

**2019 ANNUAL REPORT ON
THE CONDITION OF THE MUNICIPAL BEACHES FOR
THE BOROUGH OF STONE HARBOR, CAPE MAY COUNTY, NEW JERSEY**



This view to the north along the 123rd Street survey line presents the most vulnerable segment of the Stone Harbor oceanfront. There were few events of any significance following the summer of 2019 where sand built up on the beach to the toe of the dunes. The same situation appeared last year as minor storms cut back to the dune and generated this scarp. The pilings are installed to mour catamarans each summer. The sand fence installed last spring was destroyed between Labor Day and Oct. 15th. Note the bar offshore and the deposition of sand at the low tide line creating a minor ridge. The last high tide was almost to the catamaran poles.

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March 10, 2020

Contents

Introduction:.....	1
2019 Weather Events.....	1
Beach Monitoring Program Methodology	1
Stone Harbor Engineered Beach Performance	2
Table 1. 18 Months of Beach Sand Volume & Shoreline Changes.....	3
Table 2 Spring to Fall 2019 Sand Volume & Shoreline Changes	4
Table 3 Shoreline & Total Sand Volume Changes Above & Below the Datum May - October 2019.....	5
Individual Site Descriptions SH-82 to SH-123 Figures 1a through 8d.....	5
Summary	22
Stone Harbor Lagoon Surveys.....	22
Figures 9 through 16 Digital Comparison Maps of the Stone Harbor Lagoon Basins.....	23
Conclusions & Recommendations:.....	223

Introduction:

It has been two years since the US Army Corps of Engineers (USACE) conducted the placement of sand on the Borough's beaches between 105th and 123rd Streets. The maintenance sand was provided during the 2nd Periodic Nourishment Cycle that commenced in February 2017 using Hereford Inlet as the borrow source. By March 7, 2017 the total amount placed in the southerly section was 394,000 cubic yards, under the supervision of the Division of Coastal Engineering within the NJDEP. This was because of the continuing issue regarding the Coastal Barrier Resources Act prohibition on expending federal funds to removed sand from a CBRS for adjacent municipal beach nourishment.

In May, repairs commenced in Stone Harbor's north end beaches (80th Street to 105th Street) using Federal Flood Control Coastal Emergency Act (FCCE) funding under the direction of the US Army Corps, because Townsend's Inlet is not a CBRS area. Townsends Inlet was the sand source for approximately 320,000 CY that was placed on the Borough's north end beaches (80th to 105th Streets). Adding these two sand volume totals, the Borough oceanfront received 714,000 cubic yards of additional sand during 2017.

In 2019, the USACE proposed extracting sand from the Stone Harbor dunes that have expanded seaward onto the federal dry beach template in their design for Stone Harbor and push that sand onto the beachface to widen the beach and add protection. After considering the cost per cubic yard moved, the issue in extracting multiple rows of sand fencing and its wire fragments, and the impact on severe storm protection presented in extensive modification of the dunes by moving the sand to the beach, the Borough decided to forgo this project with a view toward seeking Department of the Interior review of the 2013 interpretation of the CBRS statutes and exceptions for moving sand from Hereford Inlet to the Stone Harbor beachfront using Federal funds. This past fall, following a meeting arranged by Congressman Van Drew with municipal officials from Stone Harbor, North Wildwood and Avalon, Secretary David Bernhardt issued a letter rescinding the 2013 legal interpretation prohibiting sand extraction for beach nourishment. However, its implementation remains a question as to the acceptance by all stakeholders, both federal, state and non-governmental environmental advocates.

2019 Weather Events;

The winter of 2018-9 started with three storms in December 2018 (9th, 16th and 21st). While not severe, these events flattened the beach berm and produced erosion in places usually vulnerable to sand loss. January and February 2019 were cold and relatively calm with westerly winds. However, that changed in March (22nd moderate NE storm), April (a longer moderate event 2nd and 3rd) and into May with a mild event on Mother's Day weekend May 12th. Hurricane season saw two Atlantic Ocean storms close enough to NJ to produce large, long period waves for a couple of days, but no direct wind or wave events occurred.

The fall of 2019 produced several very mild days with easterly winds that caused minor beach retreat, but the impact on Stone Harbor beaches was the removal of the pronounced summer beach berm crest and the redistribution of that wedge of sand up onto the back beach or redevelopment of an extensive offshore bar in the customary location about 1,000 feet seaward from the survey reference locations.

Beach Monitoring Program Methodology

The CRC established the Borough's beach monitoring program in June of 1996 to address the shoreline changes along the 13,077 feet of municipal oceanfront beaches. Eight permanent beach profile-monitoring sites were established to gather data initially on a quarterly basis but shifted to a semi-annual survey in 2007. Each profile starts at a fixed reference position behind the dunes, crosses the dunes, beach and extends over 600 feet into the water, ending at a depth of 12-16 feet. Each of the groin compartments or cells along the Borough beachfront contains one profile line. Work continues on the semi-annual monitoring schedule. More recently, the Borough requested monitoring services following the 2016 to 2017 dredging of the municipal bayside lagoons to improve navigation for all lagoon frontage owners and other users. This work involved repeating some of the

lagoon traverse transects used by the contractor after dredging was complete to prove quantities of sediment removed for payment. The CRC has repeated these transects for the past three years to determine where and if sedimentation is affecting overall navigability. This year we have attached the lagoon analysis review to this report to combine both in one document.

The following is a list of the profile locations:

◆ SH-82	82 nd Street	Border with Avalon – 84 th St. groin
◆ SH-90	90 th Street	84 th St. groin – 92 nd St. groin
◆ SH-95	95 th Street	92 nd St. groin – 98 th St. groin
◆ SH-103	103 rd Street	98 th St. groin – 106 th St. groin
◆ SH-108	108 th Street	106 th St. groin – 111 th St. groin
◆ SH-112	112 th Street (paper street)	111 th St. groin – 114 th St. groin
◆ SH-116	116 th Street	114 th St. groin – 122 nd St. groin
◆ SH-123	123 rd Street (paper street)	122 nd St. groin – terminal groin

Surveys Completed

The CRC completed three surveys between November 2018 and October 2019:

- ◆ **Survey 53** represents a full dune, beach and nearshore survey at all sites for fall 2018 (November).
- ◆ **Survey 54** represents a full dune, beach and nearshore survey at all sites for May 2019.
- ◆ **Survey 55** represents a full dune, beach and nearshore survey at all sites for October 2019.

Stone Harbor Engineered Beach Performance

Tables 1 and 2 provide shoreline and volume change information for each of the ocean beach profile locations within the Borough of Stone Harbor. Shoreline changes were calculated by comparing the zero datum positions for the 2018-2019 monitoring period. Sand volume changes across the length of the survey line were determined for each individual profile site by computing the cut and fill cell changes in the profile with the previous survey or, were calculated from the annual surveys. These values are expressed in cubic yards of sand per linear foot of beachfront (yds³/ft.). The total beach volume change is calculated using this value. The distance (cell width) between groins along the beachfront of Stone Harbor was measured between the centerlines of adjacent groins. Each cell’s net sand volume change is determined by multiplying each cross-section volume change by its corresponding groin cell width.

Table 1 represents 18 months of changes in shoreline position and across profile volume changes (June 2018 [Survey 52] to November 2019 [Survey 55]). This longer interval was thought to illustrate change to include the entire winter of 2018 – 2019 since the last beach nourishment completed in 2017. These changes cover the dunes, the ocean beach and the bar system offshore to approximately 800 to 1,000 feet from the water’s edge.

Table 1
Stone Harbor
June 2018 (#52) to November 2019 (#55)
18 Months of Shoreline and Profile Sand Volume Changes

Profile Number	Shoreline Change (feet)	Volume Change (yds³/ft)	Cell Distance (feet)	Cell Volume Change (yds³)
SH-82	-4	11.08	1,381	15,300
SH-90	-19	2.09	2,240	4,682
SH-95	23	-0.44	1,680	-743
SH-103	-18	-1.02	2,208	-2,252
SH-108	0	15.96	1,433	22,875
SH-112	-11	-15.25	804	-12,264
SH-116	10	-3.17	2,273	-7,215
SH-123	33	-5.60	1,058	-5,929
Total Volume Change =				14,454

Since the completion of the emergency fill in 2013 that added 674,224 CY of sand, the annual sand volume losses from the Borough's ocean beaches and nearshore were: -188,886 CY (2013-2014), -305,672 CY (2014-2015), and -292,889 CY (2015-2016), +827,448 (2016-2017, NJ & USACE fill), yielding a net change over 5 years of +40,001 cubic yards. The first winter (2017 – 2018) since the most recent fill produced a net change of -46,562 cubic yards. That generated a post-Sandy recovery volume of just 6,561 cubic yards across the entire oceanfront. This table shows that during the last 18 months 14.454 cubic yards of sand were added, bringing the net gain up to 21,015 cubic yards.

Table 1 shows that 5 of 8 beaches lost sand while the remaining 3 gained material. The largest gains occurred at 82nd, decreasing at 90th, then positive again at 108th Street. The net losses were relatively small across the remaining five sites, with 112th Street producing the largest sand volume loss. The 112th Street loss occurred offshore (-14,051 yds³/ft. as opposed to a loss of just 1.203 yds³/ft. in the dunes or on the beach). This table shows that the municipal oceanfront is quite stable under the prevailing conditions over the past couple of years.

Table 2 provides the changes that occurred between May and October 2019. All but two sites gained sand between May and October with the largest gains occurring between the Avalon boundary and 108th Street. The two loss sites were in single digits making this time period one of extreme sand accumulation for a period without any added material obtained from borrow sites.

Table 2
Stone Harbor Semi-Annual Survey
May 2019 (#54) to October 2019 (#55)
Shoreline and Total Sand Volume Changes

Profile Number	Shoreline Change (feet)	Volume Change (yds³ / ft)	Cell Distance (feet)	Cell Volume Change (yds³)
SH-82	22	17.65	1,381	24,375
SH-90	-2	11.32	2,240	25,355
SH-95	63	5.55	1,680	9,329
SH-103	30	11.89	2,208	26,262
SH-108	-12	8.52	1,433	12,202
SH-112	14	-2.61	804	-2,099
SH-116	16	0.57	2,273	1,287
SH-123	15	-8.38	1,058	-8,862
Total Volume Change =				87,848

The semi-annual comparison (Table 2) indicates that between May and October 2019 Stone Harbor's oceanfront beaches gained 87,848 cubic yards of sand in 5 months. This is a nice improvement over last year's net loss of over 47,000 cubic yards. On closer inspection of each cross section one finds that the May survey (#54) found that every profile had accumulated a ridge of sand as a pronounced berm deposit raising the beach elevation and making the seaward slope steeper. However, by October (#55) that berm was gone, the beach slope returned to the slope present the previous fall and spring, while extensive deposition had occurred offshore building a significant bar system at every site. The computer can calculate the sand volume change between profile dates above and below the zero-elevation datum (0 feet NAVD 1988). Below, Table 3 is a comparison of these changes for the oceanfront both above and below the zero elevation on the beach.

Each transect was examined for sand volume changes between May and October 2019 above the zero elevation point versus changes below that elevation. The left table shows changes seen on the beach and dunes where the berm built by May 2019 eroded away allowing sand to deposit offshore. The beach/dune portion of each profile comparison was negative between 3 and 13 cubic yards of sand per foot of shoreline in the 8 groin cells. The offshore portion of each profile (right table) compared positively between 5 and 22 cubic yards of sand gained per foot of shoreline in the groin cells. About twice as much sand appeared offshore as was eroded from the municipal beaches (the dunes were unaffected by these losses).

Table 3
Stone Harbor Semi-Annual Survey
May 2019 (#54) to October 2019 (#55)

Shoreline and Total Sand Volume Changes Above & Below the Zero Elevation Datum

Profile Number	Shoreline Change (feet)	Volume Change (yds ³ /ft)	Cell Distance (feet)	Cell Volume Change (yds ³)	Profile Number	Shoreline Change (feet)	Volume Change (yds ³ /ft)	Cell Distance (feet)	Cell Volume Change (yds ³)
SH-82	22	-4.69	1,381	-6,471	SH-82	22	22.34	1,381	30,846
SH-90	-2	-8.56	2,240	-19,183	SH-90	-2	19.88	2,240	44,538
SH-95	63	-6.91	1,680	-11,609	SH-95	63	12.46	1,680	20,938
SH-103	30	-3.30	2,208	-7,280	SH-103	30	15.19	2,208	33,542
SH-108	-12	-7.47	1,433	-10,697	SH-108	-12	15.98	1,433	22,898
SH-112	14	-7.90	804	-6,350	SH-112	14	5.29	804	4,251
SH-116	16	-8.60	2,273	-19,552	SH-116	16	9.17	2,273	20,839
SH-123	15	-13.10	1,058	-13,861	SH-123	15	4.72	1,058	4,998
Total Volume Change =				-95,004	Total Volume Change =				182,849

This presented a question of where the approximately 90,000 new yards of sand came from? There are two possibilities; 1) from further offshore? Probably some did, since each ending point on the October 2019 surveys is lower in elevation than earlier surveys, sand did move landward adding to the bar system surveyed. 2) Littoral transport from Avalon’s beaches? Definitely possible, since the offshore sand volume changes listed from north to south in Stone Harbor quantitatively decrease downward to the 123rd Street site. The Avalon cross sections south of 35th Street in Avalon all added or lost sand volumes in amounts at or below 1.0 yds³/ft. until the 78th Street profile which gained 7.7 yds³/ft. (all offshore). The conclusion is that Avalon’s sand supply, mostly in the offshore region migrated south along the coastline into Stone Harbor to the community’s benefit in the second half of 2019.

Individual Site Descriptions:

This section describes the changes documented at each of the beach profile locations from late May 2018 to October 2019. All the sites are located within the Federal shore protection project limits that received sand during the February-March 2017 (105th to 123rd Streets [federal \$]) or May-June 2017 (80th to 105th Streets [NJ State \$]) fill activities. No fill was provided to Stone Harbor during the 2019 maintenance work which was completed in Avalon.

SH-82 is located at 82nd Street along 1st Avenue and seaward of the 82nd Street recreation area. The profile line is set approximately midway between the Avalon border and the groin at 84th Street. This site is included in the Borough’s monitoring program to represent typical beach conditions on the Borough’s only stretch of beach without a groin (in the northern section of the community). The profile is located about 800 feet south of the Avalon border and about 1,350 feet south of the USACE federal project taper. This site consists of 200 feet of primary dune width seaward of the asphalt promenade that is set on top of the revetment from its landward offset at 83rd Street to 80th Street.

Over the past year, the dune remained stable, though with a steep seaward dune face. A sizable beach berm developed by late May as sand moved toward land over the summer. Erosion of the berm by October was the result of mild, early fall northeast storms pulling sand off the beach and rebuilding the offshore bar system clearly present in the plot for survey #55 in Figure 1d.

Site SH-82 – 82nd Street (Photos 1a-1c)



Photo 1a – Photo taken November 8, 2018, this was a year plus the summer after the federal/state project was completed.



Photo 1b - Photo taken May 28, 2019 following a series of mild northeast storms ending May 13th. No damage was seen at the dunes where the fencing installed is two thirds buried.



Photo 1c – Photo taken on October 14, 2019, looking north along the high tide line after the summer berm was eroded flat by northeast waves.

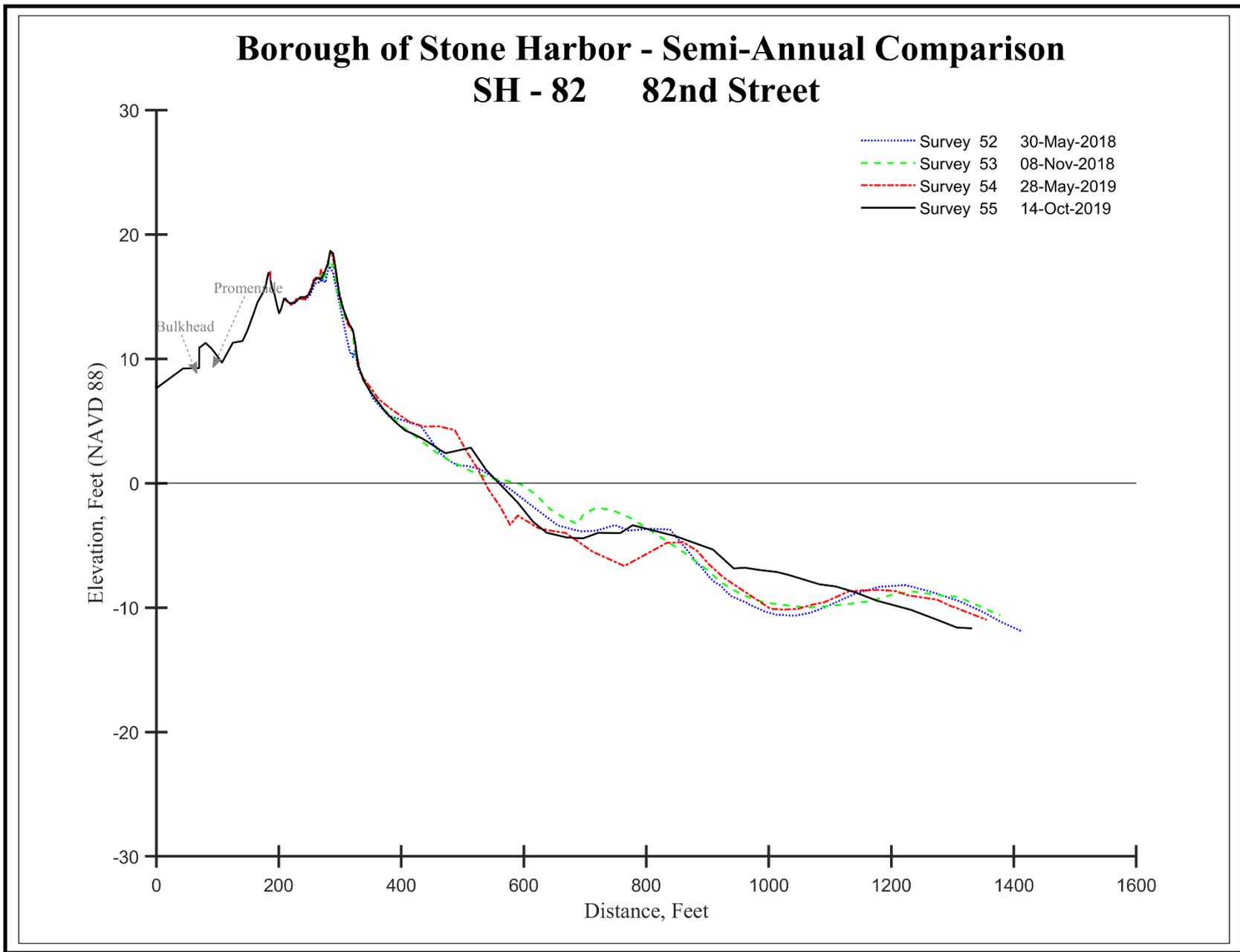


Figure 1d. The profile cross sections show the changes starting a year since the latest beach restoration took place. The berm developed by May 2019, then eroded back to generate a uniformly seaward sloping beach by October 2019, along with the growth of a significant bar offshore. The beach retreated 4 feet landward as a small berm was redeveloping, but the sand volume increased by 11.08 yds³/ft. The May to October 2019 sand volume gain was 17.65 yds³/ft., making the last 5 months the most accretional interval.

SH-90 is located at 90th Street and was originally established in 1986 as a survey site for the New Jersey Beach Profile Network (NJBPN). The profile line is set north of the public beach access path to provide a typical cross-sectional representation of the dune and beach that is bounded by groins at 84th Street and 92rd Street. The dune system consists of two ridges approximately 150 feet wide extending from the street end revetment to the seaward dune toe.

This location developed a significant summer berm by late May, as offshore sand moved landward from the bar system. Early fall northeast activity flattened the berm to prior beach slopes and built a massively enhanced bar 1,000 feet seaward from the reference point.

Site SH-90 – 90th Street (Photographs 2a-2c)



Photo 2a – Photo taken November 8, 2018 shows some loss of recent fence, but no dune damage.

Photo 2b - Photo taken May 28, 2019 as summer began. Grass is beginning to migrate seaward onto the beach.



Photo 2c - Photo taken October 14, 2019 shows substantial dune growth in spite of early winter storm waves reaching the toe of the dune.

Borough of Stone Harbor - Semi-Annual Comparison SH - 90 90th Street

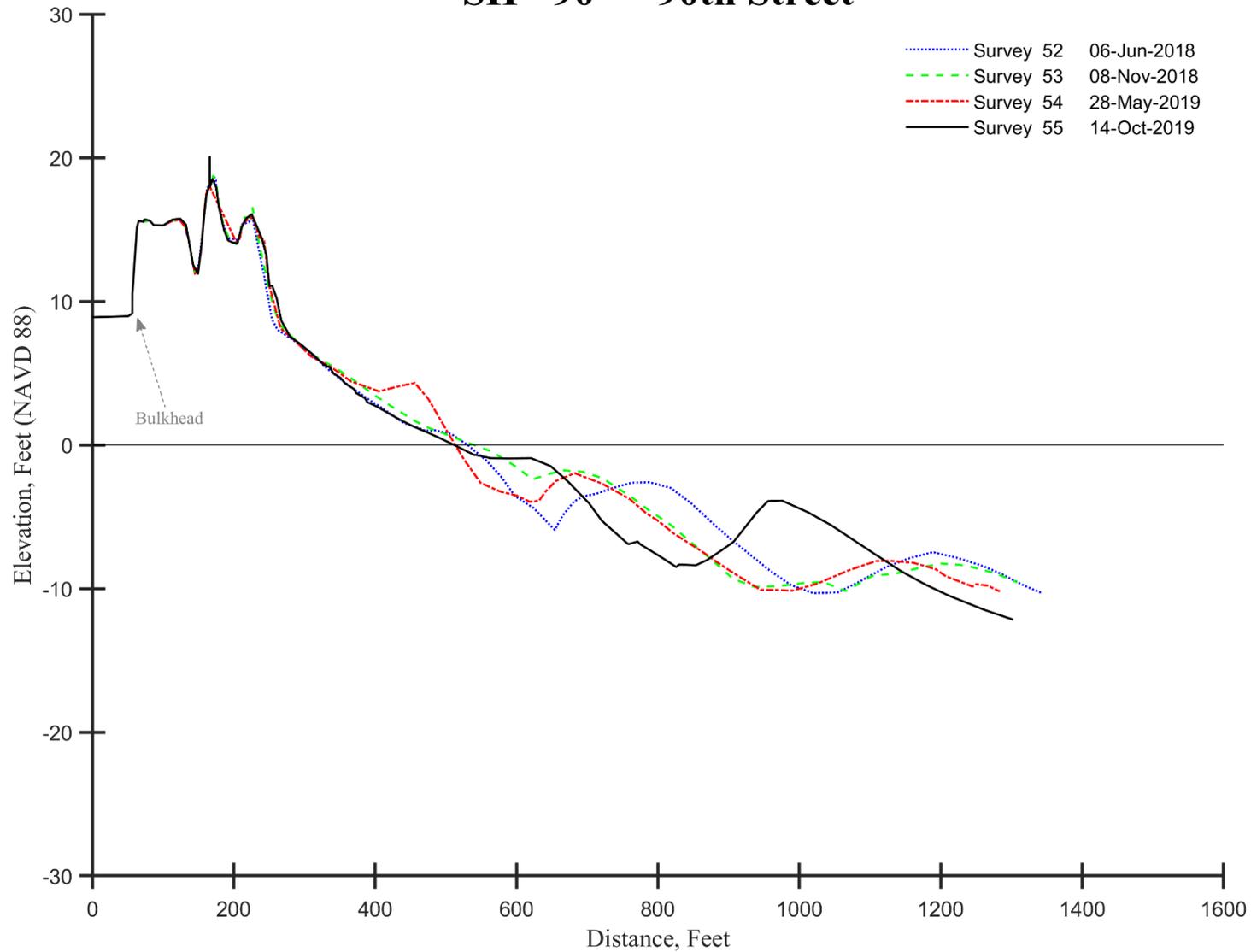


Figure 2d. The cross sections show minor additions to the dune and the May 2019 berm development. The beach slope returned to previous slopes by October 2019, while a very large offshore bar appeared at the 1,000-foot distance. The 18-month sand volume gain was 2.09 yds³/ft. (11.32 yds³/ft. May to October 2018) and the shoreline retreated 19 feet.

SH-95, the 95th Street site was established along the north side of 95th Street and the beach access path. The profile line crosses the municipal parking lot, a wooden bulkhead, access ramp and dune located just north of the municipal beach observation platform. The dune system is essentially a single ridge that extends seaward 140 feet from the street end revetment to the seaward dune toe with a crest elevation of 15 feet NAVD88.

The annual change at this site was positive in the amount of 23,515 cubic yards of sand added to the groin cell accompanied with a 39-foot shoreline advance. The summer season saw small sand volume gains 3,558 cy across the cell, but with a 22-foot shoreline retreat. The steeper beach as summer's end was the cause, not erosion.

Site SH-95 – 95th Street (Photoplates 3a-3c)



Photo 3a - Photo taken November 8, 2018 shows the dune crosswalk onto the beach looking south.



Photo 3b – The May 28, 2019 photo shows the same perspective with the seasonal trash cans installed. A sizable berm had been established at summer's start.



Photo 3c – The photo taken October 14, 2019 shows a height over the access walkway that includes the dune and the beach to the south.

Borough of Stone Harbor - Semi-Annual Comparison SH - 95 95th Street

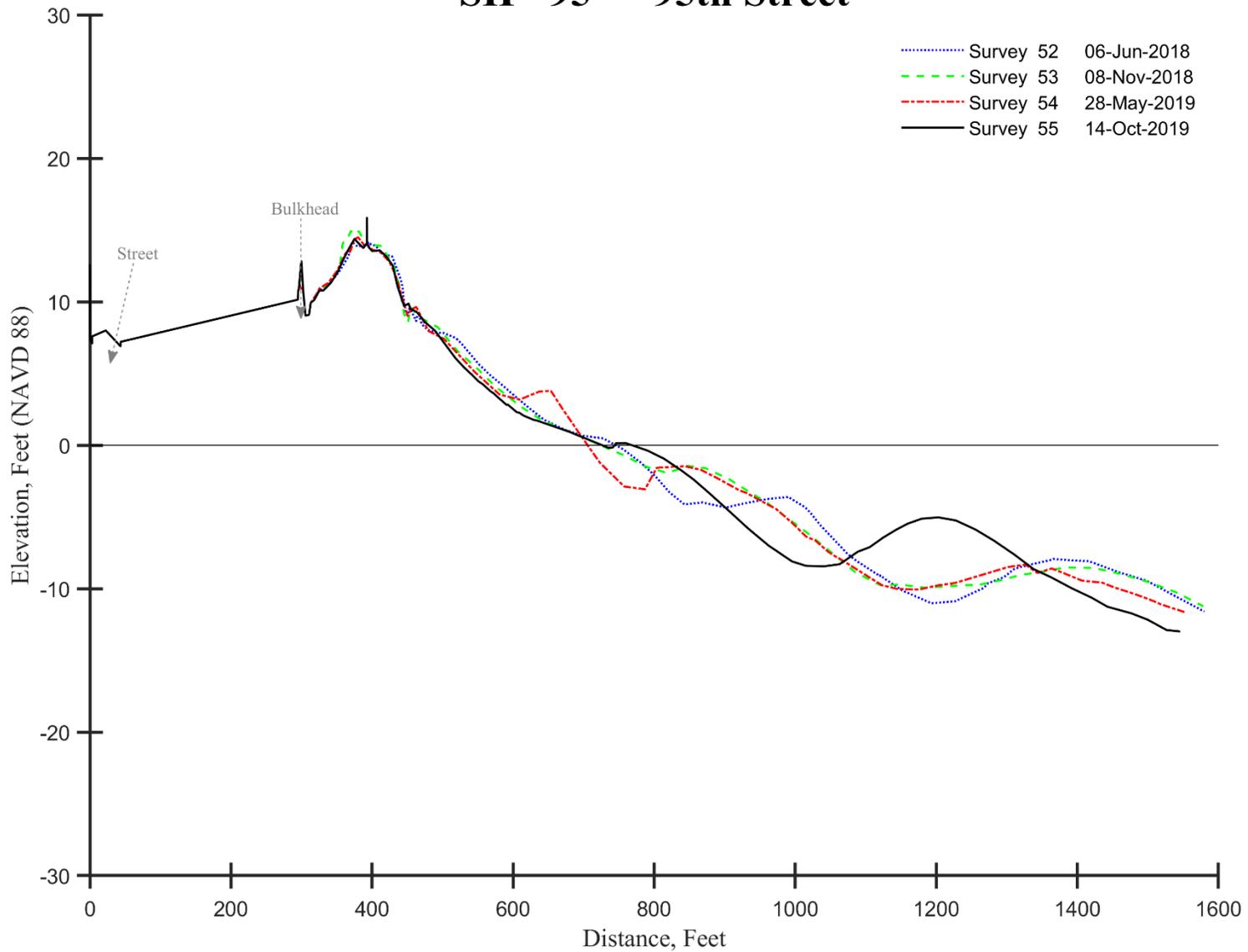


Figure 3d. The dunes and upper beach area saw little change in the past 18 months, but the same berm growth by May 2019 followed by its removal by October 2019 and the appearance of a very large offshore bar at the 1,200-foot distance required attention as to its cause. The site lost 0.44 yds³/ft. since May 2018 accompanied by a 23-foot shoreline advance.

SH-103 is located at 103rd Street was established for the Borough’s beach monitoring program at the seaward end of 103rd Street along the north sidewalk. In 2003 the initial Federal project enhanced the width of both the dune and beach that had vanished by 1998 as a result of long-term erosion. Several subsequent projects have been required to provide periodic beach maintenance that included the 2009 state/municipal project, the spring/summer 2011 federal project, the summer 2013 Hurricane Sandy emergency beach fill, and the recent work in 2017.

A modest beach berm developed by late May 2019 as a result of bar accretion at the water’s edge with subsequent attachment to the beachface. In fact, the October 2019 survey found a repetitive sand bar about to reach the low tide shoreline as of the 14th.

Site SH-103 – 103rd Street (Photoplates 4a-4c)



Photoplate 4a - Photo taken November 8, 2018 showing sand fencing partially buried and a fairly wide beach.



Photoplate 4b - Photo taken May 29, 2019 shows the added pedestrian walkway fence and the dune toe looking south.



Photoplate 4c – Photo taken October 14, 2019 showing sand continuing to fill the 4-foot high snow fencing creating a new foredune. The beach width was sufficient to provide the supply.

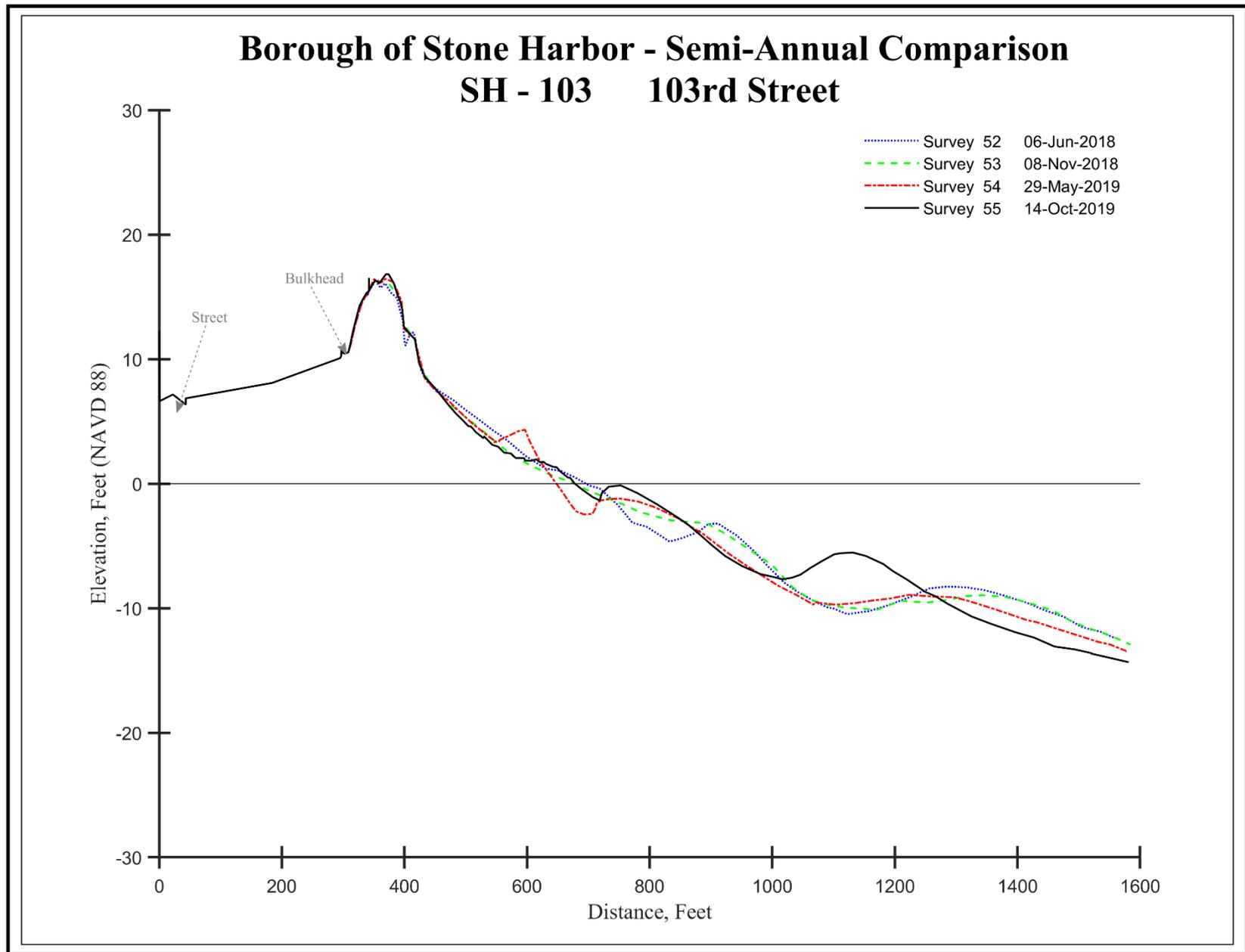


Figure 4d. The cross sections at 103rd Street show the same pattern of berm development by May 2019 followed by its erosion by October 2019. There was a nearshore bar about to attach to the beachface in October as well. The same pattern of a large offshore bar appearing added sand to that part of the system. The net change was a loss of 1.02 yds³/ft. over the past 18 months accompanied by an 18-foot shoreline retreat. The site did gain 11.89 yds³/ft. and a 30-foot shoreline advance May to October 2019.

SH-108 is located at the end of 108th Street and was placed near the middle of the groin cell. This site shares a history similar to site SH-103. Sand was placed here during the 1998 municipal beach fill that re-established a dry beach and dune ridge. In 2003, the initial Federal project enhanced the width of both the dune and beach. Post Hurricane Sandy beach fill commenced in 2013 to cover erosion from the previous storms, but the site showed repeated volume losses since the 2013 fill.

The February-March beach fill significantly increased the berm elevation from its October 2016 position. A broad summer beach berm appears in the May survey with added material in a nearshore bar that, by chance, was duplicated in the October 2019 survey. The beachface itself remained constant in place and slope.

Site SH-108 – 108th Street

(Photoplates 5a-5c)



Photoplate 5a – The November 8, 2018 photo shows the proximity of the high tide to the dunes on a narrow beach.

Photoplate 5b – The photo taken May 29, 2019 shows new dune plants within the accumulation of sand at the newest fence line. The summer berm has created a wider beach.



Photoplate 5c – Photo taken October 14, 2019 shows the wet-dry line on the beach about 30 feet from the dune toe following the erosion of the summer berm. Waves can be seen breaking on the bar just offshore.

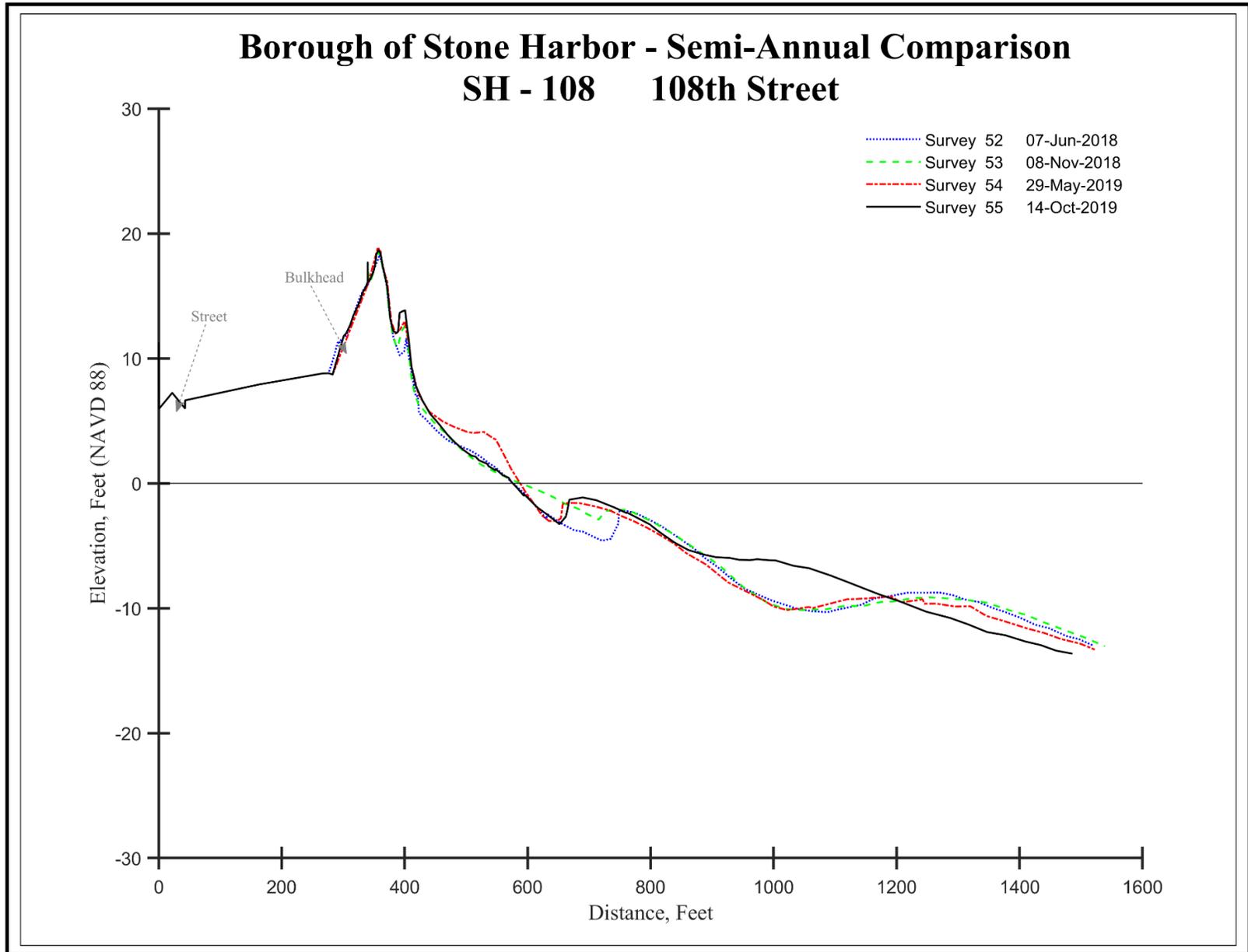


Figure 5d. The cross sections show dune development at the seaward fencing creating a new foredune. The May 2019 berm was quite pronounced along with multiple occasions where nearshore bars attached to the beach. Sand filled a trough offshore without generating a pronounced bar system here. The site gained 15.96 yds³/ft. with no change in the shoreline position over 18 months.

SH-112 is located on the open lot adjacent to the Villa Maria Catholic retreat that occupies the paper location of 112th Street. The profile line extends landward to a reference location along 2nd Avenue. An open grass lot occupies the city block between 2nd Avenue and the wooden bulkhead revetment. The wooden revetment runs parallel to the beach the entire length of the Borough along the oceanfront property lines and seaward street ends. The bulkhead is significantly offset landward at 111th Street, providing additional area for dune development to occur naturally. As a result, the width of the primary dune was nearly 200 feet from the bulkhead to the seaward dune toe. This location has a very significant primary dune largely due to the limited oceanfront development on this parcel. Occupied by the Catholic Church as a retreat for over a century, the site has no structures directly at the landward dune toe. The dunes spill over the bulkhead and occupy most of the original dry beach that existed prior to the USACE project in 2004. This site was the focus of the 2019 dune sand extraction proposal rejected by Borough Council this year.

A significant summer berm appeared on the late May profile as sand moved landward from the offshore bar system. By October 2019, the berm was gone and the beach slope had returned to previous conditions on the plots.

Site SH-112 – 112th Street

(Photoplates 6a-6c)



Photoplate 6a – The November 8, 2018 photo shows the accreting foredune with new natural plants springing up seaward of the rows of plants added in 2017.

Photoplate 6b - Photo taken May 28, 2019 a year after the rows of new plants were added and after the fence captured abundant wind transported sand as a foredune.



Photoplate 6c – Photo taken October 15, 2019 overlooking the accreting foredune encroaching onto the planted project dune slope with its neat rows of grass established. The fencing is buried with new sand from the beach that is colonized quite densely. The beach is quite narrow after early storms.

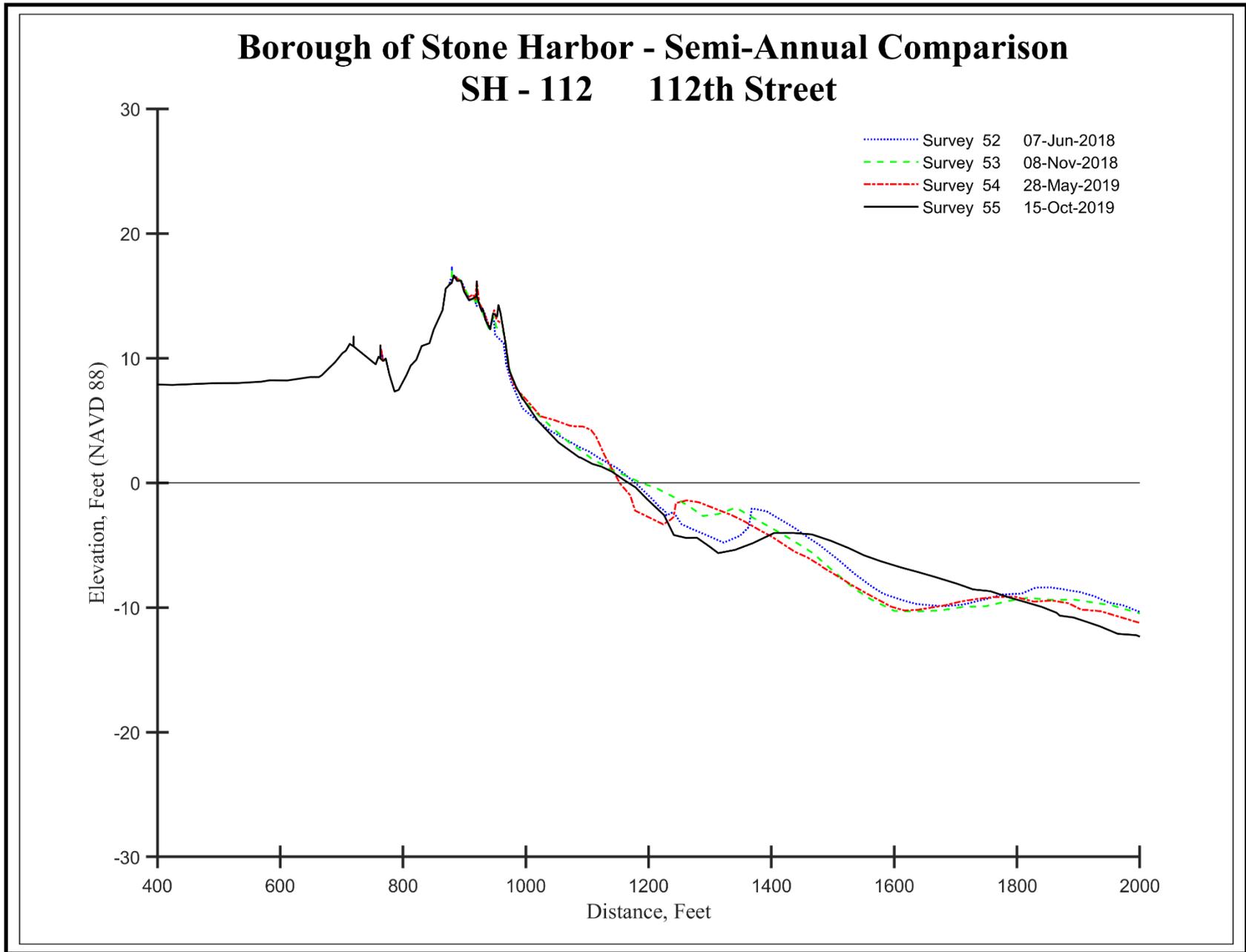


Figure 6d. The profiles at 112th Street lost the most sand over the past 18 months (-15.25 yds³/ft. and the shoreline retreated 11 feet). The May to October 2019 time interval produced a small decline in sand volume (-2.61 yds³/ft. with a 14-foot shoreline advance).

SH-116 is located along the west side of 2nd Avenue and 116th Street. Seaward of the bulkhead at 116th Street is the best-established natural dune system in the Borough. A landward offset in the bulkhead just north of this site produced the area on which this dune developed, sheltered from storm overwash by the 114th Street groin and the bulkhead offset to the west. The dune system consists of two distinct ridges with a combined width of nearly 300 feet from the street end bulkhead to the seaward dune toe with a crest elevation of 16.5 feet NAVD88.

This expanse was also on the block for sand extraction from the dunes in 2019. The pattern of berm development in May followed by its loss by October and sand transfer offshore to the bar system continued to this site.

Site SH-116 – 116th Street

(Photoplate 7a-7c)



Photoplate 7a - Photo taken November 8, 2018 shows a well-established dune with material adding to the fencing.

Photoplate 7b – Photo taken May 28, 2019 showing continued sand deposition around the fencing and a wide beach seaward .



Photoplate 7c – Photo taken October 15, 2019 finds the fencing placed in 2017 completely buried and luxuriant dune grass growing across the feature created since the fence was built.

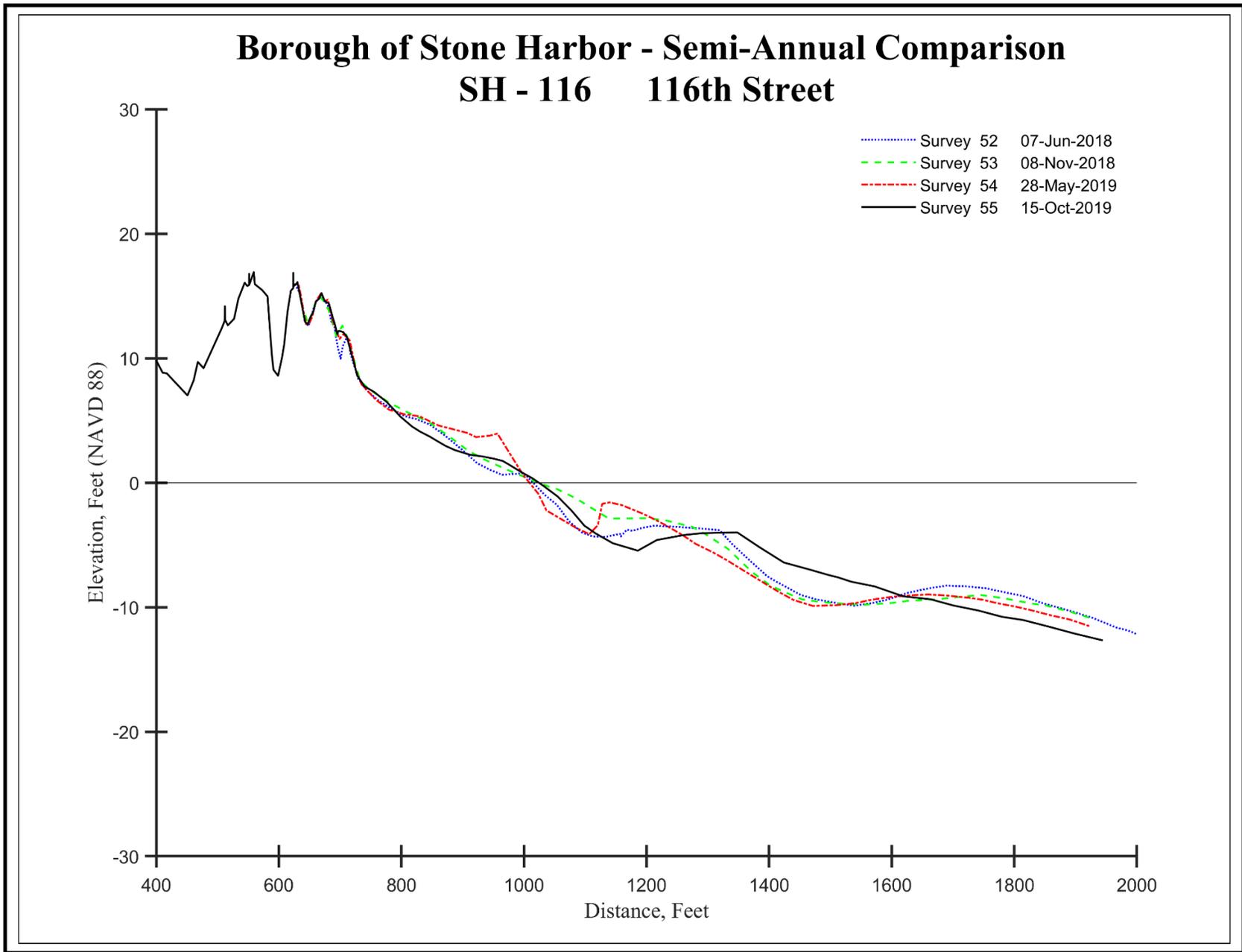


Figure 7d. The 116th Street location includes a double dune system which appears to have developed a new foredune peak adding to the dune volume. The beach produced a berm by May 2019 which was derived from the attachment of nearshore bars during the summer. This site lost 3.17 yds³/ft. over the past 18 months as the shoreline advanced 10 feet seaward.

SH-123 is located at 123rd Street south of the developed part of town and just north of the terminal groin originally constructed by the Philadelphia District of the U.S. Army Corps of Engineers. The profile reference marker is located in a dense stand of bayberry west of a vehicle access path to the Hereford Inlet terminal groin. This site has benefited tremendously since the completion of the initial USACE project both from direct sand placement and from longshore currents that have carried a substantial volume of sand shed from the northern project beaches south toward South Pointe. The result has been a larger dune system that completely buries the revetment that was once exposed along this beach and the formation of an expansive sand spit that stretches over a mile from the terminal groin into Hereford Inlet.

This year the site saw the largest of the summer beach berms built all the way to the dune toe as of May 29, 2019. Another small bar was poised to attach to the beach as well. This was also the only location to feature a fall seasonal beach ridge attach to the beachface as of October 15, 2019. The remaining offshore bar was closer than others to the beach as well.

Site SH-123 – 123rd Street

(Photoplate 8a-8c)



Photoplate 8a - Photo November 8, 2018 with the storm damage to the dune still evident. Storm high tide waves can easily reach the dune toe along this reach.



Photoplate 8b – Photo taken May 29, 2019 after sand reformed a berm at the dune toe and fencing was reinstalled.



Photoplate 8c – The photo taken October 15, 2019 following another episode of dune toe erosion generating a 4-foot scarp in the toe. The sand supply is not sufficient to maintain even a minor storm proof dune.

Borough of Stone Harbor - Semi-Annual Comparison SH - 123 123rd Street

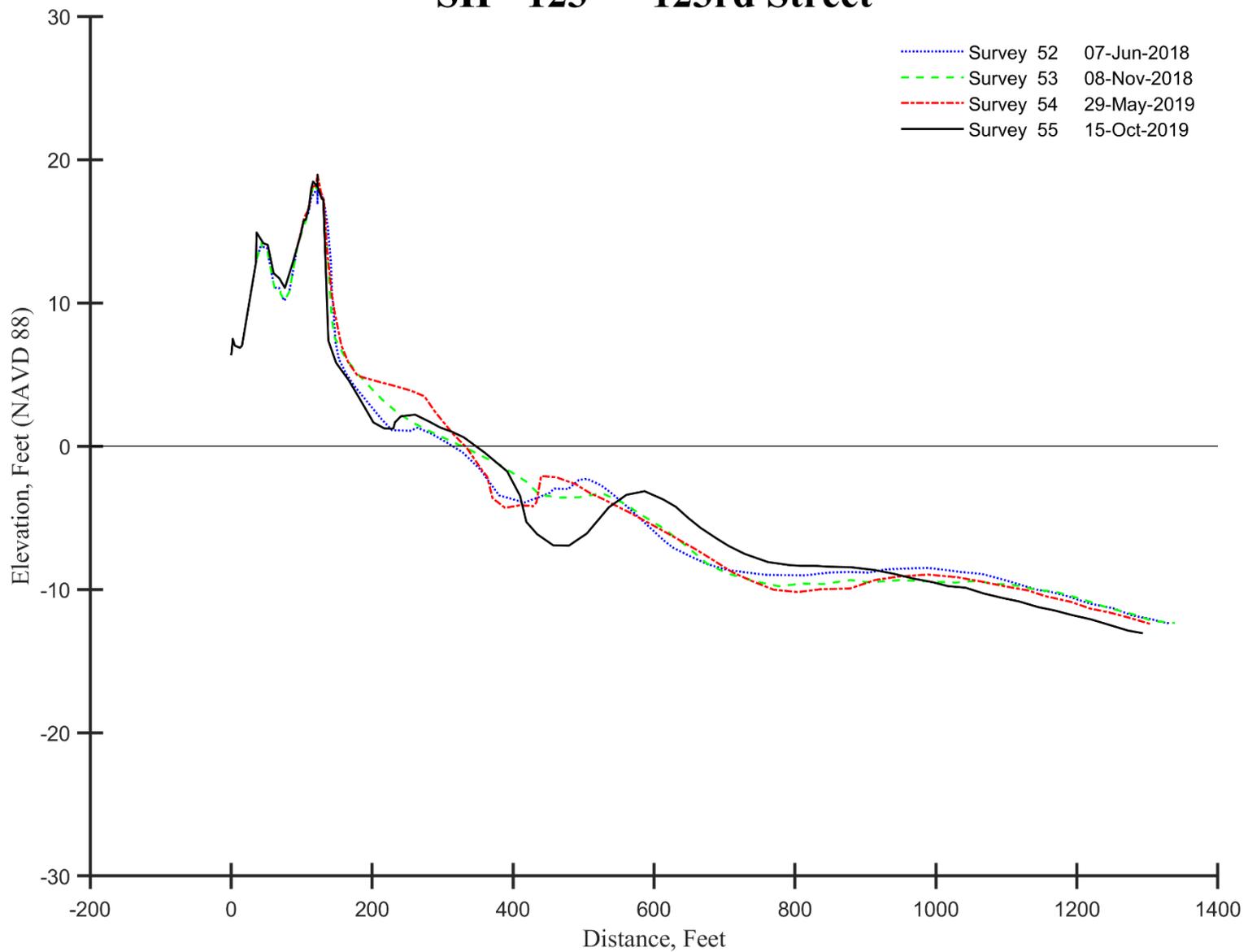


Figure 8d. 123rd Street saw nearshore bar accretion producing a decent beach berm by May 2019. Early storm events removed it and cut into the dune toe. The site lost 5.60 yds³/ft. over the past 18 months, but the shoreline advanced 15 feet seaward because of the October bar attachment. Offshore, a larger bar system appeared as well.

Summary

The 2017 joint federal and NJ State project was completed placing sand on all the oceanfront beaches south of 85th Street. The northern part of the project was funded through the Federal Flood Control Coastal Emergency Act (FCCE) program. Because of the CBRA resource issues with the Hereford Inlet site, the borrow area from Townsends Inlet was selected for the sand supplied to the north end beaches because the US Army Corps was not allowed to spend federal funds within the Hereford Inlet CBRS to acquire sand for Stone Harbor. The State of NJ, Div. of Coastal Engineering funded the southern segment of Stone Harbor's nourishment cycle because State funds may be expended moving sand from a CBRS.

The Borough's beaches logged a significant gain in volume (827,448 cubic yards) between October 2016 and October 2017 accompanied by a seaward movement of the shoreline at all monitored locations. During 2018, 46,562 cubic yards of sand were lost from the system. The Borough declined to allow the US Army Corps to excavate dune sand concentrated between 111th and 117th Streets plus adjacent areas to augment beach widths along the oceanfront. This proposal was introduced mostly due to the CBRS issues that prevented utilization of Hereford Inlet borrow zone sand supplies employing federal funds for dredging. Some progress on that front have been made following a joint municipal meeting with the Secretary of the Interior Bernhardt this fall. Orchestrated by Congressman Van Drew and participated in by Avalon, Stone Harbor and North Wildwood, the Secretary agreed with the municipal premise that the Fish and Wildlife Service had overreached in its interpretation of the 1982 Coastal Barrier Resources Act language to mean prohibition of utilization of federal funding to move any sand from NJ-09 CBRS Unit to the beaches of Stone Harbor. The USACE still needs confirming accord from the US Fish and Wildlife Service that they concur with the Secretary's determination and there are no court challenges to his letter.

The 2019 Survey of the Stone Harbor Lagoons:

Between November 2016 and February 2017, the Borough of Stone Harbor contracted with Ocean & Coastal Consultants, LLC. (OCC) to have all 8 bayside lagoons dredged to a uniform depth of -6 feet MLW to restore navigability, particularly at the entrance channels from Great Thorofare into each lagoon. The CRC was provided with the after dredging survey transect data with the objective to re-survey each lagoon to determine siltation or other obstructions appearing to hinder navigation uses. This iteration is the third year in the sequence of such surveys.

The OCC post-dredging data from 2016 or 2017 has been directly compared with the 2019 data with the two datasets entered into Arc-GIS software to generate a Digital Elevation Change Model (DEM). The green colors show water depths shallower than seen in 2016 (less deep bottom elevations) and the red/orange colors showing water depths deeper than found in 2016 (a deeper bottom elevation) (Figures 9-16). Each lagoon is presented as a single figure. This year more details associated with proximal entrance areas from Great Channel has been included.

Individual Lagoon Bathymetry:

The 2019 evaluation is confined to the specific areas that were dredged, together with two survey transects conducted parallel with the bulkheads along the Great Channel bayfront that exists between lagoon entrances. These were done as close to the bulkhead as docks or mooring pilings would permit going south, then repeated further away from the bulkheads on the return trip to the North Basin. Each lagoon has an individual distance scale bar on the drawing and the color pattern is one where yellow means no change since 2016 survey was complete. Light orange or light green colors represent depth changes between 0.2 and 1.0 feet. Deeper shades of color represent increments of 1.0 feet of added depth or decrease in measured depths (Figures 9-16).

North & South Basins, 81st to 83rd Streets & 84th to 86th Streets;

North Basin lagoon is largely devoted to housing the municipal boat slip and launch ramp area with 7 multi-family residences (condominiums) surrounding the remainder of the site. Since February 2017, the lagoon has gotten between 0.2 and 1.0 feet shallower in a large part of the basin. A percentage remains as dredged, and minor places are a bit deeper. The entrance is between 0.2 and 2.0 feet deeper in a band across the entrance from Great Thorofare with an area adjacent to the municipal slips near the entrance about 2 feet shallower with a deposit of sediment inside the entrance within the channel to the inner basin.

South Basin lagoon has behaved in similar fashion with deposition concentrated in the main entry channel adding as much as 2.0 feet of sediment in spots while the inner basin accumulated 0.2 to 1.0 feet of sediment across much of the area. South Basin did see greater entry point depths as a result of main Thorofare migration toward the bayshore in Stone Harbor. This is a relatively new pattern because prior to dredging, the entry points were the most impacted by accumulated sediments.

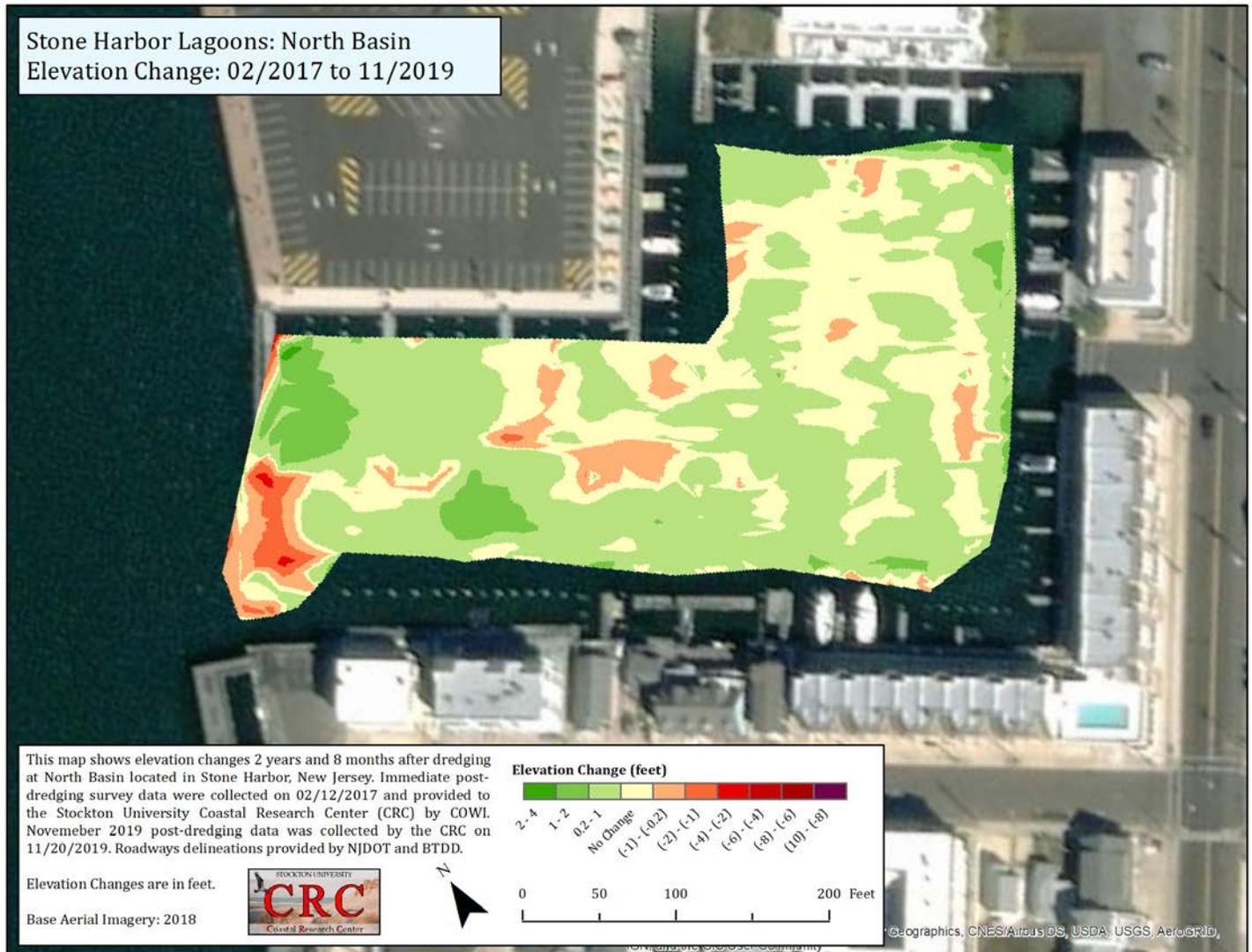


Figure 9a. This basin remains at or slightly shallower than it was immediately after dredging was complete. The entrance area is between 0.2 and 2.0 feet deeper in a narrow zone right at the point where tidal water enters the lagoon. The inner basin remains with about half the area as dredged and half about 0.2 to 1.0 feet shallower. There were a number of spots where the depths were 0.2 to 1.0 feet deeper than immediately after dredging.

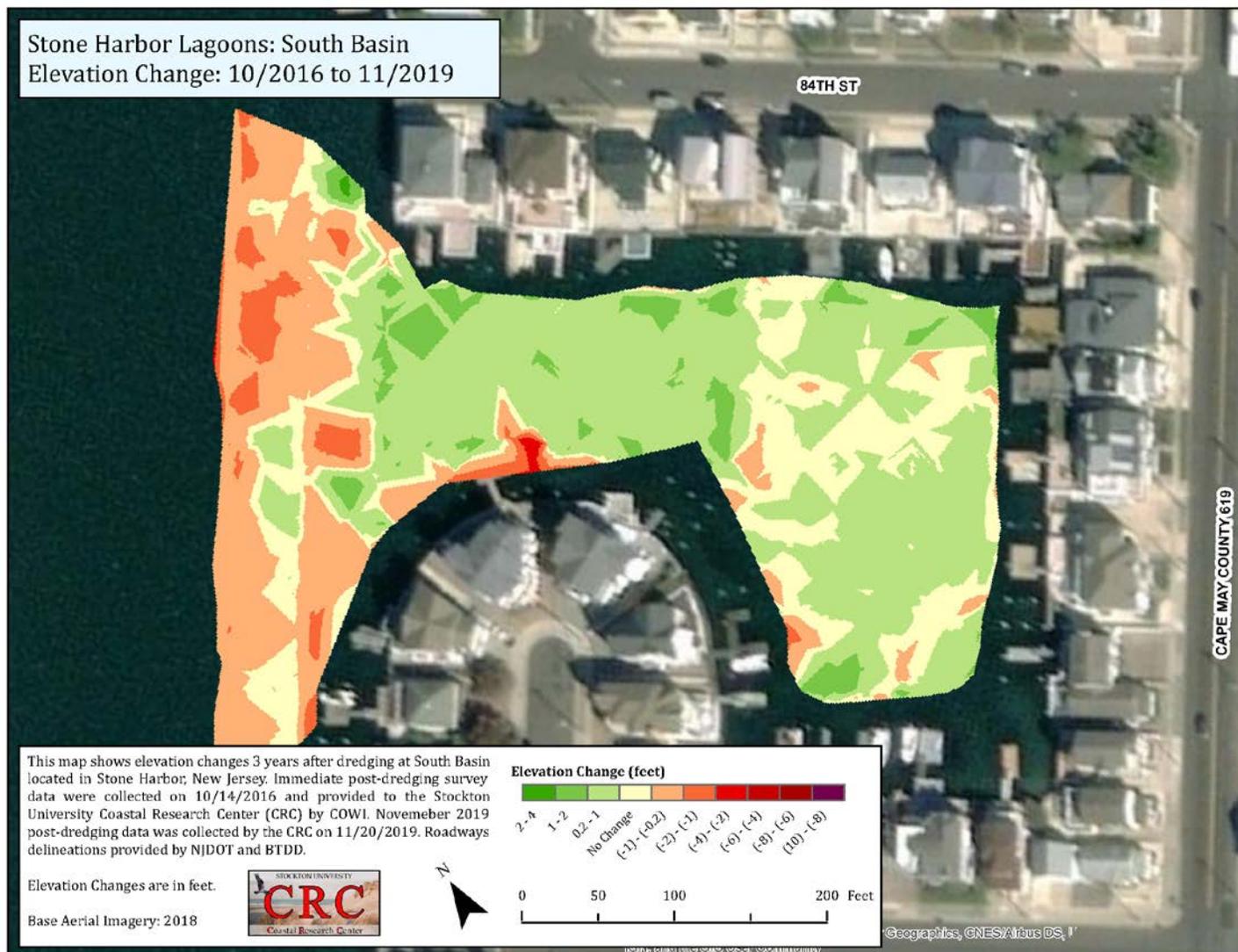


Figure 9b. South Basin has performed in similar fashion to the post-dredging changes seen in the North Basin. Between 0.2 and 1.0 feet of sedimentation since dredging has appeared over three years across the main channel and to a lesser degree, within the inner basin, while entry point erosion has created deeper water where the Great Thorofare main channel joins the navigation channel into South Basin.

Snug Harbor, 89th to 92nd Streets;

Snug Harbor shows a contrast between the inner basin where some minor deepening has occurred. The yellow color represents + or - 0.2 feet of change while the lightest green color represents between 0.2 and 1.0 feet of sediment accumulation. The entrance channel area has become between 0.2 to 1.0 feet shallower since October 2016 with a zone between 1 to 2 feet of deposition adjacent to the yacht club. At the entrance point from Great Thorofare there are multiple bands of deeper areas ranging up to 3.0 feet deeper in small patches. The eastern channel margin of Great Thorofare has been migrating closer to Stone Harbor bayside development for a couple of years, evidenced by the erosion seen right at the entry point into the lagoon basins.

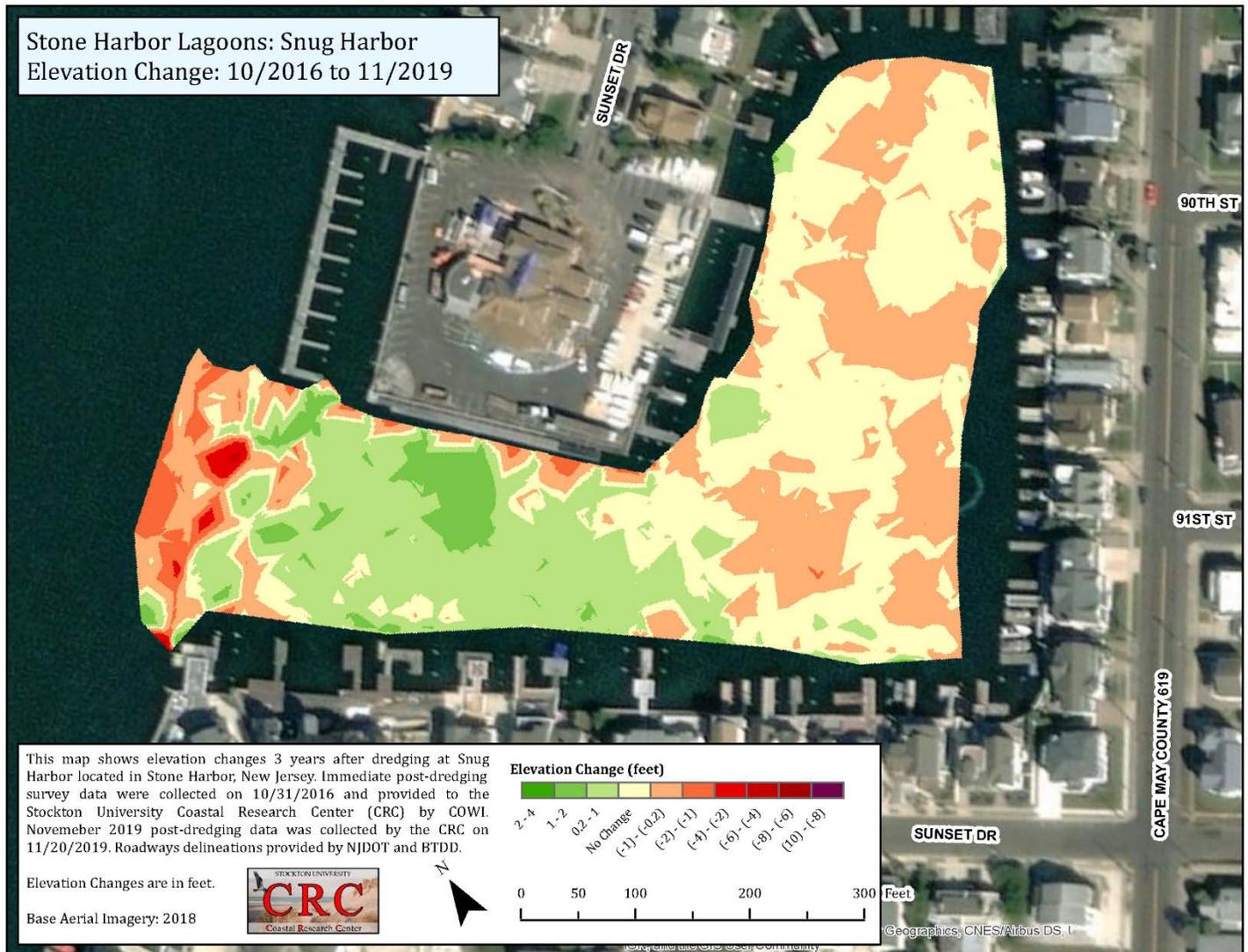


Figure 10. Snug Harbor shows between zero and 1.0 feet of deepening in the inner basin, while showing 0.2 to 2.0 feet of shallower areas within the entrance channel. A complex set of bands across the entrance show areas of deeper depths with patches of shallower areas. These range from -3.0 to zero to 1.0 foot shallower. The survey covered a zone into the main channel at the yacht club.

Shelter Haven, 96th to 99th Streets;

Shelter Haven compares in pattern to the two northern sites where the inner basin shows no change to a minor amount of sediment accumulation between 0.2 and 1.0 feet. The inner basin has a circular depression reaching 22 feet of depth in the southwest corner where depths have increased by between 2 and 4 feet. There were a few areas of deeper water as well. This excavation likely dates to the initial regional development when the lagoon basin was originally created. The entrance channel showed regional deposition by 0.2 to 1.0 feet with a few areas of no change, and erosion along the south channel margin. The entry point from Great Thorofare shows between 0.2 and 1.0 feet of sediment removal.

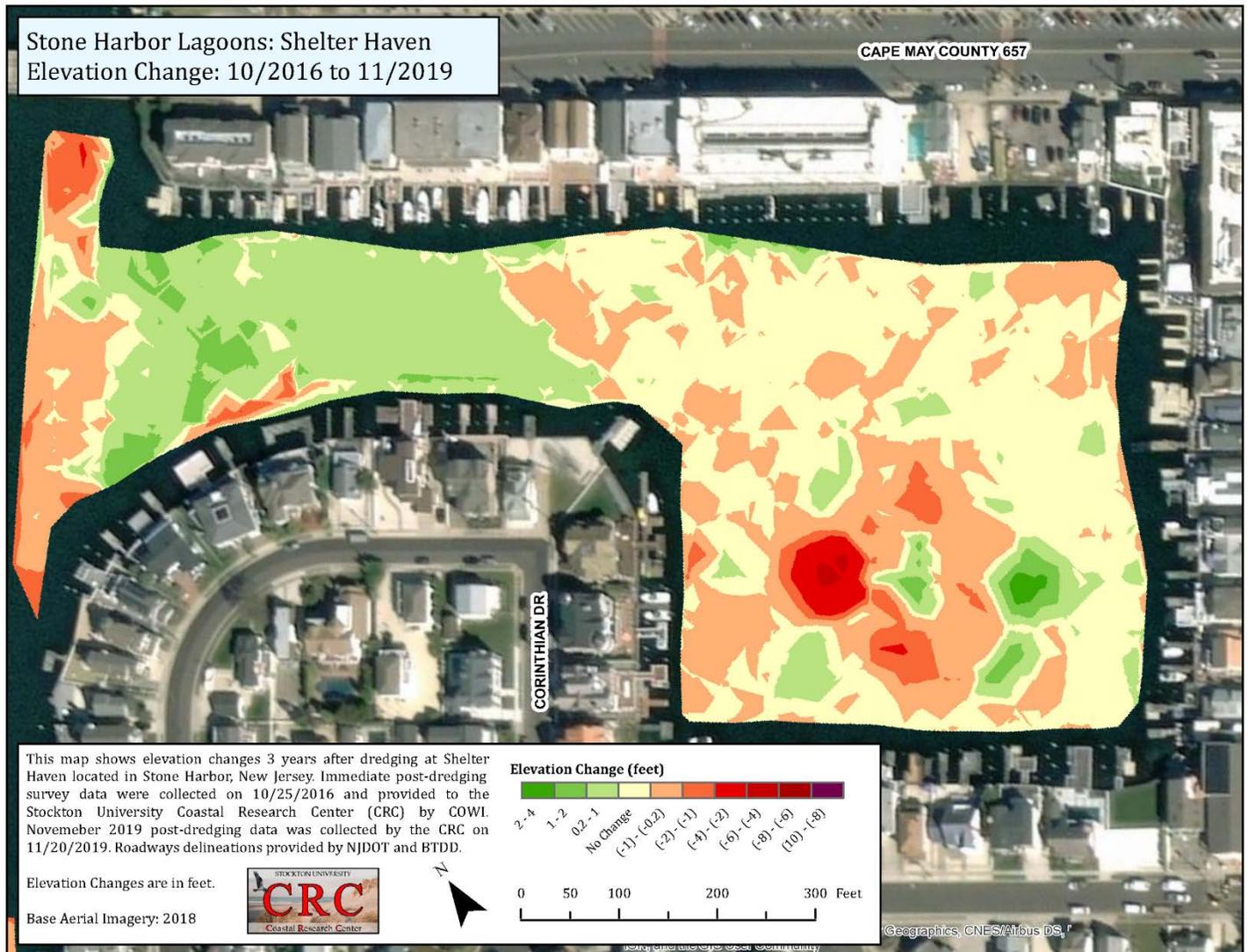


Figure 11. Shelter Haven is located just south of 96th Street and is similar in the pattern to the north where the inner basin is unchanged or marginally deeper, the entrance channel is up to a foot shallower and the entry point from Great Thorofare has seen sediment erosion at the point where the eastern Great Thorofare channel margin is met.

Stone Harbor, 99th to 104th Streets;

This lagoon shows a large pattern of inner basin sediment loss or compaction in the sub-one-foot range. The entrance channel has become between 0.2 and 2.0 feet shallower in spots leading to a significantly deeper entrance point where up to 4 feet of sediment has been removed at the southern bulkhead to the entry.

In addition, the survey conducted along the Great Thorofare east channel margin north of the entry to Stone Harbor Lagoon emphasizes the migration of the main channel toward the developed shoreline. Greater depths approaching -10 feet appear opposite the cove by Berkley Rd. and Corinthian Drive.

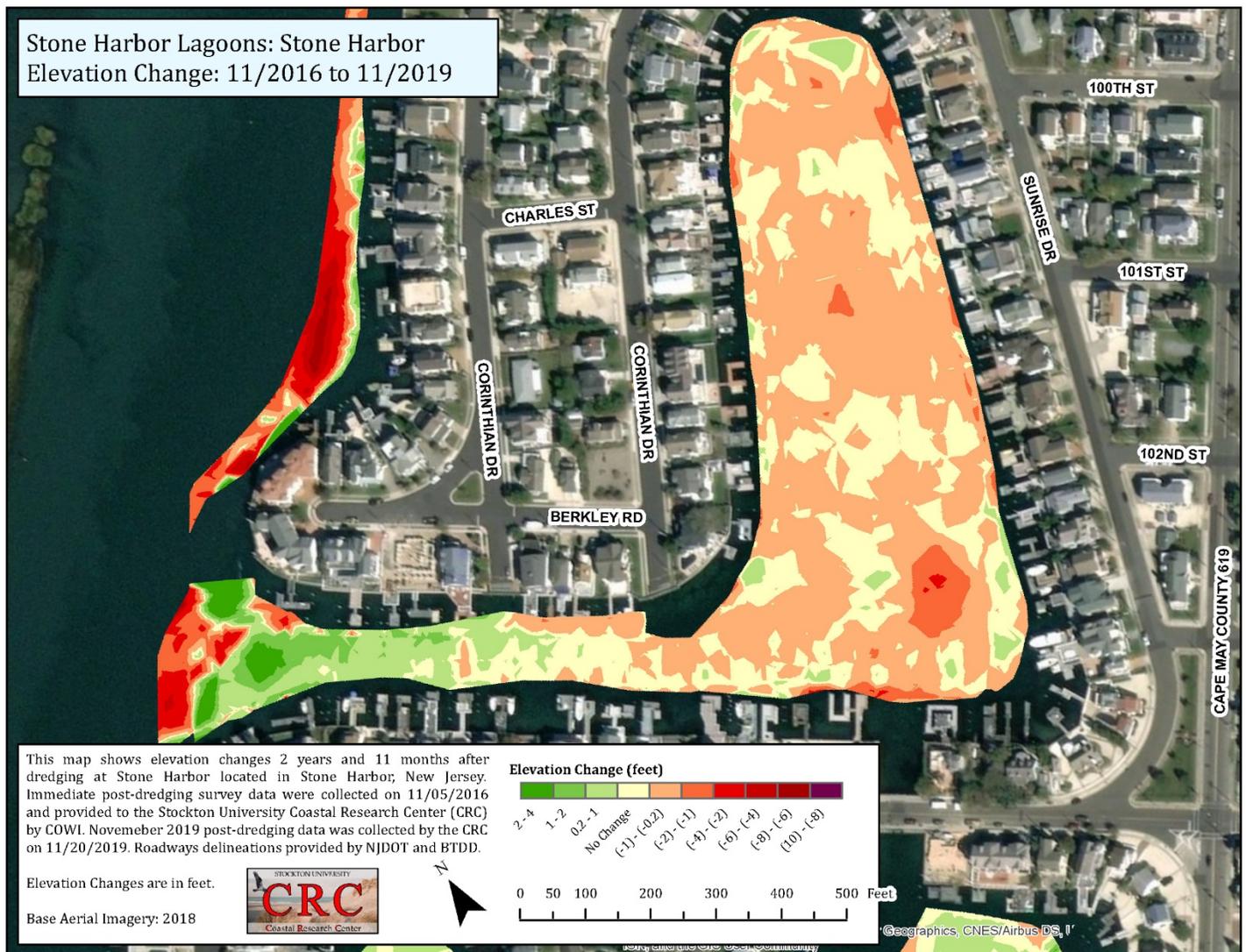


Figure 12. Stone Harbor Lagoon displays a consistent pattern associated with the northern basins where the inner basin has remained as dredged or become marginally deeper (-0.2 to -1.0 feet) while the entrance channel has become shallower since November 2016. Sediment erosion has impacted the entry point with up to 4 feet of lost material at the southern margin bulkhead. This erosion extends north of the entrance as well, reaching 10-foot greater water depths.

Pleasure Bay & Carnival Bay, 104th to 109th Streets;

Pleasure Bay is the western one of a pair of identical shaped lagoons lying between 104th and 109th Streets essentially side by side with Corinthian Drive in between. These lagoons are examined as a pair because there is a difference in performance that is striking. Pleasure Bay has generally become slightly shallower since January 2017 following dredging while there have been smaller sediment volume changes in Carnival Bay. The entire basin in Pleasure Bay shows minor depth reductions between 0.2 and 1.0 feet, while Carnival Bay has shallower areas to the south end and little change showing in the northern two thirds. Some entry channel scour occurred between Pleasure and Carnival Bays, but the south margin was excavated into a wide, very shallow sand flat that is unmarked navigationally and results in vessel grounding at all but the highest tides when the edge is crossed onto the remaining flat.

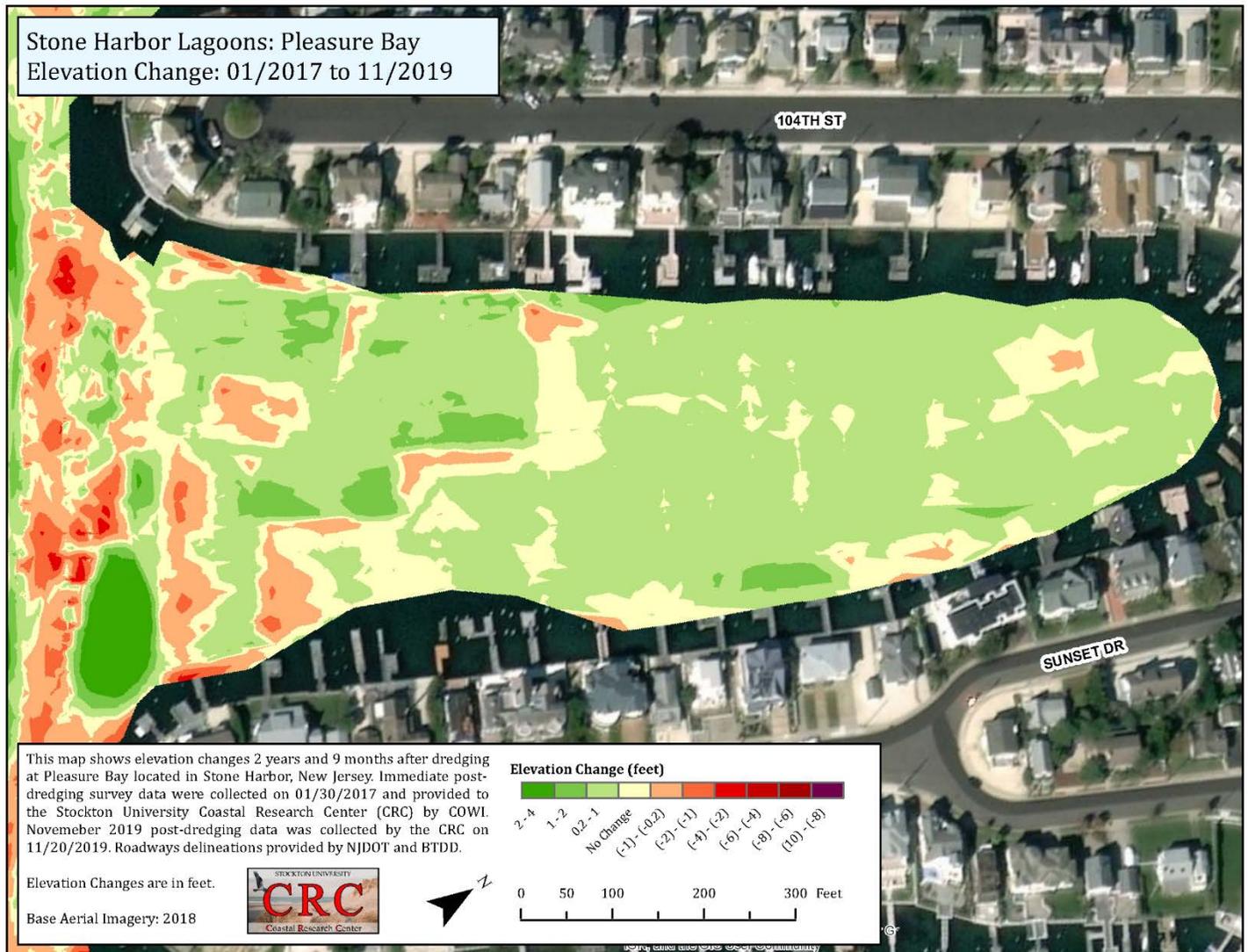


Figure 13a. Pleasure Bay is the westernmost lagoon of this pair, located south of 104th Street. This basin has become between zero and 1.0 feet shallower since March 2017. There is a scour located at the entry to Pleasure Bay that continues east to the entrance of Carnival Bay. The entry areas show spotty sediment accumulation at the entry point.

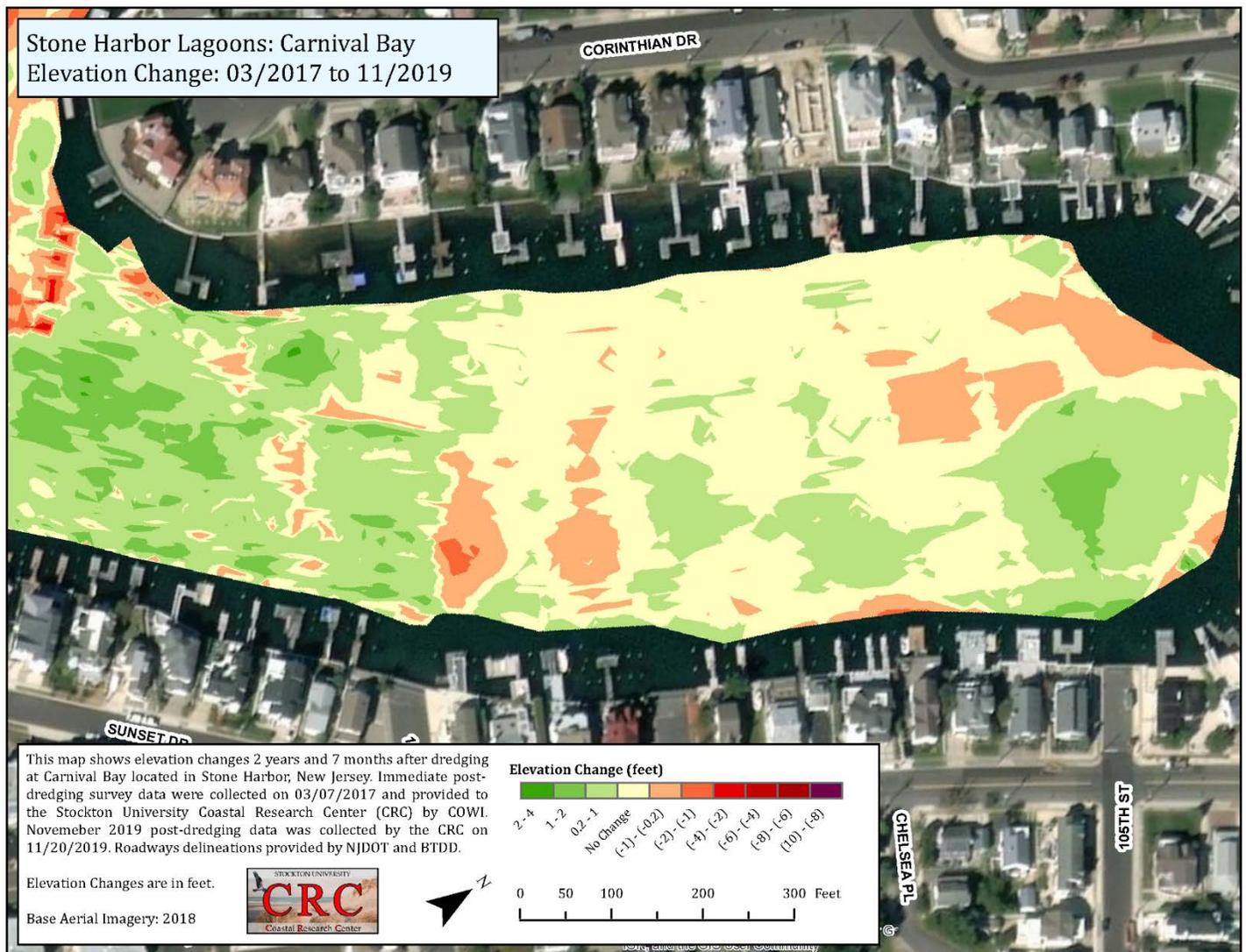


Figure 13b. Carnival Bay is east of Pleasure Bay and conforms to the same general configuration, but east of Corinthian Drive. The southern third is shallower while the remainder of the basin shows either no change or a pattern of zones of accretion and deepening. This area is at a maximum distance from the sediment source carried by incoming tidal flow, so receives smaller quantities of suspended sediment.

Sanctuary Bay; 113th to 116th Streets, including areas between lagoons;

Sanctuary Bay is a cove along the bayshore where depth changes appear generally shallower by 0.2 to 2.0 feet in the excavated cove, but deeper along the axis of the tidal channel leading from Carnival Bay to the exit point back to Great Thorofare at the bridge to North Wildwood.

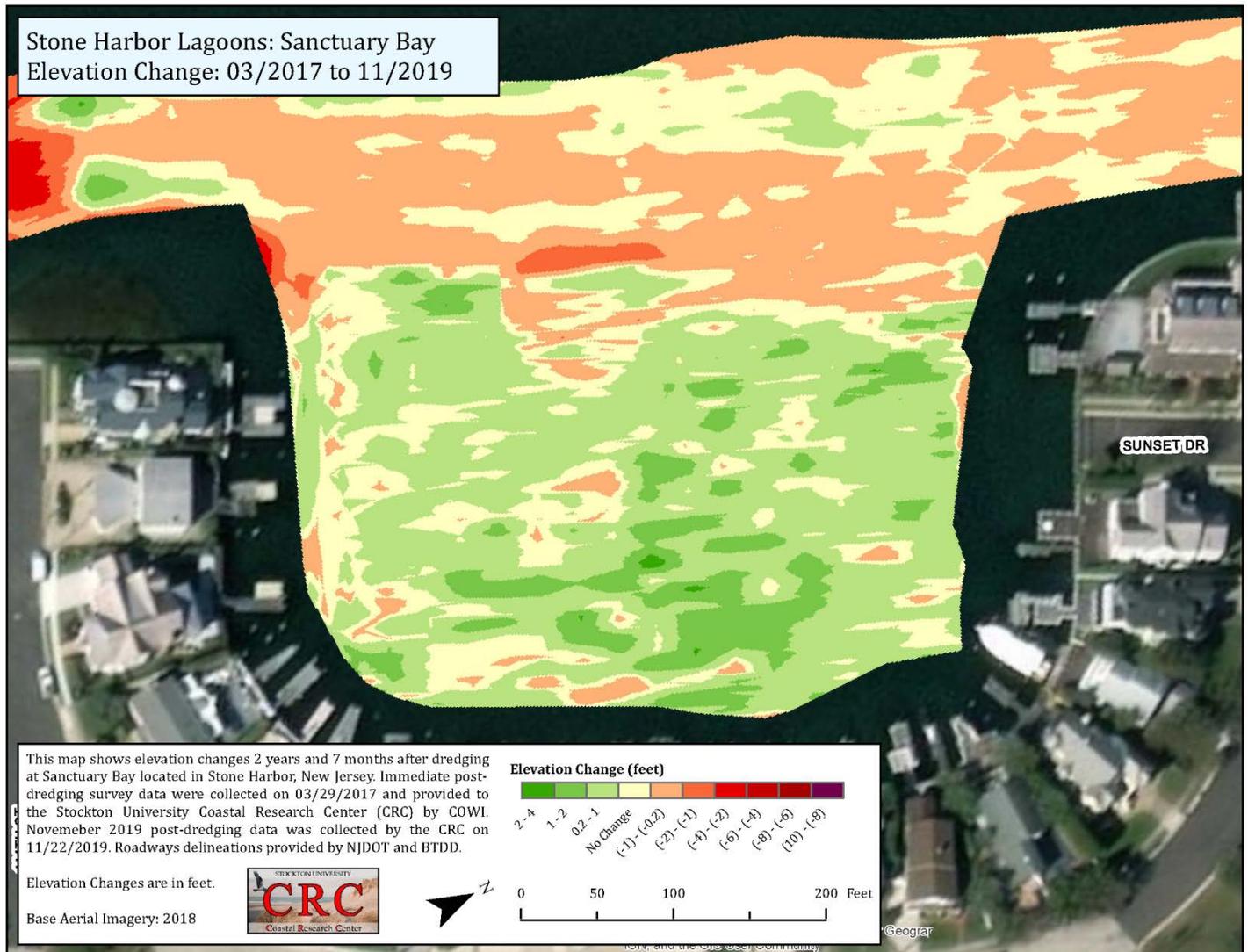


Figure 14. Sanctuary Bay lies east of the channel running south from the entrance to Carnival Bay and that exits at the bridge to North Wildwood. The excavated basin appears shallower by 0.2 to 2.0 feet in some spots, while the channel area is deeper by the same measure (0.2 to 2.0 feet). Substantial areas of no change still exist.

Paradise Bay and Adjacent channels;

The southernmost area is a developed channel margin along the original salt marsh edge more than it is a “lagoon”. This area shows a relatively linear pattern of shoals and deeper spots that mirror tidal distribution of sediment.



Figure 15a. The northern end of Paradise Bay is a dug channel between development and a marsh bay island to the west. There is spotty pattern of accumulation, no change and erosion since March 2017 when dredging was completed. The pathway south between marsh islands west of this channel is shallower to the point of avoidance by larger vessels particularly at low tide.

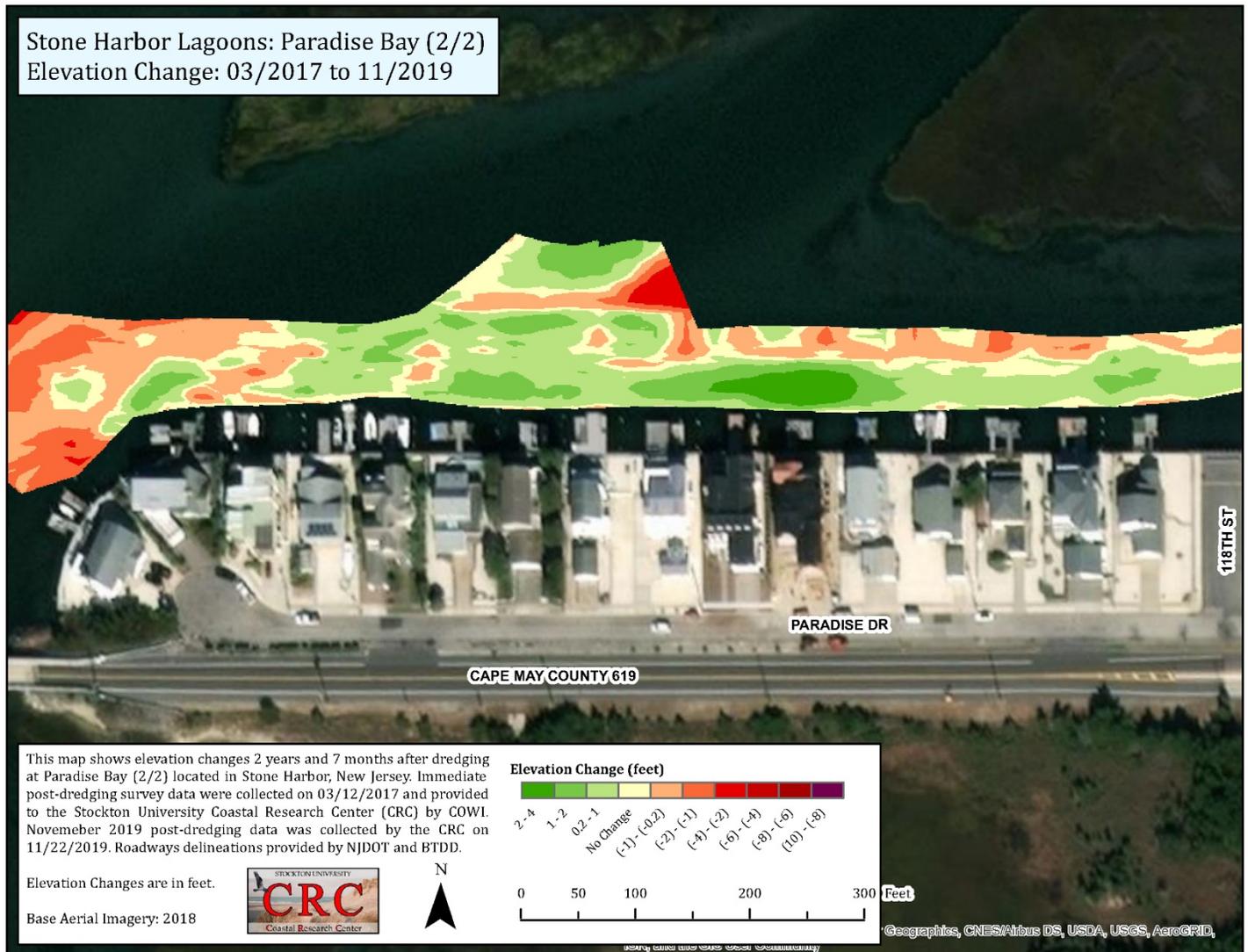


Figure 15b. The southern end of the Paradise Bay channel has accumulated sediment since dredging except for the entry back into Great Thorofare. The branch leading north between the marsh islands was surveyed but was barely navigable except within a few feet from the bay island to the right side going north in the cut. The western shoreline was exposed as a mud flat when the 2019 review was conducted.

Sediment Volume Changes per Lagoon; Table 4

Volume Change (03/2017 to 11/2019)			
Lagoon Name	Areas of Gain*	Areas of Loss*	Net Volume Change*
North Basin	1,270	-220	1,050
South Basin	1,330	-760	570
Snug Harbor	1,480	-1,460	20
Shelter Haven	2,370	-3,270	-900
Stone Harbor	2,170	-5,930	-3,760
Pleasure Bay	6,790	-1,850	4,940
Carnival Bay	5,550	-1,700	3,850
Sanctuary Bay	2,200	-860	1,340
Paradise Bay (1/2)	690	-750	-60
Paradise Bay (2/2)	1,530	-1,030	500

* All volumes are in cubic yards (yd³)

The table shows the digital volume comparisons between the survey immediately following each lagoon dredging and the survey completed in December 2019. The Digital Elevation Model computes the space between the post-dredging bottom “surface” and the new bottom “surface” generated by the December survey data. Gains are added to erosional losses to provide the balance in cubic yards of sediment added to or subtracted from each lagoon. Pleasure and Carnival Bays appear to be the sediment sinks among the nine areas surveyed, with Stone Harbor Lagoon shedding a significant volume of material.

In order to show the complex of channels and basins associated with Sanctuary Bay which includes both Pleasure and Carinival Bays, plus Paridise Bay channels, the regional map is produced as Figure 16. The entire area gained about 10,000 cubic yards of new sediment since dredging was completed, over 8,700 cubic yards of which was deposited in Pleasure and Carinival Bays. The Paridise Bay channels are the most difficult to navigate for larger vessels due to compact width limits and perioding shoals already appearing. The direct route north toward Carnival Bay is marginally navigable at present at low tide. The western margin along the marsh island was exposed as a wide mud flat in Decemeber 2019, so was not surveyed. The navigation channel exists within a few feet of the sod bank on the eastern marsh island.



Figure 16. This map ties together five separate locations above into a composite for Sanctuary Bay and its associated lagoon basins. The entire region gained just over 10,000 cubic yards of sediment since dredging was completed. This was dominated by sediment deposition in Pleasure and Carnival Bays. The access route among the four developed lagoons appears to be getting deeper since dredging with minor exceptions along Paradise Bay channel.

Recommendations:

This survey in 2019 followed the pattern of surveys conducted by OCC in 2017 but covered every other line because the pattern for dredge volume payment was set up with 50-foot spacing. The same orientation and pattern of crossing lines within basins was duplicated.

Comparison of the post-dredging data with information from December 2019 shows:

1. Sediment has eroded at the immediate points of entrance to most of the lagoons as a series of, or a single band of greater depths. The greatest depth increase was found to be under 4.0 feet at the southern side of the entry to Stone Harbor Lagoon where Great Thorofare channel migration is approaching the developed bayside shoreline.
2. The rate of sedimentation lies between 0.2 and 2.0 feet of depth reduction at present with the majority of the change falling in the 0.2 to 1.0-foot category.
3. Every lagoon still contains spots where there has been no change in depth since dredging.
4. The inner basins of the lagoons are the places which remain as dredged or slightly shallower (0.2 to 1.0 feet shallower)
5. Great Channel is migrating toward the developed bayshore in Stone Harbor making the access to the lagoon entrances deeper. The bands of greater depth at each entry point lie within this zone of scour by Great Thorofare. Some bayshore bulkheads now have 15 feet of water at their bases.
6. There are no zones of concern thus far, but the individual entrance channels into the inner basin areas need surveillance for continued sand/mud deposition in the future.
7. Access to and travel along the Paradise Bay channel from the North Wildwood bridge to Pleasure Bay's entrance is the potential trouble spot particularly in the secondary channel going north from the south entrance between Sanctuary Island and an un-named marsh bay island. Large vessel navigation is already restricted by mud flat deposition along the western margin. The CRC 24-foot vessel was unable to record depths to the west of mid-channel due to shallow water or exposed mud flats. There is sufficient depth along the eastern margin, but within 2-4 feet of the marsh bank.

Conclusions & Recommendations for Beaches and the Lagoons:

The periodic maintenance and FCCE projects brought the Borough's beaches to a higher level of storm protection. An anomalous set of conditions between May and October 2019 generated one of the largest sand accumulations in the offshore regions all along the Stone Harbor oceanfront. A substantial beach berm present at the end of May 2019 eroded away by October, but sand volumes added to the offshore region more than doubled the sand loss seen on the beaches. The dunes did gain wind transported material in modest amounts and were unaffected by the beach changes. The exception was seen at 123rd Street site where dune toe erosion was documented with the October 2019 survey.

The Division of Coastal Engineering has suspended the annual survey for the bathymetry of Hereford Inlet done since Hurricane Sandy by the CRC in the fall of the year.

The following recommendations are the result of this year's findings:

- The zigzag pattern of the installed fence captured wind-blown sand allowing the dune toe to move seaward. Fence installation should follow recommendations given in past CRC reports and from the NJ Dept. of Environmental Protection, Div. of Coastal Engineering and Div. of Land Use Regulation.
- The Borough needs to maintain pressure on the US Army to act forcefully and in concert with the City of North Wildwood and the Borough of Avalon to seek the complete restoration of Federal agencies' ability to access the Hereford Inlet borrow zone for major shore protection projects. Secretary Bernhardt provided a letter of interpretation accepting the use of CBRA material for adjacent municipal beach restoration utilizing best beach nourishment practices. He may not hold office beyond the next election and a new Interior Secretary may view CBRA sand extraction differently.

- The recently dredged bayside lagoons were surveyed in 2019 and did not present any urgent areas of shoaling to require attention this coming spring. All entrances are clear and over 6-foot below MLW in channel depths except for the array of shoals in the vicinity of the entrance to Carnival and Paradise Bays where sand transport under the Stone Harbor/North Wildwood bridge has created large, shallow areas centralized in the Great Channel upstream from the drawbridge. We suggest placing marker stakes all along the south channel margin going into these two lagoons because the dredging boundary is razor sharp between a depth of 7 feet in the navigation channel and 0.5 feet of water on the south margin at mid-tide. Navigation along the bulkhead and development in Paradise Bay is tight but acceptable except where one must exit into Great Thorofare at the bridge to North Wildwood. The marsh channel west of the Paradise Bay canal is difficult to navigate due to bank filling leading northbound into that channel.