



New Jersey Beach Profile Network

Monmouth County

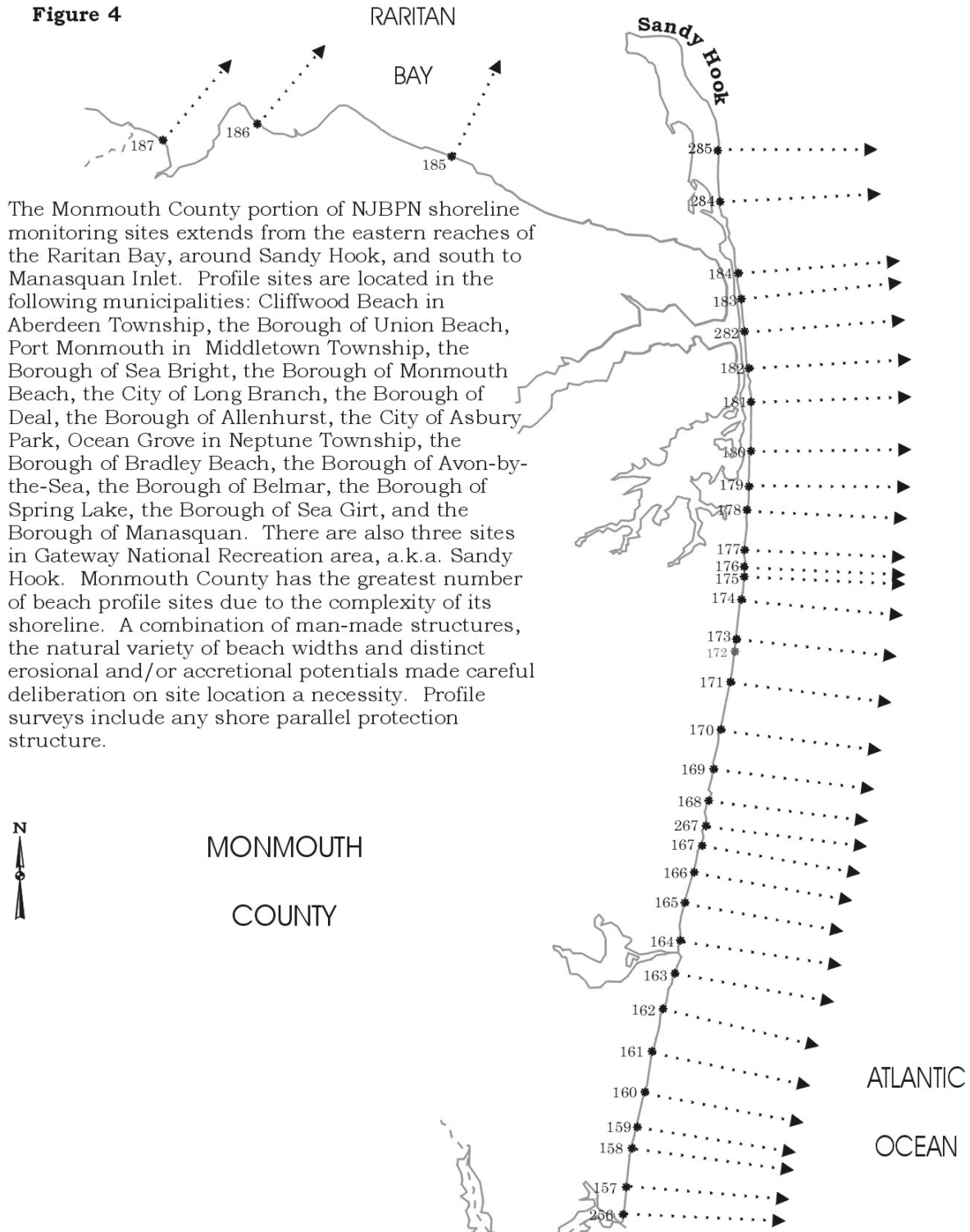
**Raritan Bay and Sandy Hook
to Manasquan Inlet**

**NJBPN Profile #'s
187 - 256**



New Jersey Beach Profile Network Monmouth County Profile Site Locations

Figure 4





Photoplate 1a. This photo was taken on October 26,2000 at NJBPN 174 (Morris Ave., Long Branch). Displayed is a relatively wide recreational beach including a pronounced berm which extends seaward covering a good portion of the groin.



Photoplate 1b. By September 23, 2002 the site showed virtually no change from 2000 with the exception of the increased vegetation along the seaward side of the boardwalk. Overall stability at this site is attributed to its position north of the end-effect losses that have taken place at the site to the south (#173).



Photoplate 2a. View taken from West End Avenue in Long Branch on October 27,2000 facing the south. At this time the wider recreational beach virtually covers the groin cells leaving only the seaward-most tips of the rocks exposed.



Photoplate 2b. Above is the same view taken almost two years later on September 23, 2002. End-effect losses caused the retreat in the shoreline and beachface which resulted in the uncovering of the groins along with minor beach offsets that are visible between the cells.

TABLE 1
MONMOUTH COUNTY
ANNUAL BEACH VOLUME CHANGES
FALL 2000 - FALL 2001 & SPRING 2001 - SPRING 2002 & FALL 2001 - FALL 2002

PROFILE SITE LOCATION	Survey		
	21-23 F2000 - F2001	22-24 S2001 - S2002	23-25 F2001 - F2002
	(volume expressed as cubic yards per foot)		
187: Cliffwood Beach Park	-0.60	-0.35	-0.29
186: Union Beach	0.27	-0.27	-1.51
185: Port Monmouth, Spy House Museum	2.88	3.30	-2.12
285: Gateway National R. A., Gunnison Beach	17.89	63.00	42.28
284: Gateway National R. A., Parking Lot E	11.45	0.30	56.19
184: Highland Beach, Gateway Entrance	-22.23	-7.82	79.83
183: Highland Beach, Via Ripa St.	-9.24	6.57	5.65
282: Sea Bright, Shrewsbury Way	32.83	11.97	-8.09
182: Sea Bright, North of Route 520	1.26	-3.10	17.50
181: Sea Bright, Municipal Beach	-8.12	-1.02	64.93
180: Sea Bright, Sunset Court	-16.79	-7.50	94.67
179: Monmouth Beach, Cottage Rd.	-25.94	-5.95	219.04
178: Monmouth Beach, Beach Club	4.15	-0.07	81.93
177: Long Branch, 404 Ocean Ave.	1.98	-5.61	-15.29
176: Long Branch, Seven Presidents Park	-14.59	-8.71	-16.37
175: Long Branch, North Broadway Ave.	-21.71	-24.71	-28.05
174: Long Branch, Morris Ave.	-12.50	-10.15	-14.29
173: Long Branch, West End Ave.	-48.84	-38.27	-40.19
171: Elberon, Pullman Ave.	-3.86	-5.62	-16.57
170: Deal, Roosevelt Ave.	-1.60	28.14	-5.16
169: Deal, Darlington Ave.	-0.39	17.28	-7.62
168: Allenhurst, Corlies Ave.	8.49	54.42	22.17
267: Asbury Park, 7th Ave.	12.55	33.13	9.41
167: Asbury Park, 3rd Ave.	-11.80	30.36	20.19
166: Ocean Grove, Ocean Pathway	-9.95	5.81	-8.48
165: Bradley Beach, McCabe Ave.	-21.58	-4.93	6.52
164: Avon-By-The-Sea, Sylvania Ave.	3.63	-0.67	-19.33
163: Belmar, 5th Ave.	6.82	3.64	6.33
162: Belmar, 18th Ave.	-11.22	-3.67	-1.17
161: Spring Lake, Brighton Ave.	-0.01	-1.16	33.64
160: Spring Lake, Salem Ave.	-3.39	-1.31	20.34
159: Sea Girt, New York Ave.	12.36	15.26	-19.64
158: Sea Girt, Trenton Ave.	13.59	-9.02	1.40
157: Manasquan, Riddle Way	-1.21	5.77	6.34
256: Manasquan, Pompano Ave.	2.63	-24.12	-12.05

TABLE 2
MONMOUTH COUNTY
ANNUAL SHORELINE CHANGES
FALL 2000 - FALL 2001 & SPRING 2001 - SPRING 2002 & FALL 2001 - FALL 2002

PROFILE SITE LOCATION	Survey		
	21-23 F2000 - F2001	22-24 S2001 - S2002	23-25 F2001 - F2002
	(shoreline change expressed in feet)		
187: Cliffwood Beach Park	-8.6	-3.4	-0.5
186: Union Beach	3.4	1.2	-2.8
185: Port Monmouth, Spy House Museum	3.5	1.3	-4.0
285: Gateway National R. A., Gunnison Beach	-14.0	14.8	148.6
284: Gateway National R. A., Parking Lot E	13.7	3.4	62.8
184: Highland Beach, Gateway Entrance	-65.6	40.3	122.5
183: Highland Beach, Via Ripa St.	-73.1	92.1	113.8
282: Sea Bright, Shrewsbury Way	36.5	79.7	25.9
182: Sea Bright, North of Route 520	5.7	-4.4	47.7
181: Sea Bright, Municipal Beach	-3.3	-6.6	95.2
180: Sea Bright, Sunset Court	-23.5	-10.7	111.4
179: Monmouth Beach, Cottage Rd.	-44.2	-8.2	236.0
178: Monmouth Beach, Beach Club	7.4	4.2	72.3
177: Long Branch, 404 Ocean Ave.	-8.6	-11.5	-17.8
176: Long Branch, Seven Presidents Park	-28.2	-22.0	-45.2
175: Long Branch, North Broadway Ave.	-31.8	-34.1	-26.7
174: Long Branch, Morris Ave.	-30.5	-7.3	-18.7
173: Long Branch, West End Ave.	-57.3	-40.4	-56.1
171: Elberon, Pullman Ave.	-42.4	-12.0	-30.6
170: Deal, Roosevelt Ave.	-19.2	68.4	-40.3
169: Deal, Darlington Ave.	-40.3	15.6	9.2
168: Allenhurst, Corlies Ave.	-47.2	64.2	66.1
267: Asbury Park, 7th Ave.	-3.6	58.9	25.1
167: Asbury Park, 3rd Ave.	-35.0	35.3	44.1
166: Ocean Grove, Ocean Pathway	-64.4	-41.3	-32.6
165: Bradley Beach, McCabe Ave.	-108.0	-36.3	-22.5
164: Avon-By-The-Sea, Sylvania Ave.	-80.3	6.7	-15.3
163: Belmar, 5th Ave.	-58.3	1.5	24.2
162: Belmar, 18th Ave.	-56.0	11.0	2.5
161: Spring Lake, Brighton Ave.	19.2	-53.0	34.3
160: Spring Lake, Salem Ave.	-17.6	-0.9	59.3
159: Sea Girt, New York Ave.	45.7	-6.5	-57.7
158: Sea Girt, Trenton Ave.	-64.2	2.0	22.0
157: Manasquan, Riddle Way	-3.3	25.3	-3.2
256: Manasquan, Pompano Ave.	-66.2	21.1	-4.0

TABLE 3
MONMOUTH COUNTY
SEASONAL BEACH VOLUME CHANGES

PROFILE SITE LOCATION	Survey				
	21-22 F00-S01	22-23 S01-F01	23-24 F01-S02	24-25 S02-F02	21-25 F00-F02
	(volume expressed as cubic yards per foot)				
187: Cliffwood Beach Park	-1.38	0.76	-0.97	1.15	-0.61
186: Union Beach	-0.04	0.42	-0.78	-0.05	-0.67
185: Port Monmouth, Spy House Museum	-0.25	2.94	0.31	-2.46	0.72
285: Gateway National R. A., Gunnison Beach	-2.30	22.43	41.31	-5.71	58.61
284: Gateway National R. A., Parking Lot E	-1.10	12.98	-12.25	69.46	68.76
184: Highland Beach, Gateway Entrance	-10.15	-12.87	4.68	73.96	55.97
183: Highland Beach, Via Ripa St.	-12.32	3.51	3.09	2.80	-2.69
282: Sea Bright, Shrewsbury Way	5.90	26.56	-13.53	5.03	24.62
182: Sea Bright, North of Route 520	-7.30	8.28	-11.82	29.36	19.23
181: Sea Bright, Municipal Beach	-0.18	-7.48	5.91	59.07	56.53
180: Sea Bright, Sunset Court	-7.40	-10.37	4.34	92.30	76.43
179: Monmouth Beach, Cottage Rd.	-25.98	0.25	-7.49	204.12	192.58
178: Monmouth Beach, Beach Club	7.57	-3.50	3.82	81.73	85.86
177: Long Branch, 404 Ocean Ave.	-0.38	1.63	-7.56	-6.65	-12.61
176: Long Branch, Seven Presidents Park	-11.38	-2.98	-6.66	-9.39	-31.15
175: Long Branch, North Broadway Ave.	-9.84	-11.66	-14.90	-8.60	-49.79
174: Long Branch, Morris Ave.	-5.78	-6.35	-1.58	-12.75	-27.10
173: Long Branch, West End Ave.	-14.04	-35.59	-2.48	-37.74	-89.24
171: Elberon, Pullman Ave.	-17.62	14.93	-20.30	3.64	-21.53
170: Deal, Roosevelt Ave.	0.21	-1.49	29.56	-34.77	-6.72
169: Deal, Darlington Ave.	-5.05	5.12	12.71	-19.47	-6.75
168: Allenhurst, Corlies Ave.	-12.91	24.86	29.09	-9.57	31.09
267: Asbury Park, 7th Ave.	2.35	10.29	22.95	-13.53	22.15
167: Asbury Park, 3rd Ave.	-13.96	1.94	27.46	-3.85	7.62
166: Ocean Grove, Ocean Pathway	-13.70	3.41	2.29	-10.90	-18.49
165: Bradley Beach, McCabe Ave.	-14.96	-6.67	1.79	5.16	-14.45
164: Avon-By-The-Sea, Sylvania Ave.	-22.09	25.38	-26.63	6.75	-15.32
163: Belmar, 5th Ave.	6.98	3.04	-0.37	6.22	13.79
162: Belmar, 18th Ave.	-11.22	0.46	-4.05	3.04	-11.48
161: Spring Lake, Brighton Ave.	-5.62	5.26	-6.51	39.58	32.63
160: Spring Lake, Salem Ave.	5.67	-6.95	4.23	12.94	17.87
159: Sea Girt, New York Ave.	-16.41	28.34	-13.28	-9.31	-8.65
158: Sea Girt, Trenton Ave.	9.61	3.60	-12.40	14.10	15.09
157: Manasquan, Riddle Way	0.23	-1.40	6.95	-0.27	4.04
256: Manasquan, Pompano Ave.	2.88	2.19	-26.61	14.54	-11.13

TABLE 4
MONMOUTH COUNTY
SEASONAL SHORELINE CHANGES

PROFILE SITE LOCATION	Survey				
	21-22 F00-S01	22-23 S01-F01	23-24 F01-S02	24-25 S02-F02	21-25 F00-F02
	(shoreline change expressed in feet)				
187: Cliffwood Beach Park	-4.5	-4.1	0.7	-1.3	-9.1
186: Union Beach	-2.2	5.5	-4.4	1.5	0.6
185: Port Monmouth, Spy House Museum	0.1	3.4	-2.1	-1.9	-0.5
285: Gateway National R. A., Gunnison Beach	-22.7	8.7	6.1	142.4	134.5
284: Gateway National R. A., Parking Lot E	-9.9	23.6	-20.2	82.9	76.5
184: Highland Beach, Gateway Entrance	-48.3	-17.4	57.7	64.9	56.9
183: Highland Beach, Via Ripa St.	-78.1	5.0	87.1	26.7	40.7
282: Sea Bright, Shrewsbury Way	-41.6	78.1	1.6	24.3	62.4
182: Sea Bright, North of Route 520	4.3	1.4	-5.9	53.6	53.4
181: Sea Bright, Municipal Beach	8.8	-12.1	5.5	89.7	91.9
180: Sea Bright, Sunset Court	-11.6	-11.8	1.2	110.3	87.9
179: Monmouth Beach, Cottage Rd.	-39.9	-4.3	-3.9	239.8	191.8
178: Monmouth Beach, Beach Club	7.3	0.1	4.1	68.2	79.6
177: Long Branch, 404 Ocean Ave.	-1.1	-7.5	-4.0	-13.8	-26.4
176: Long Branch, Seven Presidents Park	-16.4	-12.0	-10.0	-35.2	-73.3
175: Long Branch, North Broadway Ave.	-7.4	-24.4	-9.7	-17.1	-58.6
174: Long Branch, Morris Ave.	-25.1	-5.4	-1.9	-16.8	-49.2
173: Long Branch, West End Ave.	-14.2	-43.2	2.8	-58.9	-113.4
171: Elberon, Pullman Ave.	-65.4	23.0	-35.0	4.5	-72.9
170: Deal, Roosevelt Ave.	-46.1	26.9	41.4	-81.7	-59.4
169: Deal, Darlington Ave.	-32.5	-7.8	23.4	-14.2	-31.1
168: Allenhurst, Corlies Ave.	-69.6	22.4	41.7	24.4	18.9
267: Asbury Park, 7th Ave.	-44.6	41.0	17.9	7.2	21.5
167: Asbury Park, 3rd Ave.	-36.5	1.5	33.8	10.4	9.1
166: Ocean Grove, Ocean Pathway	-30.5	-33.9	-7.4	-25.2	-96.9
165: Bradley Beach, McCabe Ave.	-53.5	-54.4	18.2	-40.7	-130.5
164: Avon-By-The-Sea, Sylvania Ave.	-88.7	8.4	-1.7	-13.5	-95.5
163: Belmar, 5th Ave.	-42.3	-16.0	17.5	6.7	-34.1
162: Belmar, 18th Ave.	-50.1	-5.8	16.9	-14.4	-53.5
161: Spring Lake, Brighton Ave.	41.0	-21.8	-31.2	65.5	53.5
160: Spring Lake, Salem Ave.	3.0	-20.6	19.7	39.6	41.7
159: Sea Girt, New York Ave.	42.1	3.6	-10.1	-47.6	-12.1
158: Sea Girt, Trenton Ave.	-49.8	-14.4	16.4	5.6	-42.2
157: Manasquan, Riddle Way	20.5	-23.8	49.2	-52.4	-6.5
256: Manasquan, Pompano Ave.	-55.9	-10.3	31.4	-35.3	-70.2

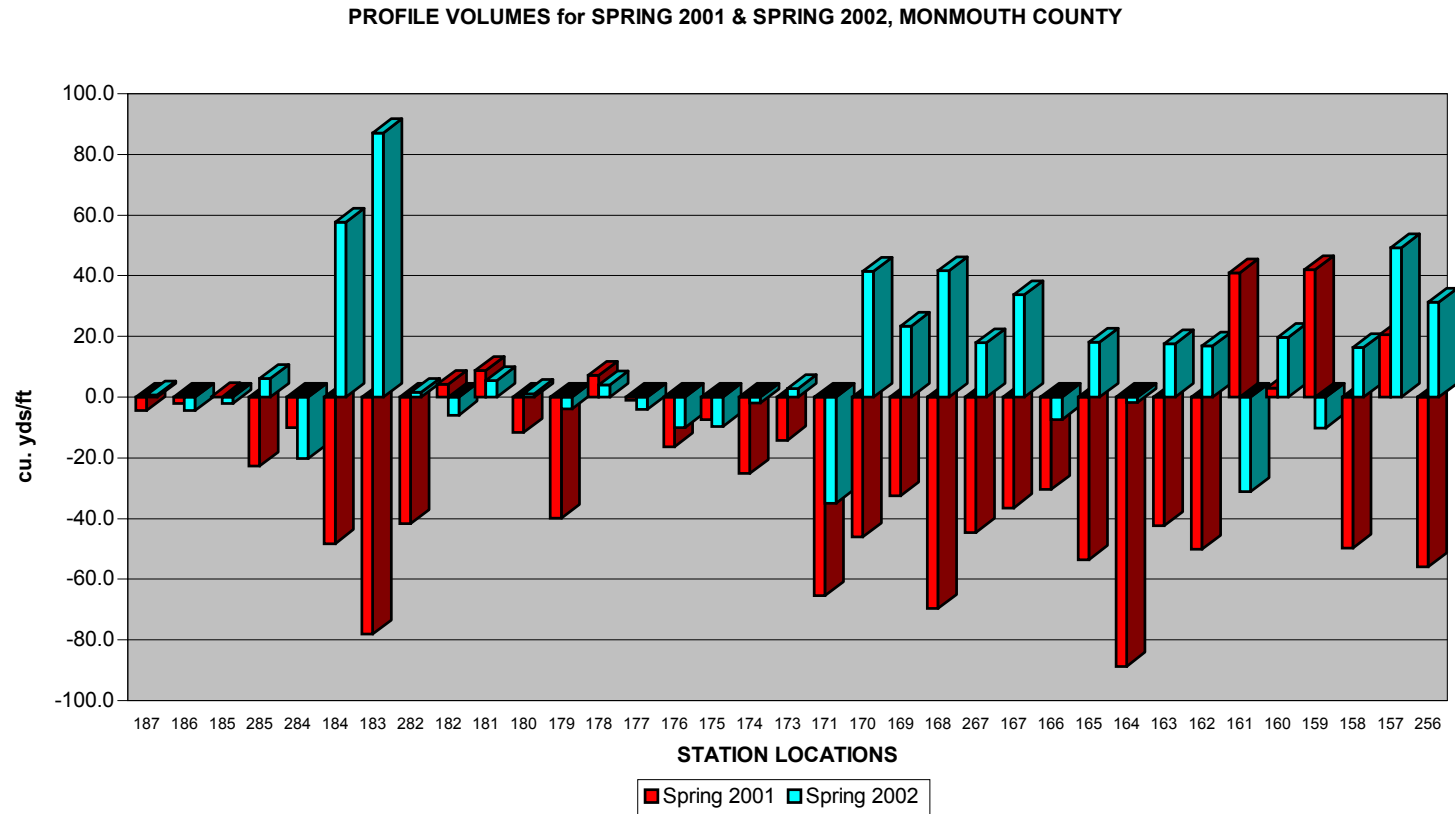


Figure 5a. The annual changes from the spring 2001 to the spring 2002 display a general trend of overall loss in the spring 2001 and a general gain by spring 2002. Specifically site #184 and the site located directly to the south #183 showed losses in 2001 but reversed this trend to display considerable gains in the spring of 2002 with the start of the ACOE maintenance nourishment.

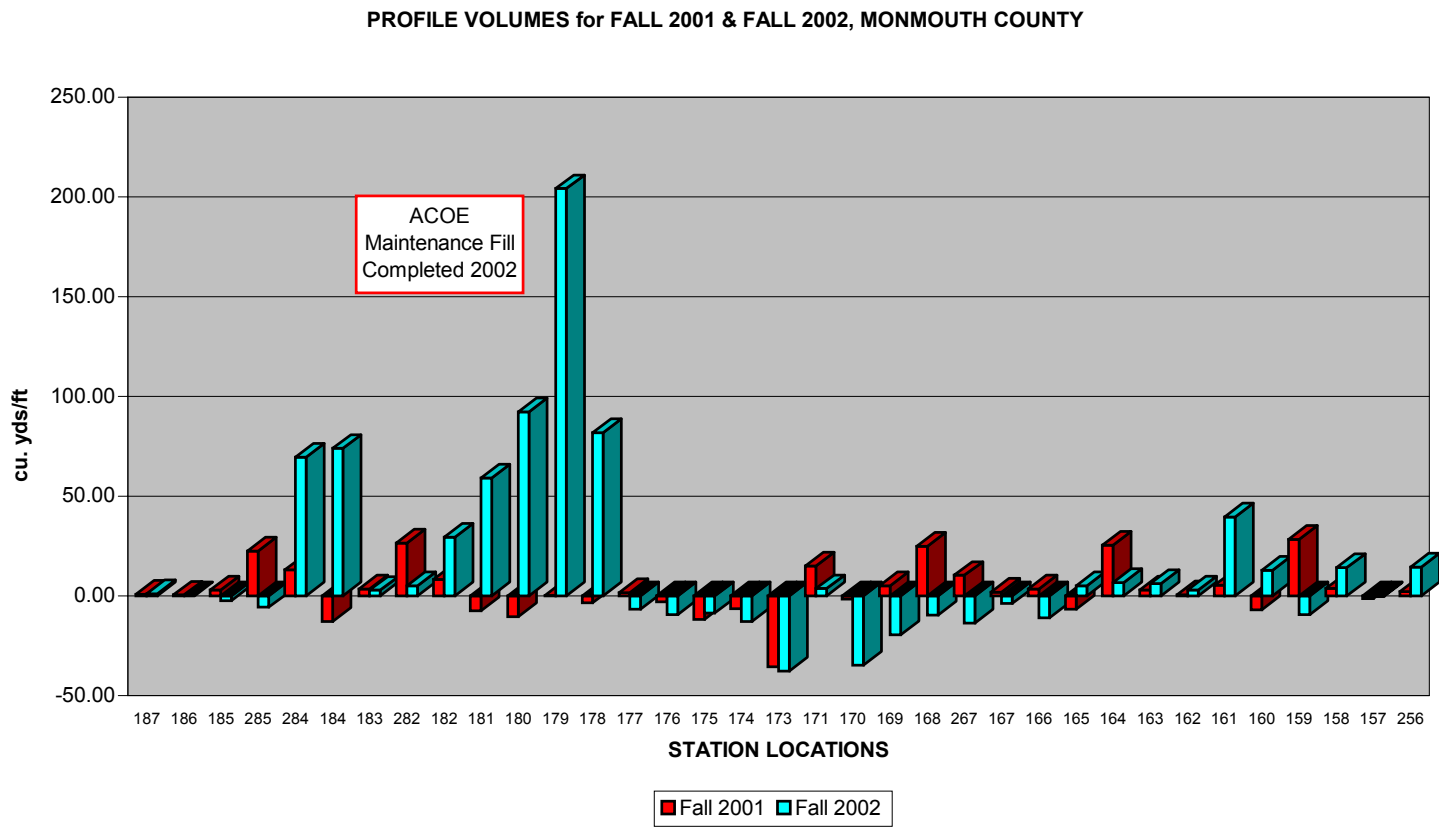


Figure 5b. The annual changes from the fall 2001 to the fall 2002 display considerable gains in the cross sections between the entrance to Sandy Hook Park and the Long Branch border due to the beach maintenance project. Completed by fall 2002 the fill placed an average of 69.43 yds³/ft of material in this reach.

PROFILE VOLUME CHANGES BETWEEN FALL 2000 & FALL 2002, MONMOUTH COUNTY

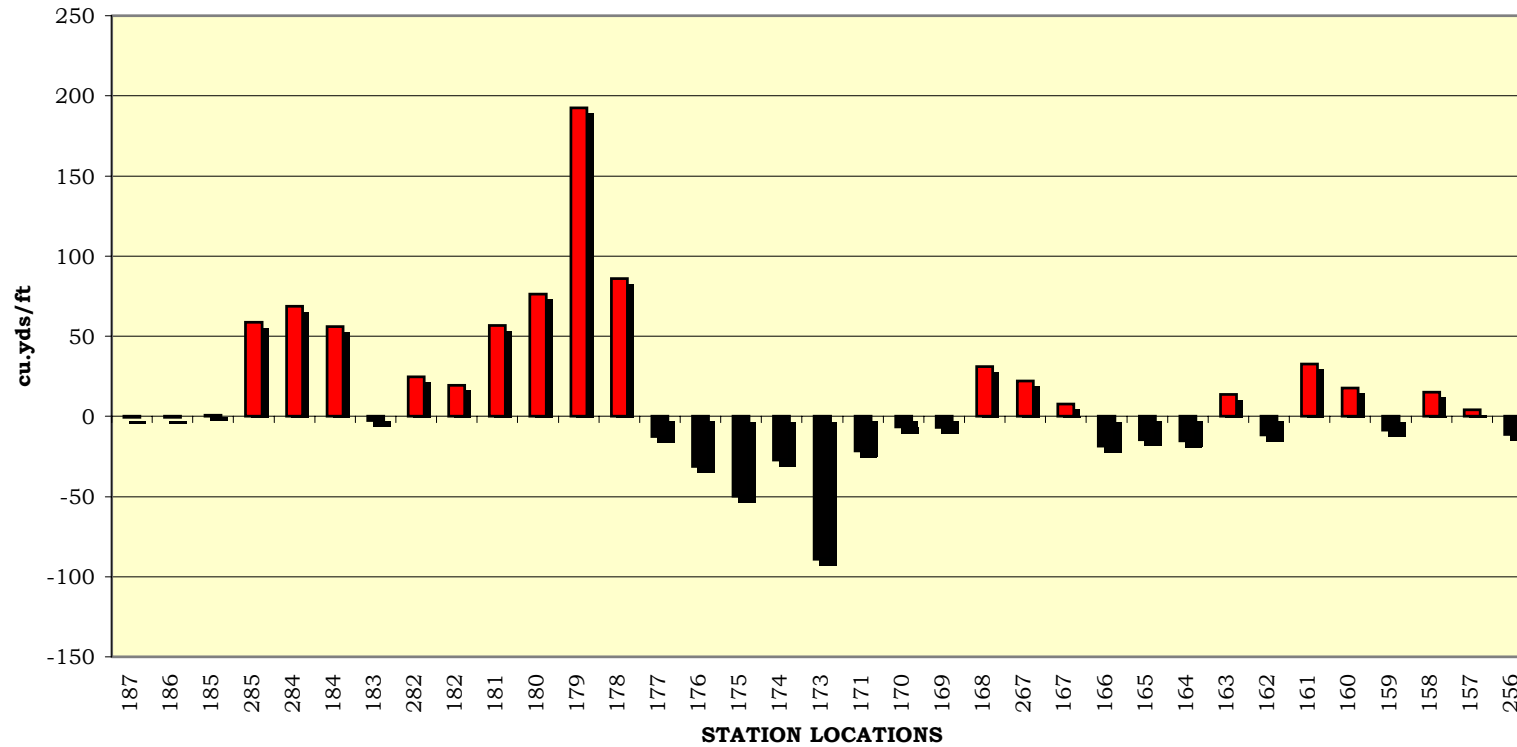


Figure 5c. Due to the completion of the most recent beachfill by fall 2002, the graph displays large volume gains in Monmouth Beach and the southern portions of Sea Bright. Although the fill did not extend as far north as Gunnison beach, overall gains occurred due in part to northerly littoral drift of some material. Volume losses were concentrated at Long Branch where end-effect losses produced the largest volume loss at site #173. Losses in Asbury Park and Ocean Grove were consistent but moderate.

PROFILE SHORELINE CHANGES - FALL 2000 to FALL 2002, MONMOUTH COUNTY

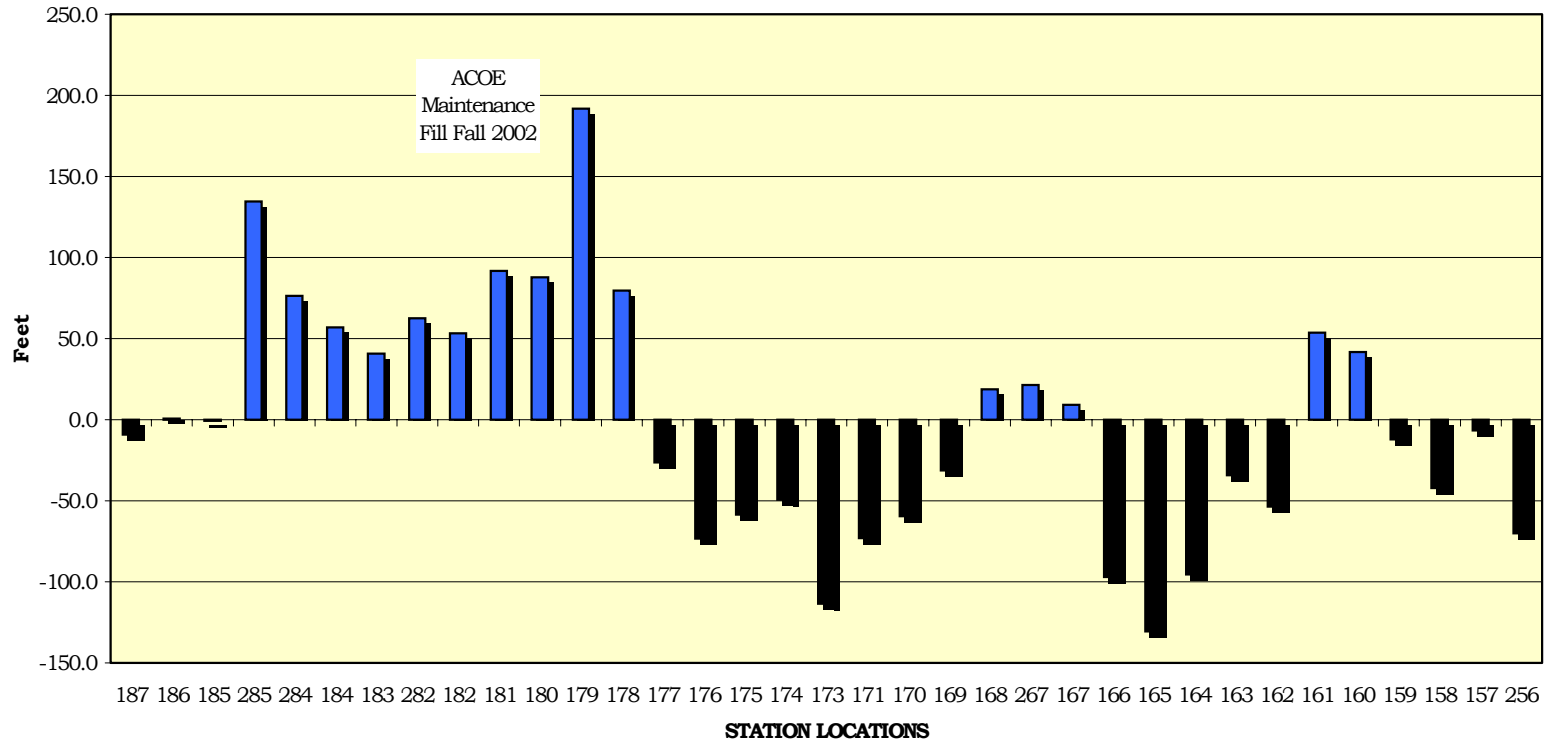


Figure 5d. The shoreline advances and retreats over this study period virtually mirror the overall volume gains and losses displayed at each site. The shoreline advances are concentrated in the northern portion of the county where beachfill efforts are most likely the catalyst. Retreats in shoreline position are concentrated in the southern two thirds of the county, particularly at site 173 in Long Branch where end-effect losses from the project area are pronounced.

SUMMARY OF INDIVIDUAL SURVEY STATIONS LOCATED IN MONMOUTH COUNTY

- **Profile #187 - Beach Park, Cliffwood Beach** (fig. 6)

The Cliffwood Beach Park profile begins on the landward side of Lenox Road, includes the curbs and street and continues over the reconstructed dune, across the beach and into the water over 500 feet from the shoreline. Dune grass has propagated and spread to cover most of the dune between the landward and seaward toe. Bayberry, beach plum and sumac have appeared on the landward slope and appear to be flourishing. A foredune ridge continued to grow about 100 feet seaward of the carsonite reference post located along the primary landward dune crest. Dune grass and early colonizing plants provide abundant ground cover between the primary seaward toe and seaward crest of the foredune. By the end of 2002 early colonizing plants had spread over the entire dry sandy area above the berm ridge bringing the seaward dune toe nearly to the high tide wrack line. Foredune accumulations continued unabated because of a lack of foot traffic and wave run up across the relatively flat upper beach.

Waves are generally small here because the wind fetch on Raritan Bay is limited and the locations considerable distance from the inlet. Although these waves have little effect upon the dune system they can have an impact upon the beachface. This is clearly seen on the cross-section by a minor but nearly continuous slow and steady retreat in the shoreline, during the study period. Total retreat between November 2000 and November 2002 was approximately ten feet along the beachface. Although the loss was small the cross-section plot shows the loss was incremental with each survey. The short period waves generated in Raritan Bay had limited impact on the seafloor and no significant cross-sectional changes occurred beyond the beachface toe, during this study period. The net volume change for the study period was just $-0.61 \text{ yds}^3/\text{ft}$ of sand lost, indicating a relative balance between sand accumulation on the foredune and material removed from the beachface and no change seen offshore.

- **Profile #186 - Union Avenue, Union Beach** (fig. 7)

At this site a PK nail along the centerline of Union Avenue is the current reference position, replacing the original reference disk located on a curbside utility pole destroyed when the pole was replaced during recent improvement projects. The profile includes the curb, bayside parking lot, asphalt walkway and wooden bulkhead all constructed during the same improvement projects. This site originally consisted of a sandy beach that sloped gently from the sidewalk to the water lacking any dune system for storm protection. Instead these relatively new hard structures provide adequate shore protection for the shore front property and infrastructure that occupy the area where dunes would naturally occur if the beach were free from development. The profile continues seaward from the base of the bulkhead across an apron of rock riprap that covers most of what little sandy beach remains here at low tide.

Between the rock apron toe and the waters edge is a narrow 20-foot wide swash zone with another 20 feet extending the beachface toe to the seafloor where some very minor changes occurred during the study period. This bay shoreline is also located in a low energy wave environment, similar to Cliffwood Beach. Consequently, the seafloor is unaffected by the small waves generated by the wind fetch across Raritan Bay, resulting in no change to the cross section offshore. With very little existing beach subject to erosion the net changes from November 2000 to November 2002 were minimal, $-0.67 \text{ yds}^3/\text{ft}$ of sand lost with 1 foot of shoreline retreat.

- **Profile #185 - Spy House, Port Monmouth** (fig. 8)

Profile #185 begins on the seaward side of Port Monmouth Road in front of the Spy House Museum at Bayshore Waterfront Park. The profile includes the park's grass yard and parking lot, continuing to the seaward dune crest where a relatively steep slope in the dune plunges 8 feet to the beach below. From the dune toe, a narrow beach approximately 80 feet in width, at low tide,

slopes towards the water's edge. The seafloor is relatively flat from the beachface toe continuing out over 1000 feet to the limit of the survey. A split rail fence separates the dune from the concrete parking space barriers along the landward dune toe. Beyond the fence, dune grass and other native species provide ground cover on the seaward crest and along a portion of the upper seaward slope.

The seaward slope has experienced periodic episodes of erosion and retreat during the past 15 years. Beach losses and shoreline retreat were associated with these events. The assessment was that the erosion was directly related to northeast storm wave activity. Dune restoration earlier in the past decade, dune grass planting, installation of fences and walkways over the dune to prevent foot traffic losses has enhanced this site's stability considerably. However, a lack of intense northeast storm events during the study period, between November 2000 and April 2002, has been the most significant reason for the remarkable period of stability here. By November 15 2002, with the onset of a series of storms that began on Labor Day weekend 2002, some minor beach erosion occurred near the dune toe. Offshore virtually no changes have occurred since the small wind fetch generated bay waves lack sufficient energy required to move sand along the seafloor. From November 2000 to November 2002 just 0.72 yds³/ft of sand was lost with less than one foot of shoreline retreat.

- **Profile #285 – Gunnison Beach, Sandy Hook, Monmouth County** (fig. 9)

This profile begins on the landward side of Atlantic Avenue, includes the sidewalk and promenade where comfort stations and gazebos are located. The profile continues across the large primary dune and wide foredune to a flat, low elevation beach that extends approximately 900 feet from the dune toe across a flat area then sloping higher toward the berm. From the berm ridge the profile continues seaward through a nearshore trough or runnel and onto a large nearshore bar or ridge feature. Beyond the bar the seafloor slope is steeper dropping quickly to an elevation of -12-feet NGVD.

The dune is 200 feet wide from landward toe to seaward toe with a crest elevation of about 16 feet NGVD. This dune is very stable with grasses and various native species providing ground cover. Large bayberry shrubs and other woody trees flourish along the primary crest and landward slope. Due to the extreme width of this profile most of the stable primary dune was omitted from the profile plot. The upper beach is relatively flat and stable despite a low elevation, 4 to 5 feet NGVD, it rises steeply at the berm ridge to 9 feet NGVD. From the berm seaward the stability of this site decreases dramatically.

The berm ridge has steadily retreated nearly 70 feet since November 2000 reducing the berm crest elevation from 9 feet to 7.5 feet NGVD with the loss of 7.67 yds³/ft of sand. However, this berm loss was insignificant compared to the amount of sand that began moving onshore by November 2001 and then welded to the beachface by December 2002. This onshore sand migration advanced the shoreline 135 feet and added 45.00 yds³/ft of new material to the beach. An additional accumulation of 26.08 yds³/ft of sand on the seafloor developed a new nearshore bar by December 2002 that appears to be following the same onshore migration pattern. Sand continued to move into this beach throughout the study period continuing the expansion of the Gunnison Beach recreational area documented during previous reports. The net result for the study period was 58.61 yds³/ft of sand added to the profile while the shoreline advanced 135 feet.

- **Profile #284 – Parking Lot E, Sandy Hook, Monmouth County** (fig. 10)

Profile #284 begins in a dense shrub and wooded area of the back dune at a reference disk attached to a utility pole. The profile crosses through this back dune area, over the primary and foredune ridges onto a wide dry upper beach. From the berm ridge the beachface slopes steeply into several feet of water. The dune is well developed with a thickly vegetated back dune area composed of large bayberry trees and other woody plants indigenous of a maritime forest, indicative of a long period of stability. From the primary dune crest seaward to the foredune crest

dune grass and other native non-grass species (i.e. Seaside Goldenrod, Poison Ivy, etc) combine to form abundant ground cover, which adds stability to this more recent accumulation. Sporadic dune grass rhizomes with a few early colonizing plants (i.e. Sea Rocket) inhabit the seaward foredune slope.

Initially during the study period, sand steadily accumulated on the upper beach. The berm width advanced and retreated seasonally, causing the ridge to fluctuate. Then between the spring 2002 and fall 2002 surveys a large volume of sand was placed on this beach as part of a federal beach nourishment project designed to address specific erosional concerns along the Sandy Hook Park shoreline. The project placed 72.33 yds³/ft of sand along this beach that produced 83 feet of shoreline advancement. The berm and recreational beach elevation was enhanced from 10 feet to 12 feet NGVD significantly improving the recreational area and shore protection potential of this beach. The seaward toe of the fill extended onto the seafloor in to water depths near -10 feet NGVD. Further offshore the seafloor was relatively stable to closure depth in -16 feet of water. For the two-year study period documented in this report, the net sand volume increased 68.76 yds³/ft and the shoreline advanced 76 feet, reflecting the benefits of sand placement prior to the December 2002 survey.

- **Profile #184 – Highlands Beach, Sandy Hook, Monmouth County** (fig. 11)

This profile begins on the landward side of Hartshorne Drive, it includes the curbs and grass lot seaward of the road. The profile continues over the large rock and concrete seawall seaward across the re-nourished beach to the berm ridge. From the ridge the beachface slope is steep into 3 to 4 feet of water. The nearshore slope is flatter to the back of the offshore bar then becomes steeper to the profile survey limit.

The location is the northernmost NJBPN site that actually received fill from the initial N.Y.C.O.E. Monmouth County beach nourishment project, completed here in the summer of 1996. There has been no effort made to establish a dune here. The seawall appears to occupy the natural dune location since sand accumulation along the rocks by aeolian accretion is sparsely colonized by dune grass and other early colonizing plant species. Natural propagation of these plants indicates that wave run up does not encroach on this region. Consequently, it could be assumed that fence installation and dune grass planting would be beneficial to sand accumulation and dune formation along the seawall toe.

From November 2000 to November 2001 the shoreline steadily retreated 66 feet with 22.23 yds³/ft of sand lost despite some accumulation along the seafloor. A large volume (22.59 yds³/ft) of this offshore sand apparently pushed onshore prior to May 29, 2002, reestablishing the lost berm and beach width from the previous year. This accumulation did not replace any sand lost from the upper beach during 2001 but was instead concentrated along the beachface. Beach nourishment efforts prior to December 2002 corrected for this loss, adding over 3 feet of elevation relief to the beach. This project placed 73.96 yds³/ft of sand along the profile that formed a new berm ridge, extended the shoreline 65 feet and raised the seafloor elevation offshore. The net change for the study period was a gain of 55.97 yds³/ft of sand and a shoreline advance of 57 feet. After the project's completion the shoreline position was 290 feet seaward of the sea wall compared to just 160 feet on November 2, 2001.

- **Profile #183 – Via Ripa Street, Sea Bright, Monmouth County** (fig. 12)

Profile #183 starts along the seaward side of Route 36. It includes an open lot seaward of Route 36 and the large seawall described above. A narrow swale formed between the seawall and a small dune that formed around installed fences and dune grass plants. A 150-foot wide dry beach extends seaward from the dune toe to the berm ridge. The relative stability of this beach is remarkable considering the recent history of this site prior to beach nourishment when no beach existed at all along this section of the Highlands Beach and Sea Bright seawall. Early NJBPN

surveys document these depleted beach conditions when waves reached the rocks even at low tide.

Since the beach nourishment project, efforts to stimulate dune growth through fence installation and dune grass planting have been successful. A small dune is well established and stabilized by a moderate coverage of dune grass. The overall project performance here continues to be good with over 250 feet of beach width consistently maintained seaward of the seawall. During periods of seasonal advances the beach width grows to over 300 feet, seaward of the seawall. This provides substantial room for dune growth, significant protection against storm damage to property and public infrastructure and should support a large population for public recreational usage. However, because of limited public access, especially the availability of parking, the public vastly underutilizes this wide recreational beach. There is no incentive for the local residents to resolve these issues and the municipality appears unwilling to force the conversion of the space between Route 36 and the seawall into public parking.

From November 2000 to November 2001 the berm and beachface eroded leading to 73 feet of shoreline retreat but a large portion of the eroded sand was deposited along the nearshore seafloor resulting in a small net volume loss of 9.24 yds³/ft during 2001. Favorable weather and sea conditions allowed sand to move back onshore prior to April 12, 2002 restoring the beach width lost earlier in the study. The restored berm eroded again prior to November 25, 2002 but sand accumulated along the beachface toe forming a large ridge, which resulted in a shoreline advance of 27 feet. The surveys do not show definitive indications that beach nourishment sand was placed here directly during this study interval. For the study interval the shoreline advance was 41 feet but most of this gain was a result of a shoreline ridge development along the beachface toe in November 2002 and not indicative of any overall recreational beach gain. Indeed the net volume change indicates relative sand budget stability during the study with just 2.69 yds³/ft of sand lost.

- **Profile #282 – Shrewsbury Way, Sea Bright, Monmouth County** (fig. 13)

This profile starts along the landward side of Route 36 and includes the road, curbs and an open lot between Route 36 and the seawall. A small swale separates the dune from the seaward seawall toe. The primary dune has remained relatively stable since its formation shortly after the project's completion. Abundant dune grass mixed with a variety of other native non-grass plants (i.e. Seaside Goldenrod) has propagated providing ground cover that further stabilized this feature. A foredune ridge developed between November 1999 and May 2000, which continued to grow in subsequent surveys. Dune grass rhizomes and early colonizing plants have spread seaward across much of the upper beach enhancing this foredune development. Limited use of this beach by the general public for recreational use and the lack of associated beach maintenance raking operations further promotes this spread of plants across the dry beach. Between April 2002 and November 2002 foredune development accelerated advancing the seaward toe 75 feet to a position nearly 140 feet seaward of the seawall. Development of this naturally occurring foredune system creates new habitat for migrating shorebirds and other native wildlife and plants.

Beyond the foredune toe the upper beach has remained relatively stable, extending 250 feet from the seawall. The actual beach width varied significantly during the study period depending upon the location of the berm ridge at an elevation above 8.5 feet NGVD, which fluctuated considerably between each survey. From November 2000 to November 2001 this berm ridge advanced nearly 100 feet. Steady erosion during 2002 caused the berm to retreat to nearly its original November 2000 position by November 2002. However, the shoreline position (zero datum) advanced during 2002 caused by a large accumulation of sand along the beachface slope toe. This deposit formed a lower ridge along the beachface at elevation 4.5 feet NGVD that lead to a shoreline position advance of 62 feet seaward of the November 2000 position. For the study period the site gained 24.62 yds³/ft of sand of which 23.51 yds³/ft was contained within the lower ridge formation or as a thin veneer extending from the berm crest across the beachface to the nearshore seafloor. Overall, this segment of the beach project has performed well sustaining a substantial beach

width giving protection against storm damage, providing needed environmental habitat and potential recreational space.

Although the same public access issues described for Profile #183 persist at this site, a benefit of this limited use has been the development of the natural foredune habitat area. This habitat continues to expand in the absence of raking and other maintenance activities associated with a municipal recreational beach or any large storm events to generate waves large enough to overwash the area, which would destroy the plants and flatten the developing foredune system.

- **Profile #182 – Public Beach Lot, Sea Bright, Monmouth County** (fig. 14)

This site is located at the public beach just north of the Rumson Road (Route 520) and Route 36 intersection. The profile includes the public parking lot and seawall then continues seaward across a small dune onto a wide-open beach. Aeolian deposition formed the dune as sand collected around fencing installed near the seawall. Sand accumulation has been limited by the dunes' location near the seawall. At this site the seawall is positioned landward by a westerly jog in the wall just a few hundred feet to the south. A few hundred feet to the north is a beach club with buildings occupying the footprint where dunes should be. The combination of these conditions creates a partially sheltered pocket beach where these structures limit effective sand transport to just an easterly wind direction. Consequently, the width and height of the dune is significantly less than that seen at the other sites along this stretch of shoreline. The dune is covered with dune grass mixed with several native non-grass species helping to stabilize the feature. Limited growth occurred on the seaward slope of the small primary dune by the June 2001 survey and dune grass rhizomes and a few early colonizing plant species had spread seaward onto the upper beach starting the natural foredune growth process. This process continued through 2002 and by November 2002 a field of small foredune hummocks had developed 240 to 300 feet seaward of the seawall, essentially in line with the seaward edge of the beach club. These features should continue to grow and form a continuous foredune ridge since an abundance of sand is available on this stable section of dry beach for aeolian process to persist.

The upper beach extends over 350 feet seaward from the seawall and was extremely stable during the study period. Variations in the berm and beachface positions caused temporary fluctuations in the overall dry recreational beach width but the shoreline position (zero datum) remained relatively stable fluctuating less than six feet from November 2000 to April 2002. A large wedge composed of 32.47 yds³/ft of sand accumulated along the shoreline and extended over the seafloor to the offshore profile limits between April 2002 and November 2002. This sand may have been transported north on littoral currents derived from sand placed during a recent beach nourishment maintenance project south of this location. The ridge that developed raised the previous shoreline position elevation 4.5 feet and advanced the shoreline position 53 feet. The net volume gain for the entire study period was only 19.23 yds³/ft because this shoreline and seafloor gain was partially offset by a small loss from the upper beachface and berm.

This site also demonstrates the project beach's remarkable stability along this shoreline segment. Public access is easy here since a public parking lot is available, but the beach is confined between two private beach clubs, which preclude public use of the dry beach north or south.

- **Profile #181 – Municipal Lot, Sea Bright, Monmouth County** (fig. 15)

Profile #181 includes the municipal parking lot, the boardwalk access ramp and promenade, which extend over the parking lot's bulkhead position. A small aeolian deposit accumulated along the seaward base of the bulkhead from sand blown across the wide swale that extends approximately 90 feet from the bulkhead to the landward dune toe. This dune was established after the initial beach project was completed and continued to accumulate sand each season, developing into three small but distinct ridge crests that eventually blended into one larger continuous feature by November 2002. Dune grass and a few other non-grass species have

colonized the dune system providing ground cover and stabilization but no rhizomes or pioneer plants extend seaward of the seaward dune toe unlike previous northern sites in this region. It is likely that increased activity levels associated with this heavily used public recreational beach thwarts colonization across the upper beach. Another contributing factor is that the dune system was established midway across the upper beach, unlike the other dunes along this shoreline segment that developed further landward on the upper beach near the seawall location. This effectively eliminated any substantial area seaward of the primary dune feature stable enough for natural expansion or colonization.

The stable beach width extends 150 - 180 feet seaward of the bulkhead to the point where berm and beachface variations caused modest fluctuations in the beach width. A steady accumulation of sand on the upper beach continued from November 2000 to March 2002 increasing the beach elevation over one foot. A larger wedge of sand was added to the upper beach and berm during the fall of 2002 elevating the berm 2 feet above the spring position and tapering back into the preexisting dune toe. A maintenance beach nourishment project during fall 2002 placed this sand on the upper beach and a larger accumulation along the shoreline position (zero datum) that extended across the seafloor to the profile limit. By November 21, 2002, a series of fall northeast storms probably had reworked the initial fill placement eroding material from the berm then concentrating the sand along the lower beachface slope forming a substantial shoreline position ridge feature. A comparison between the spring 2002 and fall 2002 surveys indicate the maintenance project placed 59.07 yds³/ft of sand creating a ridge that advanced the shoreline 90 feet. For the entire two-year study period the net volume gain was 76.43 yds³/ft with 88 feet of shoreline advance.

- **Profile #180 – Sunset Court, Sea Bright, Monmouth County** (fig. 16)

The Sunset Court profile begins landward of the seawall and includes the road, concrete pad landward of the seawall and the seawall structure. At the seaward structure base a narrow swale separated the seawall and dune system. The dune was established after the initial beach project was completed with the installation of fences and planting of dune grass. Aeolian accretion occurred quickly around the fence installation rapidly forming a small dune. Dune grass along with some associated native plant species have propagated onto the upper beach resulting in additional sand collection and dune growth. The dune width as of November 2002 occupied a 60-foot wide footprint on the upper beach and extended 80 feet from the seawall to the seaward dune toe. The dune will likely continue to grow with an additional 100 feet of stable upper beach available for rhizome and foredune expansion seaward of the present dune toe. The colonization of this region is likely since recreational activities are again limited by public access issues along this beach segment including a lack of public parking and limited public beach access locations over the seawall.

Since completion of the initial project in spring 1995 the upper beach from the seawall seaward 250 feet has been remarkably stable to slightly accretional. The position of the berm, beachface and shoreline are typically more variable because they are exposed to direct wave and current actions, which influence both erosion and beach building processes. Between the November 2000 and March 2002 surveys the beachface and berm eroded causing 22 feet of shoreline retreat with 16.47 yds³/ft of sand lost from the site. These losses were inconsequential after the completion of the maintenance nourishment project completed during the fall 2002. The November 2002 survey indicated 92.30 yds³/ft of sand was added to the berm, beachface and seafloor during this project. This wedge of sand pushed the berm seaward 100 feet with a corresponding shoreline advance of 110 feet and raised the seafloor elevations up to 5 feet tapered to near the offshore limit of the profile in water depths 15 to 16 feet NGVD. Upon completion of the maintenance project the berm ridge was located approximately 425 feet seaward of the seawall and the shoreline extended 480 feet from the seawall. The net profile sand volume increased by 76.43 yds³/ft and the shoreline advanced of 88 feet during the two-year study interval.

- **Profile #179 – Cottage Road, Monmouth Beach, Monmouth County** (fig. 17)

At Cottage Road the profile starts along the landward side of Route 36 and includes the road, curbs, sidewalk and seawall. The landward dune toe begins at the seaward base of the seawall and has grown seaward 80 feet with a continuing foredune accumulation. Dune grass propagation has developed a thick stand of grass over the region stabilizing the system and contributing to additional growth. A stable upper beach continues 40 feet seaward of the foredune toe.

A spoil pile of gravel removed from the parking lot of the adjacent beach club was deposited across the survey line just north of the club has now mixed with wind-blown sand and is partially buried beneath the developing foredune. The remainder of this material remains exposed right at the edge of the upper berm on the dry beach. The position of this beach club causes a seaward jog in the seawall of several hundred feet, which has had a detrimental effect upon the stability of this beach by creating an erosional hot spot along this feature. Consequently, unlike the site to the north along this section of the seawall, which had demonstrated remarkable stability, this site has been nearly continually erosional. From November 2000 to March 2002 the berm and shoreline steadily retreated a total of 80 and 48 feet respectively. The net profile volume loss during the same interval was 32.68 yds³/ft indicating the sand was transported away from this region. But even at this persistent stage of the erosion 200 feet of dry beach still extended seaward from the seawall. The fall 2002 maintenance project added 203.93 yds³/ft of sand to the profile, which extended the berm 250 feet and the shoreline position 240 feet. The net changes for the two-year study period was a shoreline advance of 192 feet with 192.58 yds³/ft of sand added to the net profile volume.

A comparison of the beach configuration to conditions documented here prior to the initial beach construction would find waves at the toe of the seawall rocks even at low tide. Currently the dry beach extends over 300 feet beyond the dune and over 400 feet from the seawall, producing a huge area available for recreational use by large numbers of beach patrons. However, this beach remains underutilized by the general public although Monmouth Beach does allow some limited street parking away from the beach. Additional parking is available at the old life saving/N.J. Marine Police facility at 128 Ocean Avenue recently renovated as the Monmouth Beach Cultural Center but this facility is nearly 1 mile north of this location.

- **Profile #178 – Monmouth Beach Club, Monmouth County** (fig. 18)

Profile #178 includes the municipal beach club parking lot and the club pavilion. The bulkhead and rock revetment structure was aligned along the seaward edge of the pavilion, which was buried by the dune here. Improvements to the beach club pavilion extended the width of the pavilion deck 20 feet seaward, covering a portion of the existing landward dune slope. The landward dune crest is less than 10 feet from the edge of the extended deck. Sand accumulated on the dune crest during the same period but alterations near the beach access path adjacent to the profile line caused minor losses along the seaward slope. Aeolian deposition along the dune toe raised the beach elevation 1 foot and may indicate future growth. Dune grass propagation was limited here producing only modest ground cover and limited expansion onto the upper beach. Prolific seasonal recreational and associated maintenance activities also inhibit colonization and foredune expansion onto the upper beach.

The initial 200 feet of dry beach seaward of the bulkhead was stable to accretional as was the shoreline position during the two-year report interval. Between May 2001 and October 2001 a wedge of sand accumulated on the upper beach possibly derived from sand transferred landward from the berm. The method of movement is uncertain but may have been mechanically moved during some summer maintenance activity or it may have been transferred naturally by aeolian or wave run up. Regardless of the method of transfer the results became moot after the fall 2002 maintenance project placed 81.12 yds³/ft of sand on this beach, which was tapered into the existing upper beach. The shoreline advanced 68 feet and 75 feet of additional width was added

to the berm. The wedge of fill sand continued offshore increasing the seafloor elevations up to 5 feet then tapered into the preexisting seafloor near the profile's offshore limit. For the report interval the shoreline advance was 80 feet with a net volume gain of 85.86 yds³/ft of sand.

- **Profile #177 – Ocean Avenue, Long Branch, Monmouth County** (fig. 19)

This site is part of the Monmouth County park system known as Seven Presidents Park. As part of the county park system public access is good offering abundant space for recreational use, but the general absence of a dune system provides little environmental habitat. The profile starts on the landward side of Ocean Avenue and includes the curbs, road, sidewalk and concrete seawall. There has been no significant attempt to establish a dune system at this site since completion of the A.C.O.E. nourishment project. In contrast several hundred feet north and south of this site dune establishment was successful. However, along the profile line and immediately adjacent the upper beach was relatively flat with only a small volume of sand accumulation ramped along the seaward base of the seawall. The remainder of the upper beach was relatively stable for the first 200 feet seaward of the seawall providing abundant space for recreational use.

Beyond 200 feet the berm continuously retreated approximately 50 feet in location while the shoreline position was comparatively stable fluctuating within 28 feet during the study period. The berm continued to erode throughout the study period retreating 50 feet from November 2000 to April 2002 but maintained nearly the same crest elevation at 9 feet NGVD. Prior to the November 2002 survey erosion accelerated pushing that elevation landward nearly 90 feet reducing the beach elevation three feet. Forming a lower berm further down on the beachface slope at elevation 6 feet NGVD. Seaward beyond the toe of the beachface the seafloor accumulated a minor amount of sand, spread relatively evenly across the bottom to near the profile limit, where the surveys approached closure. For the study period the shoreline retreated 26 feet with a net loss of 12.61 yds³/ft of sand from the beach not compensated by gains offshore.

- **Profile #176 – Seven Presidents Park, Monmouth County** (fig. 20)

This site was established near the main entrance to the park. The profile begins at the entrance to the beach and includes the road and an open sandy playground near the parking area. Since the sites establishment, a substantial dune has developed north and south of the profile line with abundant dune grass. However, this dune configuration is not represented in the cross section because the profile line is set between a playground and pump house that is effectively maintained clear of sand intrusion. The relatively small dune shown on the plot was formed by wind blown sand collecting along the chain link security fence around the pump station. This minor feature continues to accumulate a small volume of sand while scattered colonizing plants have begun to flourish. Unfortunately, the profile site selection pre-dated the dune development and to improve representation of the surrounding area would require moving the profile to another location.

From the dune toe seaward 250 feet across the upper beach to the berm this beach was remarkably stable. Between November 2000 and October 2001 the berm and beachface continued to retreat nearly 60 feet with an associated berm elevation reduction of 2 feet. The eroded beach sand appears to have been transferred offshore where it was redistributed as a thin veneer across the seafloor. A relatively calm winter in 2002 allowed the sand deposited along the seafloor to migrate back onshore by April 2002. This influx of sand restored some of the eroded berm elevation but the restoration was temporary. A change in the weather pattern spawned by the return of El Nino in the Pacific Ocean generated a series of storms along the New Jersey shoreline beginning on Labor Day Weekend 2002 and continuing through the winter of 2003. Subsequent erosion during the early fall storm events further eroded the berm and beachface with the sand again transferred offshore where it was spread across the seafloor. Net changes for the study period include a berm retreat of 140 feet and associated shoreline retreat of 73 feet. Despite these large onshore beach retreats a significant deposit of sand along the seafloor reduced the

profile volume loss but still 31.15 yds³/ft of sand was lost either beyond the profile limits or transported on littoral currents to nearby beaches.

- **Profile #175 – Broadway Avenue, Long Branch, Monmouth County** (fig. 21)

At North Broadway Avenue the profile begins along the landward side of the promenade, it includes the promenade and bulkhead revetment. Wind blown sand continued to accumulate along the base of the bulkhead creating a ramp effect but no effort has been made to create a dune system. Dune grass propagation ends near the beginning of the promenade that begins several blocks north of this site at the southern limit of Seven Presidents Park. Here the beach is barren of plants, although there is a 100-foot wide stable upper beach upon which a dune system could be established. However, currently shore protection is limited to the promenade bulkhead revetment.

During the study period this profile maintained at various levels a two-tiered berm system. The upper berm was relatively stable at elevation 12 feet NGVD but retreated 40 feet from October 2000 to October 2001. The lower berm was variable, dramatically affected by wave impact and storm surge. The initial lower the berm configuration on October 2000 was at elevation 7.5 feet NGVD and extended seaward 250 feet from the bulkhead. This feature eroded between October 2000 and October 2001 approximately 65 feet with a slight increase in the elevation by 1 foot. A third berm ridge developed prior to the April 2002 survey but was replaced by a larger ridge in September 2002 the enveloped both of the lower berm ridges seen in April. The final configuration for the study period had an upper berm ridge at 12 feet NGVD 100 feet seaward of the bulkhead and a second lower berm feature at elevation 10 feet NGVD 165 feet seaward of the revetment. For the study period the berm retreat was 85 feet and the shoreline retreated 59 feet. No sand was deposited offshore during the study period where the seafloor also eroded for a net profile loss of 49.79 yds³/ft of sand for the report.

- **Profile #174 – Morris Avenue, Long Branch, Monmouth County** (fig. 22)

Profile #174 starts along the west side of Ocean Avenue, includes the road, boardwalk, and rock seawall. During the summer of 1998, the Monmouth County beach nourishment project reached this location; the total placement volume was 217.7 yds³/ft with an advance in the shoreline of 325 feet. A minor volume of sand collected on top of the rocks along the seaward base of the boardwalk and a larger volume accumulated along the seawall but no attempt at dune development has occurred since the project was finished. The upper beach is stable for 150 feet seaward of the seawall and should provide a sizable platform for dune growth but a significant recreational use and a lack of installed dune fence or dune grass hinders the formation of a dune. Unlike the Sea Bright and Monmouth Beach segments the Long Branch beaches are open to the public with sufficient parking and abundant access points. Although public access to these restored beaches is desirable, unrestricted recreational and associated maintenance activities prevents the type of natural dune growth documented along the Sea Bright shoreline.

The Morris Avenue beach consisted of multi tiered berms that continued to erode during the first 18 months of this study. Erosion caused the beachface and berm to retreat up to 45 feet from October 2000 to April 2002. Most of this sand was transferred beyond the profile limits or laterally away from the survey region but minor sand accretion was documented along the seafloor near the profile limits, supporting the assumption that sand was transferred further offshore. Although wave scour from the series of fall storms that began on Labor day 2002 cut away at the toe of the beachface slope and stripped sand from the nearshore seafloor to near the profile limit a small volume of sand was pushed higher onto the berm partially restoring some of the previous elevation loss. In comparison to the volume of sand placed along the shoreline during the nourishment project the losses were minor with 49 feet of shoreline retreat and 27.10 yds³/ft of sand lost in 23 months.

- **Profile #173 – West End Avenue, Long Branch, Monmouth County** (fig. 23)

The West End Avenue profile begins west of the asphalt promenade, includes the boardwalk, grass covered bluff and rock seawall. No dune development was attempted here since the project was completed. However, shore protection is adequate with the presence of the seawall and natural bluff that brings the boardwalk elevation overlooking this beach to an elevation of nearly 32 feet NGVD. The beach is heavily used for recreation with easy access and street parking allowed. This site is several blocks north of Lake Takananssee where the beach nourishment project work terminated.

As a result, this site suffers from “open-end effects” that enhance beach erosion. Sand eroded from the project beach is transported by littoral currents north and south. Sand carried south is lost along the depleted beaches of Elberon and Deal from which no sand is readily available to feed back north to Long Branch thereby creating the net sand budget deficit and subsequent open end beach loss. An unusual observation made at this site was that during the winter and fall months the profile losses were minimal while during the summer months erosion accelerated, drastically. The profile plot clearly indicates the dramatic losses that occurred from June 2001 to October 2001 when 35.59 yds³/ft was removed and again from April 2002 to September 2002 with a loss of 37.74 yds³/ft for a net change of 73.33 yds³/ft. This is in stark contrast to typical beach configuration changes where winter produces erosion and summer is normally accretional. Here during the winter months northerly onshore winds push sand south along the coastline with the beach fill in Long Branch supplying the West End Avenue beach with an abundance of sand to help offset any losses caused by winter storms. However during the summer months the typical wind pattern is from a southerly direction, which pushes sand north along the shoreline. Consequently as sand moves further north into Long Branch from West End Avenue no abundance source of sand is available along the Elberon and Deal oceanfront to supply the West End beach with sand and a net loss develops resulting in the beach configuration changes seen at West End Avenue. Therefore, the long-term performance of this section of beach is dependant upon the completion of the beach nourishment project in Elberon and Deal, which would produce a continuous supply of sand redistributed naturally as prevailing weather patterns fluctuated seasonally.

Continued erosion eliminated the double tier berm present during the October 2000 survey. The upper beach that extended seaward 130 feet from the base of the seawall retreated 90 feet during this study interval. During the same 23-month time interval the shoreline retreated 113 feet. Erosion continued across the seafloor to near the profile limit increasing the seafloor depth and producing a cumulative net profile volume loss of 89.24 yds³/ft. The absence of any sizable gain at the Morris Avenue site, which is several blocks north of West End Avenue, indicates that a significant percentage of the material lost was carried south towards the unfilled beaches of Elberon and Deal.

- **Profile #172 – Brighton Avenue, Long Branch, Monmouth County**

The site was abandoned in 1994 with the expansion of the network because of its proximity to Profile #173. During 2000, construction of a multi-unit-housing complex began at this site effectively eliminating the onshore site.

- **Profile #171 – Pullman Avenue, Elberon, Monmouth County** (fig. 24)

At Pullman Avenue the profile starts along the north side of the street end and includes the street end, curb and large bluff. The bluff was reconstructed and dune grass planted on the seaward slope to stabilize the feature, after being severely eroded during northeast storm events in the early 1990's. Dune grass propagation has produced a relatively stable slope and rhizomes have spread from the toe towards the bulkhead and rock revetment that is the primary shore protection structure here. No stable dry beach has existed seaward of this revetment since the inception of the NJBPN program. This trend continued through June 2000 when the waves at low tide still

reached the rocks. By November 2000, a large wedge of sand moved onshore to form the largest documented beach here since 1986. This deposit of sand eroded rapidly and by June 2001 the dry beach was gone. A smaller volume of sand migrated onshore during the summer of 2001 forming a small beach at the toe of the revetment during the November 2001 survey. However, this accumulation was also temporary, by May 2002 the site was devoid of any dry beach area along the seaward toe of the revetment. This beach configuration continued through September 2002. The net changes for the study interval were a shoreline retreat of 73 feet and a loss from the profile sand budget of 21.53 yds³/ft.

This site is south of Lake Takanassee, the present southern terminus of the Long Branch segment of the beach nourishment by the New York District Corps of Engineers. This site may be within the influence of sand derived from the Long Branch contract because these changes far exceed any seen during the past 14 years of monitoring. The addition of this sand here provides support for the theory that sand lost from West End Avenue area in Long Branch moved south. However, these gains were temporary and by June 2001 the beach had eroded then partially returned and then eroded again by May 2002, exposing the rocks and pilings seaward of the bulkhead once again. This provides more evidence that the source of sand producing the increase here may have been sand derived from the project terminus since the loss here corresponds directly to the reduced volume of sand available at West End Avenue.

If the project through this segment of shoreline remains unfinished significant erosion can be expected to continue along the southern end of the project beach around West End Avenue. The issue of public access to privately owned beachfront remains a significant obstacle to the continuation of the Monmouth County project to join work completed in Asbury Park. In lieu of the project's completion, sand will likely continue to pass through this site associated with losses and periodic renourishment schedules in Long Branch. Where the nourishment project ends, these "end beaches" erode much faster than in the central regions of the fill where sand is able to move laterally along the improved shoreline. Another option to prevent this sort of increased loss rate would be to construct a long high groin (known as spite groins) at the terminus of the project to capture and prevent sand transfer south. A similar preexisting spite groin located at the northern terminus of the Asbury Park project has prevented a significant transfer of sand north into Allenhurst where the project was not completed due to similar issues in Deal and Elberon. However, this would be counterproductive to long-term sand movement and beach stability if the nourishment project were completed in the future.

- **Profile #170 – Roosevelt Avenue, Deal, Monmouth County** (fig. 25)

The profile configuration at Roosevelt Avenue consists of a rock seawall that provides the only shore protection for the property landward of the wall. A well-manicured private lawn is landward of the seawall and extends for several hundred feet to the main residence. Since establishment of this site, a lack of any significant dry beach area seaward of the wall has prevented any contemplation to develop a dune system.

Wet beaches have frequently been observed around high tide but often waves reach the rocks even at lower tide levels. Typical seasonal fluctuations dominated the beach configuration during the initial 12 months of this report. Sand moved onshore from late spring through early fall enhancing the beach elevation and width then eroded during the winter. This pattern was altered after a clam winter in 2002, which allowed additional opportunities for sand to move onshore from beyond the profile limit further enhancing the beach and nearshore seafloor. This influx produced a 27.97 yds³/ft profile volume gain with a shoreline advance of 22 feet, between November 2000 and May 2002. However, a dramatic change in the weather pattern in late summer 2002, caused by the return of El Nino in the Pacific Ocean, spawned a series of early northeast storms starting on Labor Day weekend. These events produced waves that eroded and scoured away the beach and nearshore, pushing what little wet beach remained to the base of the seawall. The net shoreline change for the report interval was 59 feet of retreat. The addition of material from the beach nourishment operations is possible here, but not likely because of the large number of

impermeable groins between either Long Branch or Asbury Park. The major sand source for these changes is more likely typical cross-shore sand transport between the beach and nearshore seafloor, since closure occurs in these repetitive surveys near the offshore profile limit. This exchange scenario of sand between the beach and seafloor is supported by the relatively minor net profile volume loss of 6.72 yds³/ft of sand for the study, despite a sizeable onshore loss and shoreline retreat.

- **Profile #169 – Darlington Avenue, Deal, Monmouth County** (fig. 26)

Profile #169 begins at the seaward street end and includes the bluff. This site is somewhat unique because the uplands bluff is not completely armored with stone or wooden bulkheads common along the Elberon and Deal shoreline. However, wooden bulkheads have been installed in recent years to stabilize the slope on adjacent private properties. There is no dune system present along this shoreline; shore protection is reliant on the rocks, bulkheads and the bluff itself.

A narrow dry beach has been present at the base of the bluff since the site was established and varies in width seasonally. The berm location has fluctuated from 50 feet to 100 feet seaward of the bluff toe. After several seasons of minor beachface and shoreline losses the beach recovered in May 2002 to nearly the same configuration recorded in November 2000. Cross-shore transfer moved significant quantities of sand between the seafloor and beach with the largest transfer occurring from May 2002 to November 2002 when sand eroded from the beachface and scoured from the nearshore seafloor was carried offshore forming a large shore parallel bar. Cross-shore sand transfer within the profile's existing sand budget is substantiated by the relatively small 6.75 yds³/ft net profile volume change for the study period despite nearly 31 feet of shoreline retreat and associated beachface and berm loss. It is unlikely that sand from the project area has influenced this beach because of the significant distance and large number of impermeable groins from either Long Branch or Asbury Park to Darlington Avenue.

- **Profile #168 – Corlies Avenue, Allenhurst, Monmouth County** (fig. 27)

The Allenhurst beach extends approximately two thousand feet south from Deal to the southern border with Loch Arbour (an even smaller beach community located between Asbury Park north of the Deal Lake spillway flume and Allenhurst) located just beyond the landward toe of the concrete seawall footing protecting the Allenhurst pool club. This beach is held in place by a large L-shaped groin positioned at the northern boundary with Deal. The groin forms a pocket beach that provides an area for recreational use but the beach width tapers in towards the south. The profile is located just south of the end of the L-shaped groin extension but north of a smaller timber/rubble groin seaward of the pool club. At this site a concrete seawall armors the bluff with a boardwalk on the landward side and a dry sand beach seaward of the wall. There is no dune present along this section of beach. Therefore, storm protection for public infrastructure and private property is reliant upon the seawall.

The same public issues that have hindered completion of the nourishment project in Deal and Elberon persist in Allenhurst and Loch Arbour preventing completion of the project along this section of shoreline. This site maintained a relatively stable dry upper beach that extends 50 feet seaward of the seawall during the report interval while the berm location varied from 50 feet to 110 feet from the base of the seawall. The shoreline fluctuated 90 feet during the report interval from 90 to 185 feet seaward of the seawall although the net change was 19 feet of shoreline advance. In addition to the onshore gain the nearshore continued to accrete during the last four surveys forming a sizable nearshore bar. The combination of onshore and seafloor gains resulted in a 31.09 yds³/ft net profile gain. This may indicate that beach fill sand placed in 1999 has begun to migrate north around the large groin located at the northern Asbury Park border with Loch Arbour.

- **Profile #267 – Seventh Avenue, Asbury Park, Monmouth County** (fig. 28)

The profile consists of a boardwalk established on a low grassy bluff. Initial beach nourishment was completed here between April 1999 and November 1999 adding 174.34 yds³/ft of sand, which significantly expanded the beach width. Despite the enhanced beach conditions no effort was made by the city to establish a dune system through fence installation or dune grass planting. Aeolian transport moved some sand from the berm up onto the dry upper beach, which accumulated along the base of the boardwalk, increasing the beach elevation seaward of the boardwalk by over one foot. This natural aeolian accretion along the boardwalk indicates that dune development would occur rapidly if fences were installed. In the absence of dune development the beach provides the only storm protection for the boardwalk, public infrastructure and property landward of the boardwalk. Although the beach does provide ample area for recreational use and is easily accessed by the general public a significant storm surge would allow storm waves to impact the boardwalk, resulting in potential infrastructure damage, property loss and street flooding. Generally, south of Allenhurst, Monmouth County beaches are open to the public. Beach access and parking is readily available in most towns, which supports a lucrative tourist industry, unlike many towns in northern Monmouth County where beach access is limited and parking is restricted.

When the project was completed the berm was located 250 feet seaward of the boardwalk, more than sufficient for dune development. The berm initially retreated 60 feet during the winter of 2000 and the shoreline moved 66 feet landward with 18.38 yds³/ft of sand lost while the project beach configuration adjusted and stabilized. Sand blown from the berm accumulated along the upper beach in a wide wedge extending from the boardwalk 100 feet then tapering into the preexisting beach elevation. The berm was relatively stable during this study period retreating 10 feet to a location approximately 160 feet seaward of the boardwalk at elevation 11 feet NGVD. The beachface and shoreline were more variable initially retreating 45 feet between October 2000 and June 2001, but then by October 2002 had continuously advanced to a position 21 feet seaward of the October 2000 initial shoreline location. On the seafloor sand accumulated during the study increasing the elevation up to 3 feet across a wide swath of the offshore profile length. During the study period, the net profile volume increased by 22.15 yds³/ft indicating an influx of sand from beyond the profile limits.

- **Profile #167 – Third Avenue, Asbury Park, Monmouth County** (fig. 29)

As seen at the previous site there was no dune development or effort to establish a dune on the Third Avenue beach in Asbury Park during this study interval. The NY District ACOE project was completed at this site prior to the October 1999 survey. The project placed 165.36 yds³/ft creating a 145-foot wide berm at an elevation of 10.2 feet NGVD 29. The following winter 26.88 yds³/ft of sand were removed from the berm, but 17.58 yds³/ft of that loss were added to the offshore region raising the seafloor elevation from the shoreline to beyond the 800-foot survey distance by 2.5 feet. This redistribution of the design profile is expected as wave energy creates the “equilibrium profile” slope. After a period of relative stability from May 2000 to October 2000 the beach eroded during 2001. The shoreline retreated 36 feet, the berm cut back 20 feet and 13.96 yds³/ft of sand was lost from the profile. Despite these losses the recreational area was still substantial with 150 feet of dry beach seaward of the boardwalk. During 2002 the berm and shoreline recovered all of this loss and then continued to advance seaward with an influx of sand both onshore and offshore. Consequently, the berm advanced to a location approximately 220 feet seaward of the boardwalk. For the study period a net shoreline advance of 9 feet occurred with a sand volume gain of 7.62 yds³/ft the majority of this accumulation was to the berm and beachface.

- **Profile #166 – Ocean Pathway, Ocean Grove, Monmouth County** (fig. 30)

In contrast to Asbury Park, Ocean Grove has made substantial efforts to establish a dune system. Consequently, a small dune has developed as sand accumulated around installed fence and subsequently dune grass was planted to help stabilize the sand. These efforts have been ongoing for several years culminating in a modest dune 50 feet in width at the toe with a crest elevation of 18 feet NGVD. Aeolian processes deposited a small quantity of sand on the seaward dune slope during the winter of 2001. As documented at the Asbury Avenue sites the ACOE project was completed along this section of beach prior to the December 1999 survey. The berm was widened to 340 feet seaward of the boardwalk and the beach gained 232.20 cubic yards per foot of sand out to a point 800 feet from the reference point. Immediate losses were substantial as the post-fill beach configuration adjusted towards a more stable profile. During the winter of 2000 the shoreline retreated 109 feet and the berm lost approximately 80 feet of width with 44.69 yds³/ft of sand lost laterally or beyond the survey limits.

The berm continued to erode back to a location 225 feet seaward of the promenade by October 2002. The shoreline position retreated 97 feet between October 2000 and October 2002. Despite the shoreline and upper berm position losses a smaller berm did develop lower on the beachface by May 2002, which persisted to the October 2002 survey. Offshore a nearshore bar developed by October 2001 but eroded when the nearshore seafloor was scoured at the beachface toe. Further offshore near and beyond the profile limits sand accumulated on the seafloor from June 2001 to October 2002. However, since most of this accumulation occurred beyond the profile limit the offshore gain only partially offset the 26.06 yds³/ft of sand eroded from the berm, beachface and nearshore generating a net profile volume loss of 18.49 yds³/ft for the study period.

- **Profile #165 – McCabe Avenue, Bradley Beach, Monmouth County** (fig. 31)

This profile includes the road, sidewalk, open lot, promenade and bulkhead. The wooden bulkhead supporting the seaward side of the promenade also provides shore protection for public infrastructure and property landward. The beach nourishment project was completed prior to the December 1999 survey and added 199.03 yds³/ft to the cross section, pushing the berm 300 feet seaward of the bulkhead. Just prior to the October 2000 survey, the municipality installed a new dune fence and between October 2000 and May 2001 wind transported sand accumulated around the fence to form a small dune approximately 25 feet wide, which was subsequently planted with dune grass. Subsequent surveys indicated continued growth vertically and seaward with a small foredune developing 15 to 20 feet seaward of the toe, prior to the October 2002 survey. The upper beach extends 250 feet seaward of the promenade, which is wide enough to support continued development and expansion of this dune system.

The berm initially eroded 40 feet from October 2000 to May 2001 then continued at a slower rate to erode another 10 feet through October 2002. The beachface and shoreline position also eroded during the two-year study period with a cumulative beachface retreat of 30 feet and shoreline loss of 130 feet. The shoreline loss was exaggerated by the loss of a nearshore shallow platform that projected just above the zero datum causing the computer program to include this area in the shoreline calculation, which extended nearly 100 feet seaward of the beachface toe during the October 2000 survey. Scour at the beachface toe formed a nearshore trough and bar system that replaced this platform by October 2002. Further offshore near the profile limits sand accumulated on the seafloor partially offsetting the 28.38 yds³/ft of sand lost from the berm, beachface and nearshore for a net cumulative profile volume loss of 14.45 yds³/ft for the report interval.

- **Profile #164 – Sylvania Avenue, Avon-By-The-Sea, Monmouth County** (fig. 32)

The Avon profile is located just north of the Shark River Inlet and includes the road, sidewalk, bulkhead and boardwalk. Public access to the beach is easy with abundant street parking and

boardwalk stairways. A lack of any natural dune development and no effort to establish a dune by the municipality was apparent during the study period. Natural development is inhibited by regular maintenance grading and raking from the berm to the seaward base of the boardwalk. Consequently, shore protection for the infrastructure and shorefront properties is more dependent on the presence of an old bulkhead 15 feet landward of the boardwalk. The addition of 132.32 yds³/ft of sand to the beach during the initial beach nourishment project pushed the berm ridge 300 feet seaward of the boardwalk. The additional beach width enhances shore protection against minor to modest storms but would provide minimal storm protection during a larger event with a significant storm surge since the maximum beach elevation is 11 feet NGVD. A dune system would add several feet of relief to the beach producing a more significant wave buffer and thereby protect the boardwalk from wave assault, prevent storm overwash along the bulkhead and limit street flooding. The beach width is sufficient to support a significant dune system if established.

After the project was completed the berm suffered significant erosion cutting back the beach and shoreline up to 94 feet by May 2000. However, the sand was transferred to the immediate offshore seafloor where it formed a large bar. Subsequent surveys show the berm ridge has been relatively stable maintaining a dry beach width that extended approximately 200 seaward of the boardwalk. The berm ridge position fluctuated within a 20-foot range of this 200-foot position from October 2000 to October 2002 for a net retreat of 10 feet during this period. The nearshore shoreline and seafloor were scoured considerably resulting in a shoreline position retreat of 96 feet for the study period. Offshore seafloor elevations fluctuated up to four feet. From a high in October 2001 when a shallow nearshore platform extended seaward from the shoreline several hundred feet, to May 2002 when the nearshore and offshore seafloor were scoured. By the final survey in October 2002 the offshore seafloor configuration had recovered restoring nearly the same profile surveyed October 2000 but the nearshore platform was lost causing 96 feet of shoreline retreat and 15.32 yds³/ft of sand removed.

- **Profile #163 – Fifth Avenue, Belmar, Monmouth County** (fig. 33)

This site is located just south of the Shark River Inlet jetties. The profile includes the boardwalk but because beach access steps were attached to the seaward edge of the boardwalk at the profile line, which covers the small dune that has accumulated along the seaward base of the boardwalk is not illustrated by the cross-section. This dune feature is less than 10 feet in width with a maximum crest elevation flush with the boardwalk at 13 to 14 feet NGVD. Seaside Goldenrod and dune grass sparsely colonized the feature. Any storm protection provided by this feature would be minimal.

This site did not receive any direct volume of sand from the nourishment project that was completed in the region between Shark River Inlet and Manasquan Inlet prior to the November 1997 survey, but it still shows the effect of offshore redistribution of sediment. Historically, this beach had been much wider due to the sand-trapping effect of the Shark River Inlet jetties.

The upper beach was remarkably stable for the initial 150 feet seaward of the boardwalk. The berm ridge has been accretional during this study period advancing seaward approximately 75 feet. The beachface on this advancing berm is relatively steep resulting in a 34-foot shoreline retreat despite the net onshore volume gain of 7.76 yds³/ft of sand added to the berm and beachface. This berm advance extended the dry beach width to 275 feet seaward of the boardwalk. The nearshore seafloor was scoured forming a shallow nearshore trough but most of the eroded sand was subsequently transported to the offshore portion of the profile that increased the seafloor elevation several feet. This deposition resulted in a slight sand volume gain offshore of 6.03 yds³/ft that when combined with the onshore increase resulted in a net profile volume gain of 13.79 yds³/ft.

- **Profile #162 – Eighteenth Avenue, Belmar, Monmouth County** (fig. 34)

The profile includes the road and boardwalk but this line also occurs at a boardwalk beach access, which crosses over a small dune along the seaward base of the boardwalk north and south of the site. As described at the previous site this dune feature is also minimal, less than ten feet in width with the crest elevation flush with the boardwalk at 13 to 14 feet NGVD. This site is used by large numbers of patrons for recreational activities much of the year, which inhibits natural dune growth seaward of the fenced region with no significant effort by Belmar to enhance this small dune feature by adding additional fence seaward of the current location. The beach nourishment project was completed here prior to November 1997. Since completion the shoreline retreated 61 feet but is relatively stable around the notched position in the rock groins along this segment of shoreline.

The initial 100 feet seaward of the boardwalk was relatively stable with some minor elevation changes likely caused by maintenance and recreational activities. The berm initially advanced 15 feet from October 2000 to May 2001 despite 20 feet of shoreline retreat during the same period. Prior to October 2001 the berm ridge retreated 30 feet but without any significant shoreline retreat because the eroded berm material was transferred to the nearshore beachface and offshore seafloor. The subsequent two surveys showed continuous berm growth that extended the dry beach width to 140 feet seaward of the boardwalk. During the study period the nearshore seafloor was scoured, reducing the shallow platform elevation up to four feet. Some sand was transported to the offshore seafloor forming a small bar by October 2001 but this feature's sand was quickly dispersed reestablishing the original seafloor profile. The net shoreline retreat for the report interval was 54 feet with a loss of 11.48 yds³/ft of sand from the overall profile volume.

- **Profile #161 – Brighton Avenue, Spring Lake, Monmouth County** (fig. 35)

Unlike the Belmar sites, this profile includes a dune located between Ocean Avenue and the landward side of the boardwalk. The feature pre-dates the beach nourishment project and is well established with flourishing vegetation that provides stability. With a crest elevation of 21 feet NGVD this dune provides substantial storm protection for property and public infrastructure landward of the boardwalk but does nothing to protect the boardwalk from wave assault. The initial nourishment project was completed here by November 1997 and stability seems to have followed initial sand redistribution. The upper beach at the base of the boardwalk has an elevation of about 13 feet NGVD and slopes gently seaward for 100 feet to a berm at elevation 10 feet NGVD. This portion of the beach remained relatively stable during this study interval, increasing in elevation slightly. Beyond this upper berm the beach was more variable, fluctuating seasonally.

Sand shifted offshore along the seafloor more dramatically forming a deeper nearshore trough and establishing an offshore bar by May 2002. Prior to the September 2002 survey a maintenance beach nourishment project was completed in Spring Lake adding 52.17 yds³/ft of sand to the profile, extending the berm and shoreline seaward 66 feet. The elevation of the beach increased 4 feet at the berm with the ridge located 250 feet seaward of the boardwalk. The net profile volume gained 32.63 yds³/ft of sand with a shoreline advance of 54 feet contributed to the beach nourishment volume offsetting previous losses.

- **Profile #160 – Salem Avenue, Spring Lake, Monmouth County** (fig. 36)

The Salem Avenue profile includes the road and has a long-established dune between the boardwalk and an open grass lot along Ocean Drive. The dune is stabilized with dune grass, which has flourished as a thick ground cover on the landward slope and crest. Along the seaward slope, grass coverage is sparse and the sand is relatively unconsolidated. A deposit of wind blown sand accumulated on both sides of the boardwalk adding a minor volume to the seaward dune toe during each survey included in this report. The initial beach nourishment project was completed

here during the fall of 1997 creating a wide stable beach across which aeolian processes redistributed sand from the beach to the dune.

Minor changes in elevation on the initial 100 feet of relatively stable upper beach seaward of the boardwalk were likely caused by maintenance and recreational activities while the berm location varied significantly from survey to survey. Through the first four surveys two berm ridges persisted but varied in location within a 30 foot range approximately 140 feet seaward of the boardwalk. The two features mimicked each other during each survey initially advancing from October 2000 to June 2001 then retreated prior to October 2001. The eroded sand accumulated offshore forming a bar, which subsequently moved onshore enhancing the beachface and berm position. Along the seafloor sand was scoured from the nearshore and transported offshore during the initial surveys. Prior to the final survey on September 24, 2002 the maintenance beach nourishment project added 23.66 yds³/ft of sand to the profile extending the shoreline 40 feet and forming a single enhanced berm ridge located 150 feet seaward of the boardwalk. Sand from the project may have combined with offshore material moving landward to fill the nearshore trough, which reduced the seafloor elevations further offshore. For the study interval the net profile sand volume increased 17.87 yds³/ft with a corresponding shoreline advance of 42 feet.

- **Profile #159 – New York Avenue, Sea Girt, Monmouth County** (fig. 37)

At New York Avenue the profile includes the sidewalk, road and street end parking along the west side of the boardwalk. A dune system is absent at this site despite the wide beach created by the beach nourishment project in 1997. Immediately south of the site a well-established dune has developed west of the boardwalk in front of the shorefront property but at the profile site and to the north, Ocean Avenue and street end parking occupy the location of the dune footprint. No attempt has been made to establish a dune seaward of the boardwalk. A dune feature developed in this location would enhance storm protection for the boardwalk and property west of the boardwalk. The beach is heavily used for recreational activity and is maintained as part of the municipal public beach system, consequently natural dune development is inhibited. The upper beach accumulated some wind-blown sand along the seaward base of the boardwalk during the period indicating natural dune growth would be successful if given an opportunity.

Minor accretion over the initial 100 feet of upper beach seaward of the boardwalk is likely a combination of aeolian deposition, maintenance and recreational activities. The dry beach extends approximately 200 feet seaward of the boardwalk to an active berm ridge but the region 100 feet west of the berm was remarkably stable. The berm ridge was variable within a 40-foot range initially retreating 20 feet from October 2000 to June 2001 then advancing 40 feet through April 2002 before retreating 20 feet prior to November 2002 to nearly the same initial configuration surveyed October 13, 2000. The shoreline position was also variable within a 50-foot range initially advancing 40 feet when eroded berm sand was redistributed seaward to the beachface toe. This shoreline position was relatively stable through April 2002 but retreated 48 feet prior to November 2002 when the beachface and nearshore were scoured forming a deep nearshore trough. The eroded sand was transported further offshore and deposited forming a small bar. The offshore seafloor was extremely variable in elevation during the entire study interval with sand movement between the beach and offshore region beyond the profile limit. Despite these topographic changes the net profile sand volume change for the study interval only loss 8.65 yds³/ft, which came from the seafloor and probably is accountable by the sand carried beyond the profile limit. The net shoreline change was also minimal retreating 12 feet for the report interval.

- **Profile #158 – Trenton Avenue, Sea Girt, Monmouth County** (fig. 38)

Profile line #158 is located between homes that were built near the landward toe of the natural dune. These property owners have nurtured a well-established dune crest with abundant and diversified plant species that help stabilize the feature. Accretion on the seaward slope has buried all but a few pilings of a bulkhead constructed for shore protection following bluff erosion

during the December 1992 northeast storm, prior to the beach nourishment project. Sand has continued to accumulate along the seaward slope and toe between the boardwalk and buried bulkhead.

The dry upper beach was extremely stable for 150 feet seaward of the boardwalk to the upper berm ridge. A second lower berm developed along the beachface slope and was variable between elevation 6 and 8 feet NGVD. Initially this feature grew from 6 to 8 feet as sand from a nearshore bar moved onshore. Subsequent erosion eroded this berm, cut back the beachface and scoured the nearshore forming a shallow trough but a large nearshore bar developed from this sand transferred from the beach prior to October 2001. This bar was scoured away forming a nearshore trough by April 2002. By November 2002, sand accumulated along the beachface enhancing the berm and restoring the shoreline position. The beachface slope was steep terminating in a 3-4 foot deep 100-foot wide nearshore trough extending further offshore where sand accumulated near the profile limits. This steep beachface and nearshore trough replaced the shallow nearshore platform initially surveyed October 2000, resulting in 42 feet of shoreline retreat despite the berm development and a net profile sand volume increase of 15.09 yds³/ft.

- **Profile #157 – Riddle Way, Manasquan, Monmouth County** (fig. 39)

The Riddle way profile includes the asphalt promenade and small dune, established by the Borough of Manasquan prior to the beach nourishment project. The dune feature is approximately 40 feet wide at the toe and accumulated a small volume of sand along the crest during the report period but the overall width change was minimal. Dune grass mixed with seaside goldenrod produce a modest ground cover across most of this feature providing sand stabilization. Along the landward slope a split rail fence was installed for aesthetic value instead of traditional dune fence but results in significant sand movement onto the adjacent asphalt promenade. This spill over could be substantially reduced with the installation of traditional dune fence to the seaward side of the split rail fence. Along the seaward dune toe the initially installed dune fence is buried but not replaced allowing wind blown sand to accumulate on the crest while limiting seaward expansion. A temporary seasonal shore parallel dune fence was installed along the upper beach approximately 50 feet seaward of the current seaward dune toe. Accumulation can be expected along this fence but since the installation was as a single straight row the potential growth is limited.

During the report period the upper beach was stable for 100 feet seaward of the dune that gently sloped seaward from 16 feet NGVD elevation at the dune toe to 11 feet at the upper berm ridge. During each of the survey intervals, a lower berm feature developed on the beachface at approximately 7 feet NGVD elevation, except the October 2001 survey when the beachface was cut back significantly by wave run up. The berm position varied within a 50-foot range approximately 200 feet seaward of the dune toe. After an initial advance of 25 feet through June 2001 the beachface began to erode significantly, removing the berm by October 2001. The eroded sand was transferred offshore where a large bar developed. Prior to the May 2002 survey this sand moved back onshore extending the beachface, restoring the berm and shoreline. Subsequent erosion during the fall 2002 cut into the beachface pushing the berm and shoreline back to its original October 2000 position and forming a shallow scour trough near the beach. Once again the eroded sand was transported just offshore reforming the bar by November 2002. Despite the significant topographic changes the net profile volume and shoreline changes were minimal. For the report interval the net shoreline retreat was 7 feet while the profile volume increased 4.04 yds³/ft.

- **Profile #256 – Pompano Avenue, Manasquan, Monmouth County** (fig. 40)

The profile at Pompano Avenue beach in Manasquan is located about a thousand feet north of the Manasquan Inlet jetty and is the last cross section in the county. This profile includes the road, a steeply sloped lot between beachfront homes, the asphalt promenade and a small dune established just seaward of the walkway. The homes and the promenade occupy the footprint of the pre-development dune system, a fact that explains a substantial storm damage history along

this municipal coast. During the past 24 months, the dune gained a small volume of sand along the crest but the dune width was maintained at approximately 30 feet at the toe. A modest ground cover consisting of dune grass mixed with seaside goldenrod helped stabilize this feature. As described a Riddle Way split rail fencing was installed along the landward toe and the seaward fence is buried causing the same problem of sand blowing landward onto the walkway. The temporary fence installed 50 feet onto the upper beach is too far seaward of the dune to significantly inhibit the volume of sand blown over the dune. The fence should be installed along the toe to reduce the aeolian deposition of sand onto the walk.

The Manasquan portion of the Monmouth County beach nourishment project was completed between the spring and fall of 1997. The dry upper beach remained stable 100 feet seaward of the dune toe to the upper berm. A lower berm ridge developed during each of the survey intervals within a 60-foot range approximately 200 feet seaward of the promenade. Beachface and shoreline position were variable but exaggerated by a small platform that extended seaward of the beachface to during the October 2000 survey. The loss of this platform and scouring of the nearshore seafloor resulted in a net shoreline retreat of 70 feet. Most of the eroded sand was transferred to an offshore bar that developed prior to the October 2001 and then again before the November 2002 survey. Consequently, the net profile sand volume only lost 11.13 yds³/ft during the study interval.

A final issue that has surfaced nearby at Manasquan Inlet after many years with little sand circulating in the nearshore system is the accumulation of shoals and bars, which affect navigation through the inlet. The Federal project added millions of cubic yards of sand north of the inlet's north jetty. Northeast waves have been moving some of this sand into the inlet's sphere of tidal current activity. The net result may be an increased demand for inlet dredging by the boaters using this popular waterway. Any excavated sand should be mandated for return to the shoreline system.

SUMMARY OF MONMOUTH COUNTY:

Monmouth County represents the vast majority of the developed shoreline on a sedimentary bluff overlooking the beach and ocean. There are two geologically modern features one that extends to the north from Long Branch/Monmouth Beach ending at the Sandy Hook spit enclosing part of Raritan Bay. The other is a second sand spit extending south from Bay Head in northern Ocean County ending at Barnegat Inlet. The Manasquan Inlet is surrounded by very low elevation bluffs with modern sedimentary beach features derived from erosion of the bluff material that combine to continue the shoreline past Manasquan Inlet. The bluff disappears in Bay Head as the pre-existing mainland surface elevation became low enough to permit tidal flooding of sufficient depth to create Barnegat Bay. The community of Bay Head lies at the "head of Barnegat Bay". An engineering project connected Barnegat Bay with the Manasquan Inlet estuary with a sea level canal early in the 20th Century. Multiple changes around the Manasquan Inlet began in 1881 with the construction of the first wooden "jetty" along the north inlet shoreline at the Manasquan beach.

Development commenced in earnest along the Monmouth County shoreline by 1870 with the construction of the New York and Long Branch Railroad. This access allowed tourism to develop and eventually permitted commuting to the urban north by full-time residents. The early tourist hotels built in Long Branch, Asbury Park, Ocean Grove and Spring Lake were set back from the edge of the bluff. The exact retreat rate is unknown, but relatively soon, property owners were beginning to construct wooden walls at the base of the bluff, parallel to the shoreline and add timber groins on the beach perpendicular to the shoreline. Improvements in engineering design and better technology allowed more durable and larger projects to essentially armor the bluff shoreline with walls of concrete timber and rock. The same effort was also applied to dividing the beach into cells separated by rock groins sometimes spaced under 700 feet apart. Groin design knew no limits during the 1960's and every Monmouth County shorefront municipality built at least one of these structures. Spaced frequently at every other street-end, the groins severely

reduced the meager sand supply's ability to move in any direction except directly offshore during bigger storm events.

Little by little the Monmouth County beaches became very narrow with miles of shoreline without a sand beach of any kind. The ultimate armored shoreline was found in Sea Bright where a seawall started by the long-gone railroad company whose tracks were laid parallel to the dunes at the end of the 19th Century, had been rebuilt ever stronger during the 20th Century. Groins were also included about every quarter mile along the 12-mile shoreline. The only bathing beaches were found in tiny pockets tucked into the corner made by the seawall and one of the groins. The situation was slightly better from Asbury Park to the south, but storm damage to boardwalk and other public infrastructure were commonplace. The 1991 Halloween and 1992 December storms did substantial damage to the entire Monmouth County shoreline, piling the boardwalk into Ocean Avenue as splintered debris in Belmar, Avon-by-the-Sea, and Spring Lake. Damage to homes occurred in Manasquan as the ocean easily overtopped the beach and modest dune along that oceanfront. Even the Sea Bright seawall was not sufficient to prevent sand, debris and millions of tons of seawater from landing in Ocean Avenue.

These storms culminated three decades of slow retreat at various places along the Monmouth County shoreline in spite of all the effort to prevent it. The City of Long Branch lost multiple blocks of Ocean Avenue's northbound highway located at the edge of the bluff. Deal saw bluff retreat property erosion and several structures disappear over the years. Following the December 1992 storm, Bradley Beach was forced to remove the remains of its boardwalk from the beach and move it landward to the bluff, onto a former grass plot between Ocean Avenue and the boardwalk. The community gained a very valuable 40 feet of beach width formerly located under the boardwalk decking.

By 1994 the State of New Jersey became very serious about finding a solution to this shoreline loss and turned to a Federal project initially authorized in July of 1958 to undertake a Federal study to determine the best method of beach erosion control in Monmouth County. This work, modified under the Federal Water Resources Development Acts of 1986, 1988 and 1992 progressed through the three Federal phases leading to construction. The Federal lead agency is the New York District of the US Army Corps of Engineers with the local sponsor as the New Jersey Department of Environmental Protection. The NY Corps District carried the project through the Reconnaissance phase into the jointly sponsored Feasibility phase that chose a design plan. The State spent years in negotiations with local municipalities along the Monmouth County coast to generate detailed plans and define local and State financial and governance responsibilities. Real estate issues and public access to the federally funded project were likewise long, tedious and frequently frustrating. Finally the Army Corps approved the Planning and Engineering Design for construction and Congress authorized the funding to start construction of the nation's largest beach restoration project ever attempted.

The project consists of 21 miles of shoreline from the Township of Sea Bright to the Manasquan Inlet in Monmouth County, New Jersey. The protection is provided by the construction of a 100-foot wide beach berm at an elevation of 10 feet above mean low water (MLW). The project also called for notching existing stone groins and extending storm water outfall pipelines. The project includes periodic nourishment of the restored beaches on a 6-year cycle for a period of 50 years from the start of the initial construction.

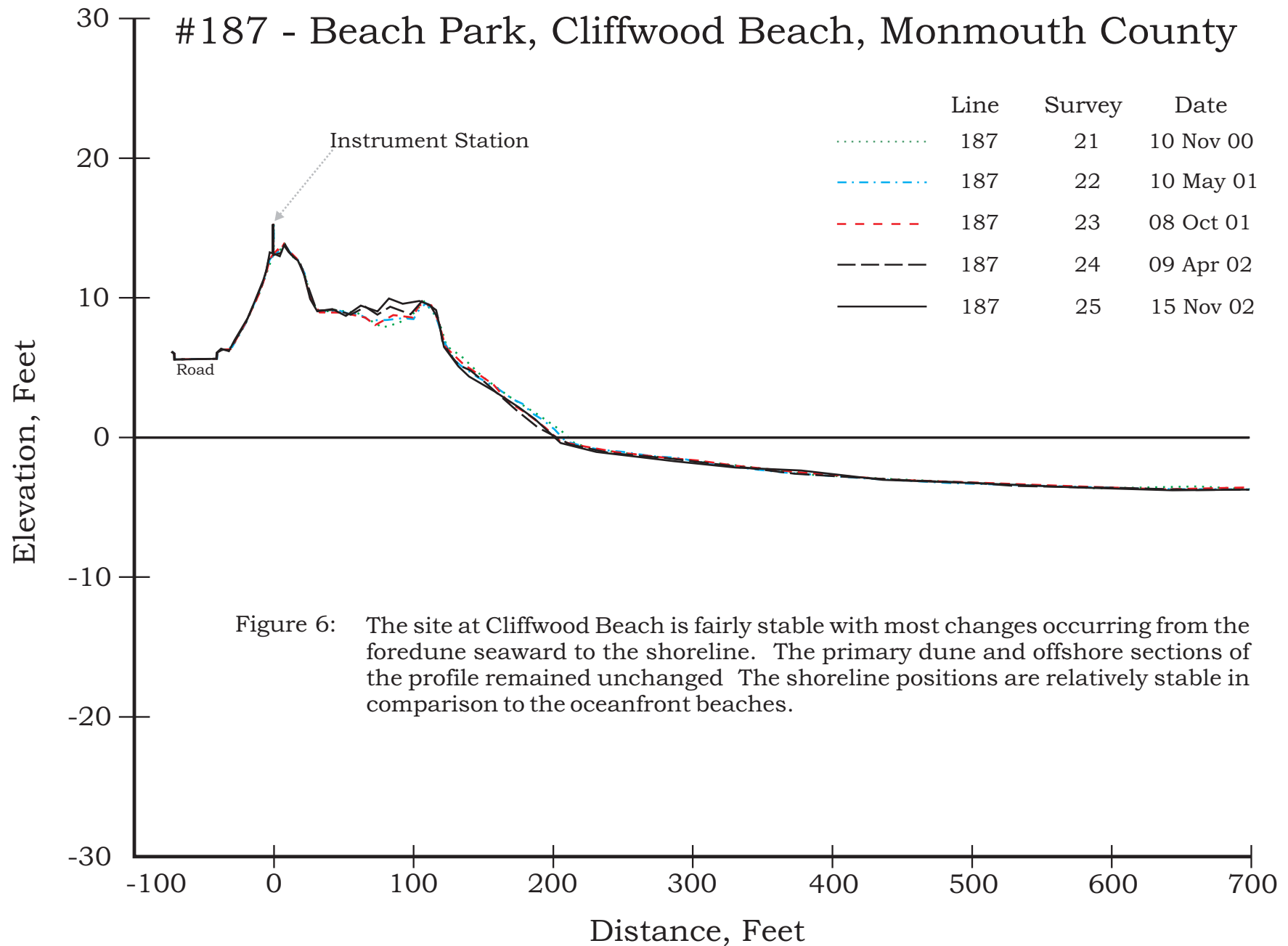
Construction commenced following the January 1994 award of the initial contract for Monmouth Beach. Over the next six years 24.9 million cubic yards of sand were pumped from about a mile offshore to the beach at a cost of \$210,000,000. Beach nourishment efforts have provided a vast supply of new sediment to the beaches of 9 out of 12 oceanfront municipalities. The earliest sites with sand added have responded well, requiring little augmentation since the project started. Some early maintenance work was done at Monmouth Beach due to sand losses when material migrated south toward Long Branch. Most visitors are amazed by the difference in the shoreline following nourishment work. Over the past seven years, the extensive shoreline advances and

large increases in sand volume have provided tremendous increases in shore protection, vastly increased habitat and new recreational opportunities to all municipalities involved.

The Sea Bright segment, nourished in 1996 and touched up during late 1997 in Monmouth Beach, changed an average of 0.19 yds³/ft (fall 98), +0.02 yds³/ft (spring 99), -3.05 yds³/ft (fall 99), -5.59 yds³/ft (spring 2000), -3.28 yds³/ft (fall 2000), -3.96 yds³/ft (spring 2001), -5.51 yds³/ft (fall 2001), -0.14 yds³/ft (spring 2002) and 69.43 yds³/ft (fall 2002) for the eight cross sections between the entrance to the Sandy Hook Park and the Long Branch border. These beaches lost only an average of 2.67 yds³/ft seasonally of their initial placement volumes for a net loss of 21.32 yds³/ft from placement to spring 2002. The first maintenance contract was completed in this reach by fall 2002, placing an average 69.43 yds³/ft of sand on these beaches, returning this segment back to the design sand volume.

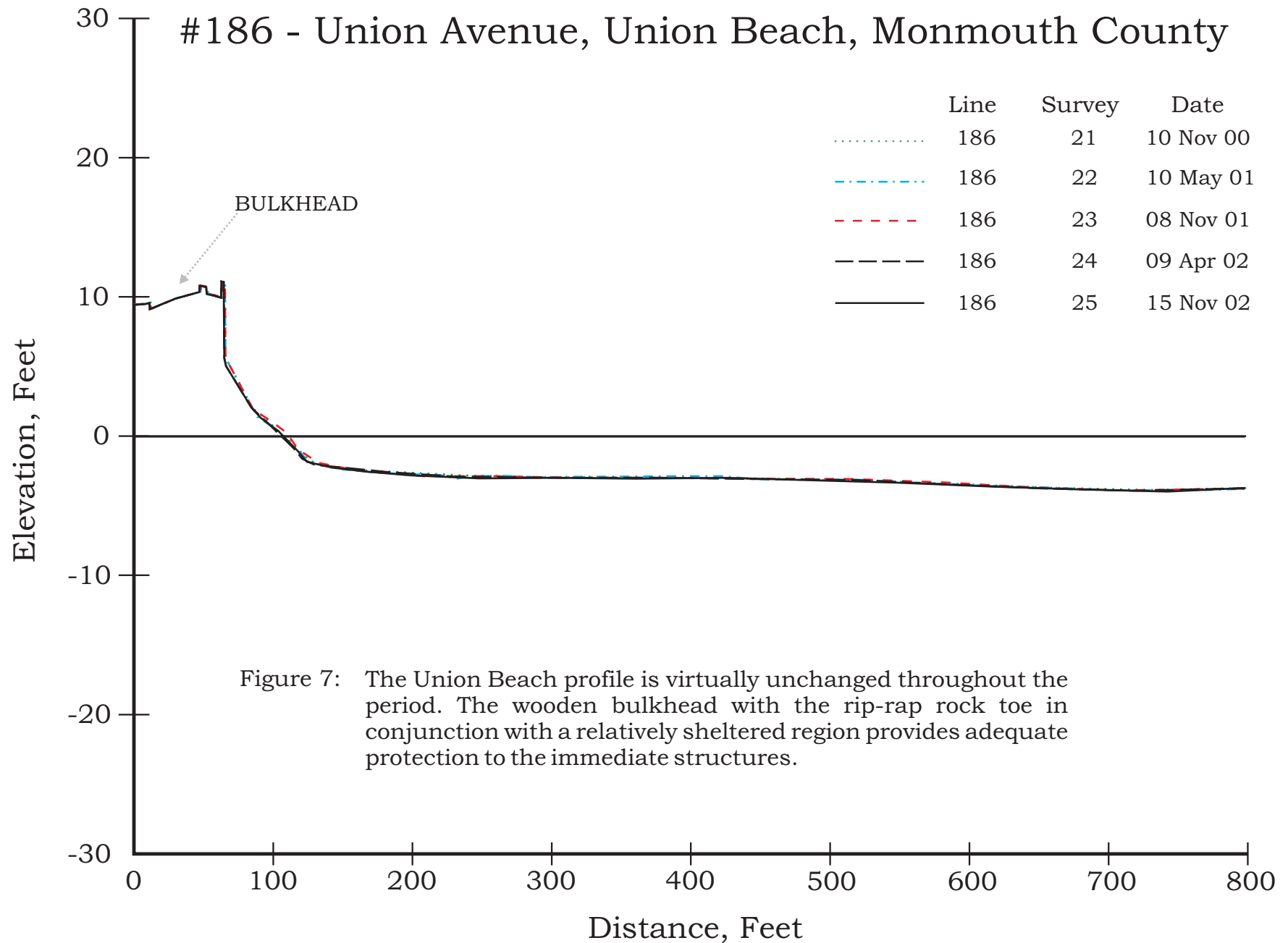
New Jersey Beach Profile Network

#187 - Beach Park, Cliffwood Beach, Monmouth County



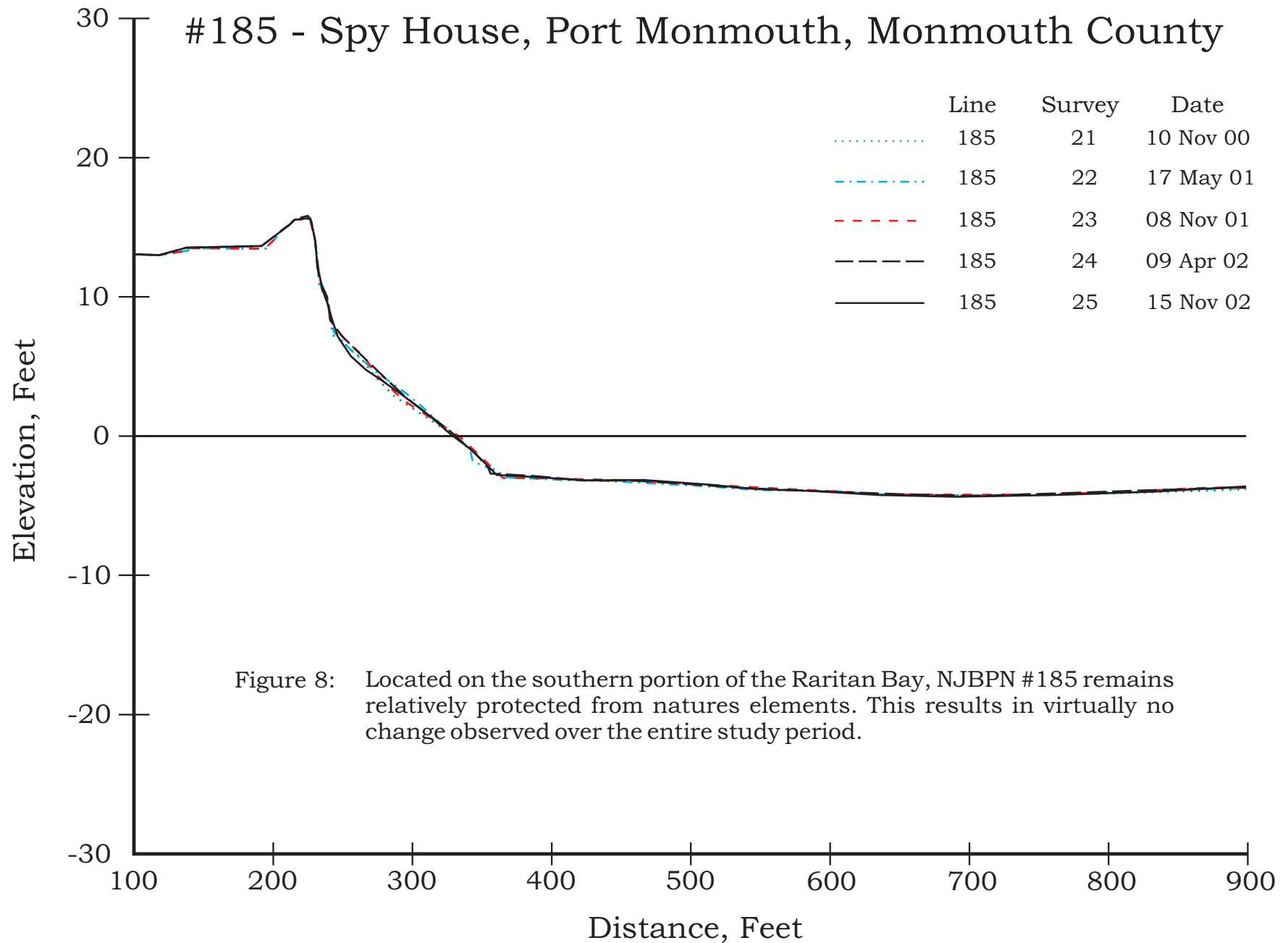
New Jersey Beach Profile Network

#186 - Union Avenue, Union Beach, Monmouth County



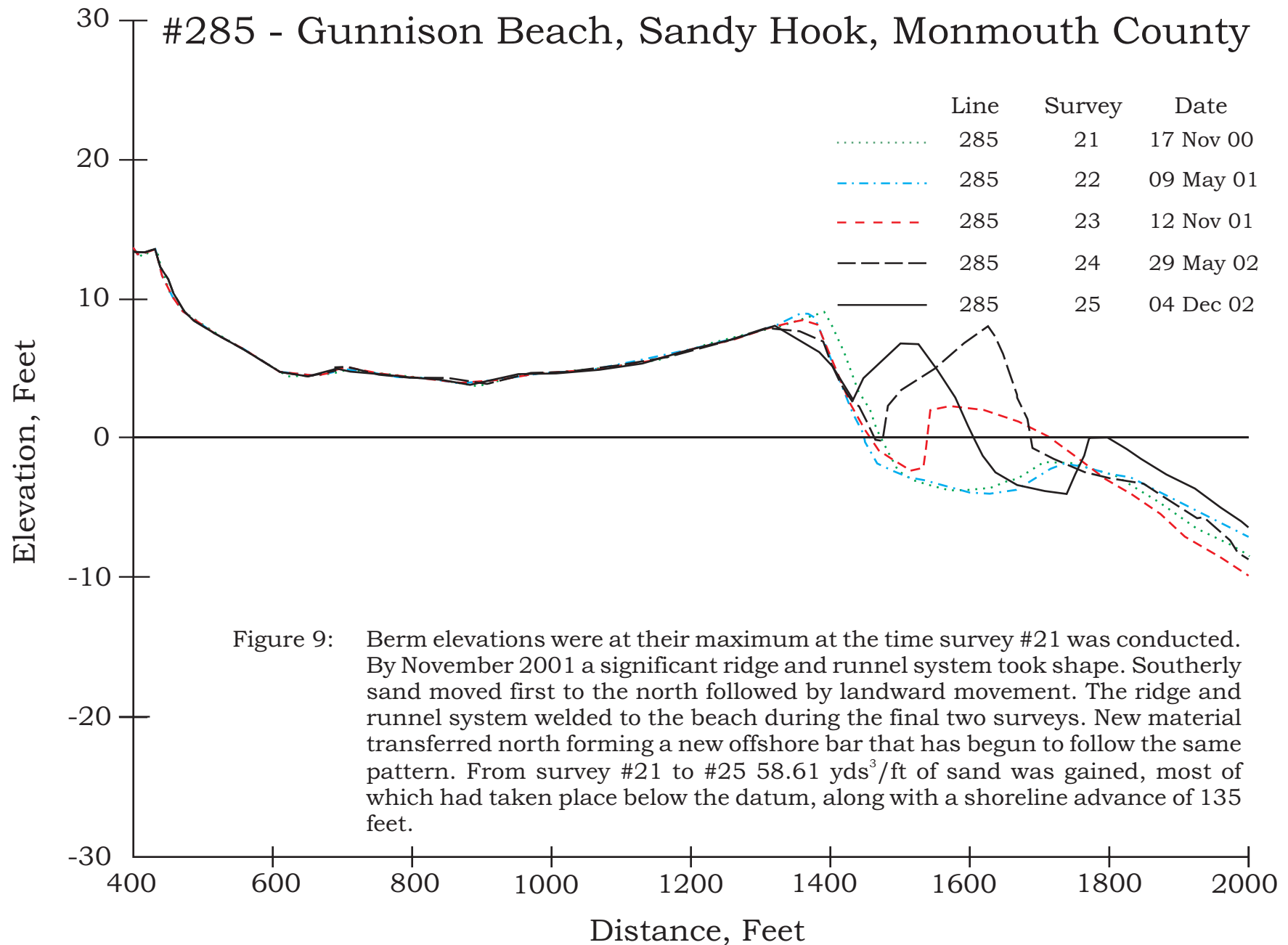
New Jersey Beach Profile Network

#185 - Spy House, Port Monmouth, Monmouth County



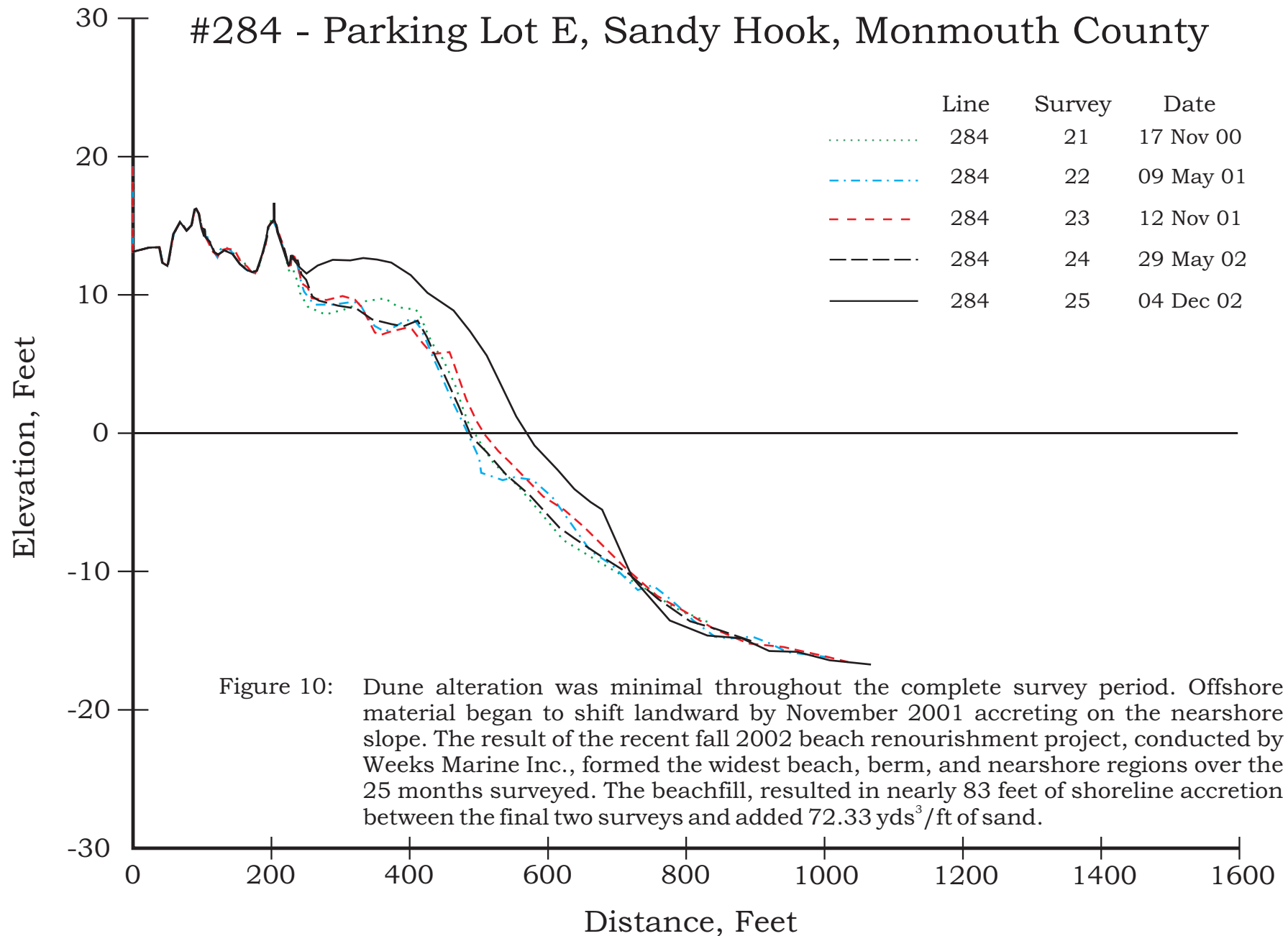
New Jersey Beach Profile Network

#285 - Gunnison Beach, Sandy Hook, Monmouth County



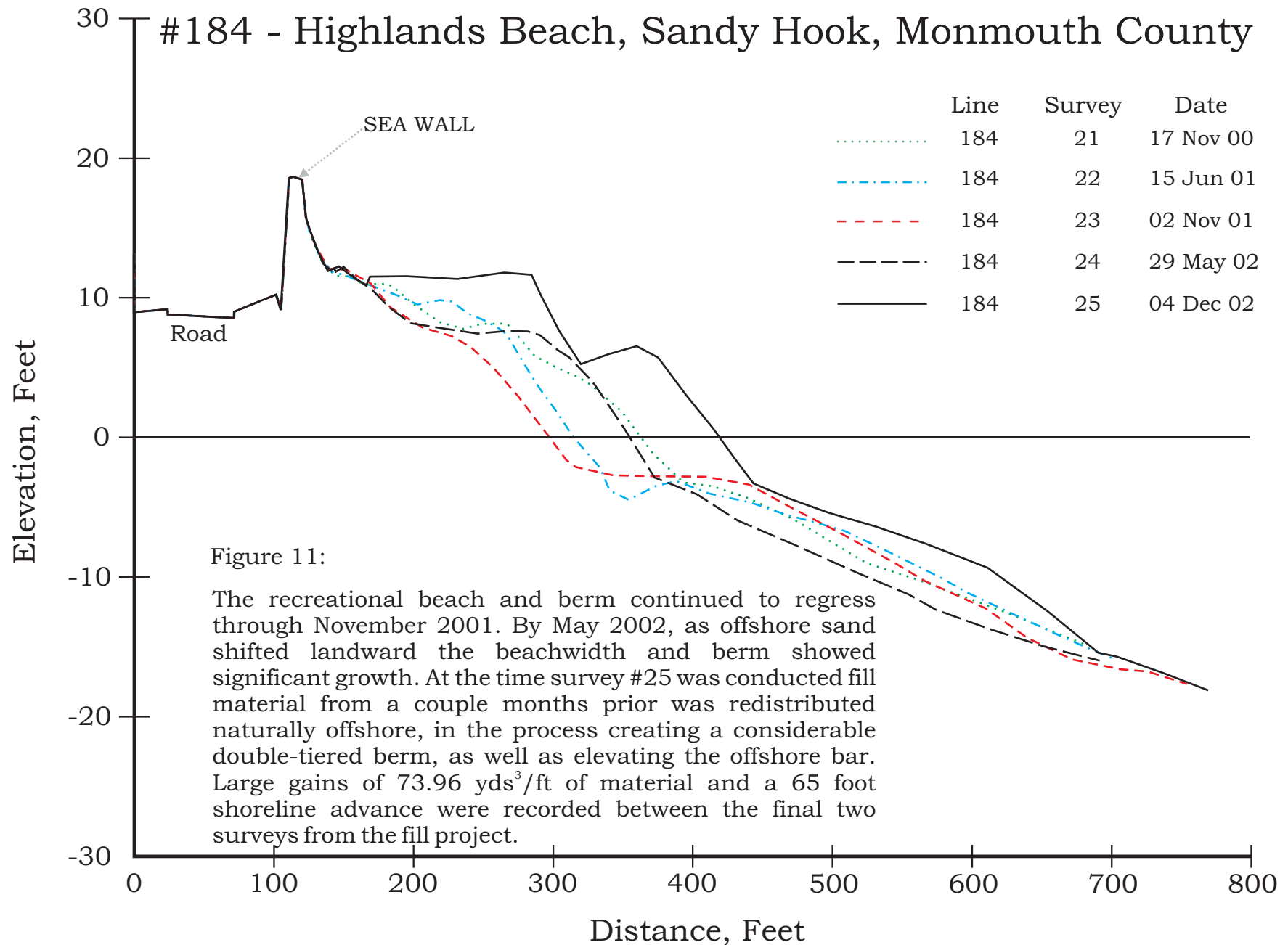
New Jersey Beach Profile Network

#284 - Parking Lot E, Sandy Hook, Monmouth County



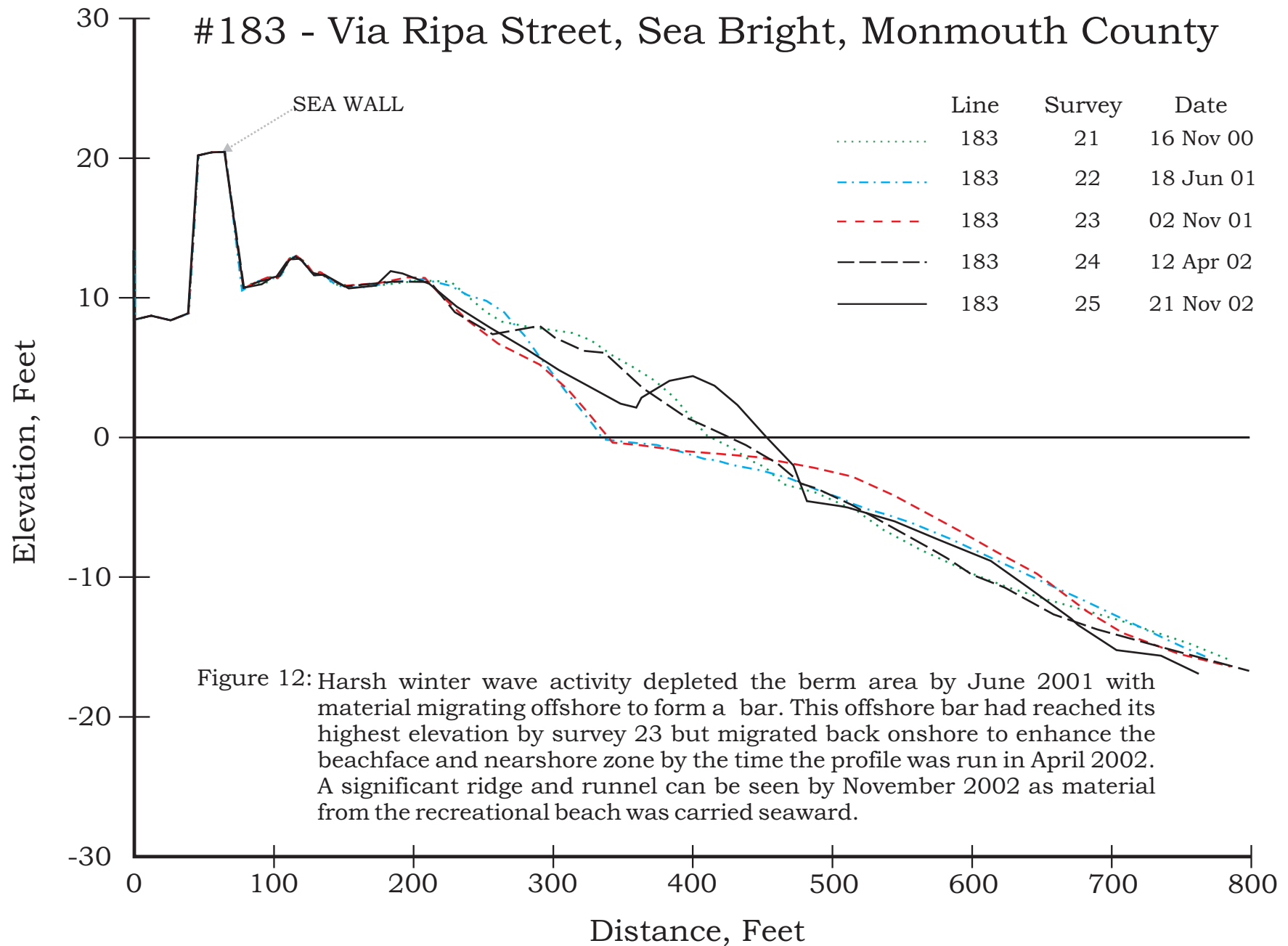
New Jersey Beach Profile Network

#184 - Highlands Beach, Sandy Hook, Monmouth County



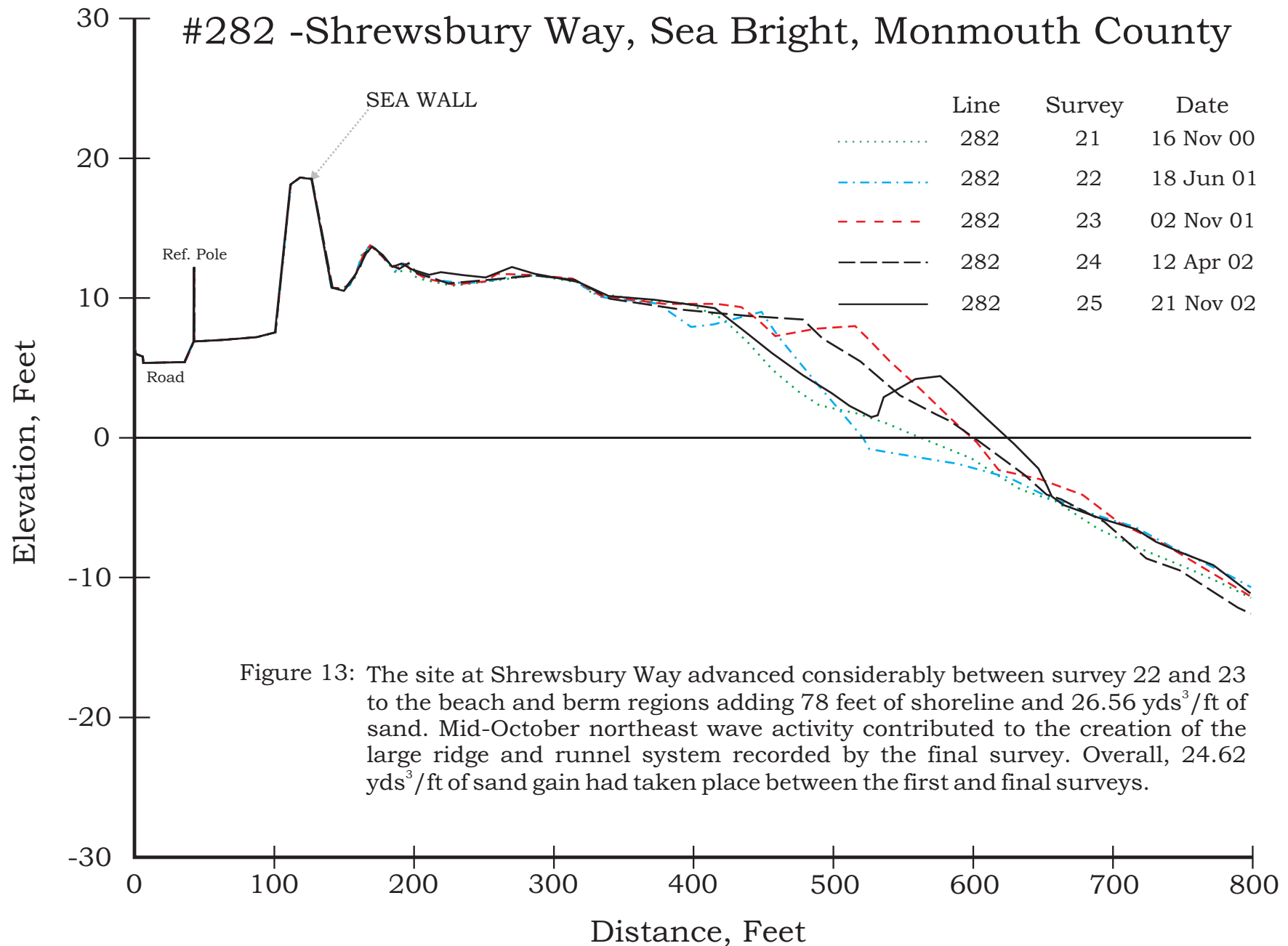
New Jersey Beach Profile Network

#183 - Via Ripa Street, Sea Bright, Monmouth County



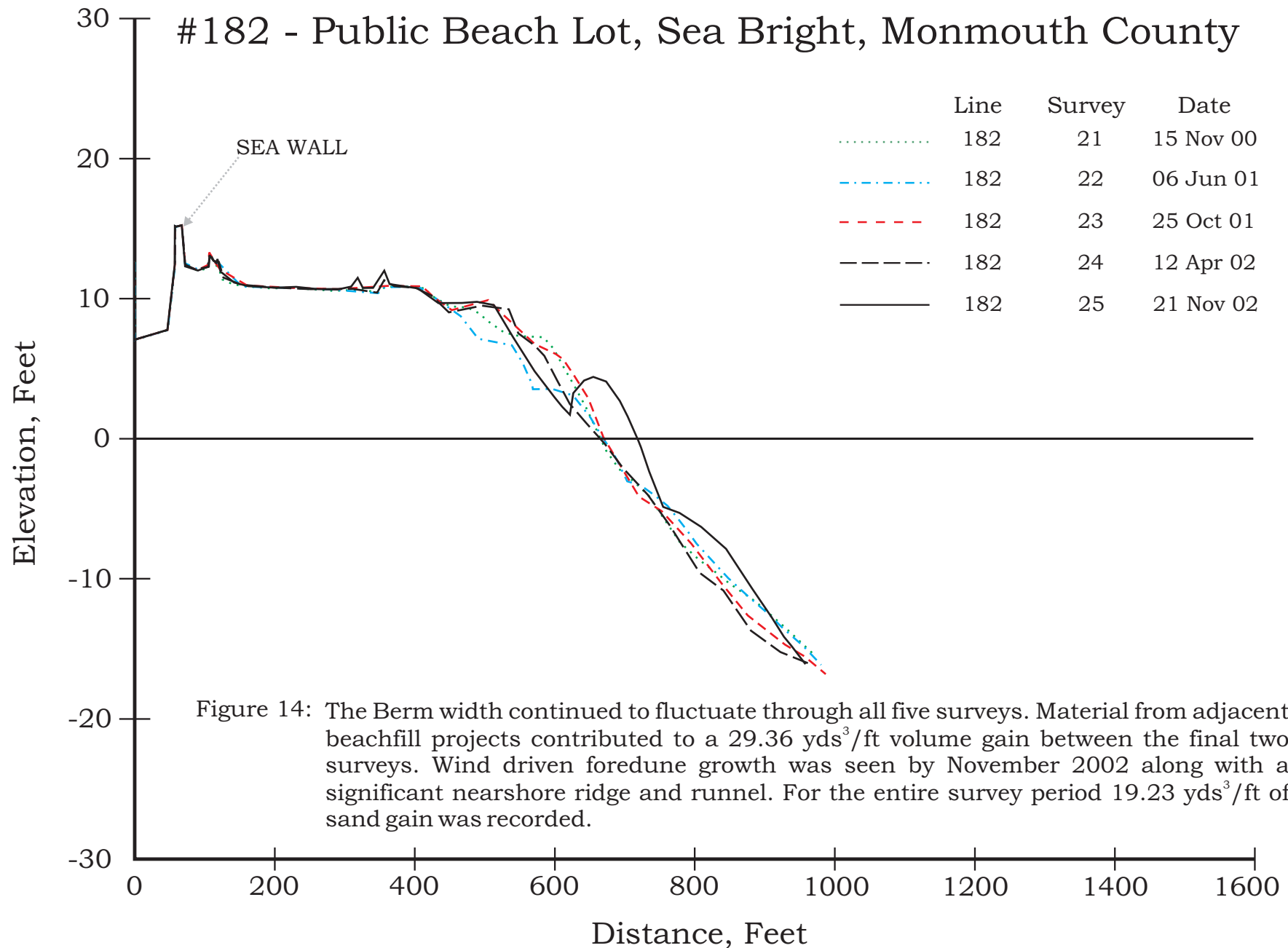
New Jersey Beach Profile Network

#282 -Shrewsbury Way, Sea Bright, Monmouth County



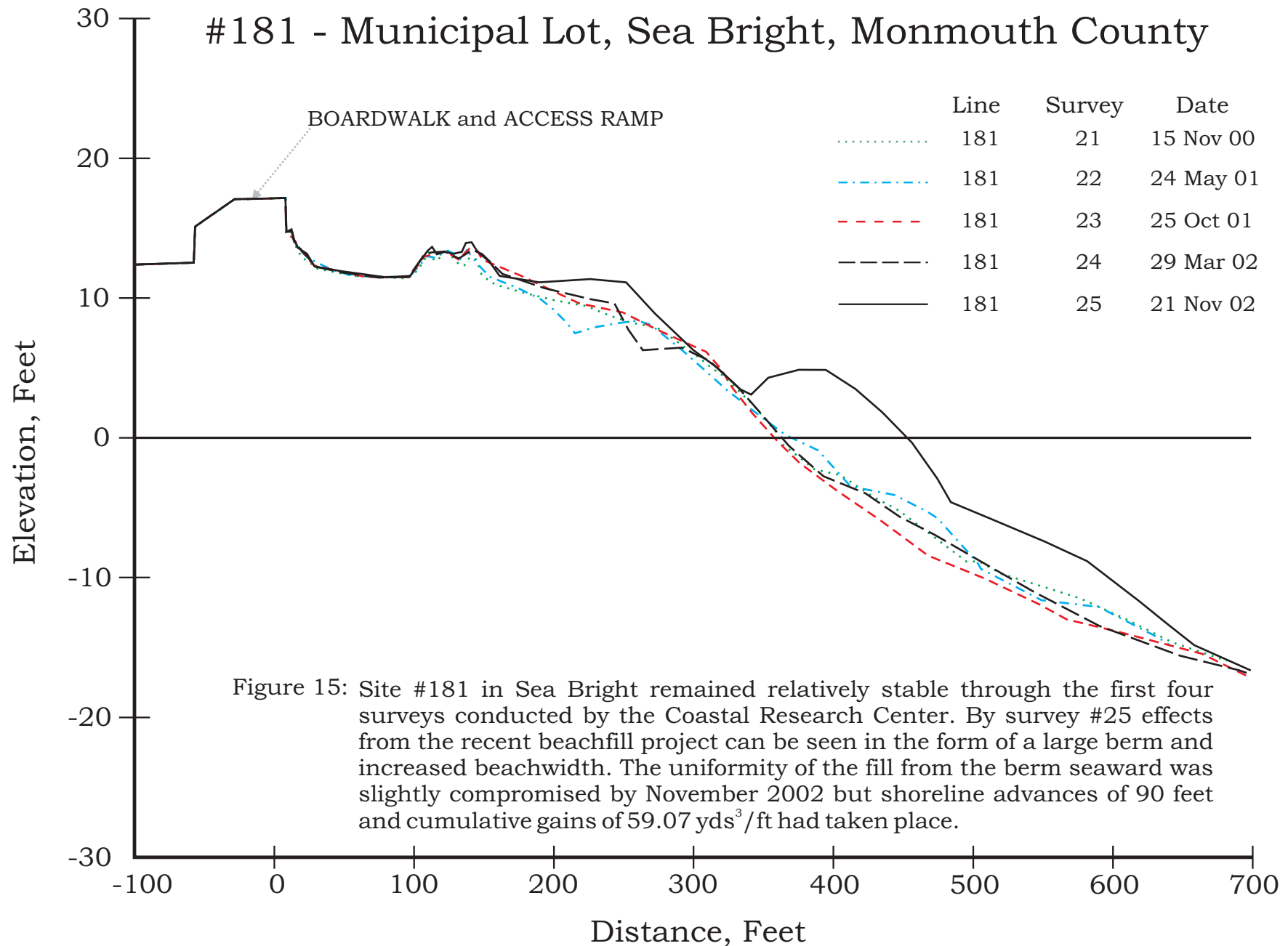
New Jersey Beach Profile Network

#182 - Public Beach Lot, Sea Bright, Monmouth County



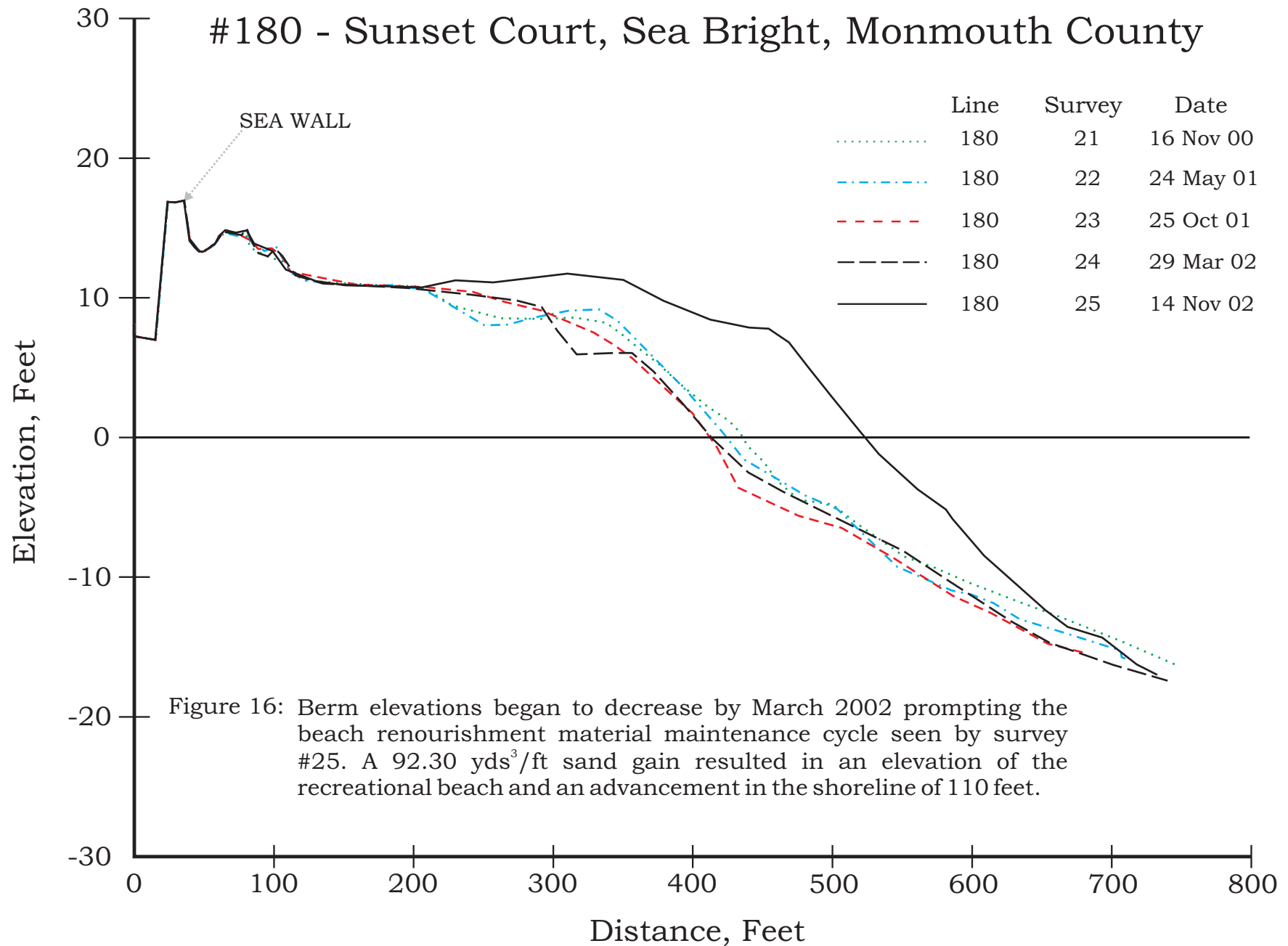
New Jersey Beach Profile Network

#181 - Municipal Lot, Sea Bright, Monmouth County



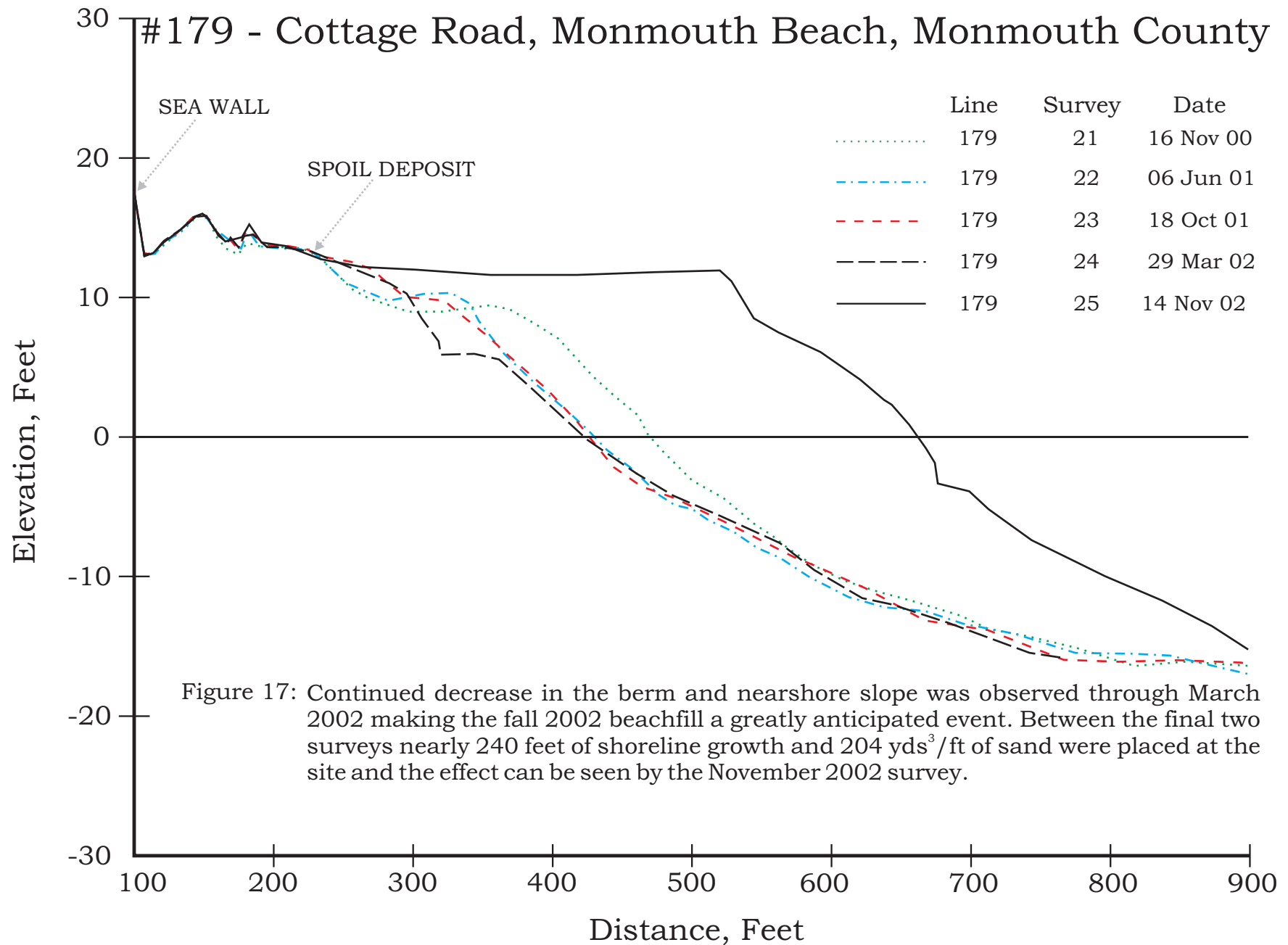
New Jersey Beach Profile Network

#180 - Sunset Court, Sea Bright, Monmouth County



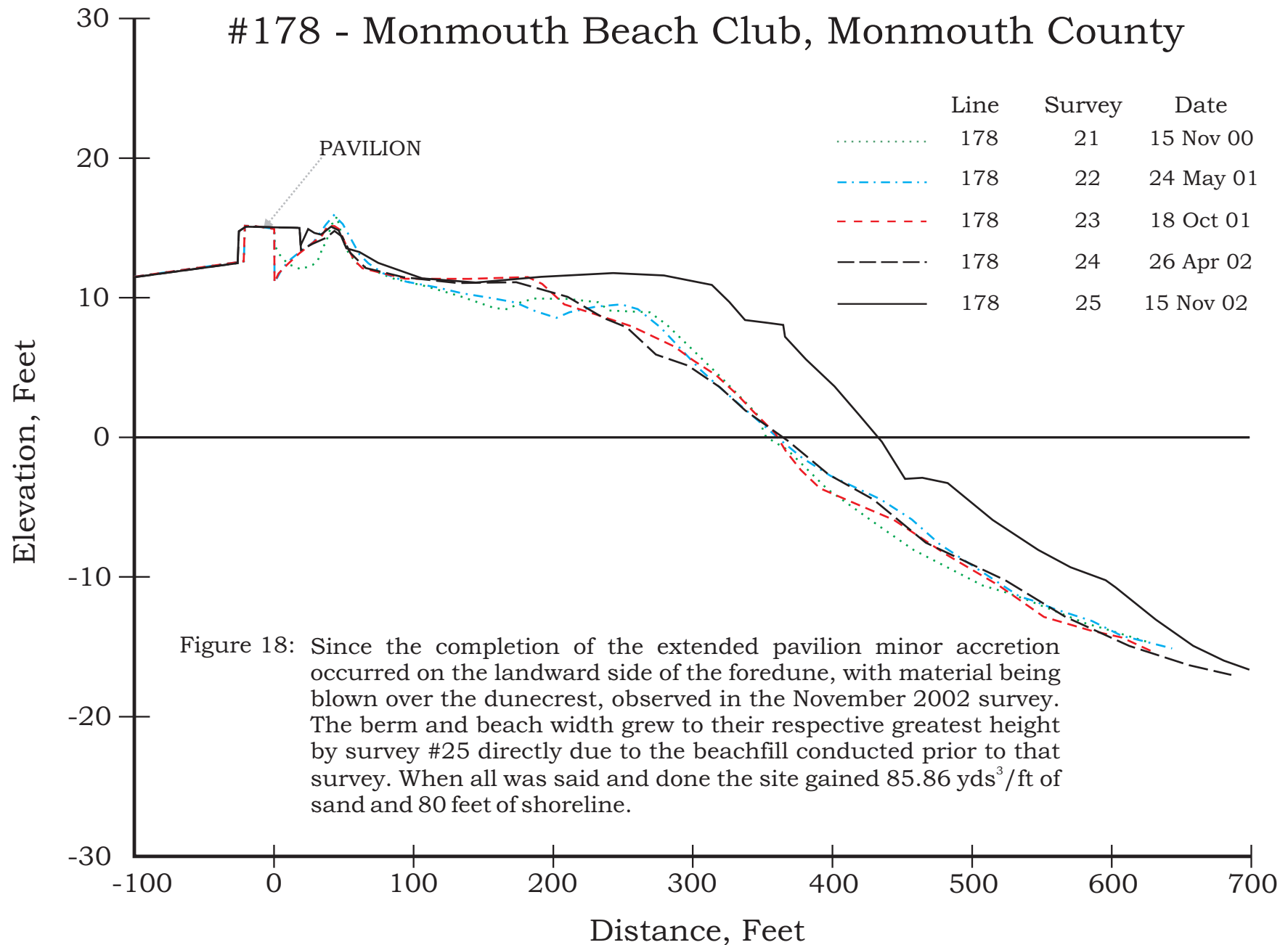
New Jersey Beach Profile Network

#179 - Cottage Road, Monmouth Beach, Monmouth County



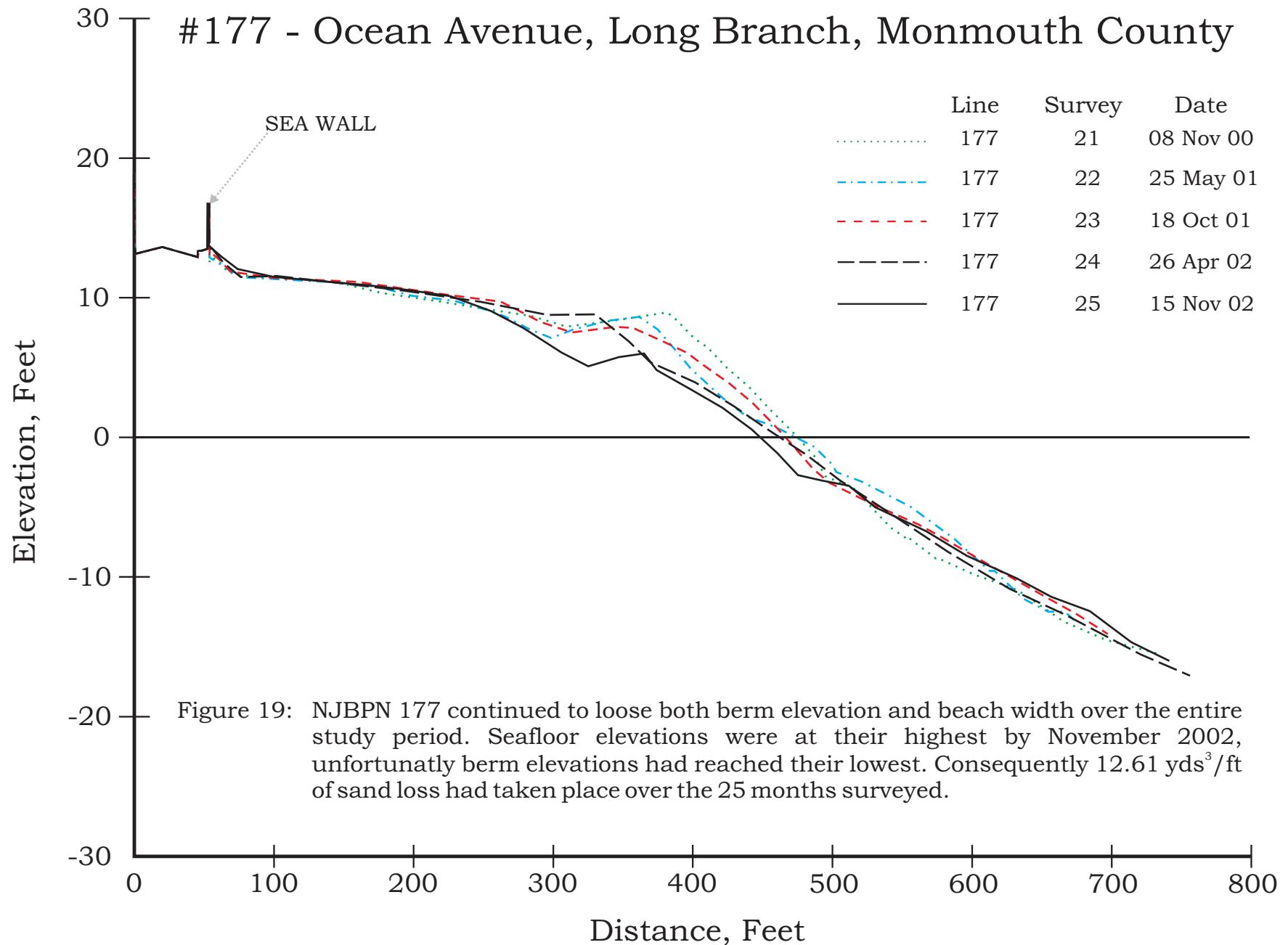
New Jersey Beach Profile Network

#178 - Monmouth Beach Club, Monmouth County



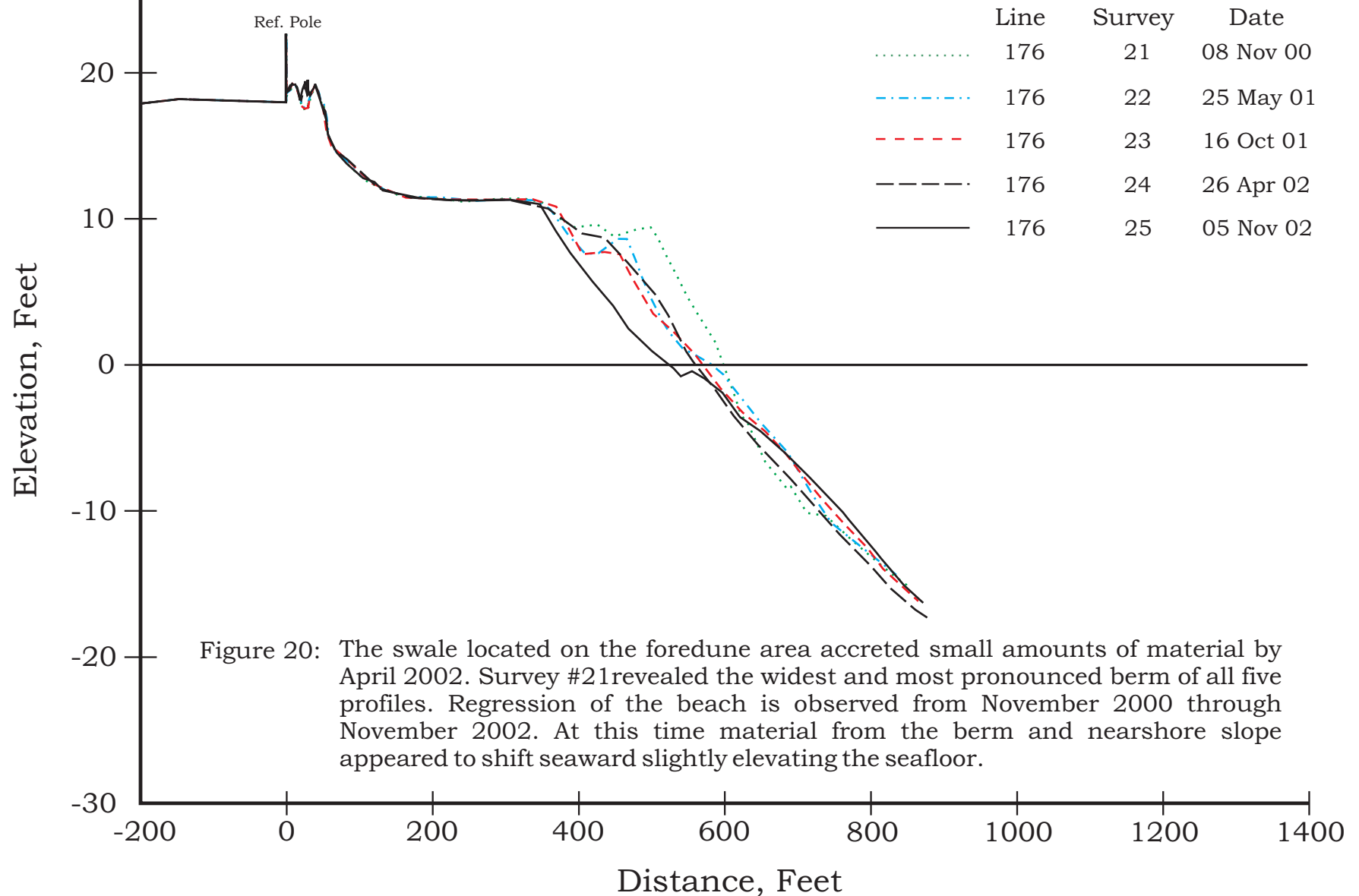
New Jersey Beach Profile Network

#177 - Ocean Avenue, Long Branch, Monmouth County

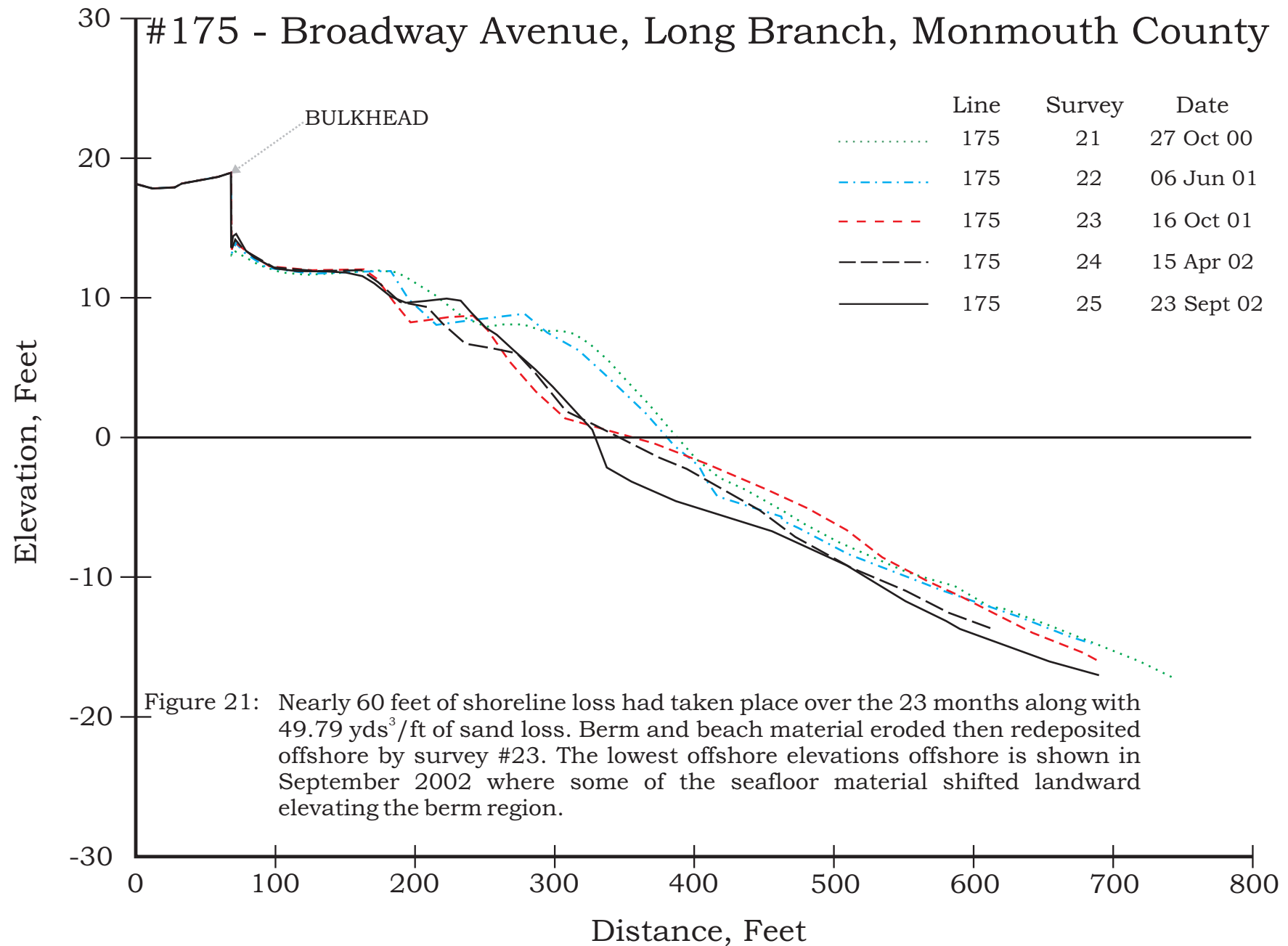


New Jersey Beach Profile Network

#176 - Seven Presidents Park, Monmouth County

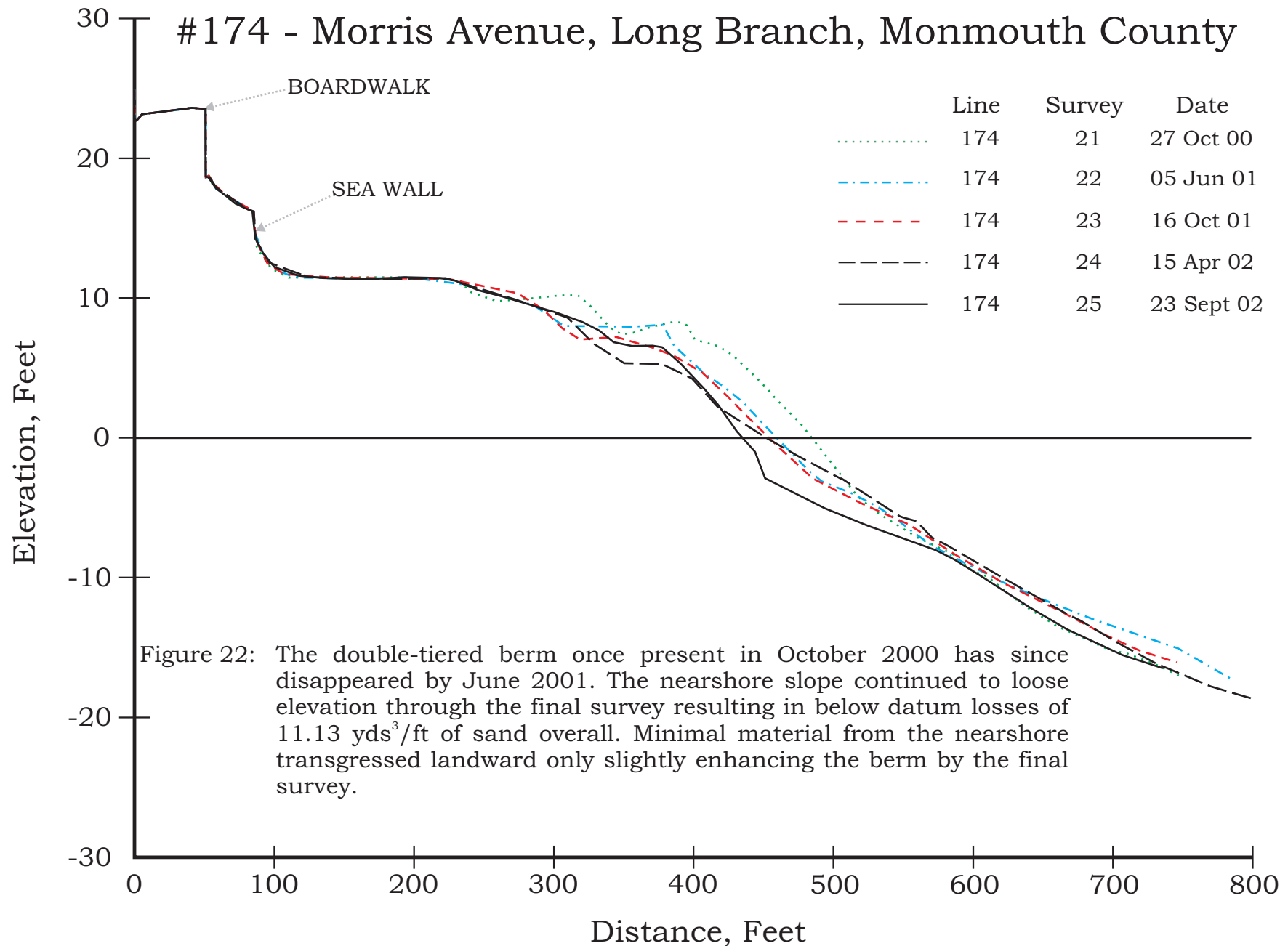


New Jersey Beach Profile Network

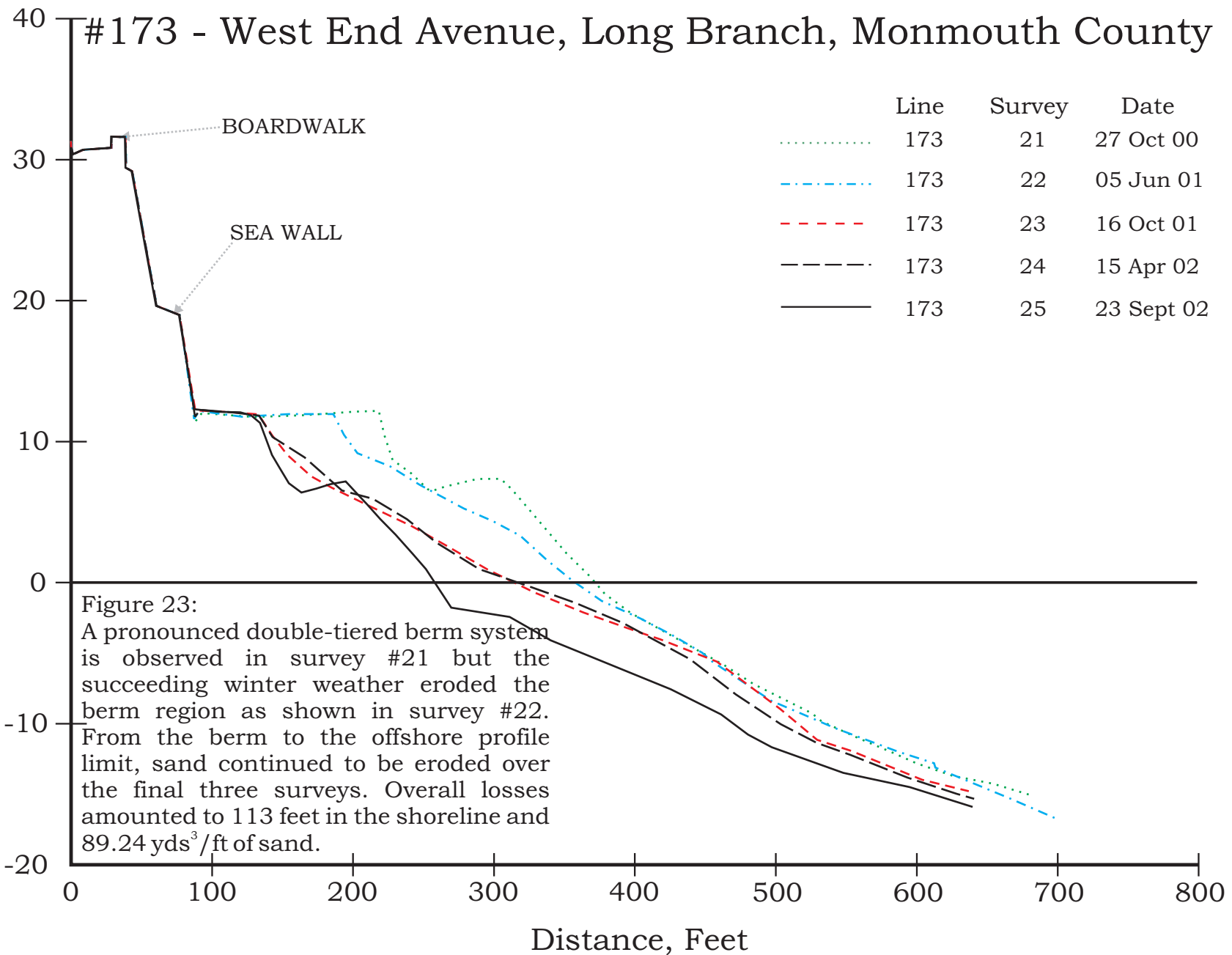


New Jersey Beach Profile Network

#174 - Morris Avenue, Long Branch, Monmouth County

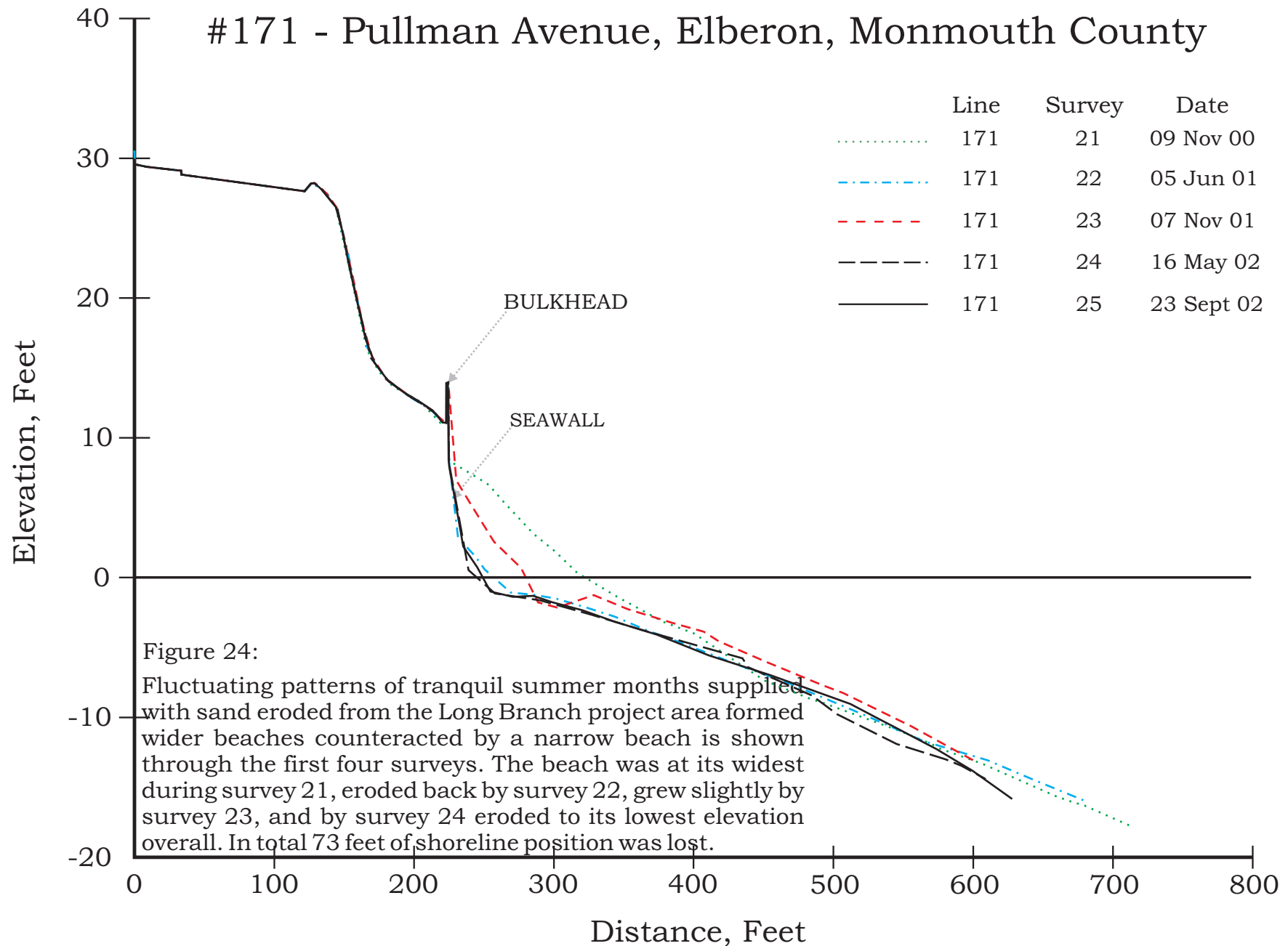


New Jersey Beach Profile Network



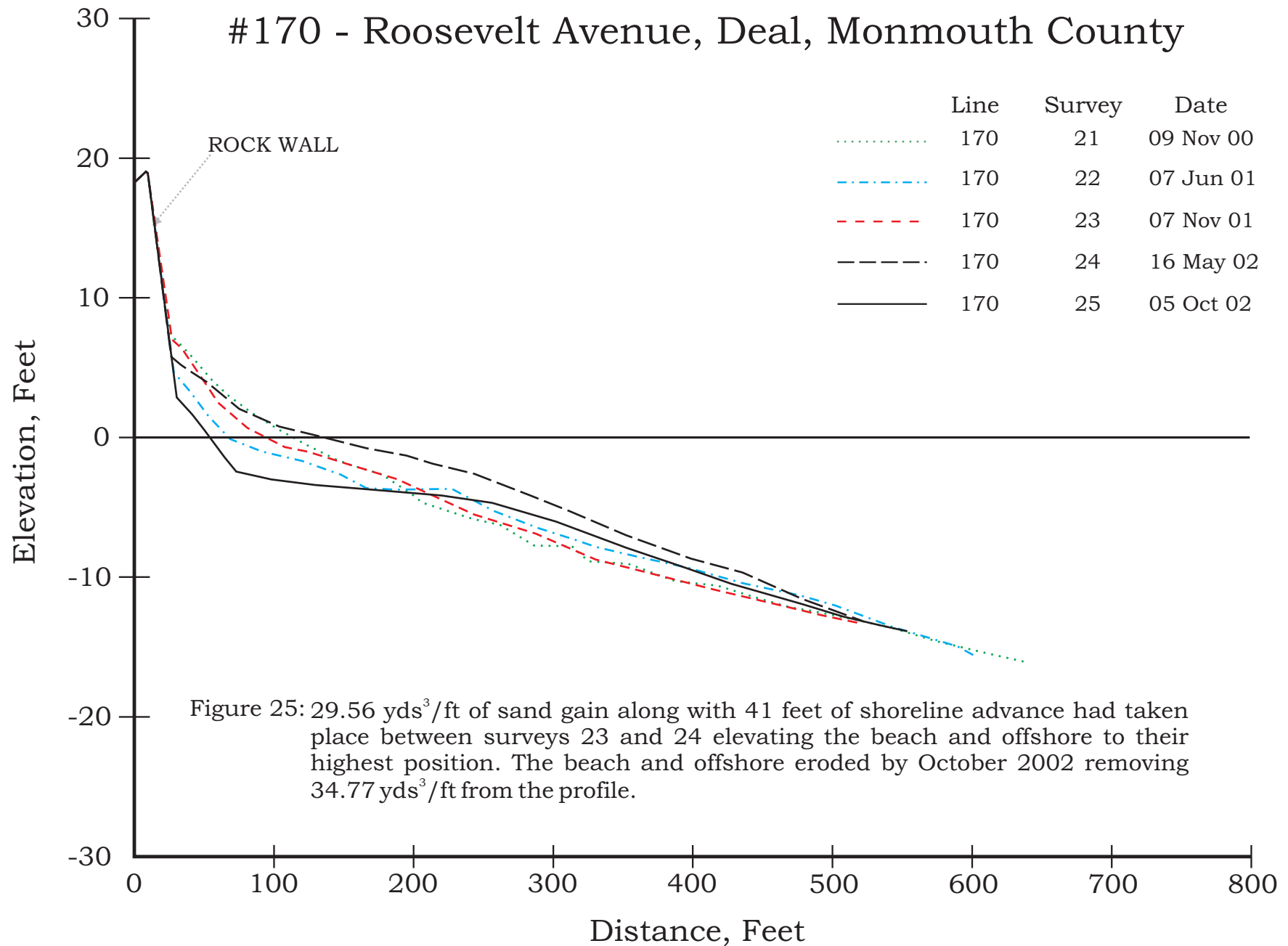
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#171 - Pullman Avenue, Elberon, Monmouth County



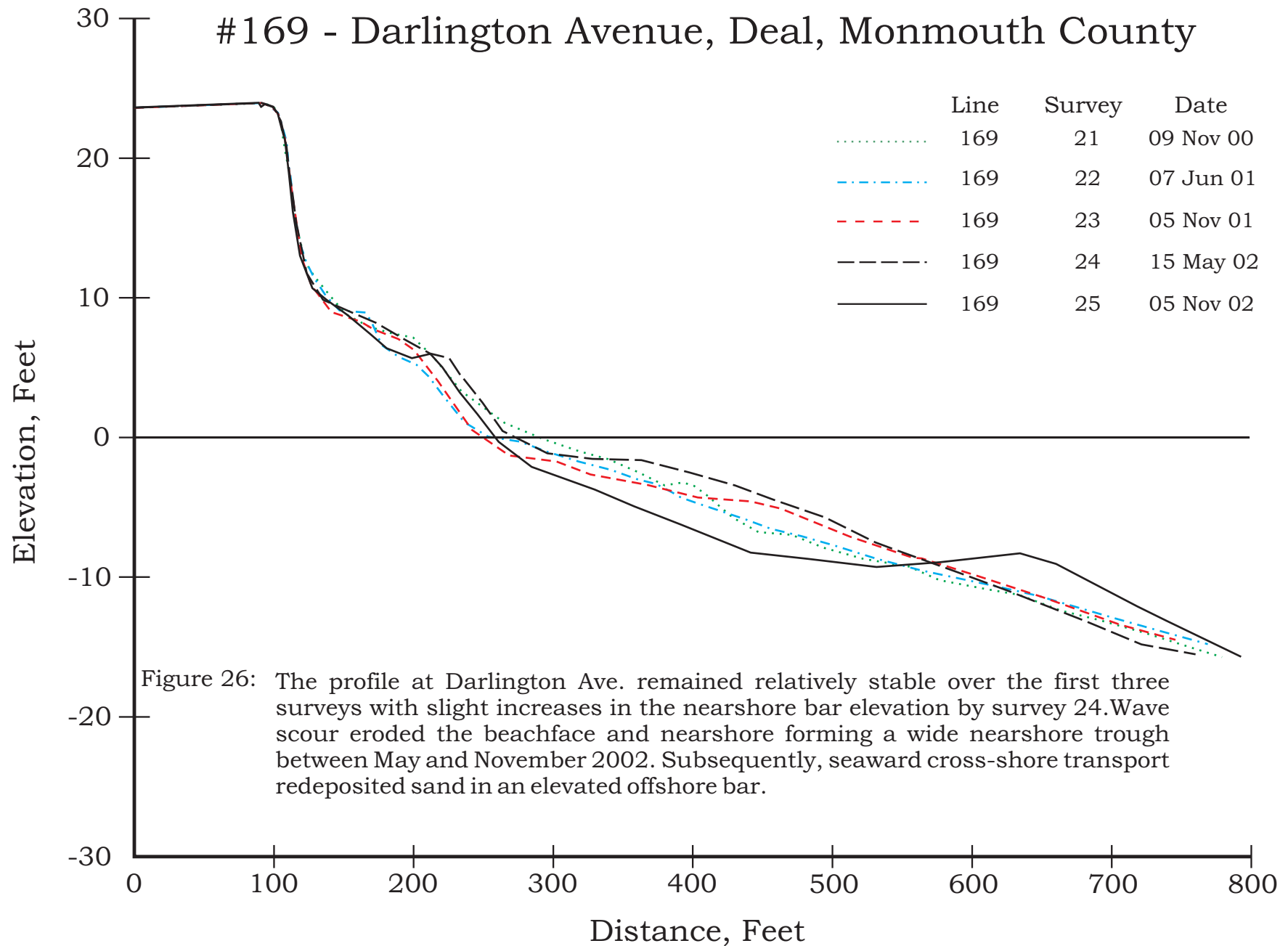
New Jersey Beach Profile Network

#170 - Roosevelt Avenue, Deal, Monmouth County



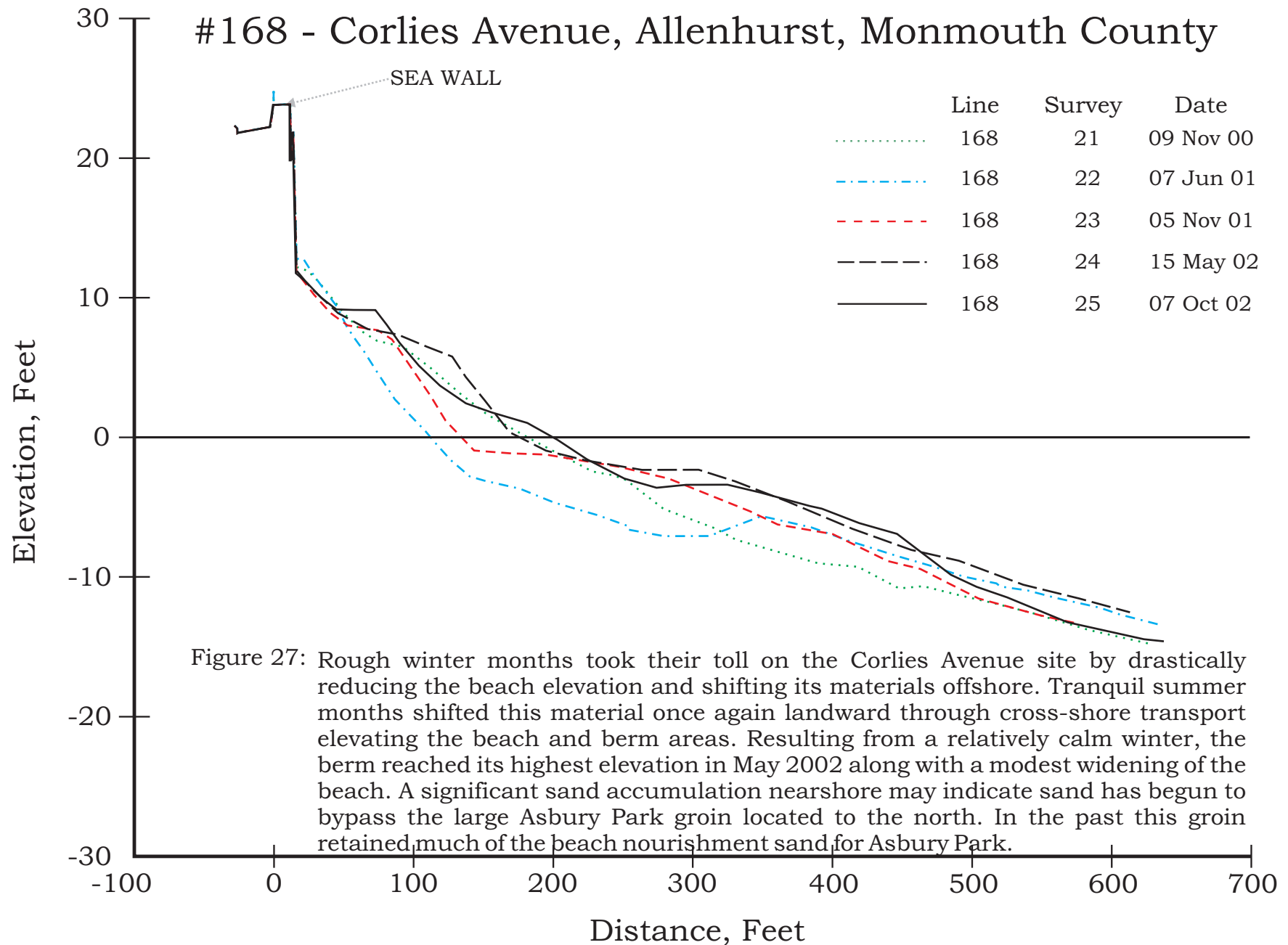
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#169 - Darlington Avenue, Deal, Monmouth County



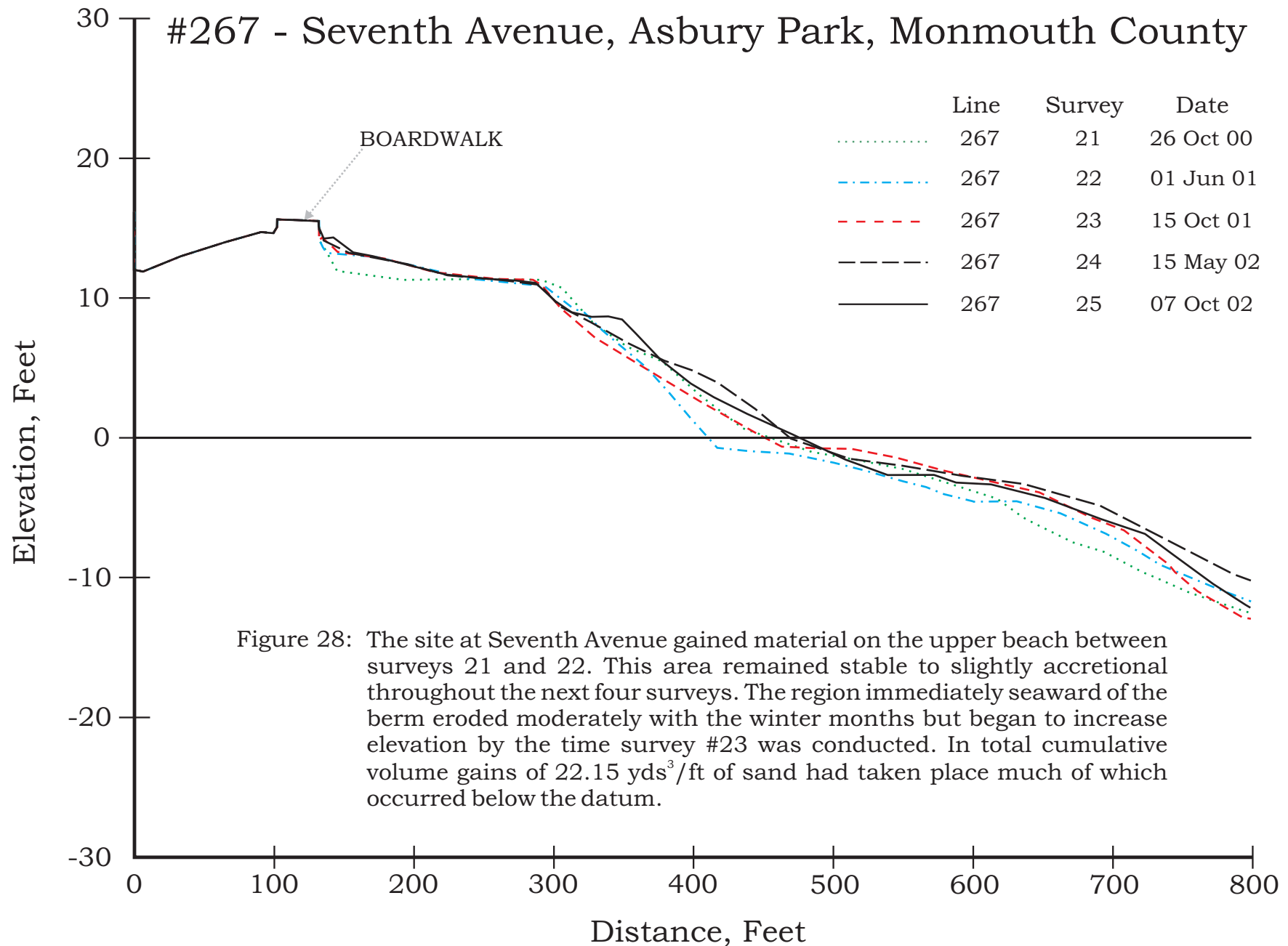
New Jersey Beach Profile Network

#168 - Corlies Avenue, Allenhurst, Monmouth County



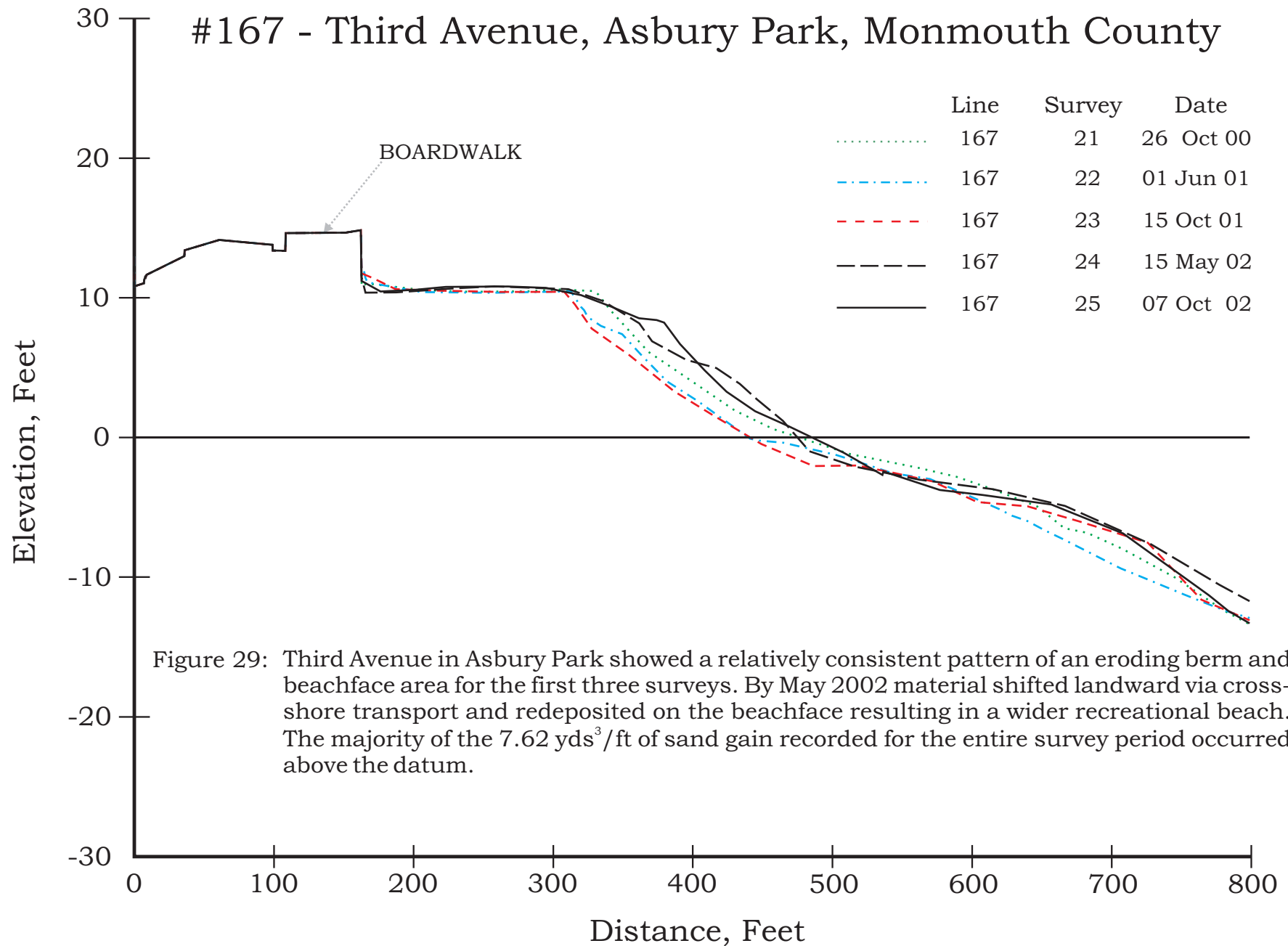
New Jersey Beach Profile Network

#267 - Seventh Avenue, Asbury Park, Monmouth County



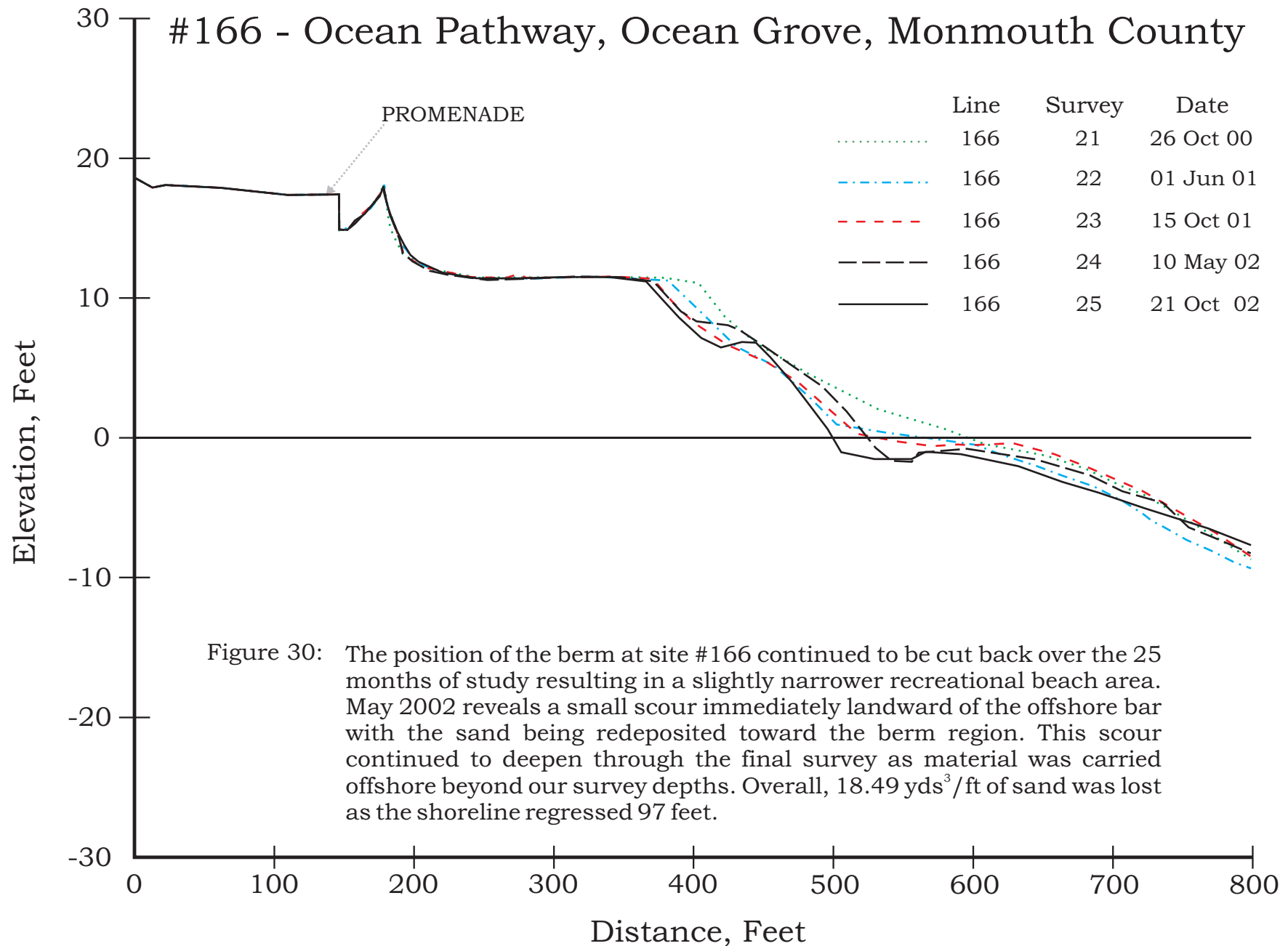
New Jersey Beach Profile Network

#167 - Third Avenue, Asbury Park, Monmouth County

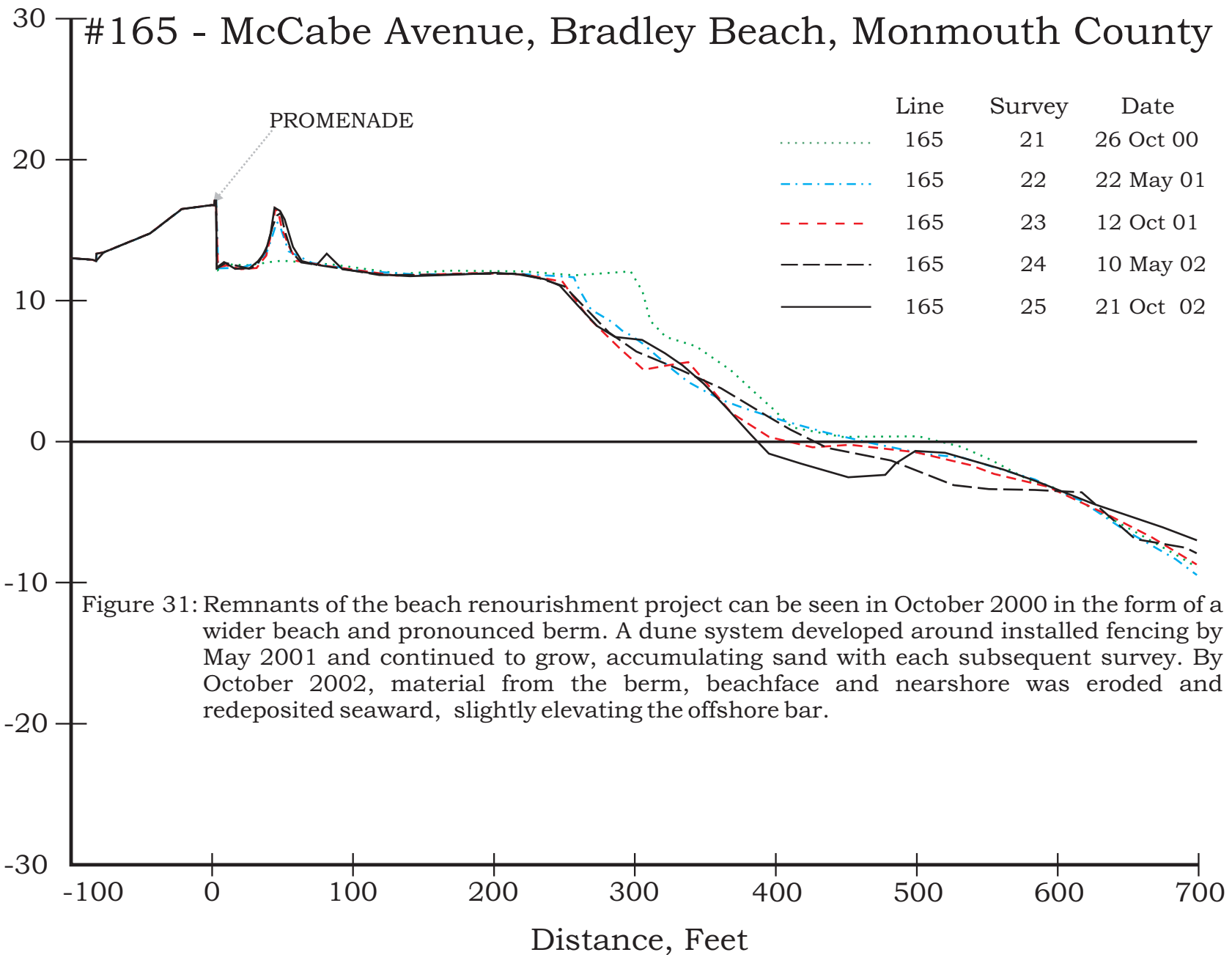


New Jersey Beach Profile Network

#166 - Ocean Pathway, Ocean Grove, Monmouth County

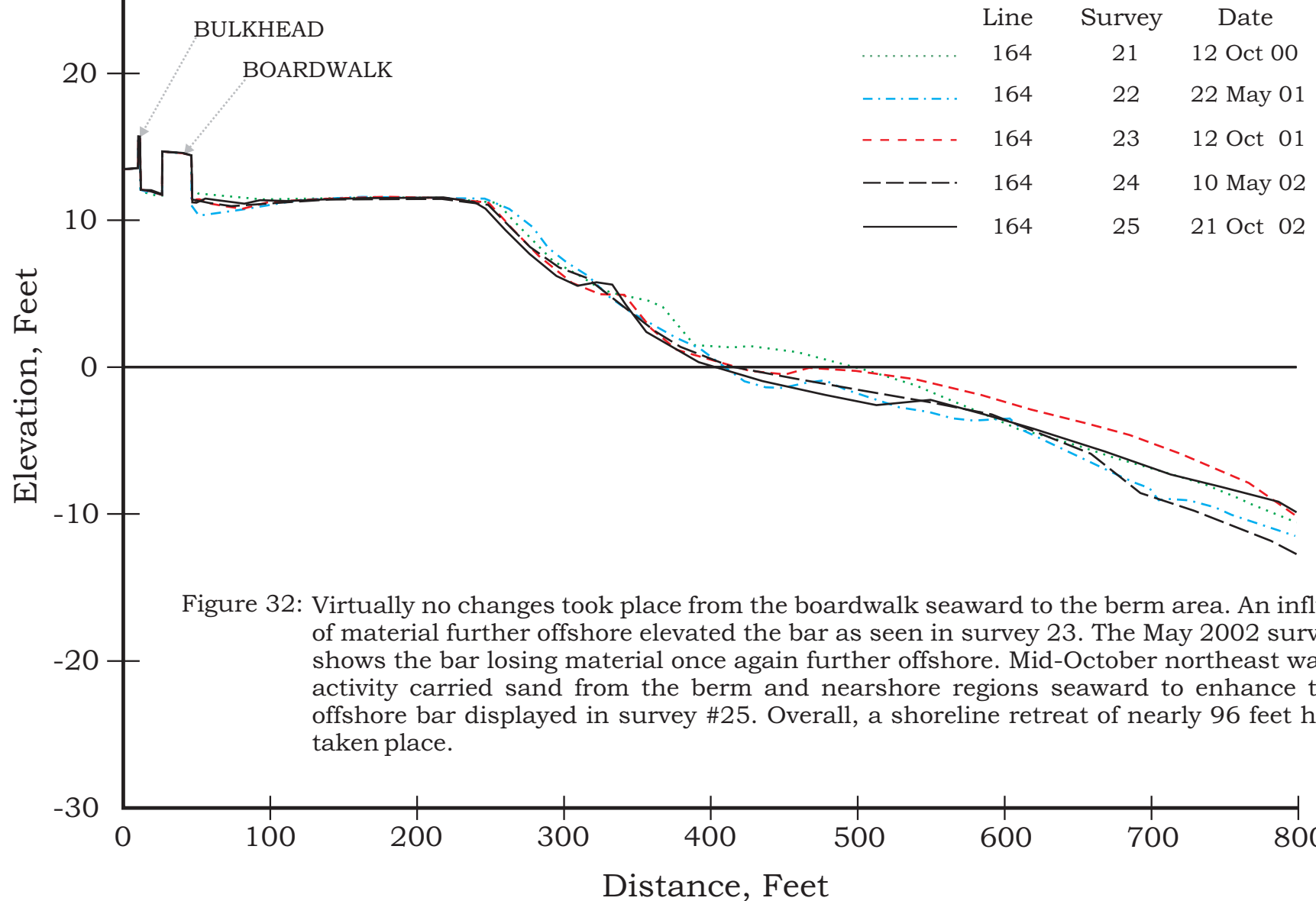


New Jersey Beach Profile Network



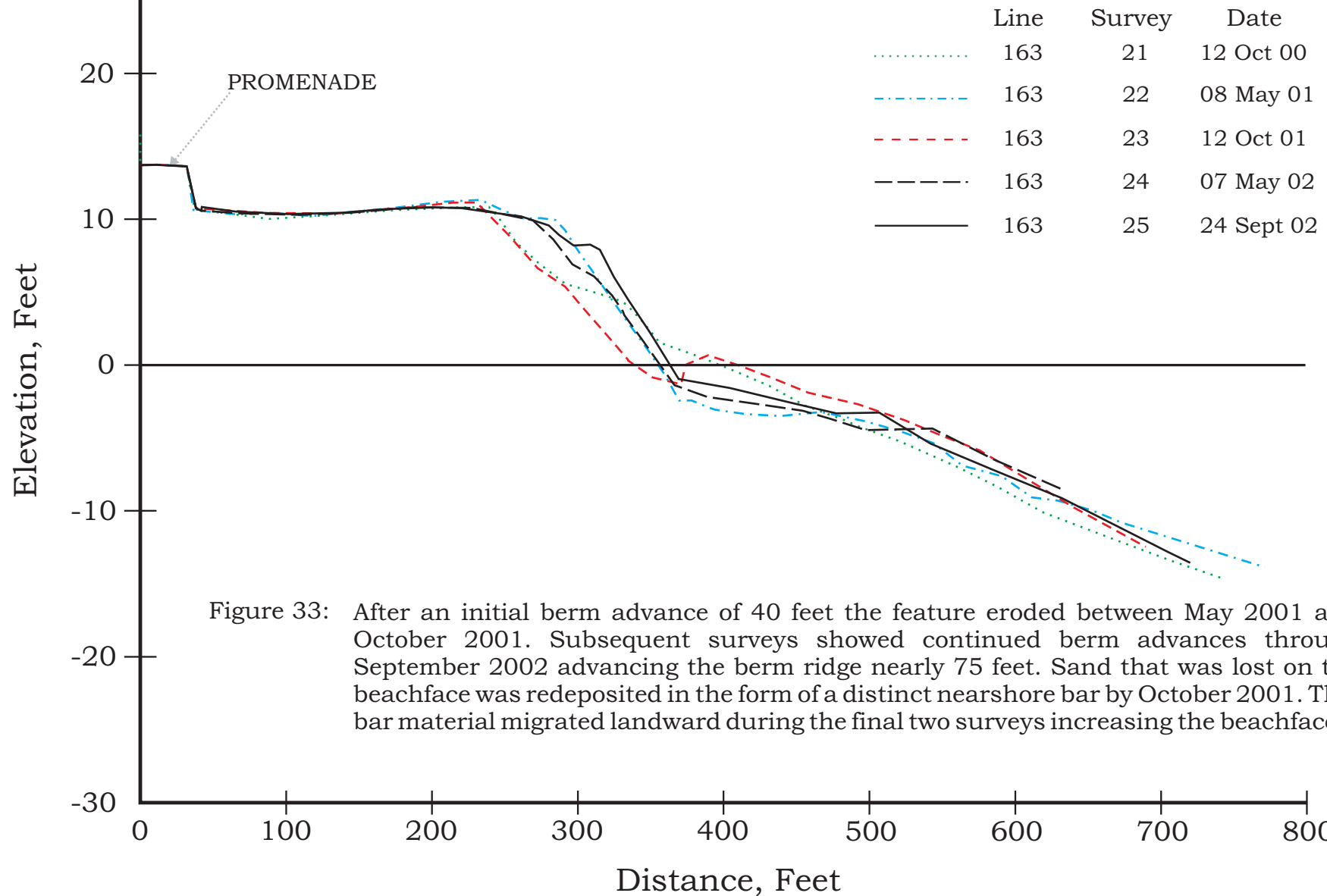
New Jersey Beach Profile Network

#164 - Sylvania Avenue, Avon By The Sea, Monmouth County



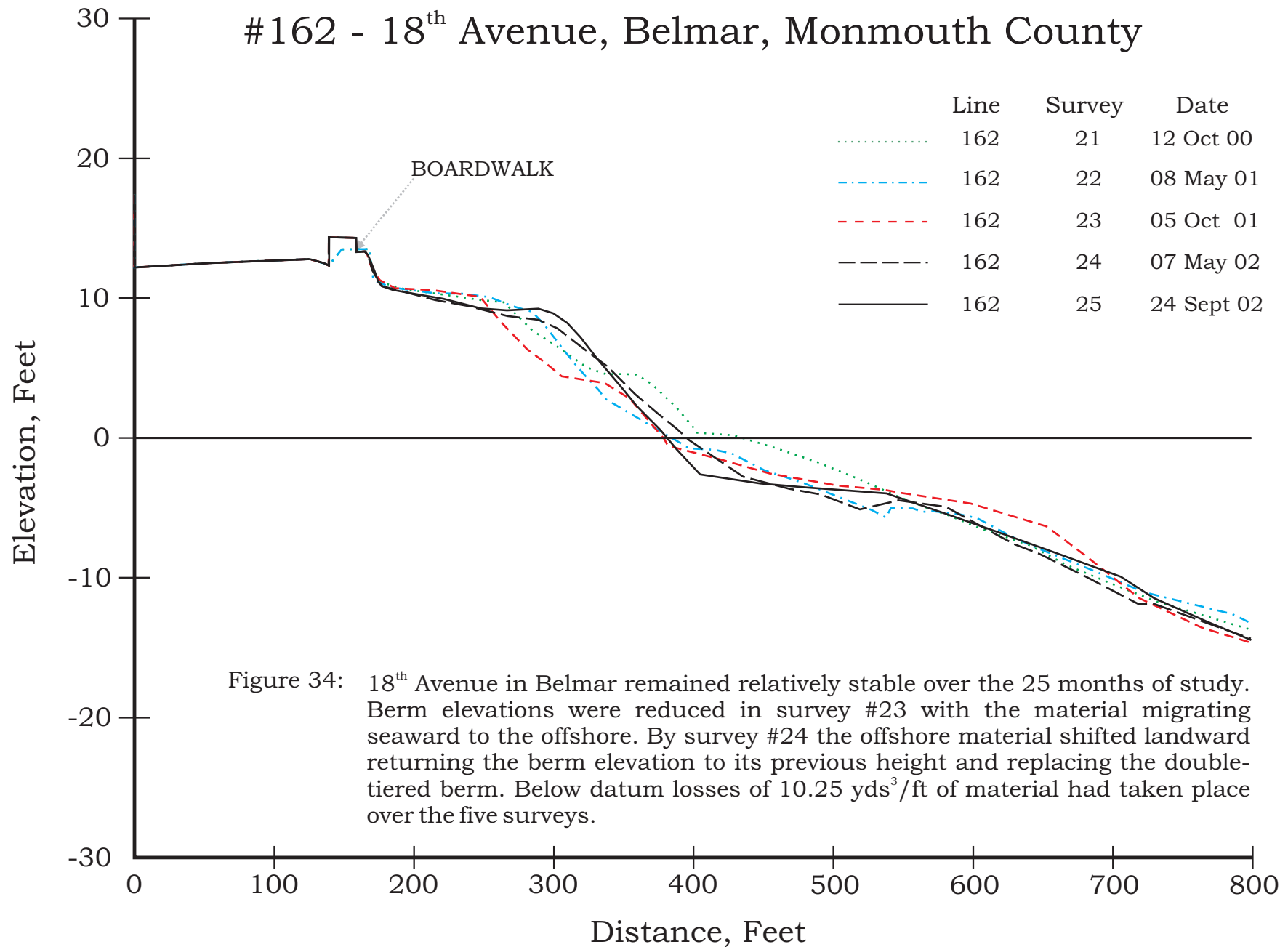
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#163 - 5th Avenue, Belmar, Monmouth County



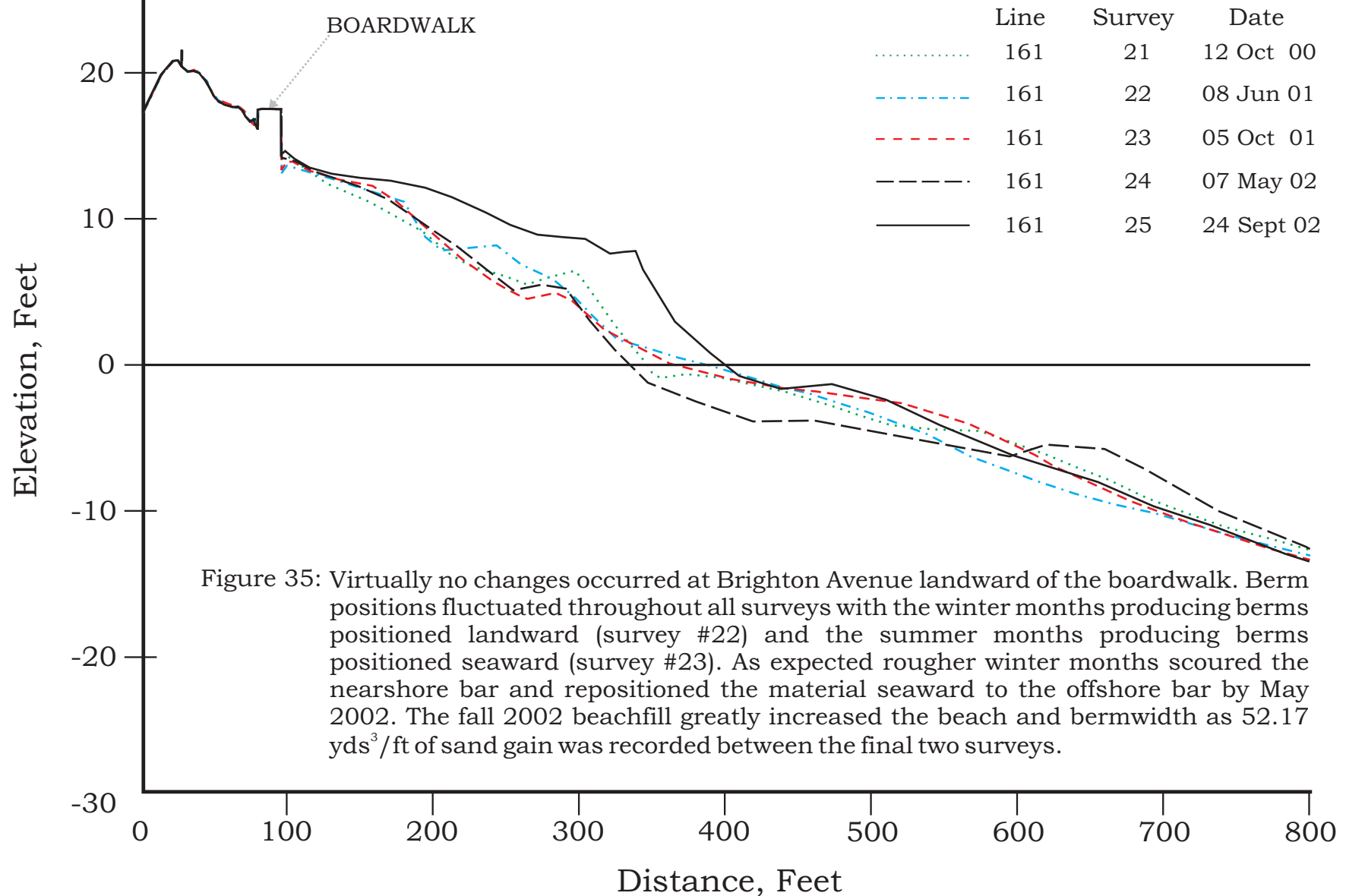
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#162 - 18th Avenue, Belmar, Monmouth County



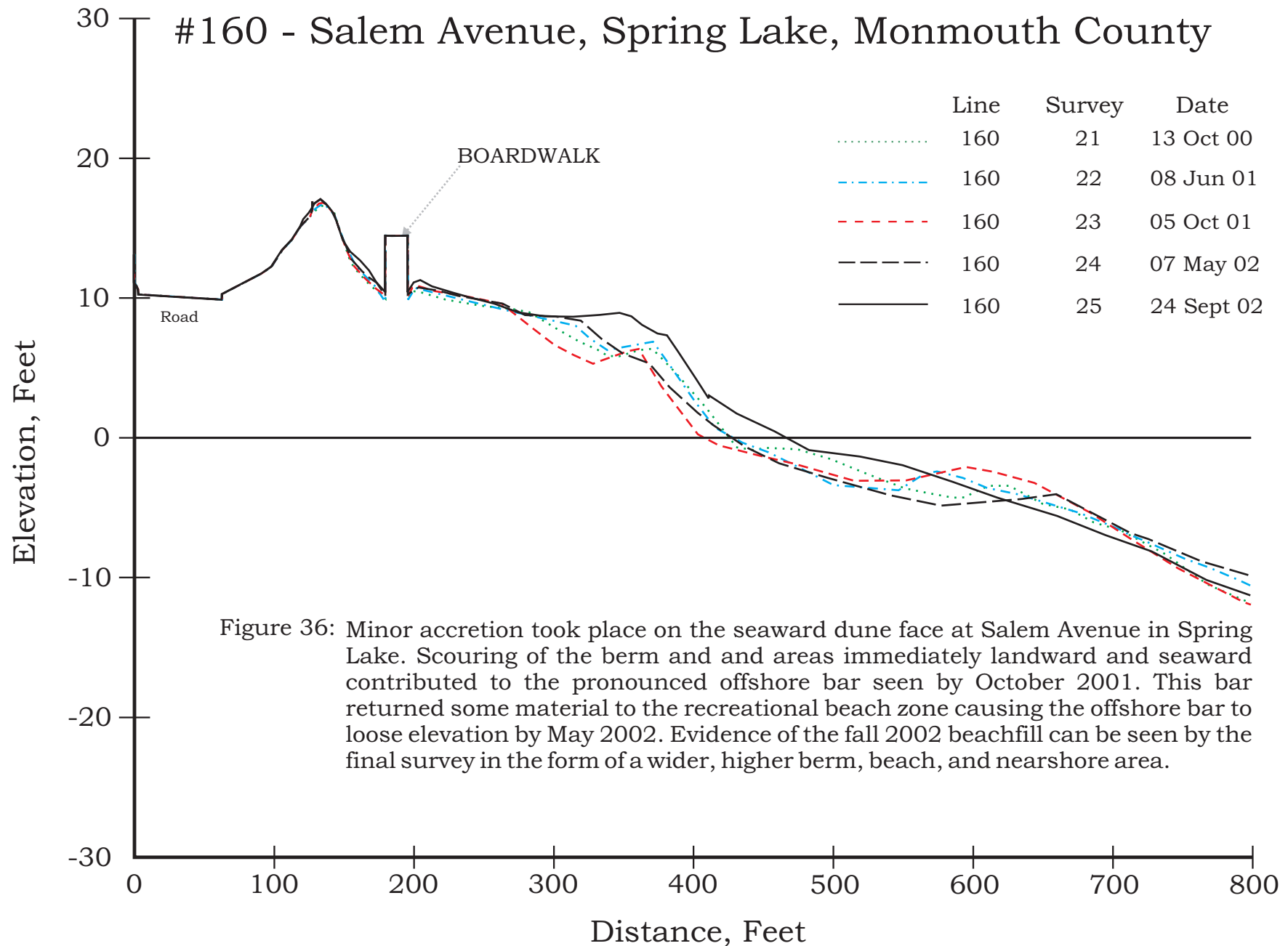
New Jersey Beach Profile Network

#161 - Brighton Avenue, Spring Lake, Monmouth County



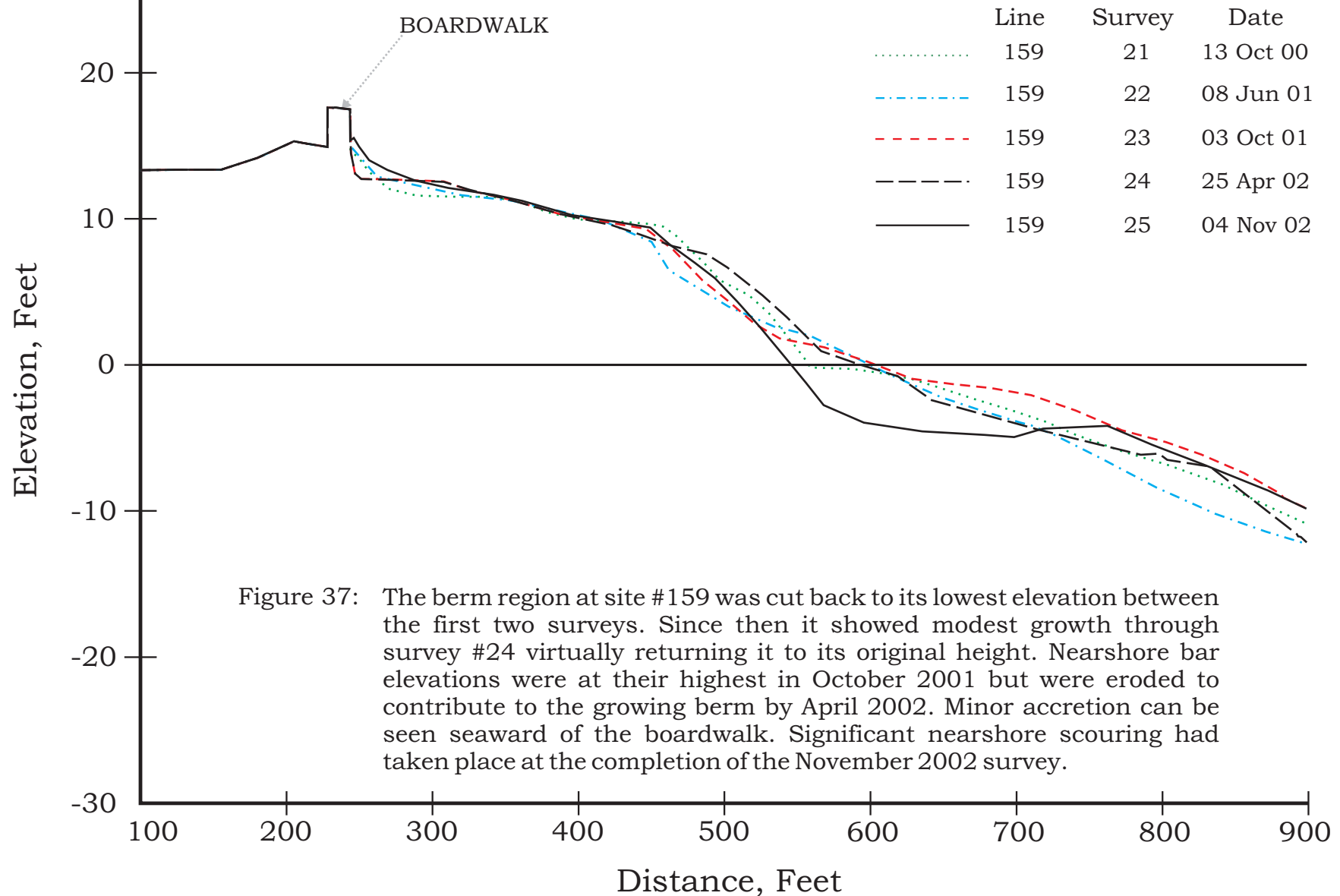
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#160 - Salem Avenue, Spring Lake, Monmouth County



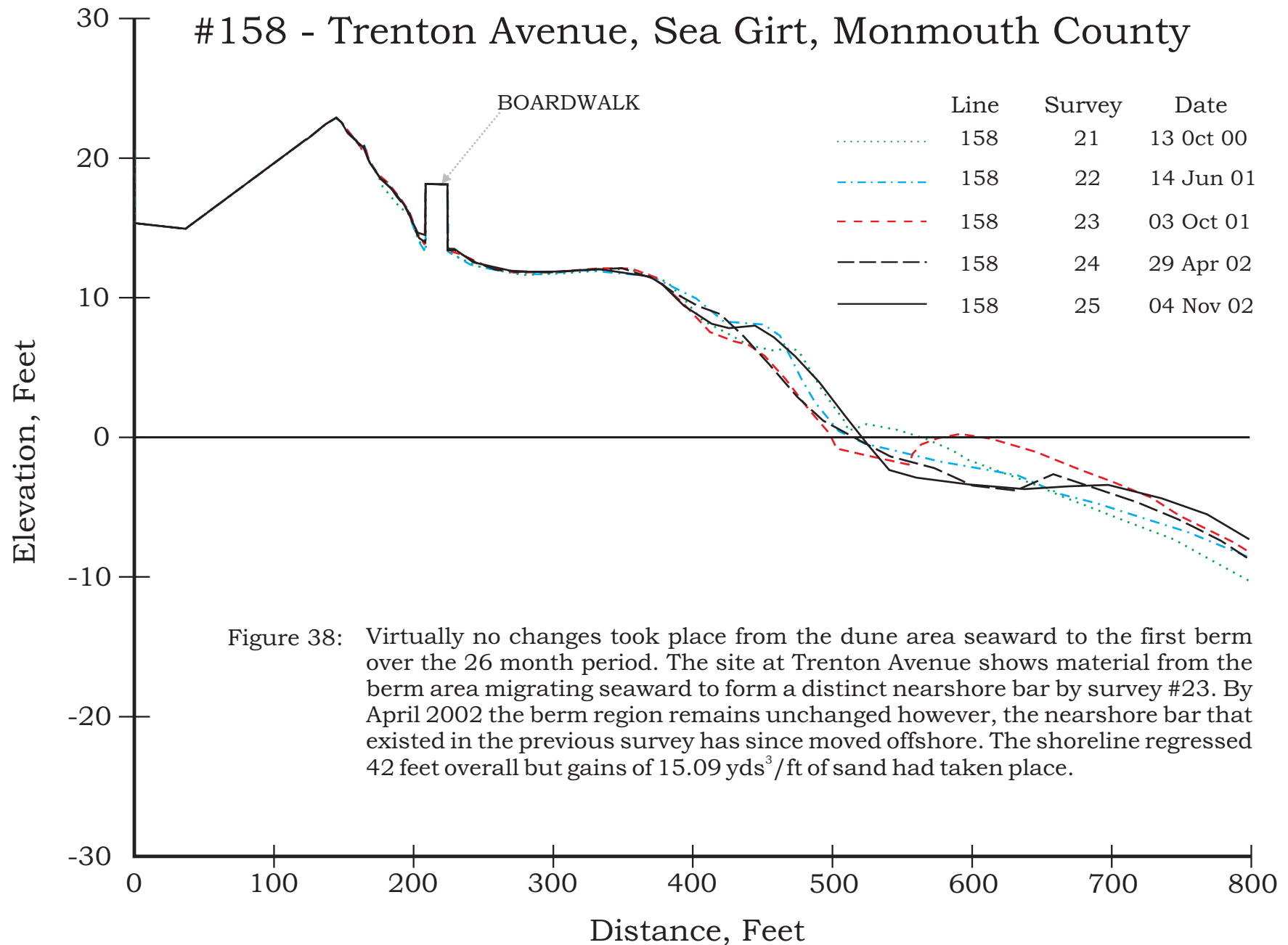
New Jersey Beach Profile Network

#159 - New York Avenue, Sea Girt, Monmouth County



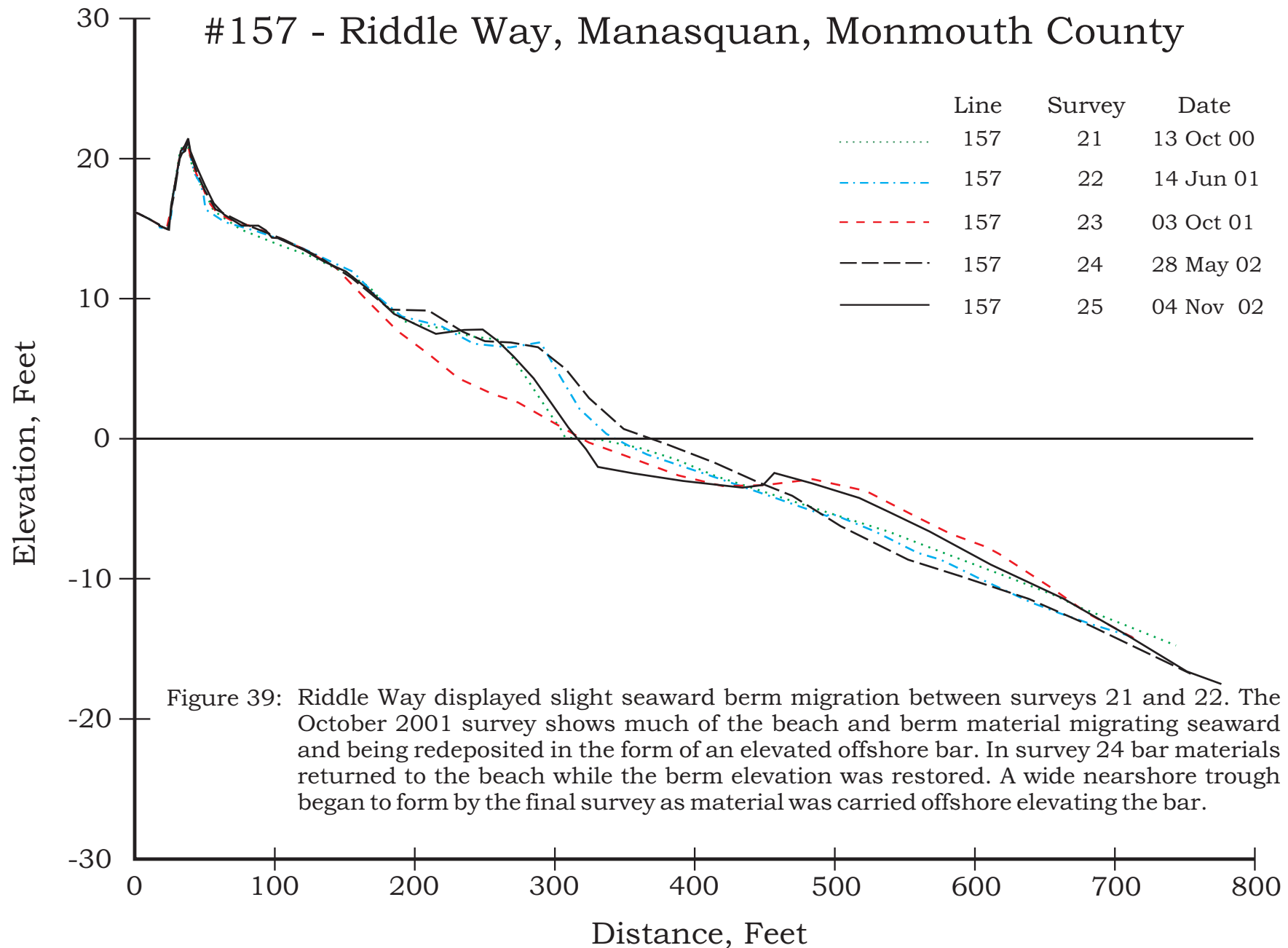
New Jersey Beach Profile Network

#158 - Trenton Avenue, Sea Girt, Monmouth County



New Jersey Beach Profile Network

#157 - Riddle Way, Manasquan, Monmouth County



New Jersey Beach Profile Network

#256 - Pompano Avenue, Manasquan, Monmouth County

