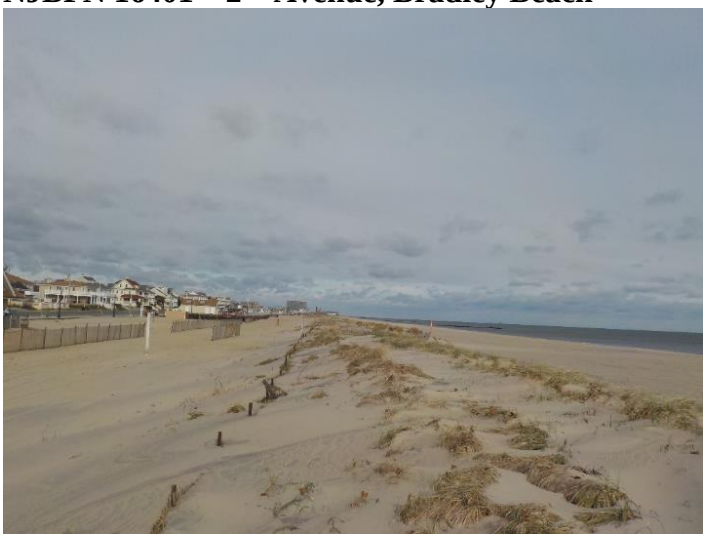


Figure 72. The USACE design beach remains in place with adjustments to the beachface slope. The dune ridge shown on the cross section has grown larger over the past 18 months becoming significant. Changes over 18 months (0.71 yds^3/ft. in sand volume gain, with a 6-foot shoreline advance).

NJBPN 16401 – 2nd Avenue, Bradley Beach



The left picture from Nov. 28, 2018 shows the dunes considerably seaward of the promenade in Bradley Beach while the Nov. 22, 2019 view on the right shows extensive grass growth over the year and sand added to the seaward slope as well.

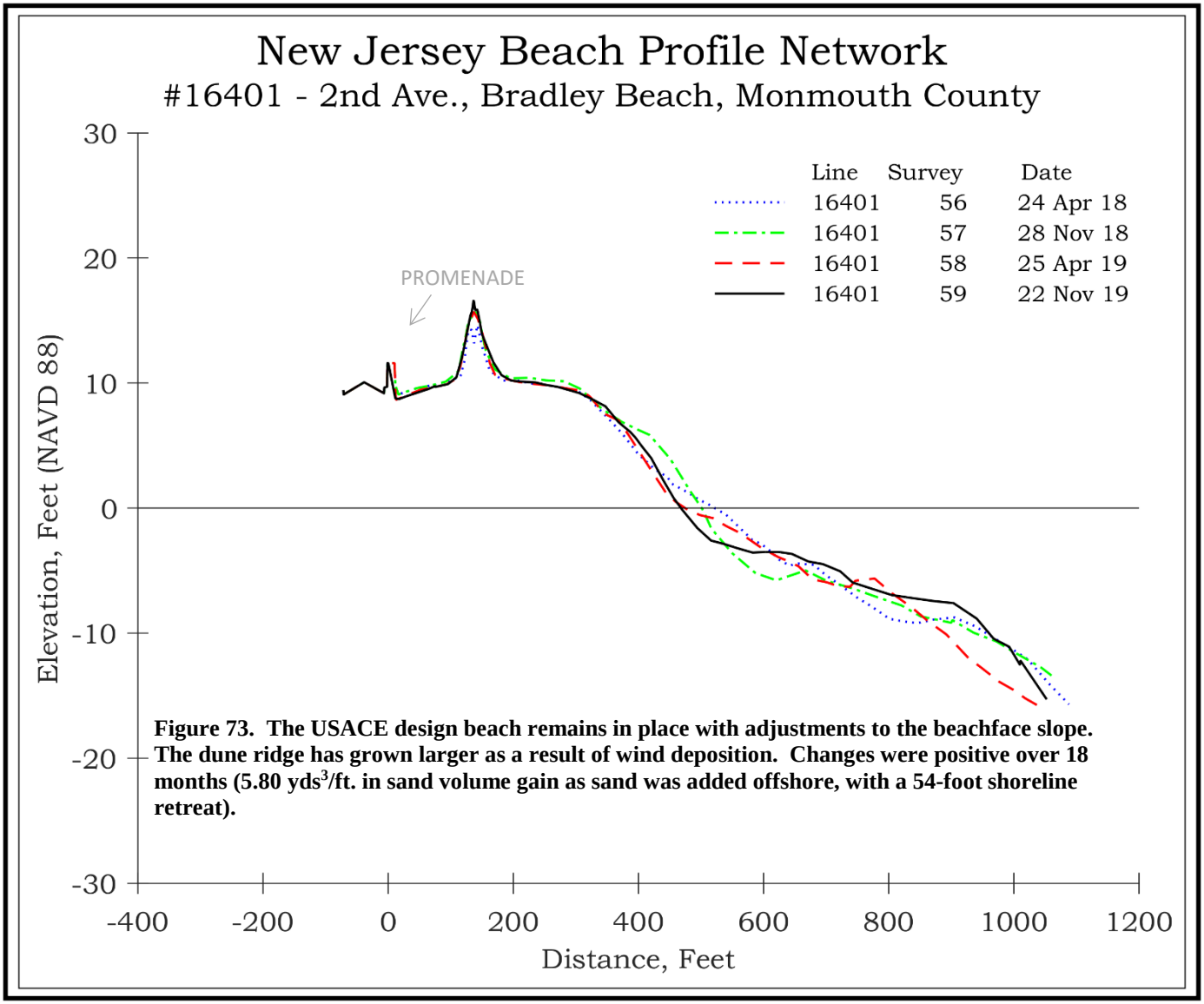
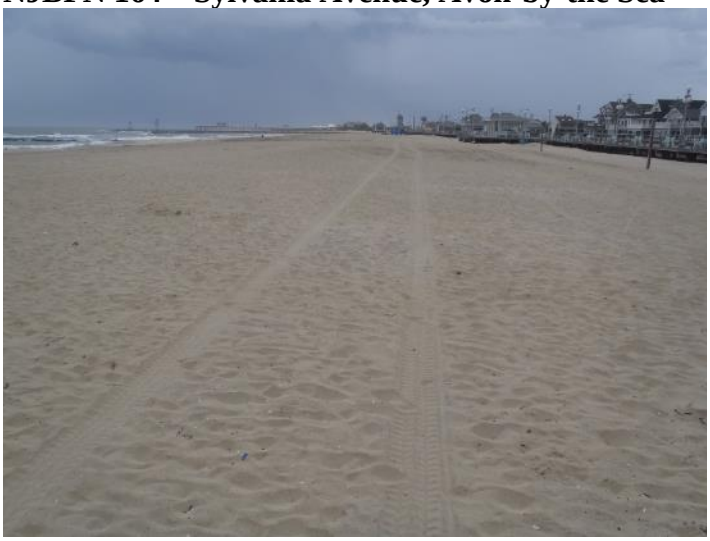


Figure 73. The USACE design beach remains in place with adjustments to the beachface slope. The dune ridge has grown larger as a result of wind deposition. Changes were positive over 18 months (5.80 yds^3/ft. in sand volume gain as sand was added offshore, with a 54-foot shoreline retreat).

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



This site is located north of the Shark River Inlet. The left view shows the beach looking south toward the inlet on September 18, 2018. On October 11, 2019 the view from the berm crest shows the beach width and configuration around the groins on the beach north of the inlet jetties.

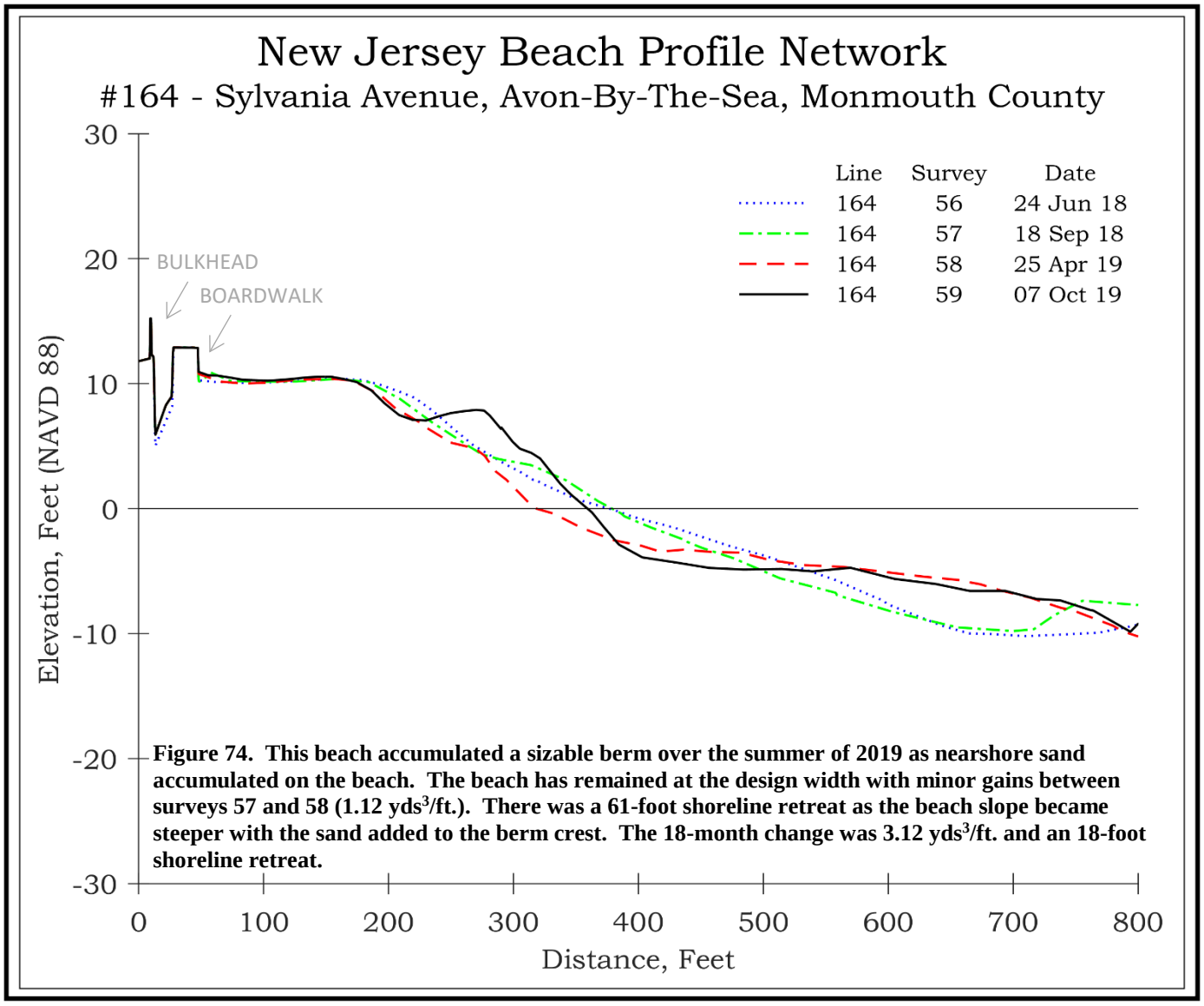
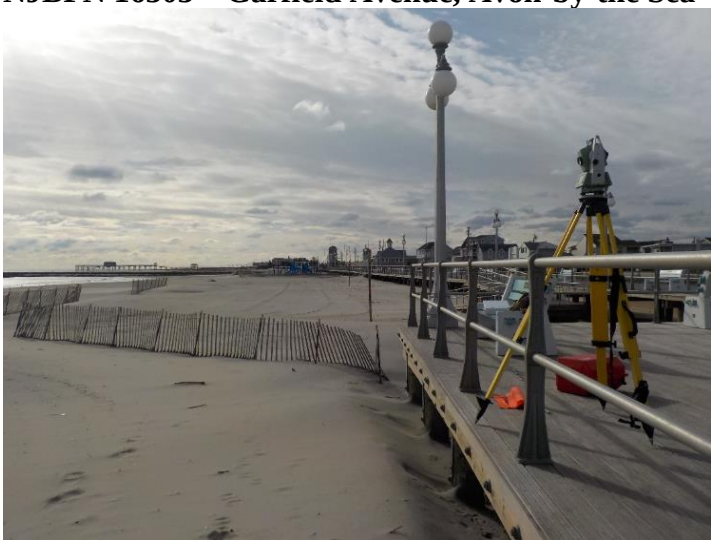


Figure 74. This beach accumulated a sizable berm over the summer of 2019 as nearshore sand accumulated on the beach. The beach has remained at the design width with minor gains between surveys 57 and 58 (1.12 yds^3/ft.). There was a 61-foot shoreline retreat as the beach slope became steeper with the sand added to the berm crest. The 18-month change was 3.12 yds^3/ft. and an 18-foot shoreline retreat.

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



Sand has accumulated at the boardwalk in the absence of any dune system. The Nov. 28, 2018 view to the south shows sand fencing on the beach. The beach as of Oct. 10, 2019 is free of the fencing and the dry beach width is substantial.

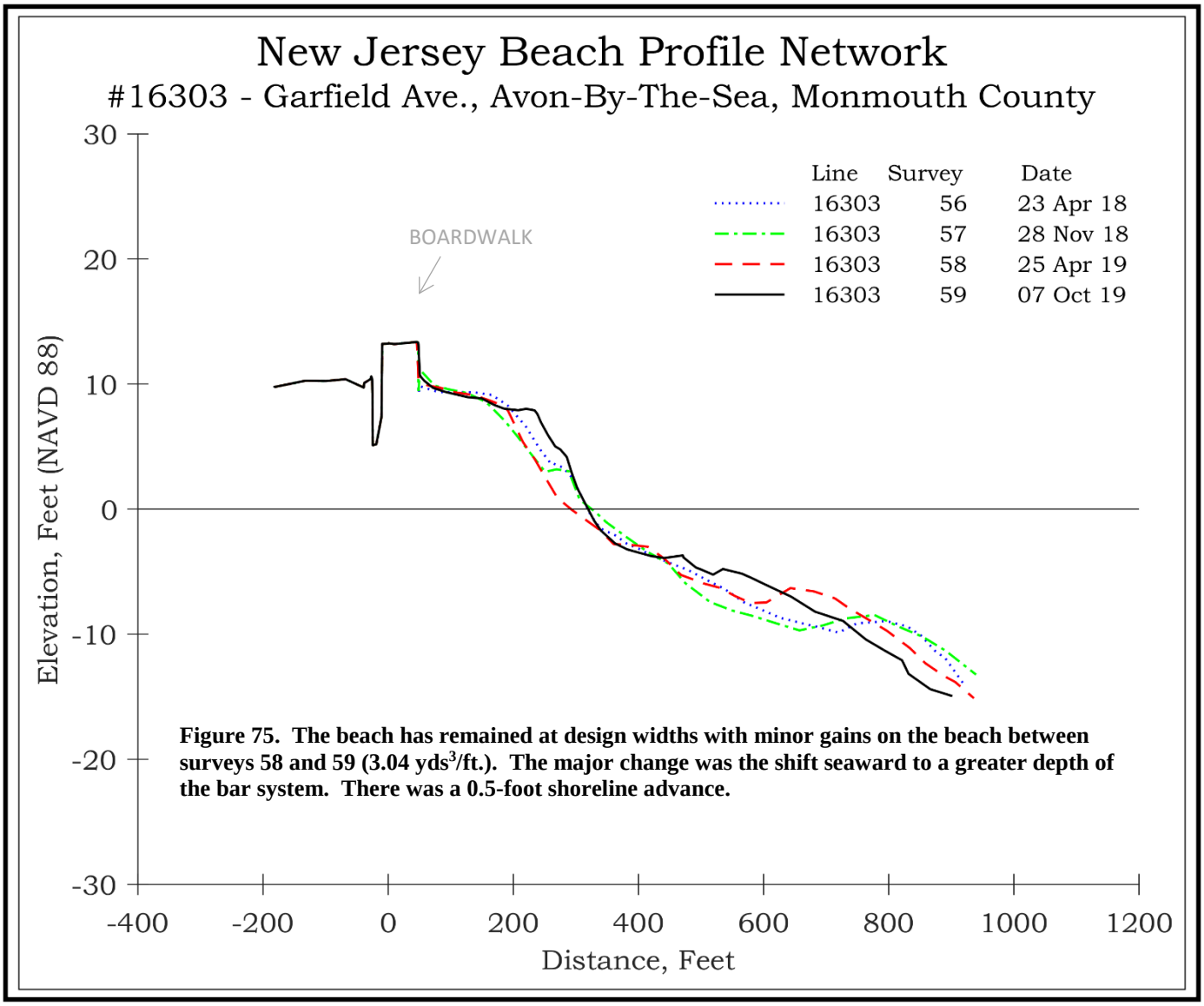
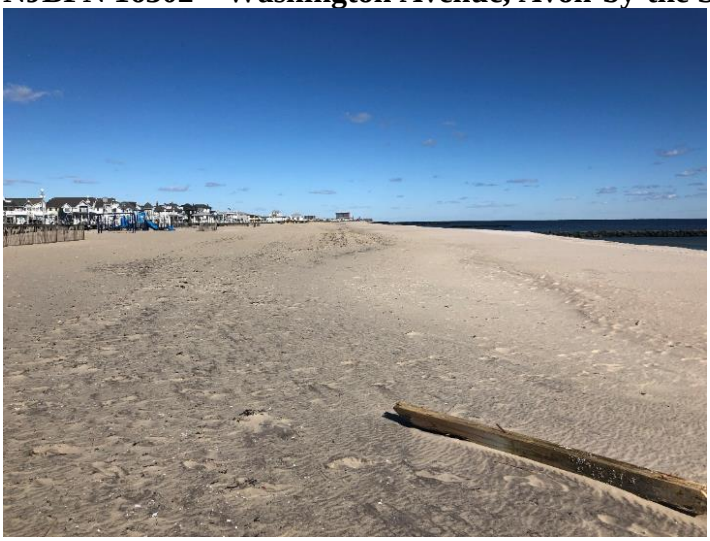


Figure 75. The beach has remained at design widths with minor gains on the beach between surveys 58 and 59 (3.04 yds^3/ft.). The major change was the shift seaward to a greater depth of the bar system. There was a 0.5-foot shoreline advance.

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 18, 2018 view on the left shows the dry beach and the fencing present along this municipal oceanfront. The October 7, 2019 view on the right was taken at the boardwalk looking north along the dry beach with the fencing removed.

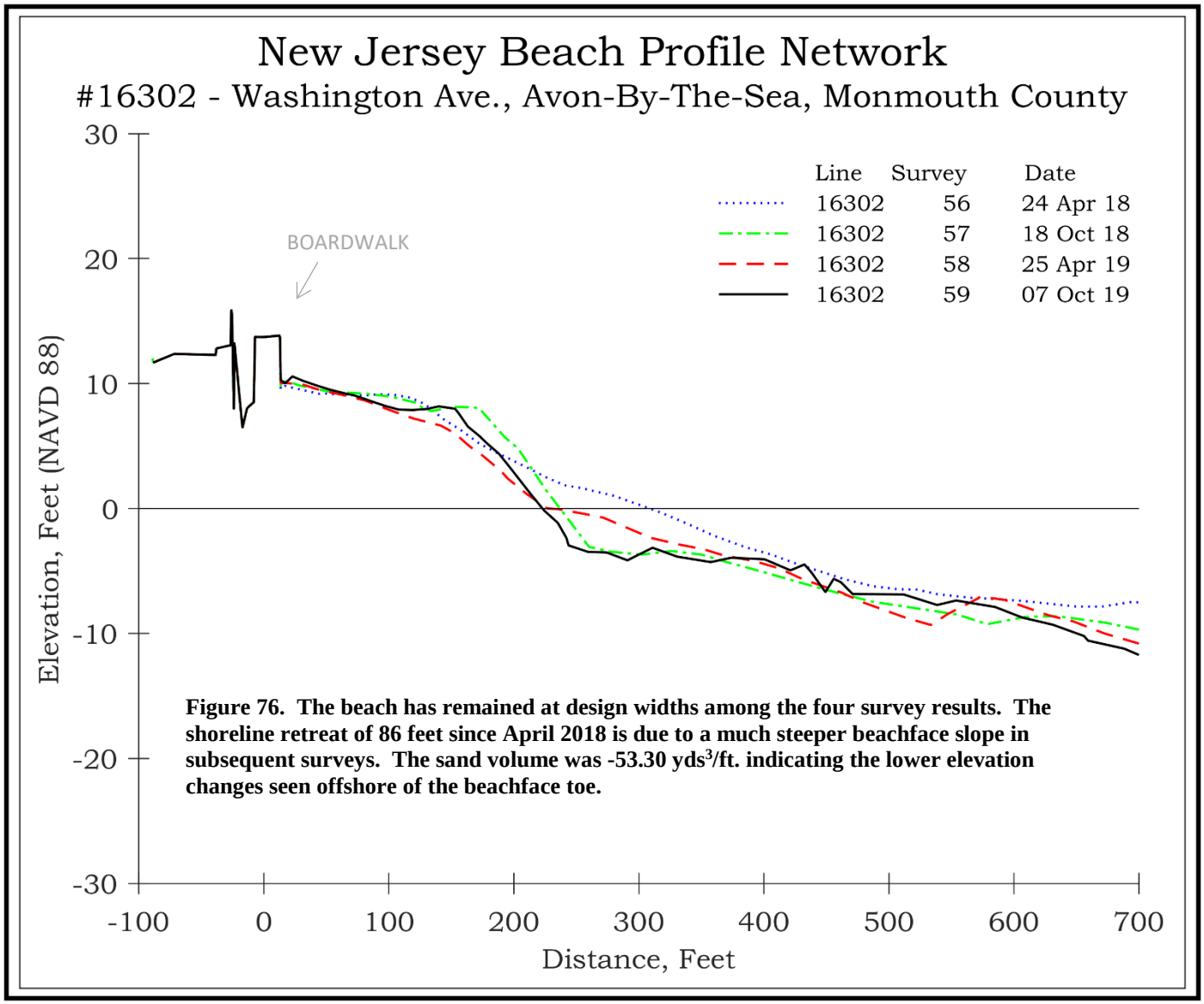
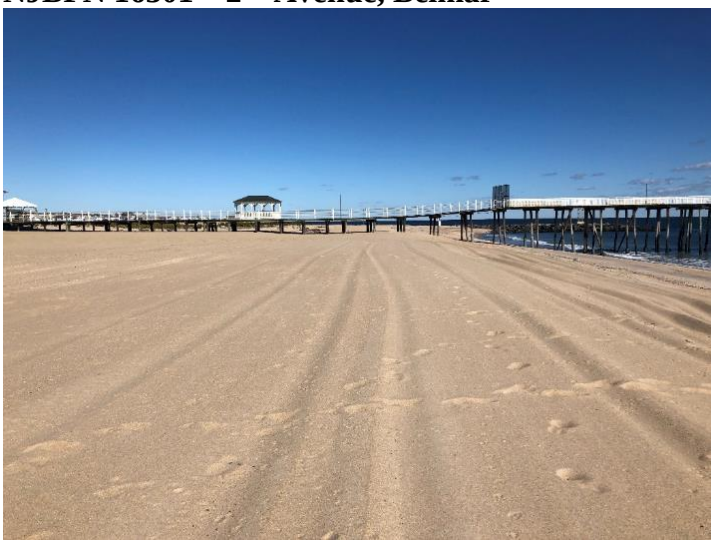


Figure 76. The beach has remained at design widths among the four survey results. The shoreline retreat of 86 feet since April 2018 is due to a much steeper beachface slope in subsequent surveys. The sand volume was -53.30 yds^3/ft. indicating the lower elevation changes seen offshore of the beachface toe.

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. 18, 2018 is slightly seaward of the same view on the right taken Oct. 7, 2019.

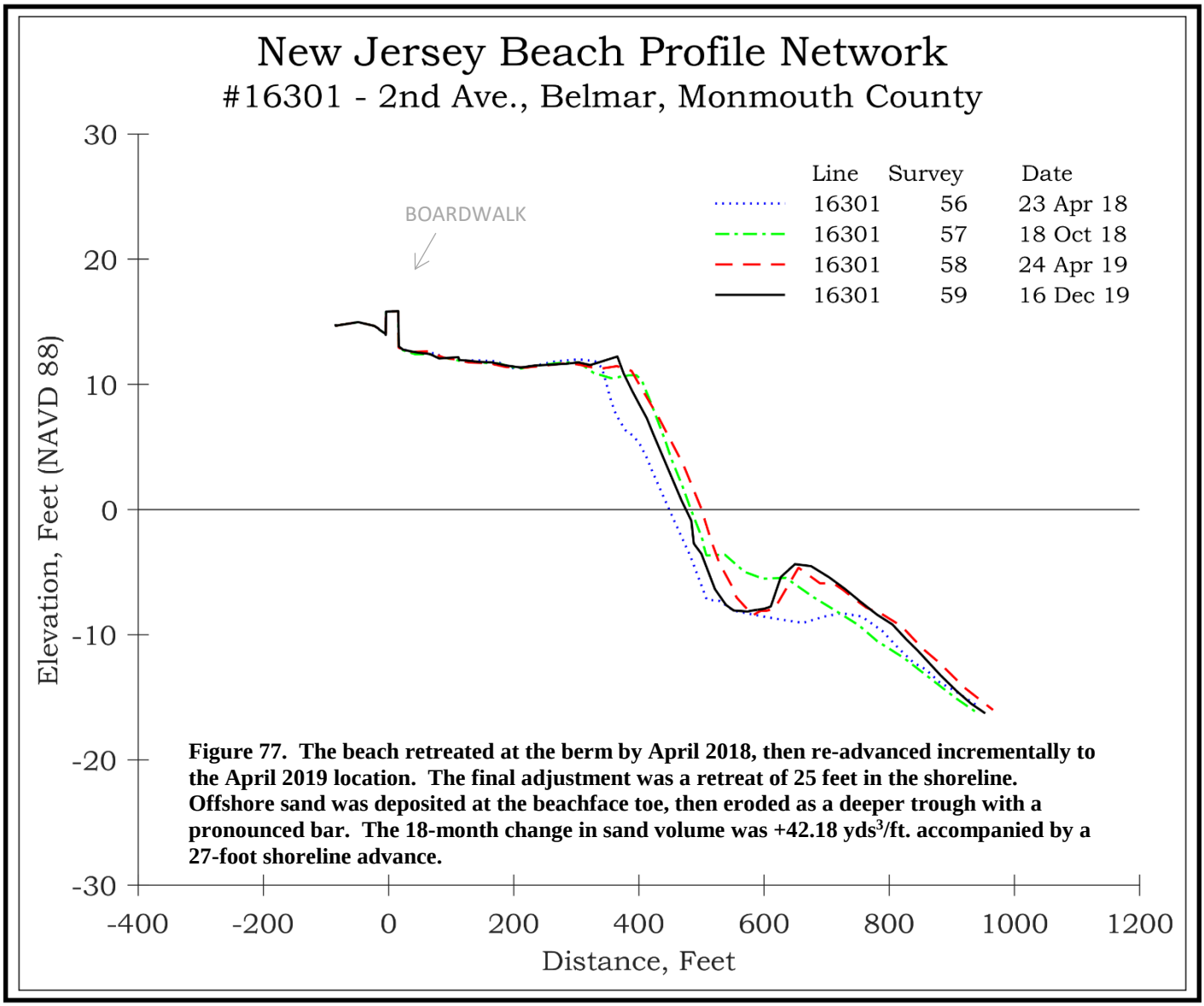
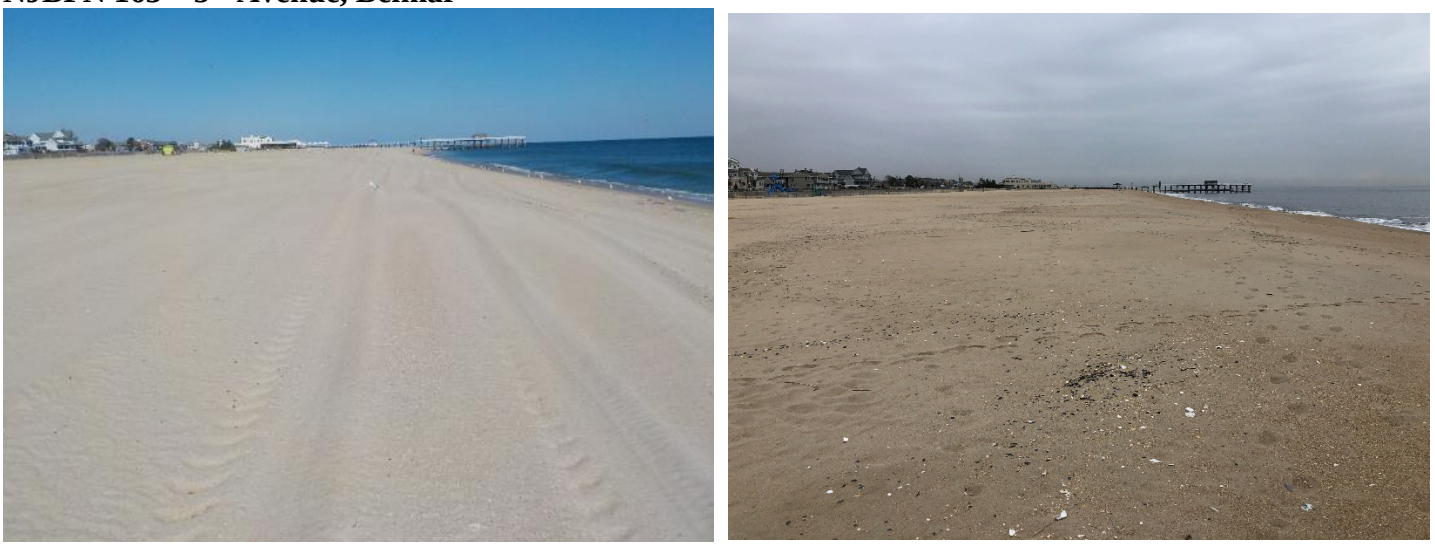


Figure 77. The beach retreated at the berm by April 2018, then re-advanced incrementally to the April 2019 location. The final adjustment was a retreat of 25 feet in the shoreline. Offshore sand was deposited at the beachface toe, then eroded as a deeper trough with a pronounced bar. The 18-month change in sand volume was +42.18 yds^3/ft. accompanied by a 27-foot shoreline advance.

NJBPN 163 – 5th Avenue, Belmar



This site never has had a dune but had a wide, dry beach. The north view on October 17, 2018 (left photo) shows this wider than normal beach due to sand trapping by the Shark River Inlet jetty. By October 7, 2019 (right photo) the shoreline was in a similar position.

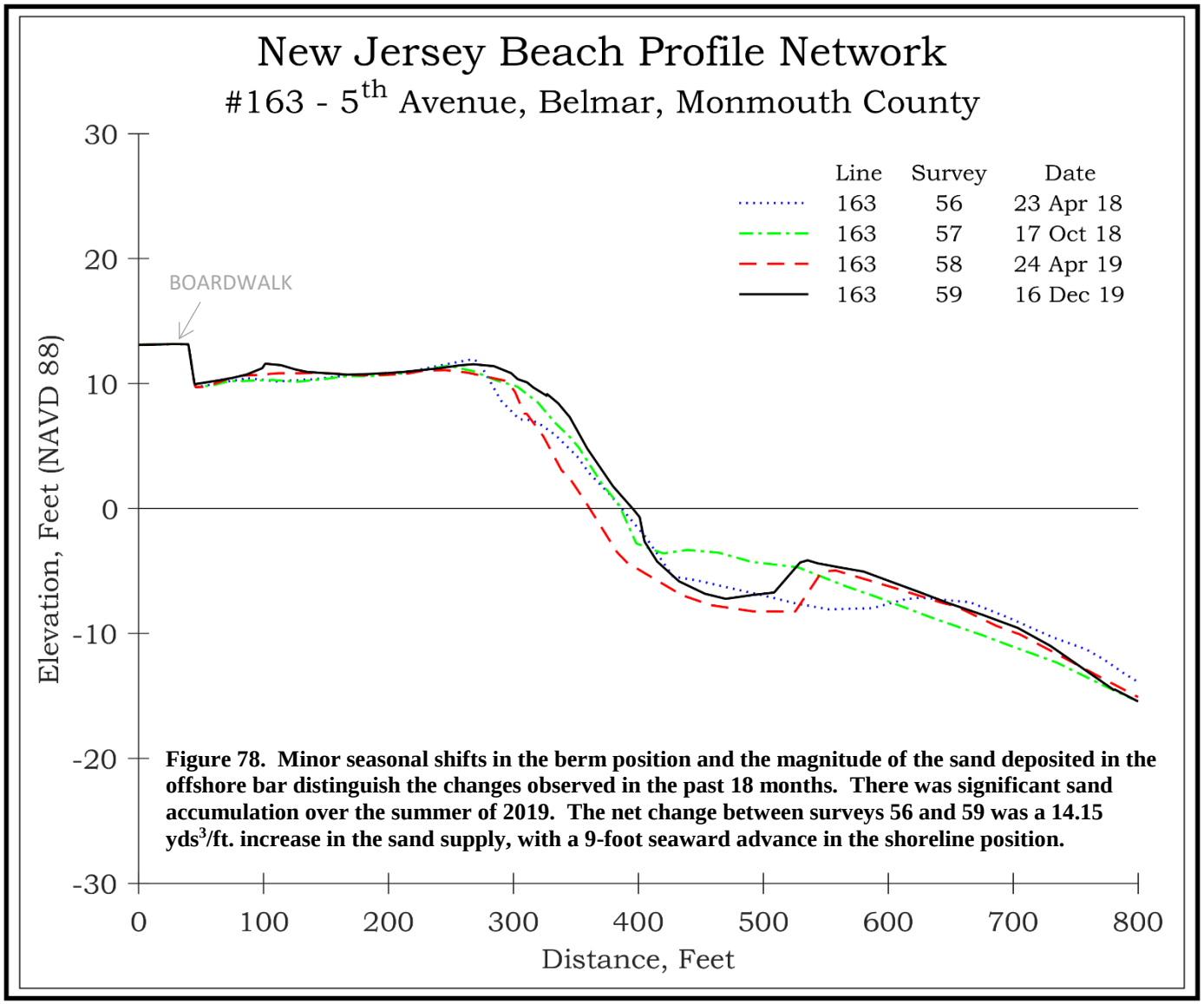


Figure 78. Minor seasonal shifts in the berm position and the magnitude of the sand deposited in the offshore bar distinguish the changes observed in the past 18 months. There was significant sand accumulation over the summer of 2019. The net change between surveys 56 and 59 was a 14.15 yds^3/ft. increase in the sand supply, with a 9-foot seaward advance in the shoreline position.

NJBPN 16202 – 8th Avenue, Belmar

The boardwalk is the backstop for the beach, since there is no dune system. The left photograph from Oct. 17, 2018 shows the dry beach width. The Dec. 13, 2019 view on the right shows the fencing at the boardwalk put in to lessen wind transport into Ocean Avenue during the winter.

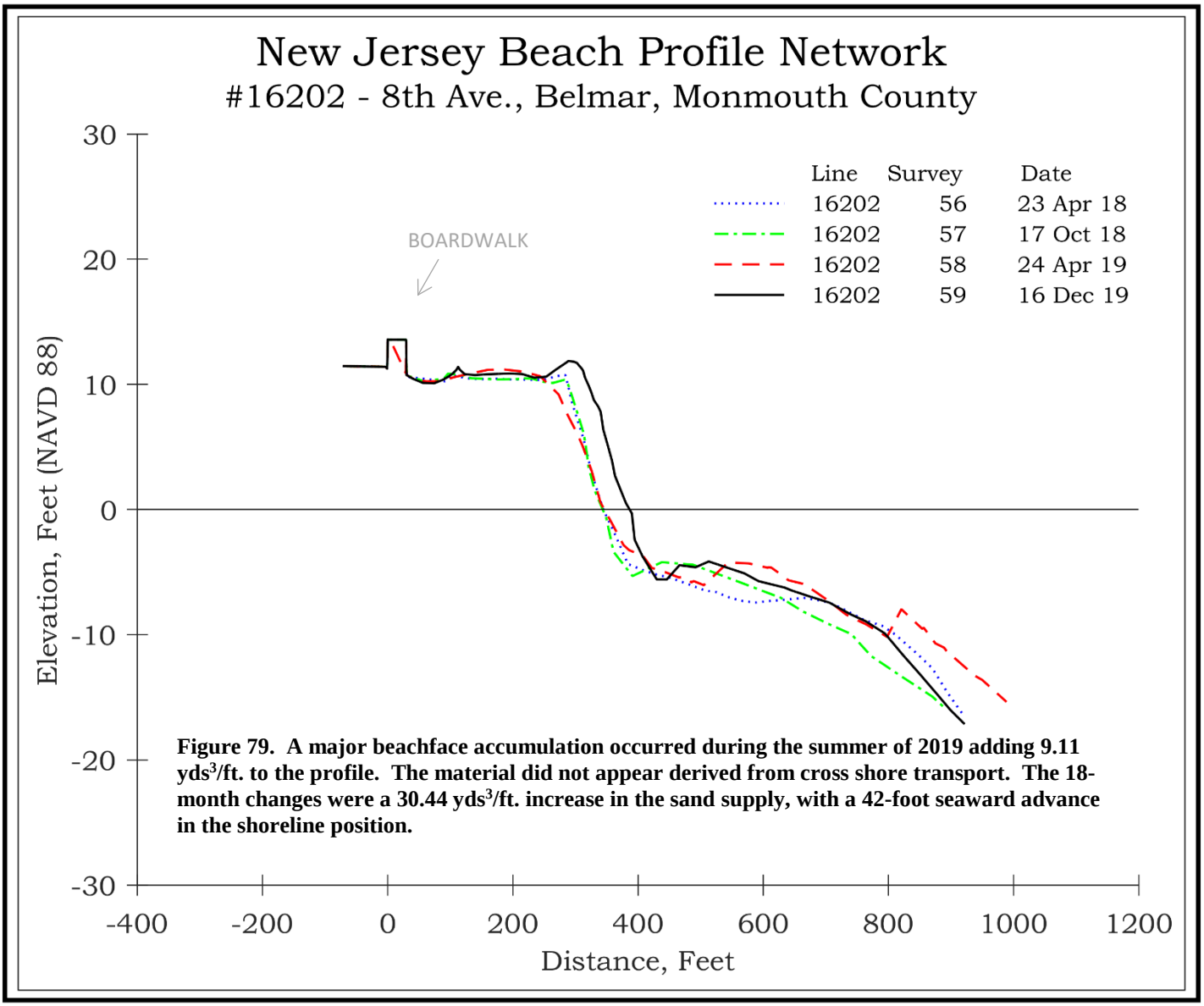


Figure 79. A major beachface accumulation occurred during the summer of 2019 adding 9.11 yds^3/ft. to the profile. The material did not appear derived from cross shore transport. The 18-month changes were a 30.44 yds^3/ft. increase in the sand supply, with a 42-foot seaward advance in the shoreline position.

NJBPN 16201 – 14th Avenue, Belmar

The 14th Avenue site does have a tiny dune feature immediately seaward of the boardwalk. As of Oct. 17, 2018, there was a large storm ridge pushed up on the mid beach area. As of Dec. 5, 2019, this ridge was absent with the beach width entirely open to the boardwalk.

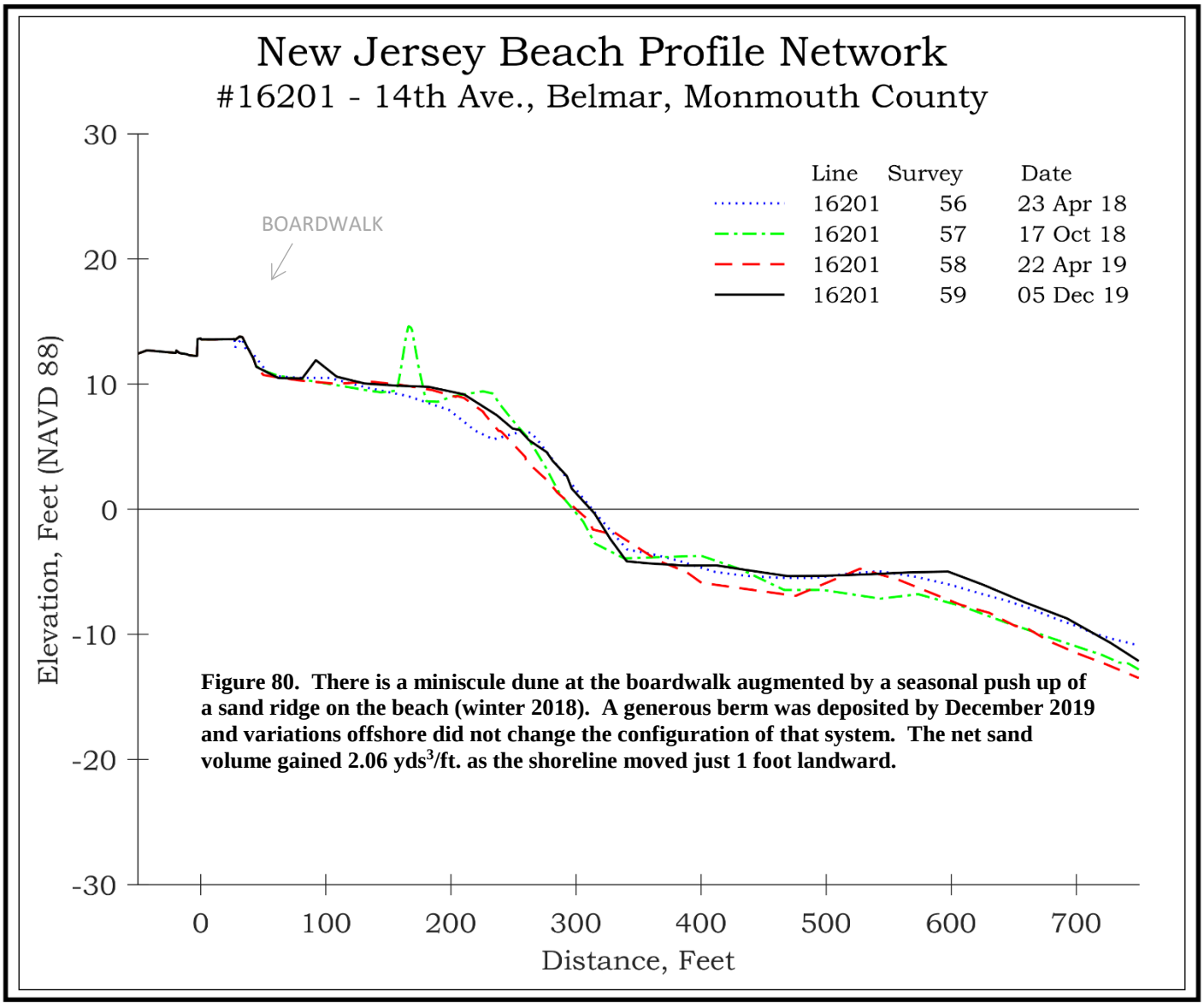


Figure 80. There is a miniscule dune at the boardwalk augmented by a seasonal push up of a sand ridge on the beach (winter 2018). A generous berm was deposited by December 2019 and variations offshore did not change the configuration of that system. The net sand volume gained 2.06 yds^3/ft. as the shoreline moved just 1 foot landward.

NJBPN 162 – 18th Avenue, Belmar

The October 17, 2018 view on the left shows the new boardwalk and facilities built since Sandy with the storm ridge pushed up for the winter. The December 5, 2019 view taken at a sand fence put in place to collect material from blowing into Ocean Avenue show an un-cluttered dry beach seaward.

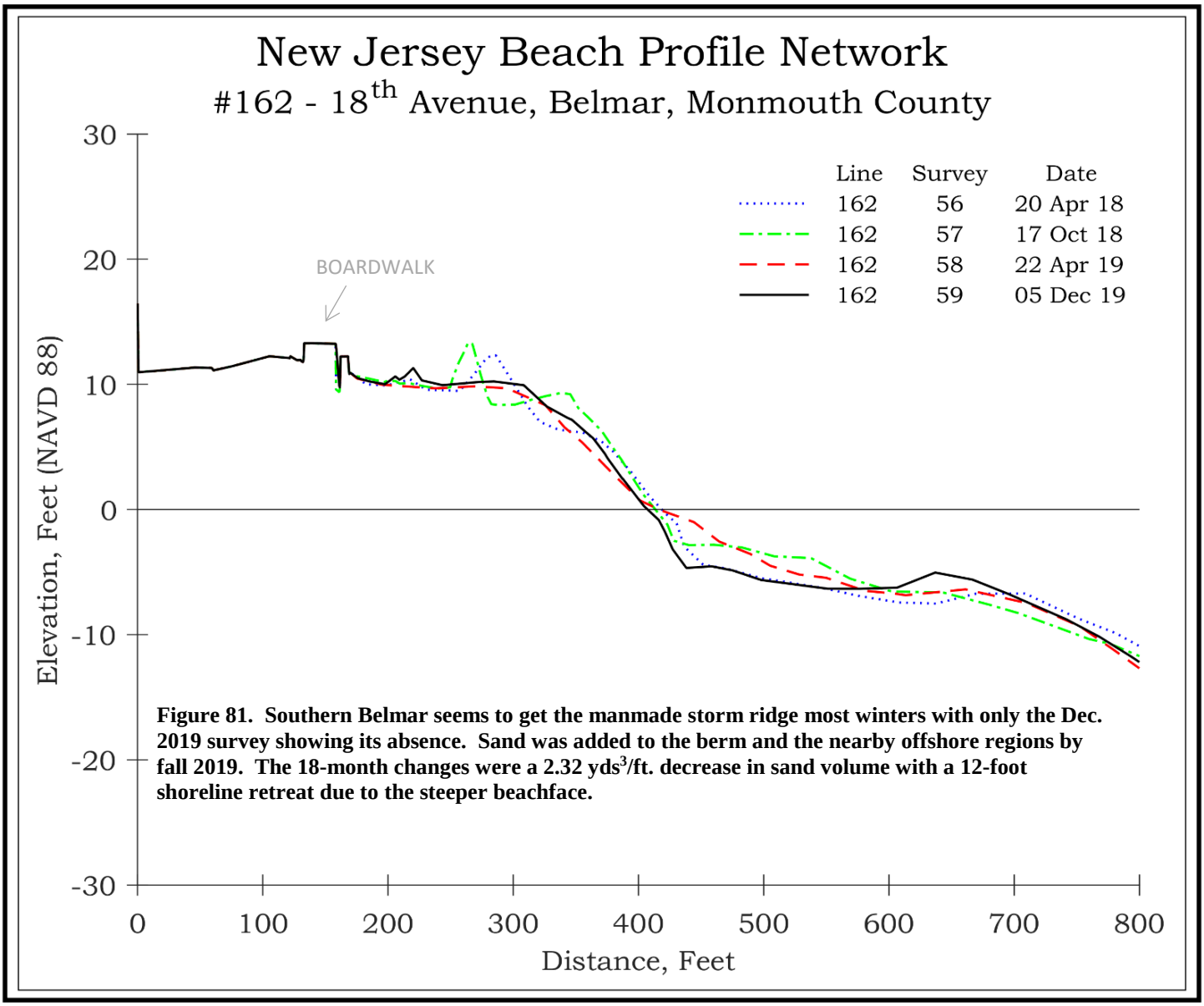
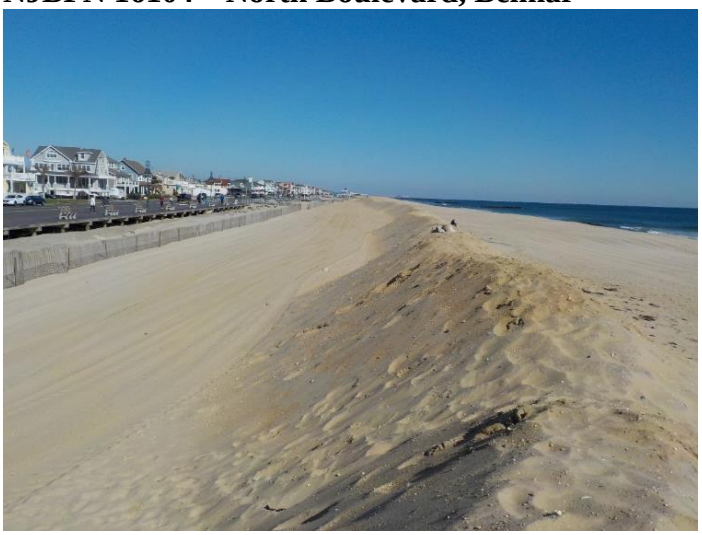


Figure 81. Southern Belmar seems to get the manmade storm ridge most winters with only the Dec. 2019 survey showing its absence. Sand was added to the berm and the nearby offshore regions by fall 2019. The 18-month changes were a 2.32 yds^3/ft. decrease in sand volume with a 12-foot shoreline retreat due to the steeper beachface.

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 left view shows a storm ridge pushed up as of Oct. 17, 2018 along the Belmar oceanfront. The Dec. 13, 2019 view on the right shows sand fencing instead of a storm ridge along this beachfront in southernmost Belmar.

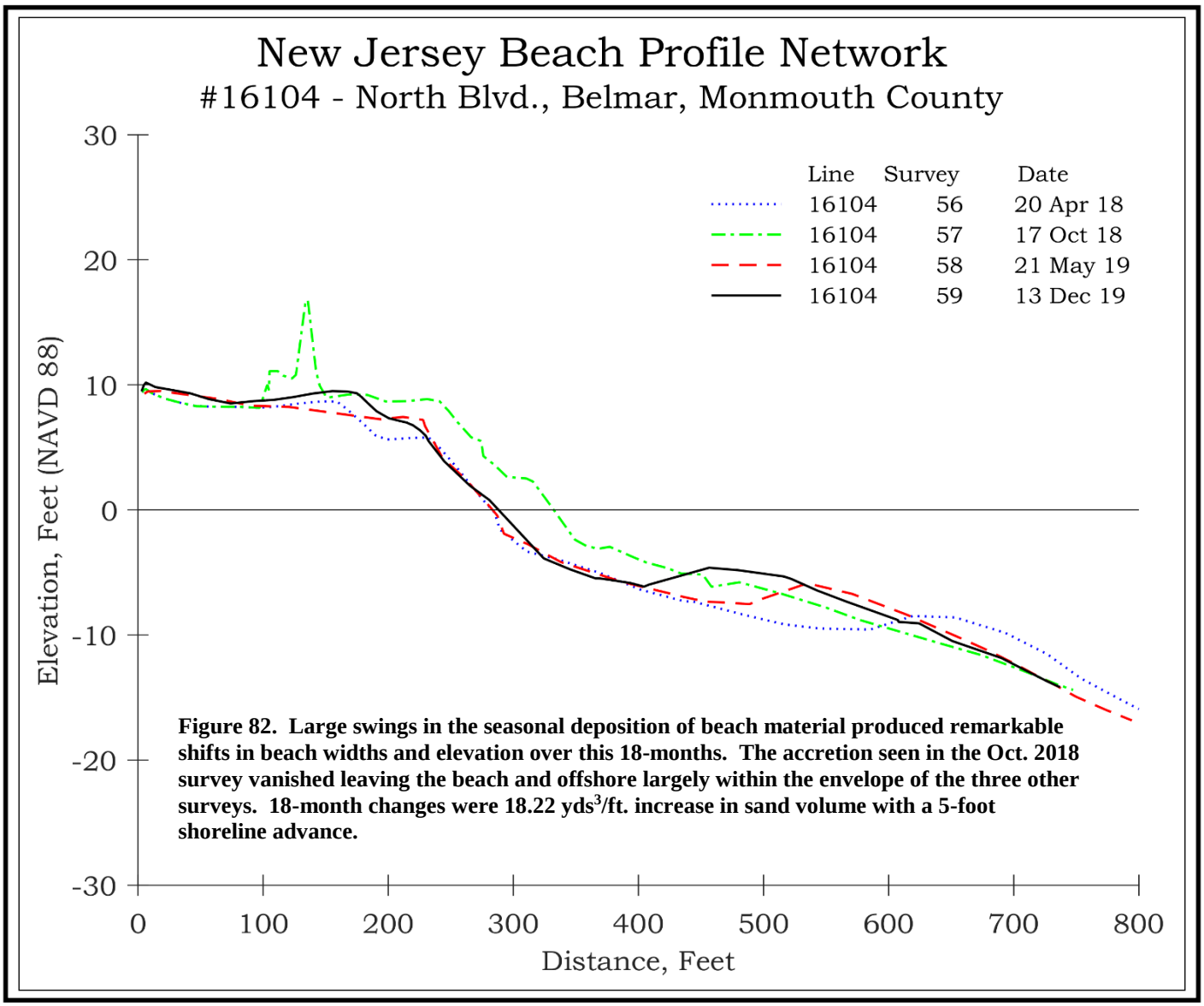
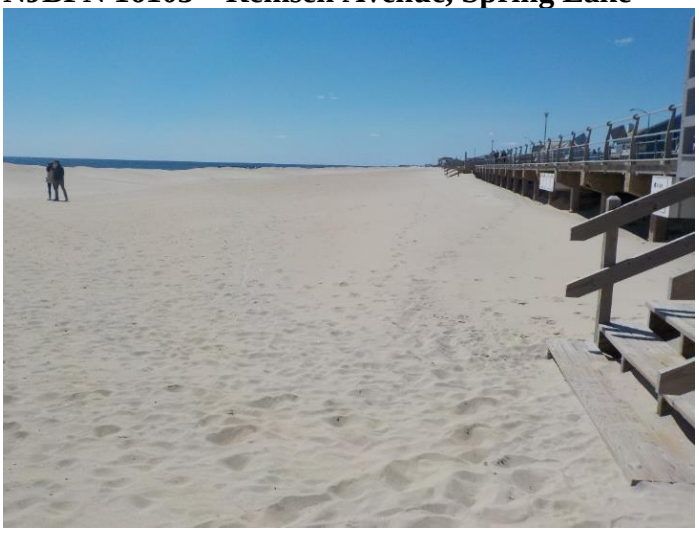
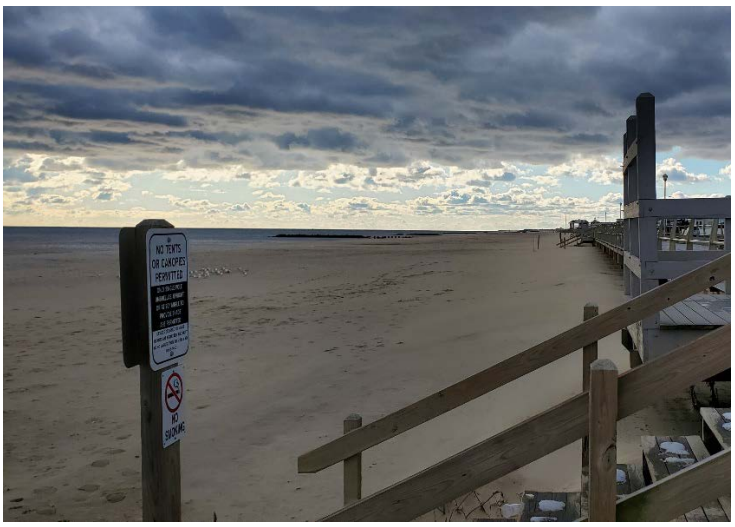


Figure 82. Large swings in the seasonal deposition of beach material produced remarkable shifts in beach widths and elevation over this 18-months. The accretion seen in the Oct. 2018 survey vanished leaving the beach and offshore largely within the envelope of the three other surveys. 18-month changes were 18.22 yds^3/ft. increase in sand volume with a 5-foot shoreline advance.

NJBPN 16103 – Remsen Avenue, Spring Lake





A grass strip separates Ocean Avenue and the boardwalk. The left photograph taken Oct. 18, 2018 shows the boardwalk and dry beach seaward of the boardwalk. As of December 3, 2019, sand had ramped up under the boardwalk as wind transport moved it landward. In Spring Lake and dunes exist landward of the boardwalk between it and Ocean Avenue.

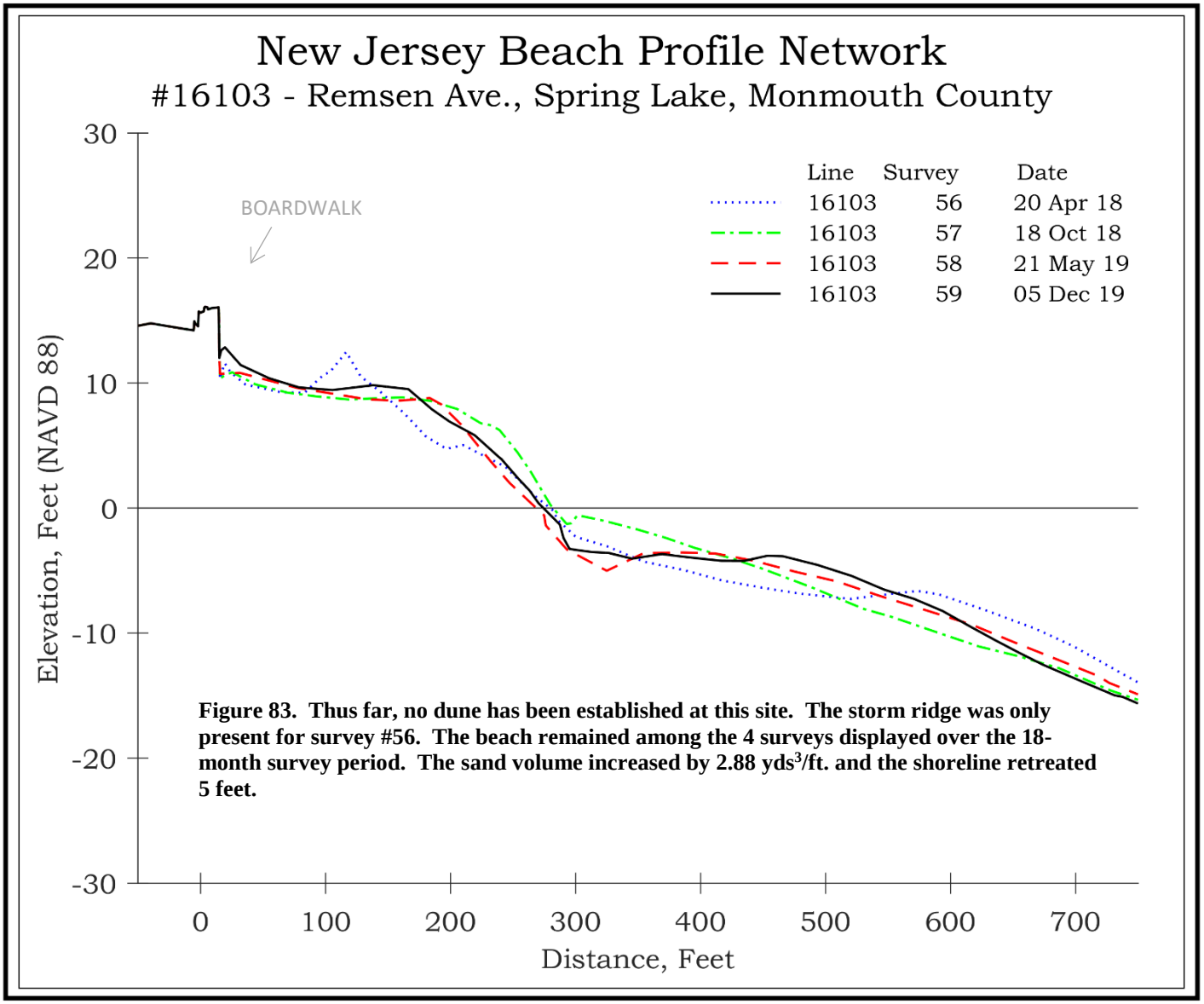


Figure 83. Thus far, no dune has been established at this site. The storm ridge was only present for survey #56. The beach remained among the 4 surveys displayed over the 18-month survey period. The sand volume increased by 2.88 yds^3/ft. and the shoreline retreated 5 feet.

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. The left photograph in Oct. 18, 2018 shows the wide, dry beach, while the Dec. 5, 2019 view on the right shows a similar scene with little change in a year.

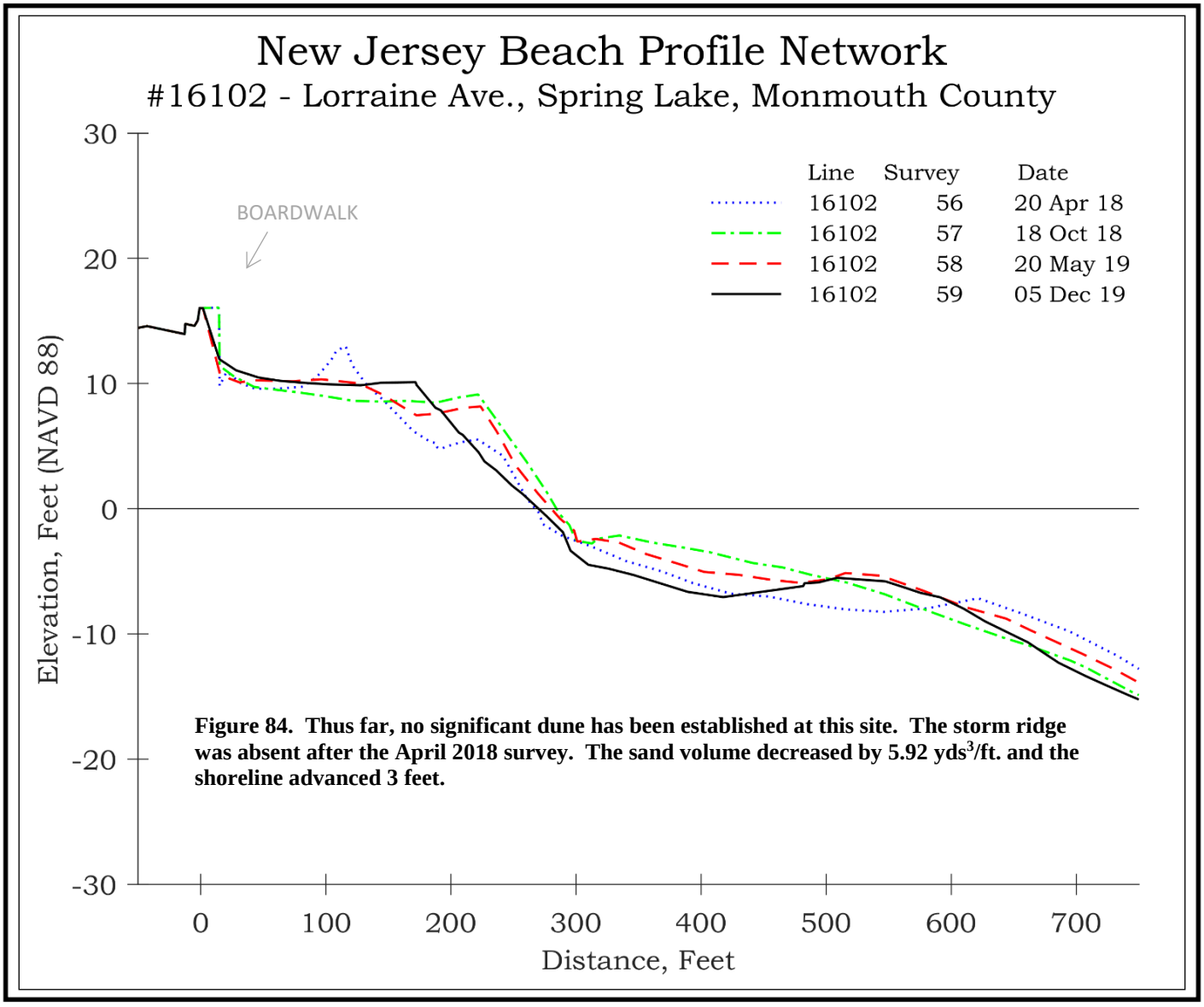


Figure 84. Thus far, no significant dune has been established at this site. The storm ridge was absent after the April 2018 survey. The sand volume decreased by 5.92 yds^3/ft. and the shoreline advanced 3 feet.

NJBPN 16101 – Tuttle Avenue, Spring Lake

The Oct. 18, 2018 view on the left shows the wide dry beach, while the Dec. 5, 2019 view shows sand accumulating under the boardwalk as the wind deposits the material there and some into the vegetated dunes present landward of the boardwalk.

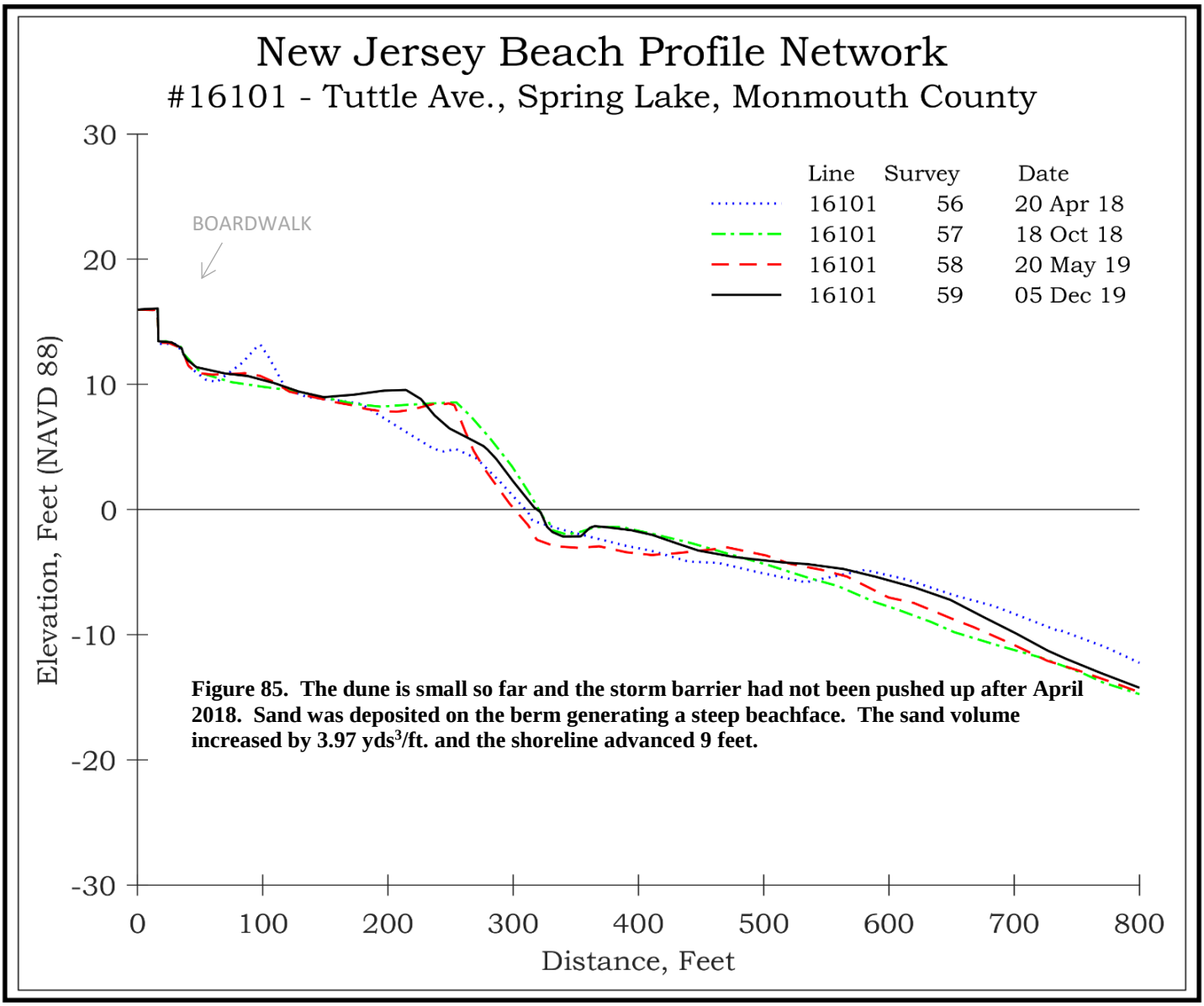
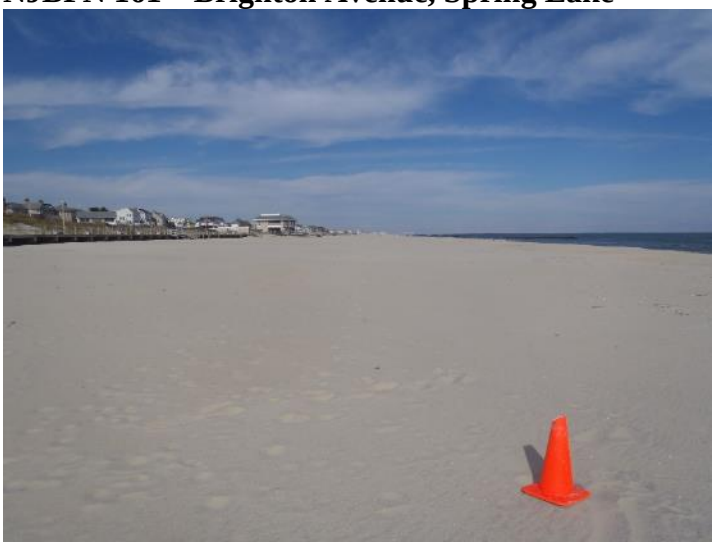


Figure 85. The dune is small so far and the storm barrier had not been pushed up after April 2018. Sand was deposited on the berm generating a steep beachface. The sand volume increased by 3.97 yds^3/ft. and the shoreline advanced 9 feet.

NJBPN 161 – Brighton Avenue, Spring Lake



The left photo shows the beach as of Nov. 14, 2018 looking north in Spring Lake from the center of the dry beach. The right 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.

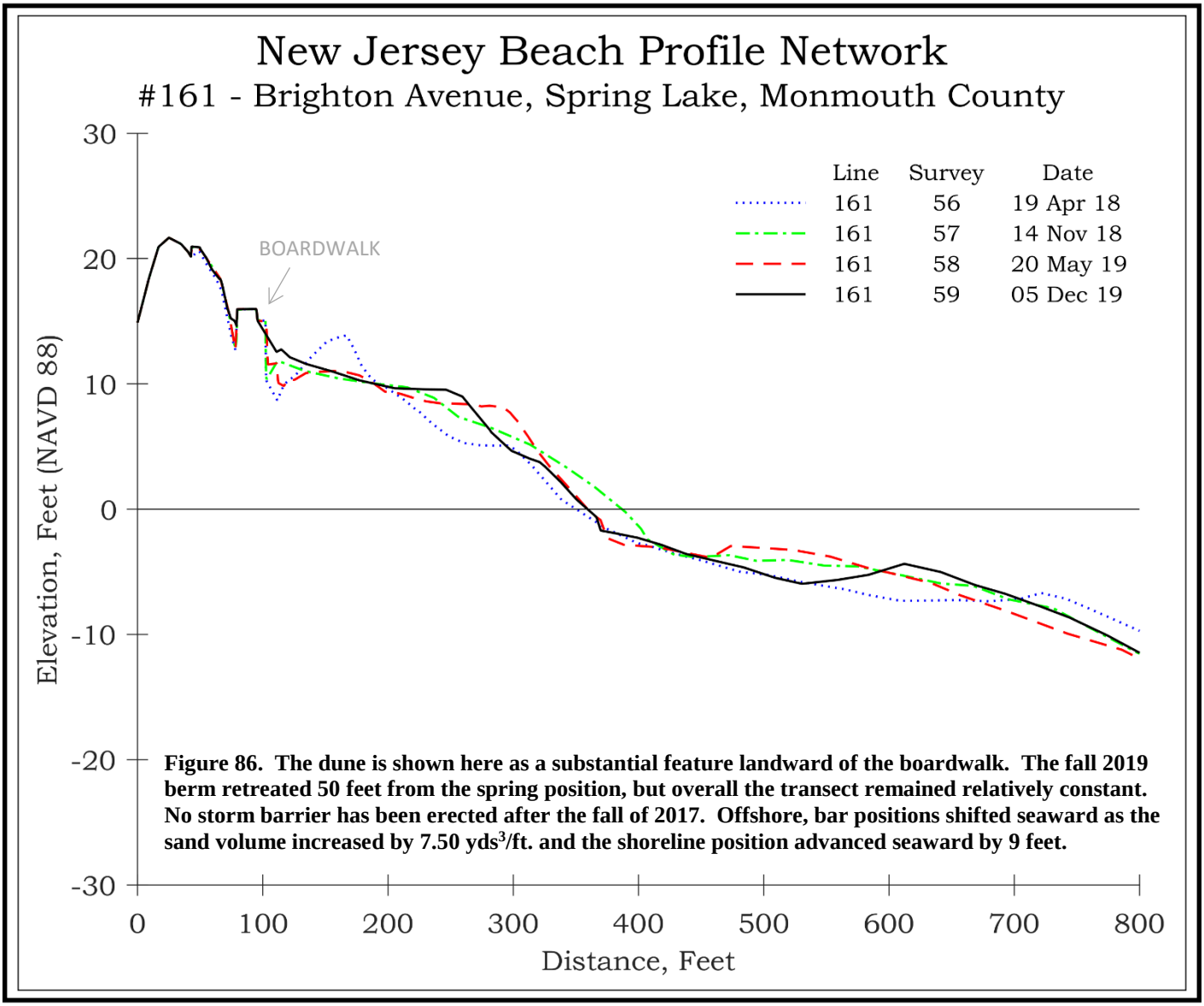


Figure 86. The dune is shown here as a substantial feature landward of the boardwalk. The fall 2019 berm retreated 50 feet from the spring position, but overall the transect remained relatively constant. No storm barrier has been erected after the fall of 2017. Offshore, bar positions shifted seaward as the sand volume increased by 7.50 yds^3/ft. and the shoreline position advanced seaward by 9 feet.

NJBPN 16004 – Madison Avenue, Spring Lake

The dune is robust between Ocean Avenue and the boardwalk. The Nov. 14, 2018 view was taken on the dry beach showing its width on the left. 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.

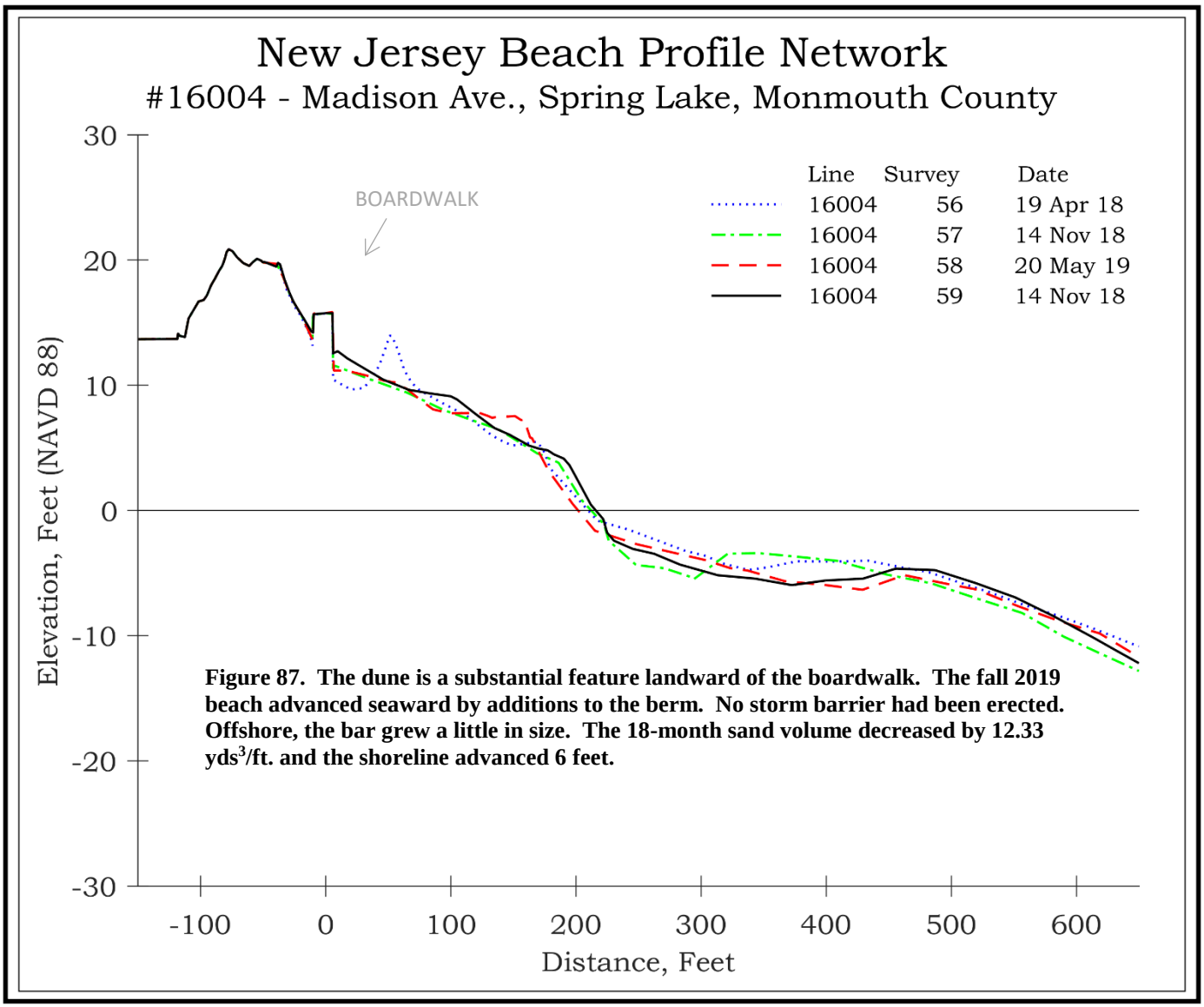


Figure 87. The dune is a substantial feature landward of the boardwalk. The fall 2019 beach advanced seaward by additions to the berm. No storm barrier had been erected. Offshore, the bar grew a little in size. The 18-month sand volume decreased by 12.33 $yds^3/ft.$ and the shoreline advanced 6 feet.

NJBPN 16003 – Morris Avenue, Spring Lake

The left photograph was taken Nov. 12, 2018 on the beach just seaward of the boardwalk. The righthand photograph, taken on Dec. 5, 2019, shows the sand accumulating under the boardwalk, but some retreat in the beach width has occurred.

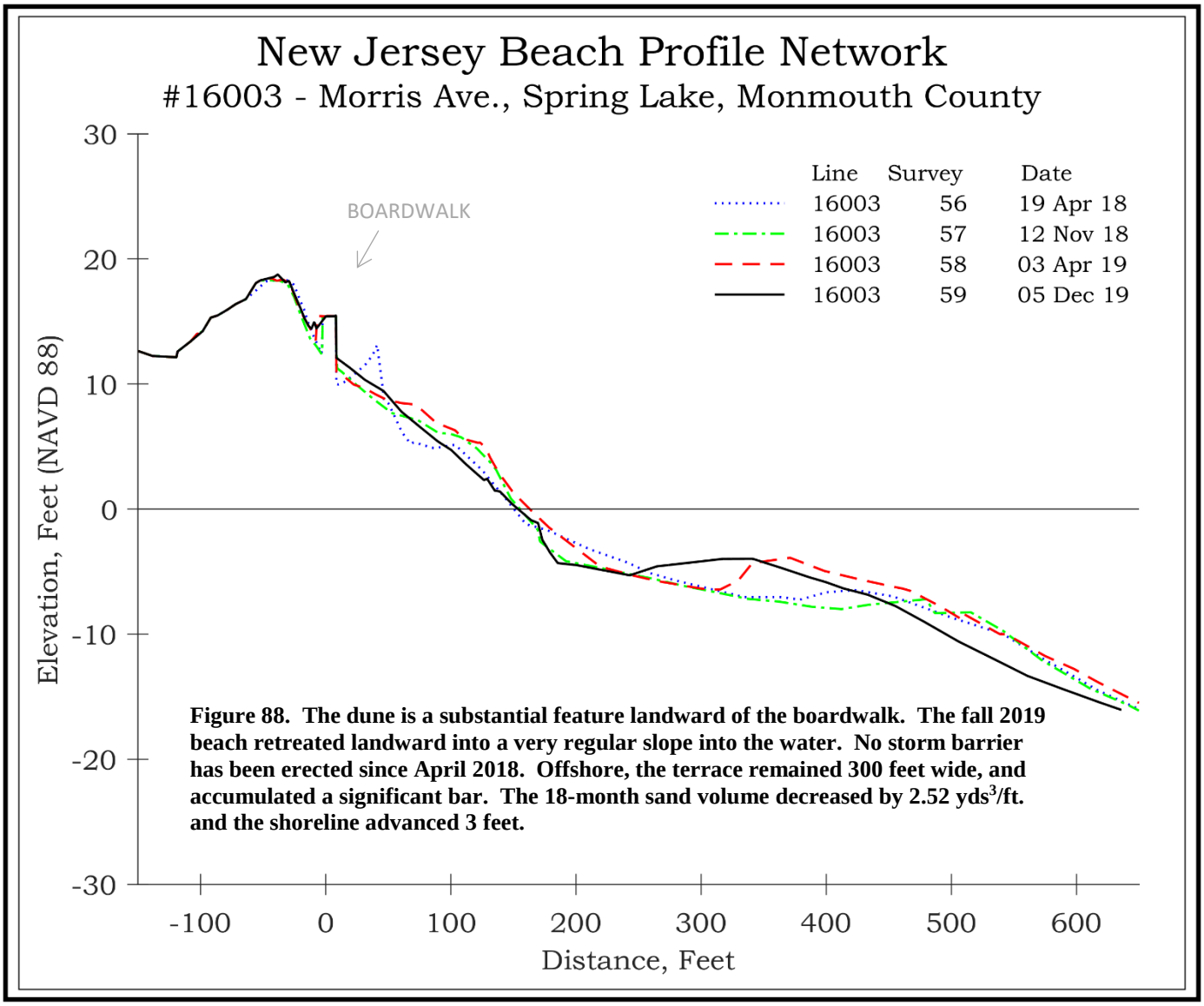


Figure 88. The dune is a substantial feature landward of the boardwalk. The fall 2019 beach retreated landward into a very regular slope into the water. No storm barrier has been erected since April 2018. Offshore, the terrace remained 300 feet wide, and accumulated a significant bar. The 18-month sand volume decreased by 2.52 yds^3/ft. and the shoreline advanced 3 feet.

NJBPN 16002 – Mercer Avenue, Spring Lake

The dune is slightly lower and narrower at Mercer Avenue with a distinct separation from the boardwalk. The Nov. 12, 2018 view on the left shows the beach width close to the limit of wave runup on the beach. The Dec. 5, 2019 view depicts the beach at the base of the boardwalk and it appears to indicate a narrower beach a year later.

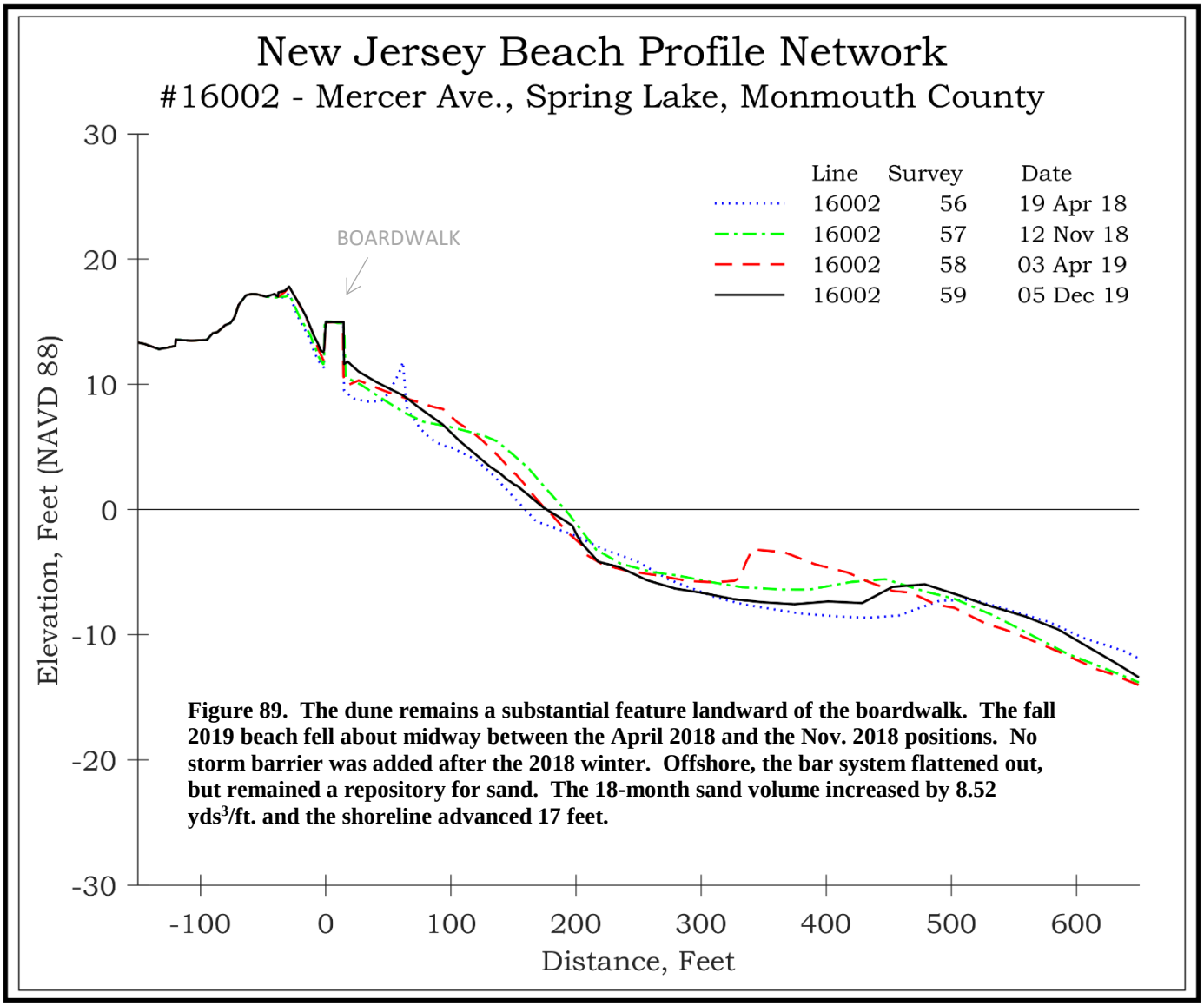


Figure 89. The dune remains a substantial feature landward of the boardwalk. The fall 2019 beach fell about midway between the April 2018 and the Nov. 2018 positions. No storm barrier was added after the 2018 winter. Offshore, the bar system flattened out, but remained a repository for sand. The 18-month sand volume increased by 8.52 yds^3/ft. and the shoreline advanced 17 feet.

NJBPN 16001 – Essex Avenue, Spring Lake

The dune/boardwalk combination are quite large as a storm barrier. However, past experiences have proven that the boardwalk seaward of the dunes increases the likelihood that it will be destroyed in a serious storm (Irene and Sandy most recently). The left view taken in Nov. 12, 2018 shows the dry beach and the dunes to the right. The Dec. 5, 2019 view on the right demonstrates the sand deposition at the boardwalk ramping to the surface at this site. This would save the boardwalk in a storm, but makes maintenance very difficult.

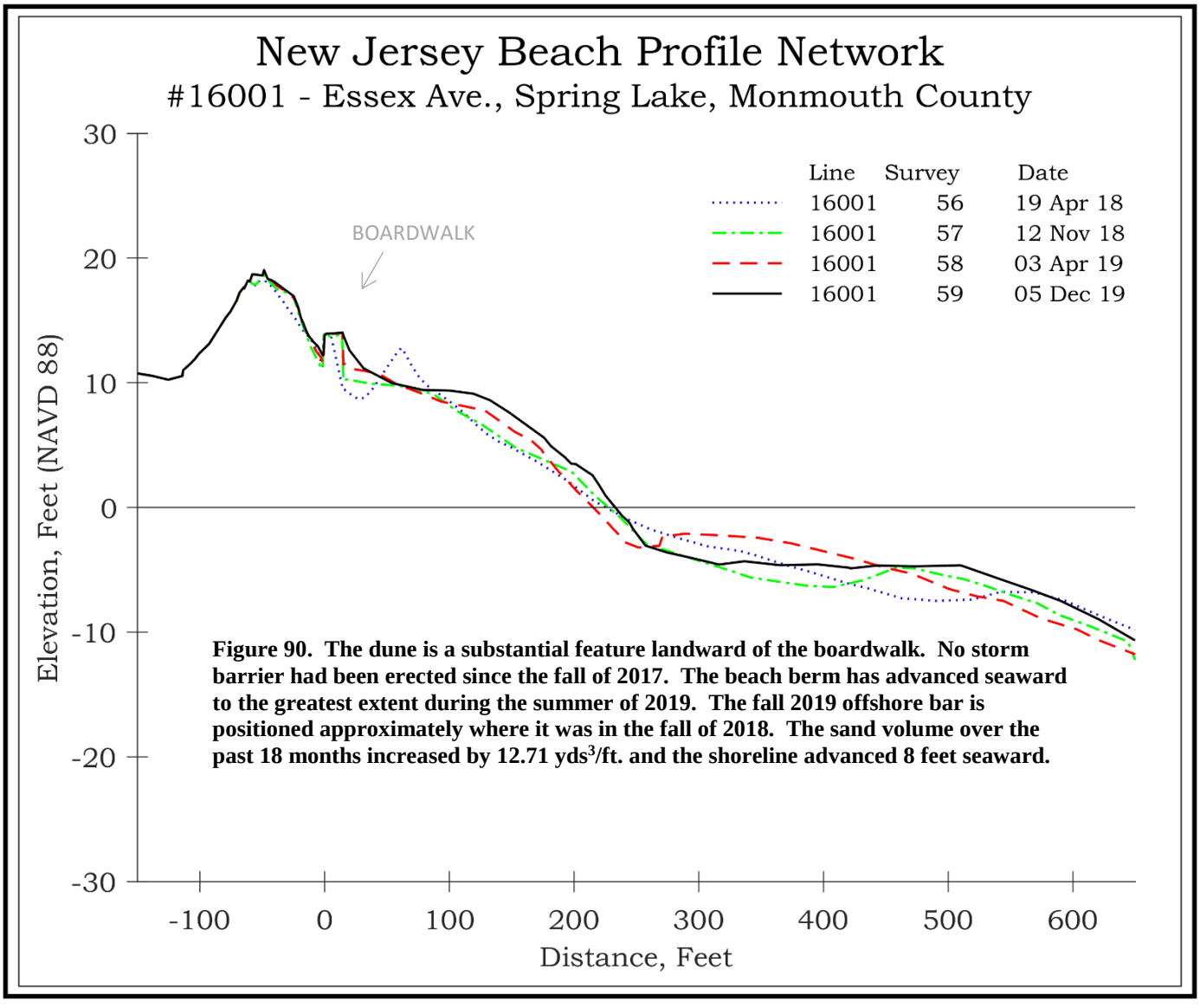


Figure 90. The dune is a substantial feature landward of the boardwalk. No storm barrier had been erected since the fall of 2017. The beach berm has advanced seaward to the greatest extent during the summer of 2019. The fall 2019 offshore bar is positioned approximately where it was in the fall of 2018. The sand volume over the past 18 months increased by 12.71 yds^3/ft. and the shoreline advanced 8 feet seaward.

NJBPN 160 – Salem Avenue, Spring Lake

The Salem Avenue beach site lies just south of one of the municipal beach facilities. The left photo was taken Nov. 12, 2018 showing a decent berm and wide, dry beach. On the right, the Dec. 3, 2019 view shows a similar beach in place with snow on the boardwalk.

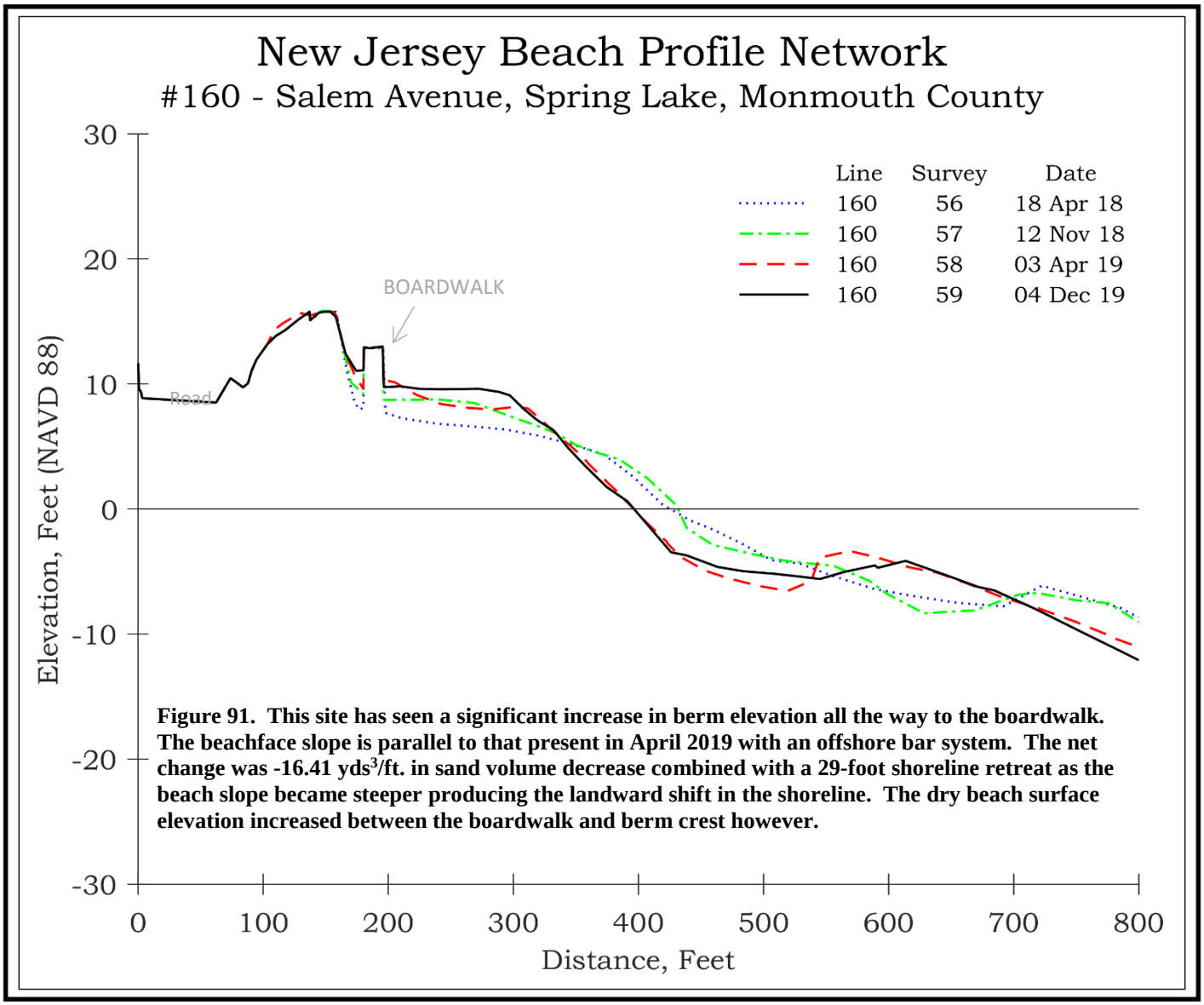
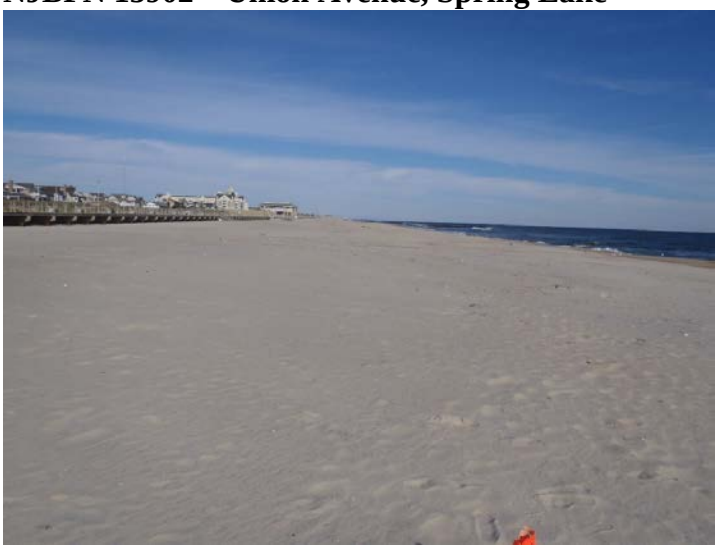


Figure 91. This site has seen a significant increase in berm elevation all the way to the boardwalk. The beachface slope is parallel to that present in April 2019 with an offshore bar system. The net change was -16.41 yds^3/ft. in sand volume decrease combined with a 29-foot shoreline retreat as the beach slope became steeper producing the landward shift in the shoreline. The dry beach surface elevation increased between the boardwalk and berm crest however.

NJBPN 15902 – Union Avenue, Spring Lake



This site has a narrow dune with the boardwalk seaward of it. The Nov. 14, 2018 view on the left shows the dry beach width. The Dec. 4, 2019 view was taken at the berm crest following a minor snowfall.

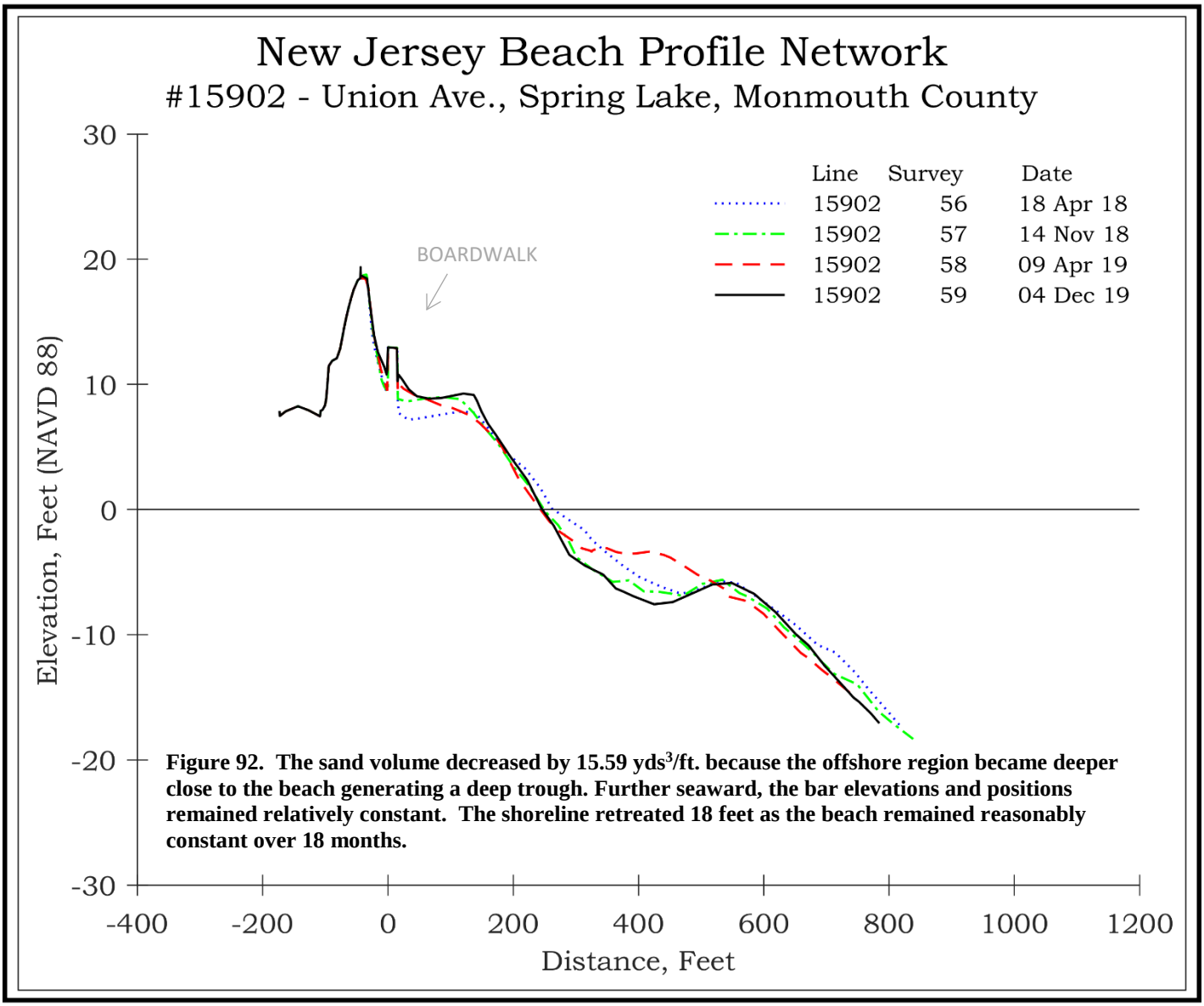


Figure 92. The sand volume decreased by 15.59 yds^3/ft. because the offshore region became deeper close to the beach generating a deep trough. Further seaward, the bar elevations and positions remained relatively constant. The shoreline retreated 18 feet as the beach remained reasonably constant over 18 months.

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 left view from Nov. 12, 2018 shows the beach with a timber groin exposed on the beach. The Dec. 4, 2019 view on the right shows the boardwalk and dune system to the right and a wide beach to the center of the view.

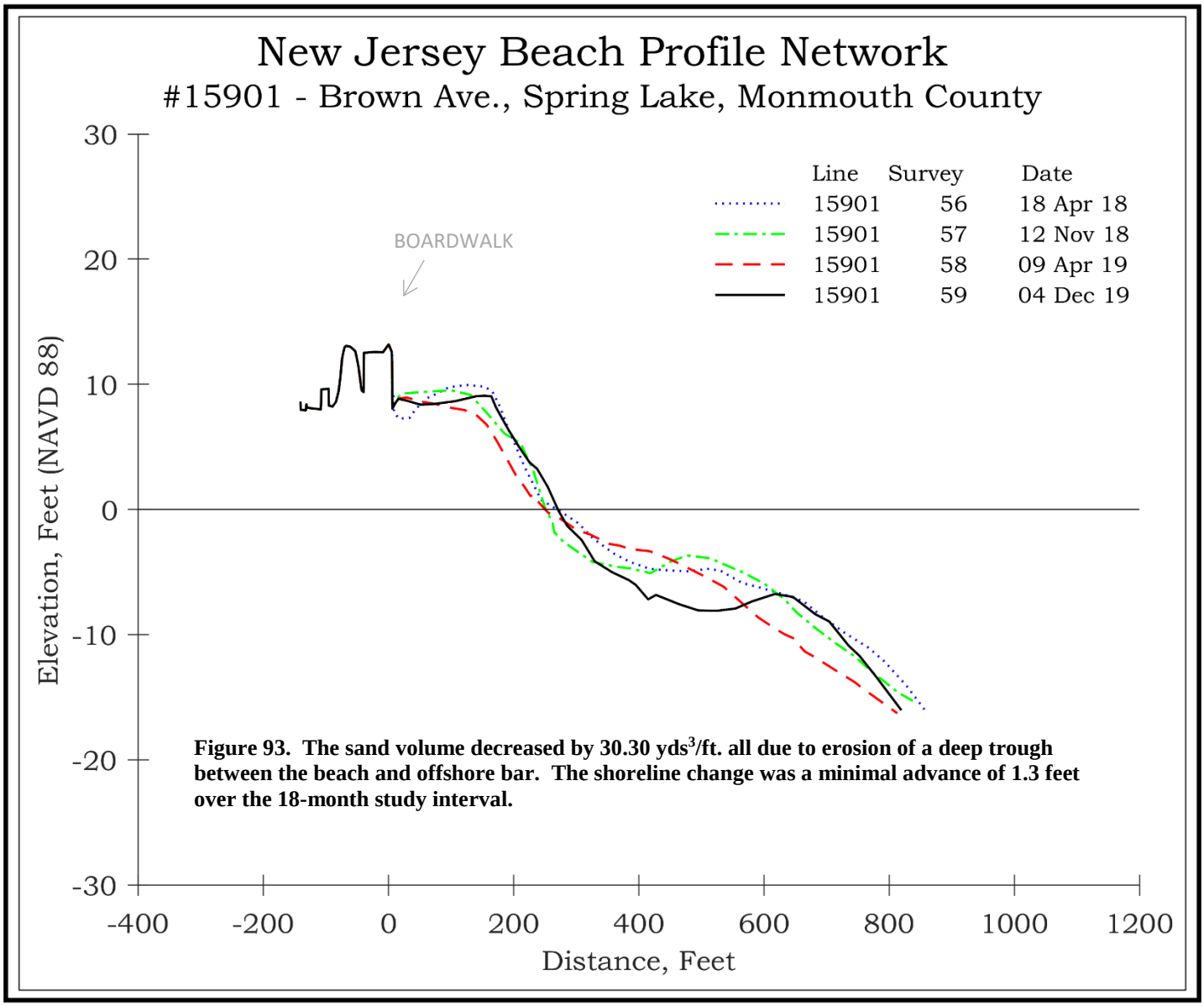


Figure 93. The sand volume decreased by 30.30 yds^3/ft. all due to erosion of a deep trough between the beach and offshore bar. The shoreline change was a minimal advance of 1.3 feet over the 18-month study interval.

NJBPN 159 – New York Avenue, Sea Girt

The left view, taken Nov. 12, 2018 shows the post-Sandy dune and the beach at New York Ave. The Dec. 4, 2019 view on the right followed a snow storm that dusted the beach. The dune toe lobe on the left appears a bit truncated in 2019, but damage was minimal.

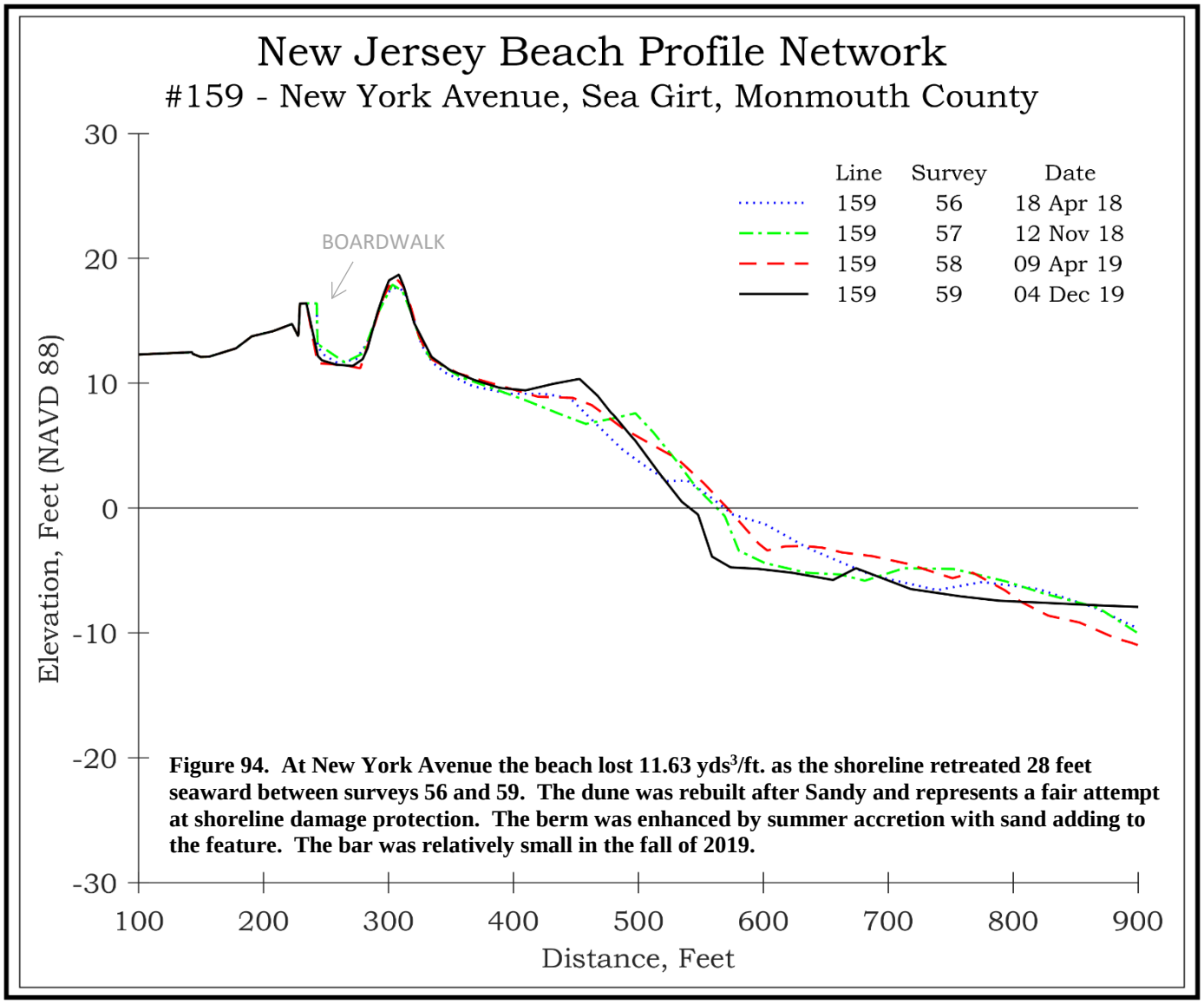


Figure 94. At New York Avenue the beach lost 11.63 yds^3/ft. as the shoreline retreated 28 feet seaward between surveys 56 and 59. The dune was rebuilt after Sandy and represents a fair attempt at shoreline damage protection. The berm was enhanced by summer accretion with sand adding to the feature. The bar was relatively small in the fall of 2019.

NJBPN 15801 – Crescent Park, Sea Girt

The dune was fenced by Nov. 12, 2018, but fence damage may have been storm induced, but the beach and dune system appear to be fine. By Jan 10, 2020 on the right the grass was partially buried by added wind deposition and the damaged fence was still unrepaired over a year later with no further storm wave impacts.

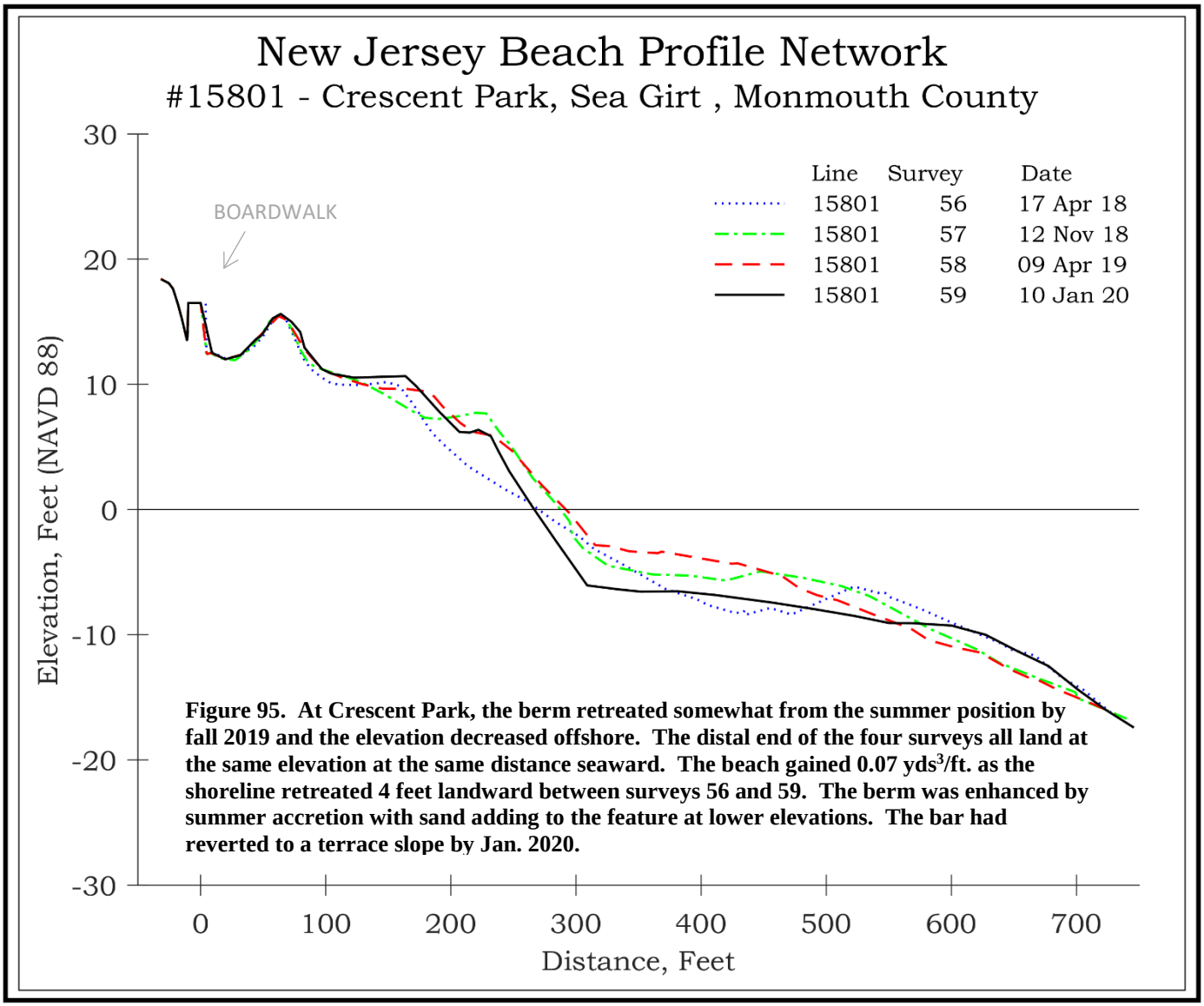
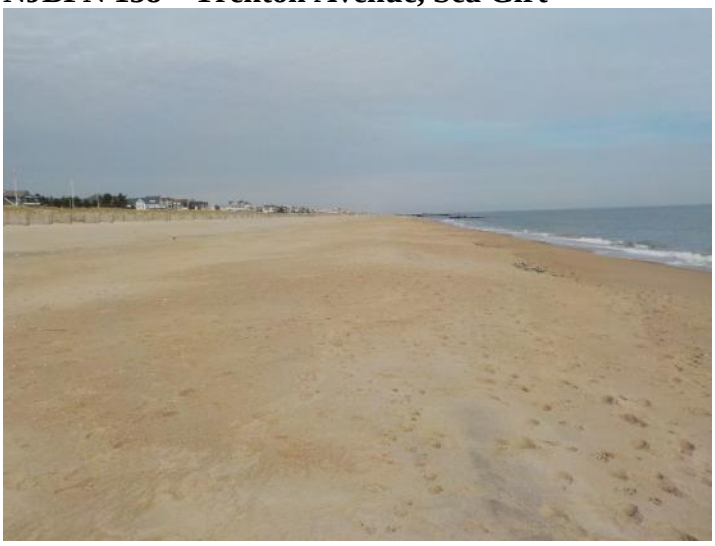


Figure 95. At Crescent Park, the berm retreated somewhat from the summer position by fall 2019 and the elevation decreased offshore. The distal end of the four surveys all land at the same elevation at the same distance seaward. The beach gained 0.07 yds^3/ft. as the shoreline retreated 4 feet landward between surveys 56 and 59. The berm was enhanced by summer accretion with sand adding to the feature at lower elevations. The bar had reverted to a terrace slope by Jan. 2020.

NJBPN 158 – Trenton Avenue, Sea Girt



The Nov. 12, 2018 view on the left shows the beach at the berm crest with the dune toe to the extreme left in the photograph. The Nov. 25, 2019 view (right photo) is at the toe of the dunes showing minor scarping and fence damage similar to that seen to the north at site 15801.

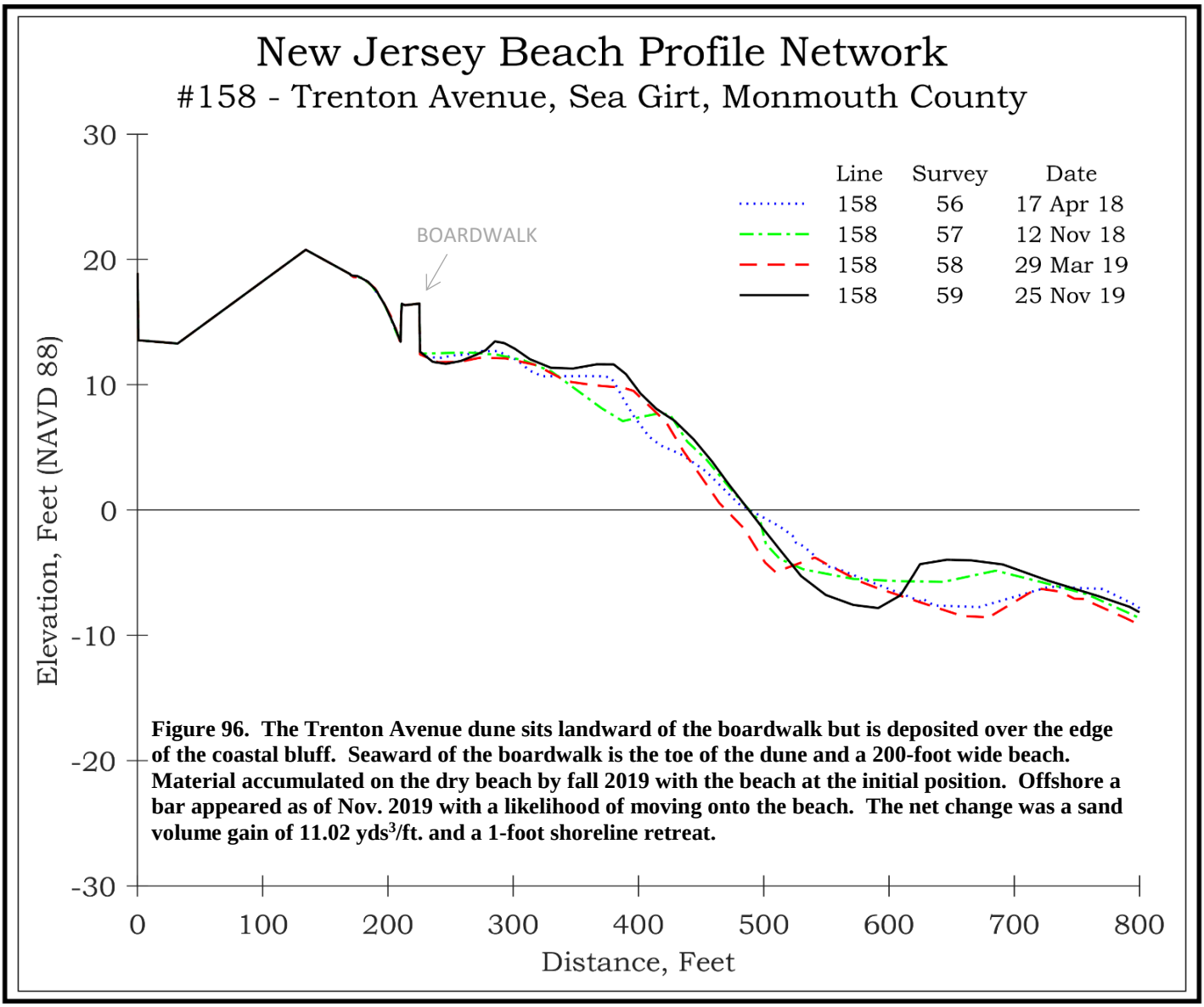


Figure 96. The Trenton Avenue dune sits landward of the boardwalk but is deposited over the edge of the coastal bluff. Seaward of the boardwalk is the toe of the dune and a 200-foot wide beach. Material accumulated on the dry beach by fall 2019 with the beach at the initial position. Offshore a bar appeared as of Nov. 2019 with a likelihood of moving onto the beach. The net change was a sand volume gain of 11.02 yds^3/ft. and a 1-foot shoreline retreat.

NJBPN 15703 – Seaside Place, Sea Girt

Located at the southern limit of Sea Girt, the site was clipped by dune erosion as of Nov. 28, 2018, as indicated in the left photograph. Wind transport appears to have replaced some dune toe sand as of Jan. 10, 2020 in the right photograph.

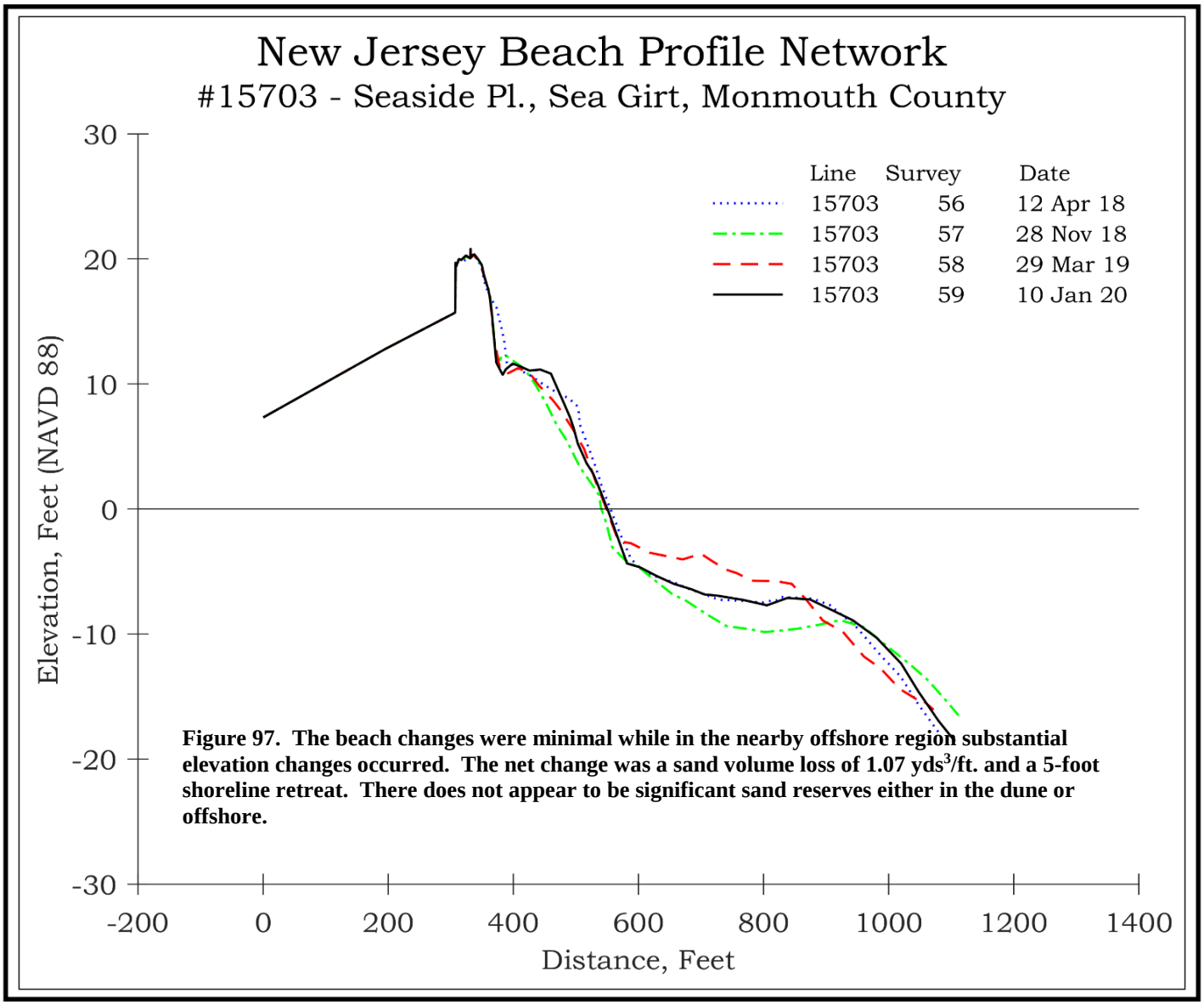


Figure 97. The beach changes were minimal while in the nearby offshore region substantial elevation changes occurred. The net change was a sand volume loss of 1.07 yds^3/ft. and a 5-foot shoreline retreat. There does not appear to be significant sand reserves either in the dune or offshore.

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. The Jan. 3, 2019 view to the north on the left shows the beach width and modest foredune at the seaward toe of the primary dune. As of Jan. 10. 2020, the site continued to accumulate sand in the foredune zone as the main dune remained unchanged.

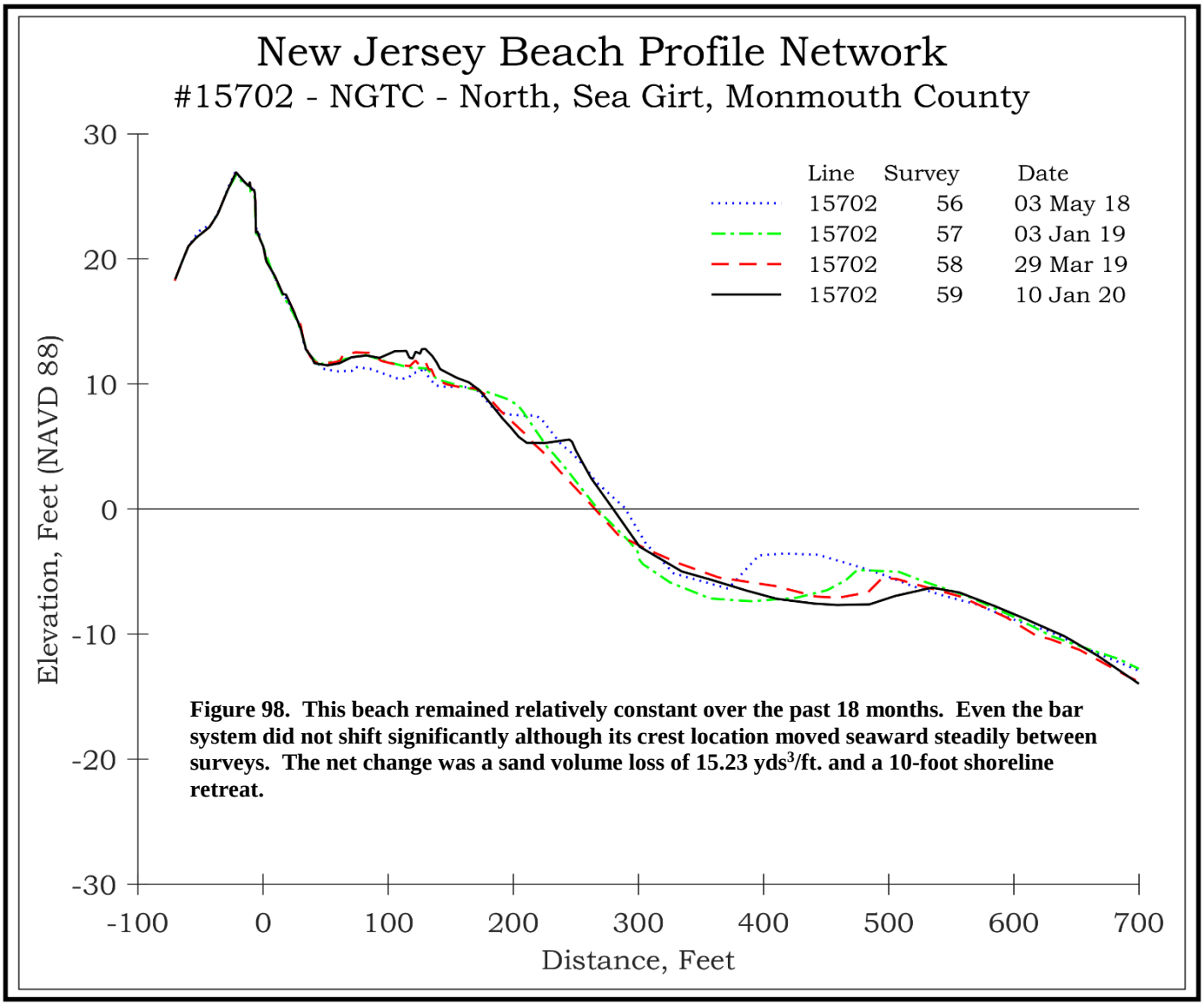


Figure 98. This beach remained relatively constant over the past 18 months. Even the bar system did not shift significantly although its crest location moved seaward steadily between surveys. The net change was a sand volume loss of 15.23 yds^3/ft. and a 10-foot shoreline retreat.

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 Jan. 3, 2019 view on the left is the southern dune toe and dry beach looking into Manasquan. The right photo was taken Jan. 10. 2020 in the same perspective showing little change in the upper beach and dune.

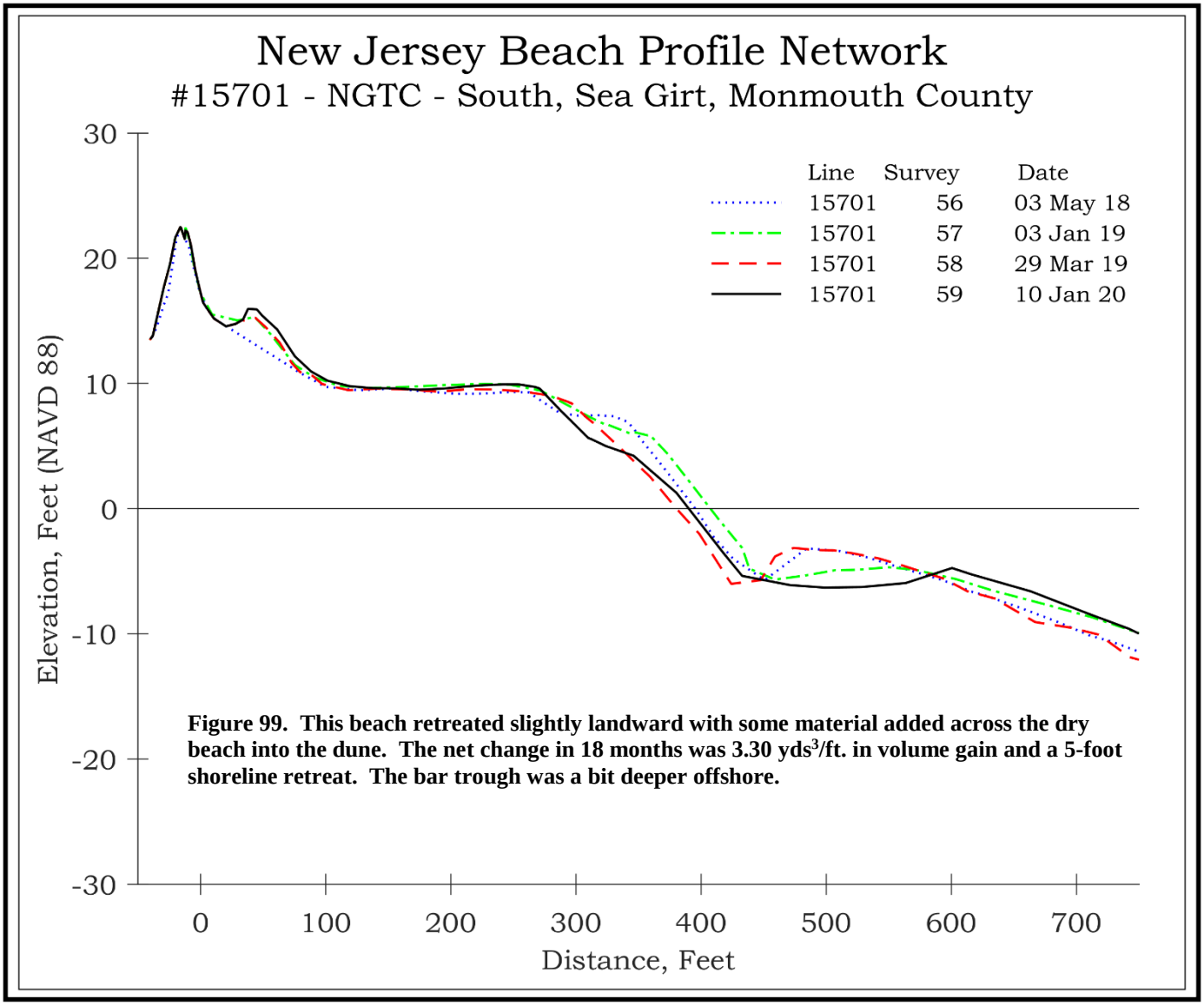


Figure 99. This beach retreated slightly landward with some material added across the dry beach into the dune. The net change in 18 months was 3.30 yds^3/ft. in volume gain and a 5-foot shoreline retreat. The bar trough was a bit deeper offshore.

NJBPN 157 – Riddle Way, Manasquan

The Nov 27, 2018 view to the north in Manasquan (left photo) shows the row of fencing placed in an attempt to keep the sand off the promenade along with a ridge of sand pushed up to reduce potential storm wave damage. On the right 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 storm ridge was absent as of the survey date.

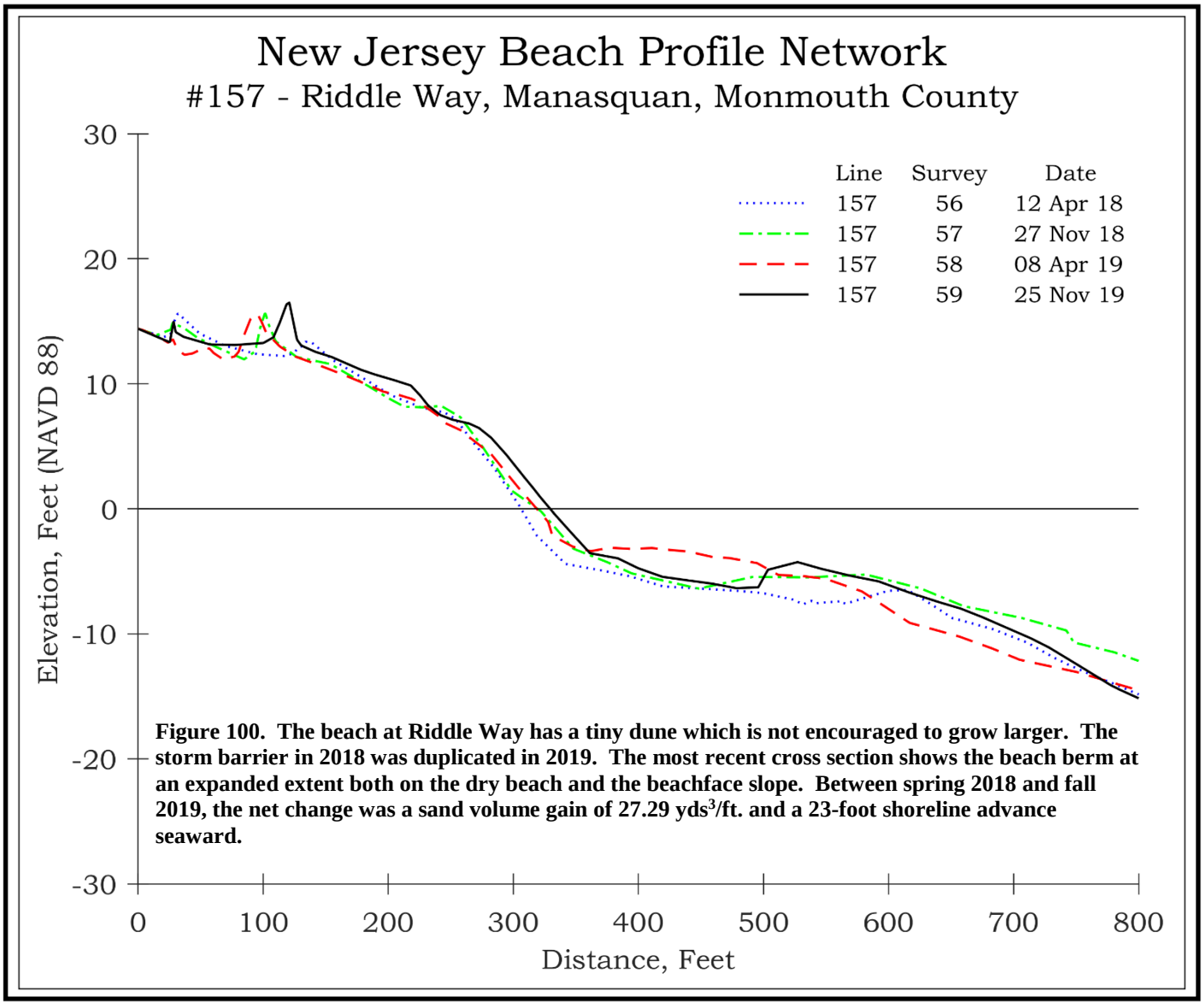


Figure 100. The beach at Riddle Way has a tiny dune which is not encouraged to grow larger. The storm barrier in 2018 was duplicated in 2019. The most recent cross section shows the beach berm at an expanded extent both on the dry beach and the beachface slope. Between spring 2018 and fall 2019, the net change was a sand volume gain of 27.29 yds^3/ft. and a 23-foot shoreline advance seaward.

NJBPN 25602 – Main Street, Manasquan

The Nov. 27, 2018 view on the left shows that the pushed up sand ridge was not universally installed with no dune present at the sand fencing seaward of the paved promenade. On the right, a year later (Nov. 25, 2019) sand has collected at the sand fencing largely having been pushed back off the promenade repeatedly. Sand hummocks appear on the open beach, but the storm ridge is absent.

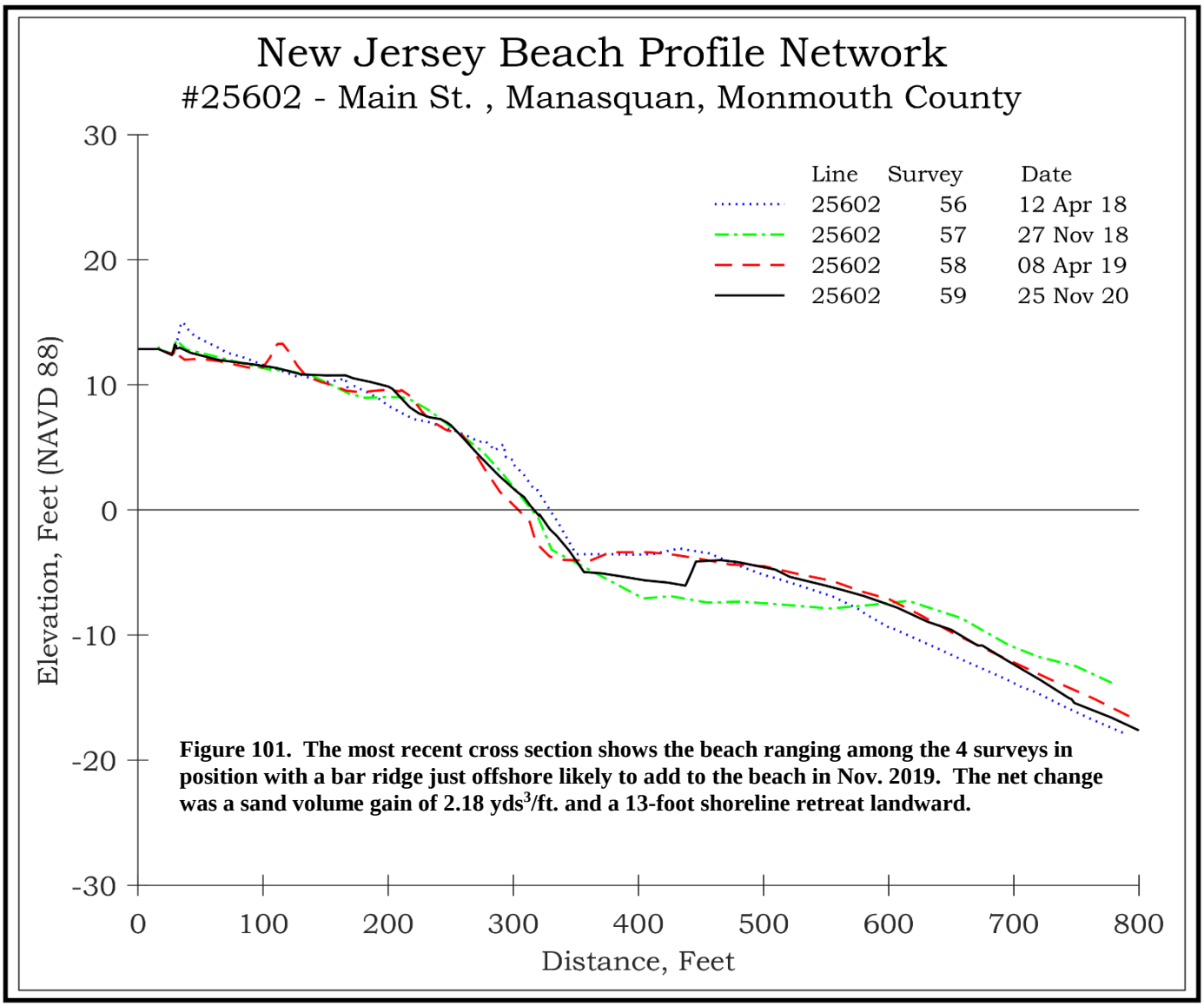


Figure 101. The most recent cross section shows the beach ranging among the 4 surveys in position with a bar ridge just offshore likely to add to the beach in Nov. 2019. The net change was a sand volume gain of 2.18 yds^3/ft. and a 13-foot shoreline retreat landward.

NJBPN 25601 – Brielle Road, Manasquan

This site did have a storm ridge pushed up as of Nov. 28, 2018, but it ended just south of the transect line. The Nov. 25, 2019 view on the right 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.

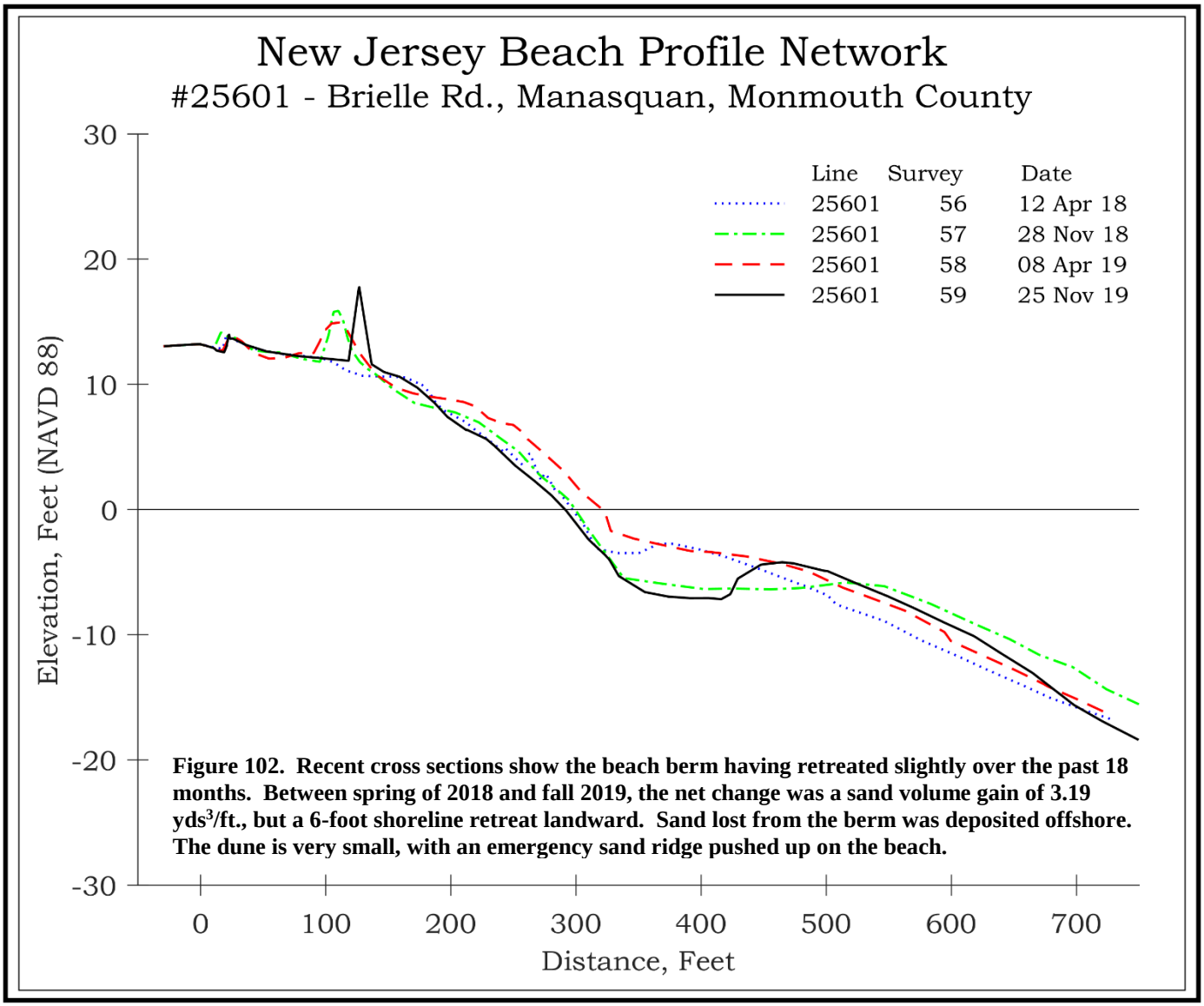
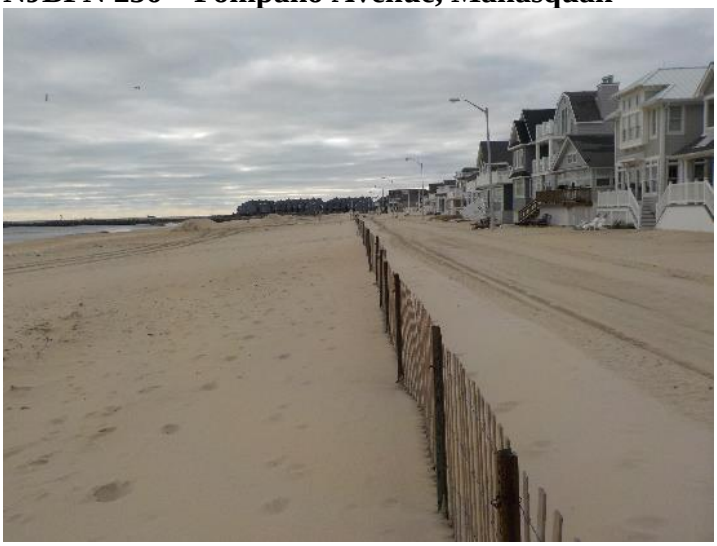


Figure 102. Recent cross sections show the beach berm having retreated slightly over the past 18 months. Between spring of 2018 and fall 2019, the net change was a sand volume gain of 3.19 yds^3/ft., but a 6-foot shoreline retreat landward. Sand lost from the berm was deposited offshore. The dune is very small, with an emergency sand ridge pushed up on the beach.

NJBPN 256 – Pompano Avenue, Manasquan



The Nov. 27, 2018 view (left photo) includes the promenade, houses, and the wind-transported sand causing problems because there was no dune system in the Borough. 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.

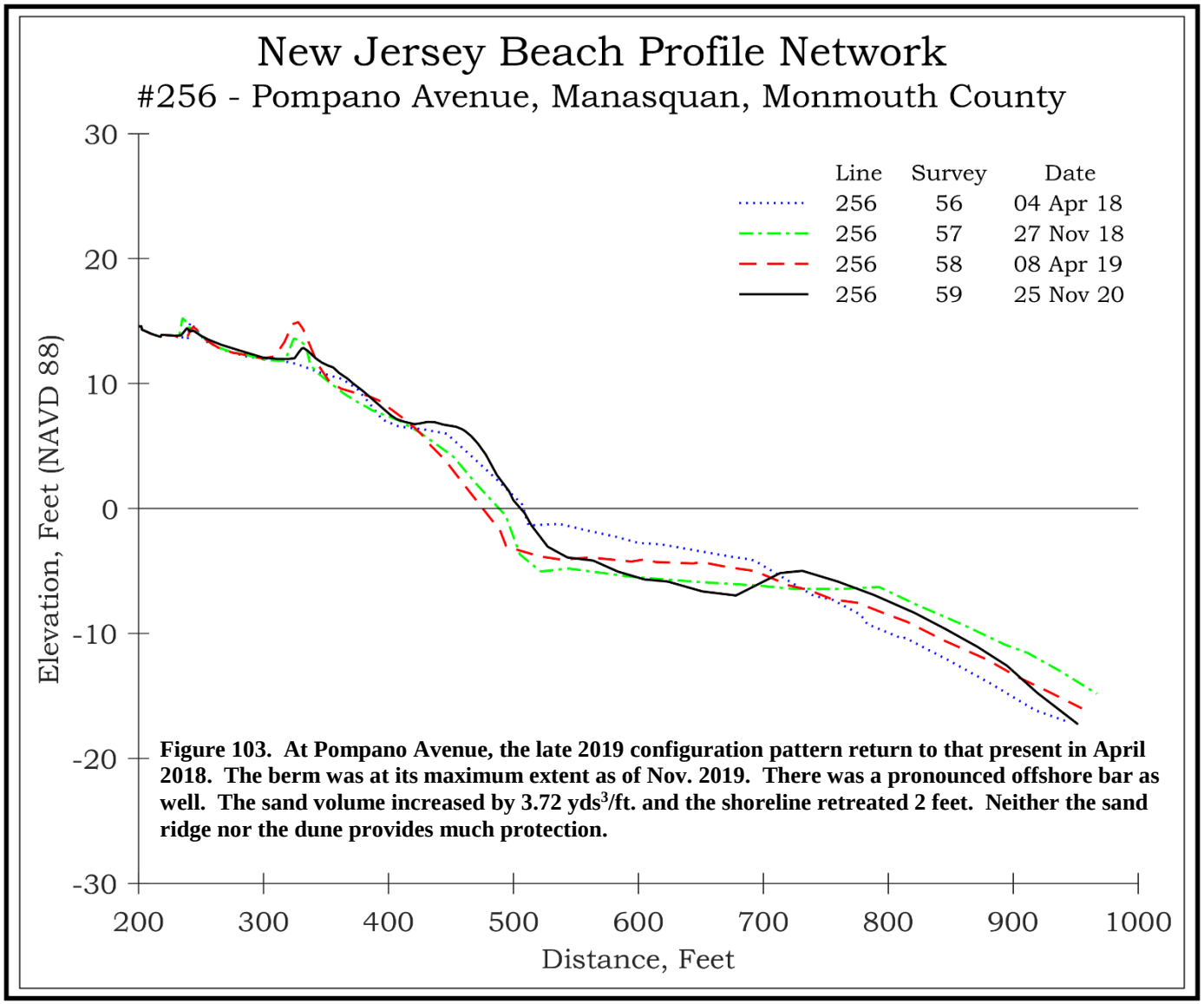
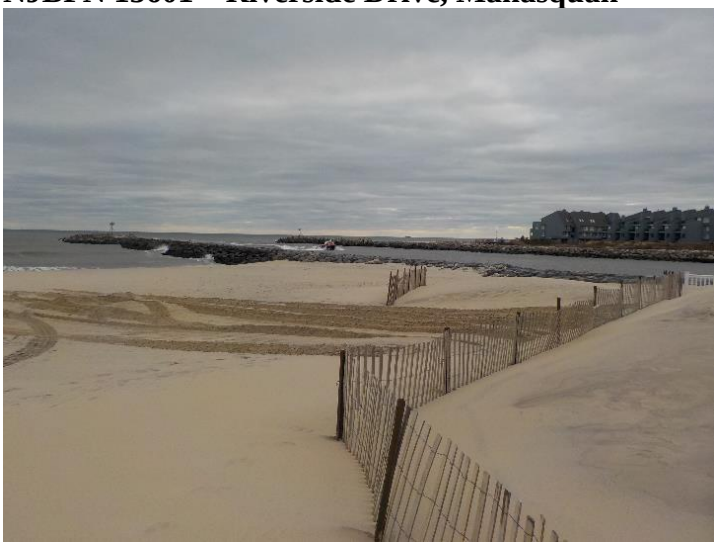


Figure 103. At Pompano Avenue, the late 2019 configuration pattern return to that present in April 2018. The berm was at its maximum extent as of Nov. 2019. There was a pronounced offshore bar as well. The sand volume increased by 3.72 yds^3/ft. and the shoreline retreated 2 feet. Neither the sand ridge nor the dune provides much protection.

NJBPN 15601 – Riverside Drive, Manasquan



The southernmost survey site in Monmouth County lies a few hundred feet from the north Manasquan Inlet jetty. The Nov. 27, 2018 photograph on the left shows the toe of the only "dune" on a Manasquan transect. This feature is fenced but with minimal plants. The right 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.

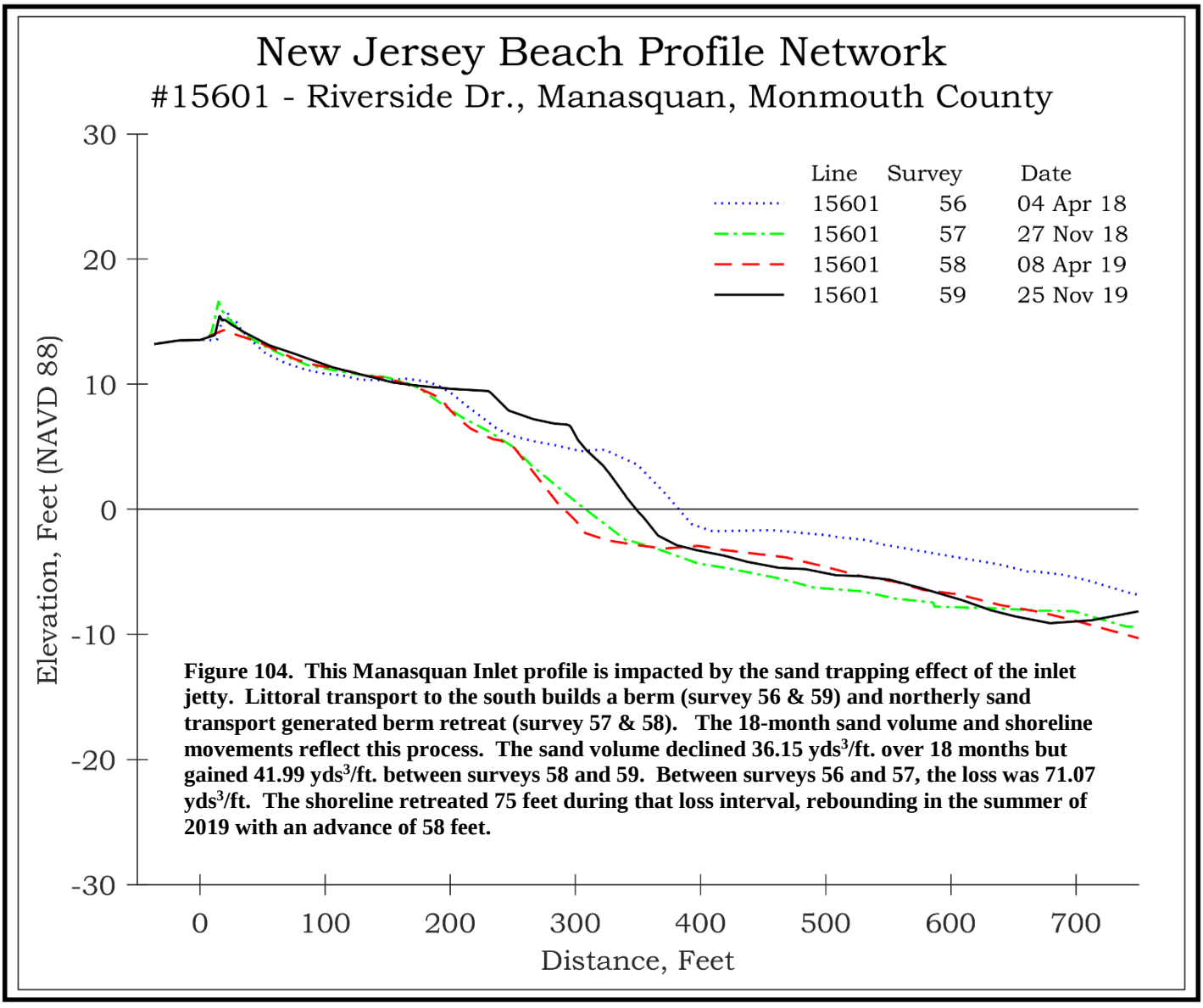


Figure 104. This Manasquan Inlet profile is impacted by the sand trapping effect of the inlet jetty. Littoral transport to the south builds a berm (survey 56 & 59) and northerly sand transport generated berm retreat (survey 57 & 58). The 18-month sand volume and shoreline movements reflect this process. The sand volume declined 36.15 yds^3/ft. over 18 months but gained 41.99 yds^3/ft. between surveys 58 and 59. Between surveys 56 and 57, the loss was 71.07 yds^3/ft. The shoreline retreated 75 feet during that loss interval, rebounding in the summer of 2019 with an advance of 58 feet.

Summary & Conclusions

The NY District of the US Army Corps of Engineers completed the Loch Arbor, Allenhurst, Deal, Elberon into Long Branch Phase III of the Monmouth County shore protection project in late 2016. The complete project allows for a natural redistribution of sand with a consistent level of migration opportunity between Manasquan Inlet and the Sand Hook National Seashore. 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 2019 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 3,200 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 yds^3/ft. The greatest shoreline advance was seen at Gunnison Beach at 670 feet of new dry beach width.

Sandy Hook continues to be of increased interest in the NJBPN research, since most 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. "This site's review only extends back to the 1994 establishment date for the National Seashore sites, but the changes observed since the establishment 21 years ago was 232.53 yds^3/ft. in added sand with a 564-foot shoreline advance" (quote from the CRC 2016 report). The recent addition of a new cross section 3,200 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 24,886 feet between Via Ripa (site #183) and Gunnison Beach (site #285). This was the motivation for adding the new site some 3,200 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 largely confined to the Elberon segment between Pullman Avenue and Lake Takanassee (survey transects 17101, Plaza Court to 17005, 981 Ocean Ave.). At these locations, shoreline retreat and upper beach scarps indicate sand loss exceeds resupply from other areas via littoral transport mechanisms. We understand that post-this report that spot nourishment was conducted at a number of places with decided levels of erosion. Subsequent surveys will provide documentation.

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. 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. Comparison plots are now possible in 2019 to gain insight on beach performance over the past 24 months.

Appendix Tables 2 and 3 provide the seasonal and annual profile volume and shoreline changes for Monmouth County. After the completion of Phase III, the Monmouth County oceanfront shoreline has had a post-Sandy sand volume increase of 51.44 yds^3/ft. or 141.8% of the Hurricane Sandy sand volume loss. Seasonally, the oceanfront beaches lost 4.44 yds^3/ft. between spring 2018 and fall 2018, then just 1.61 yds^3/ft. during the winter of 2018 to 2019. The oceanfront gained 2.93 yds^3/ft. during the summer of 2019. The Long Branch oceanfront lost the most sand (18.23 yds^3/ft. over the 18 months), while from Deal south the oceanfront gained sand (0.36 yds^3/ft.). Just the Phase II sites from Asbury Park to Manasquan gained 2.38 yds^3/ft.

There were numerous minor northeast events, but they did little damage. The oceanfront shoreline retreated an average of 12.82 feet largely due to sand transfer offshore into bar systems. Long Branch beaches retreated 27 feet on average, Sea Bright and Deal's retreated 20 feet while the Phase II sites retreated 4 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.

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 actually larger because the much shorter surveys back in 1994 were extended to the 2019 ending distance from the reference point, but at an elevation equal the 1994 ending elevation. The Gunnison Beach zero-elevation position advanced 670 feet seaward since 1994. The other two sites had 119 and 250-foot shoreline advances over the same interval. No attempt was made to estimate the offshore slope out to sea to provide a 1994 depth at the same distance measured along the 2019 transect.

If the same calculations are made for the 3 years since site #385 was established and surveyed and includes the added 3,200-foot shoreline distance the sand volume amounts to 545,456 cubic yards added to the Sandy Hook Park shoreline in 3 years.