

**2020 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 as of October 4, 2020 a year after the view presented on the cover for the 2019 report. This view shows the best outcome for natural accumulation during a summer of mild wave action and wind transport. The scarp cut last fall is still present, but the wind has deposited a slope of dry sand about half way up the eroded bluff. The beach berm has added a narrow strip between the normal high tide line and the dune toe completing the typical summer beach “profile”. However, the most moderate of northeast storms will renew the erosion of the primary dune scarp going into the winter months.

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Introduction:

A maintenance sand supply was provided during the 2nd Periodic Nourishment Cycle that commenced in February 2017 using Hereford Inlet as the borrow source. It has been three years since the US Army Corps of Engineers (USACE) conducted the placement of sand on the Borough's beaches between 105th and 123rd Streets. By March 7, 2017 the total amount placed in the southerly section of the Borough oceanfront was 394,000 cubic yards, under the sponsorship 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 remove 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 cubic yards 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, Stone Harbor determined that the USACE proposal to extract sand from the Stone Harbor dunes that have expanded seaward onto the federal dry beach template creating their design beach and push that sand onto the beachface to widen the beach and add protection was too fraught with cost per cubic yard, extraction of the buried dune fencing and the general loss of storm protection that the existing dunes provide the Borough.

Last fall, following a meeting arranged by Congressman Van Drew with municipal officials from Stone Harbor, North Wildwood and Avalon, Department of the Interior Secretary David Bernhardt issued a letter rescinding the 2013 legal interpretation prohibiting sand extraction from CBRS Unit 9 in NJ (Hereford Inlet shoals) for beach nourishment. However, its implementation remains a question due to litigation in opposition filed by the National Audubon Society to preclude its utilization for such activities including for Stone Harbor nourishment.

2020 Weather Events;

The winter of 2019-20 produced very few northeast storms with none having durations over one day or winds in excess of 35 MPH. The hurricane season saw Hurricane Isaias make landfall in North Carolina, pass through Pamlico Sound, then Chesapeake Bay, cross into New Jersey and move into New England by August 4, 2020. Winds in New Jersey were of tropical storm force, but with the storm center inland, the event failed to generate serious beach erosion. There were few northeast storms leading up to the final survey in 2020 with two events in the latter part of December 2020 that did erode the beachface and produce tidal flooding in low lying areas. All the fall beach cross sections show a profile at or superior to sand volumes on the beach than those from one year earlier. The relatively early final survey for 2020 essentially captured a summer-like beach profile because the storm pattern was so muted thus far this year.

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 14-16 feet. Each of the groin compartments or cells along the Borough beachfront contains one profile line. Work continues with a 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 four years to determine where and if sedimentation is affecting overall navigability.

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 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.
- ◆ **Survey 56** represents a full dune, beach and nearshore survey at all sites for April 2020.
- ◆ **Survey 57** represents a full dune, beach and nearshore survey at all sites for October 2020

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 May 2020-Oct. 2020 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. 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 sand volume and shoreline changes seen during the past summer between the April and October 2020 surveys just on the beaches and in the dunes to elevation zero at the water's edge. The zero elevation represents NAVD 1988 datum equal to zero feet elevation. Of note is the relatively large gains with minimal shoreline shift seen at the north end of the Stone Harbor oceanfront. Shoreline retreat occurred at 5 of 6 central and southern sites in the Borough but only SH-95 showed any sand volume lost from the beach and dune part of the shoreline.

A similar assessment done between October 2019 and April 2020 produced a remarkably small winter summary sand volume for the entire oceanfront from the dunes to the offshore region. Just 380 cubic yards of sand were added across the entire Stone Harbor oceanfront. Losses at 90th, 95th, 103rd, and 108th Streets were balanced by gains at the other four locations. The dominate gains were seen from 112th Street to the terminal groin plus at 82nd Street as Avalon beach sand moved onto Stone Harbor's northern shoreline.

The annual total sand volume was dominated by the beach retreat seen during the summer months of 2020 yielding an annual beach and offshore loss of 76,849 cubic yards. This is approximately 10% of the sand placed back in 2017 and means conditions as of the existing data available are quite good.

Table 1
Stone Harbor
April 2020 (#56) to October 2020 (#57)
6 Months of Dune and Beach Sand Volume Changes to the Zero Elevation Point

Profile Number	Shoreline Change (feet)	Volume Change (yds³/ft)	Cell Distance (feet)	Cell Volume Change (yds³)
SH-82	2	8.00	1,381	11,047
SH-90	0	7.94	2,240	17,788
SH-95	-24	-1.50	1,680	-2,527
SH-103	20	4.07	2,208	8,976
SH-108	-16	0.08	1,433	118
SH-112	-5	3.20	804	2,572
SH-116	-16	4.25	2,273	9,649
SH-123	-10	3.40	1,058	3,594
Total Volume Change =				51,216

The 51,216 cubic yard sand volume gain could be considered typical of an average summer accumulation rate when mild ocean wave conditions tend to move sand onto the shoreline from the bar system seaward. The data shown below in table 2 confirm that the offshore sections of each of the 8 cross sections were the most likely source of the sand gained on the beach.

The 77,229 cubic yard loss was seen in the central and southern cells in Stone Harbor. The northern two profiles experienced very minor sand losses. The single digit loss values are relatively modest for the six-month period given the 13,000-foot extent of the municipal oceanfront. This value is for the entire length of cross section and includes both the beaches, dunes and the offshore regions.

Subtracting the onshore gains from the net change of -77,229 cubic yards, the offshore region lost 128,444 cubic yards of material with 40% of the total loss moving onto the beaches and dunes. These sand volume losses are dominated by sand shifting south along the bar system adding to the growth and maintenance of the South Point spit into Hereford Inlet.

Table 2
Stone Harbor Semi-Annual Survey
April 2020 (#56) to October 2020 (#57)
Shoreline and Total Sand Volume Changes

Profile Number	Shoreline Change (feet)	Volume Change (yds³ / ft)	Cell Distance (feet)	Cell Volume Change (yds³)
SH-82	2	-1.10	1,381	-1,518
SH-90	0	-0.22	2,240	-486
SH-95	-24	-6.03	1,680	-10,129
SH-103	20	-6.05	2,208	-13,354
SH-108	-16	-12.28	1,433	-17,599
SH-112	-5	-4.57	804	-3,673
SH-116	-16	-9.53	2,273	-21,655
SH-123	-10	-8.33	1,058	-8,815
Total Volume Change =				-77,229

Individual Site Descriptions:

This section describes the changes documented at each of the beach profile locations from late May 2019 to October 2020. 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 extensive 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.

The dune remained stable, though with a steep seaward dune slope to the toe. A sizable beach berm developed during the summer of 2020 as seen in the early October 2020 survey. Offshore, the bar shown in the April 2020 survey appears to have provided the sand supply generating the berm and higher beach elevation seen in October 2020.

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



Photo 1a – Photo taken October 14, 2019, the debris on the berm was left by early northeast waves.



Photo 1b - Photo taken April 16, 2020 showing a wide, dry beach and sand accumulation at the dune fencing.



Photo 1c – Photo taken on October 6, 2020, looking north along the dune crest where sand has been transported into the dunes and the sand fence is essentially buried by what could become a new foredune line.

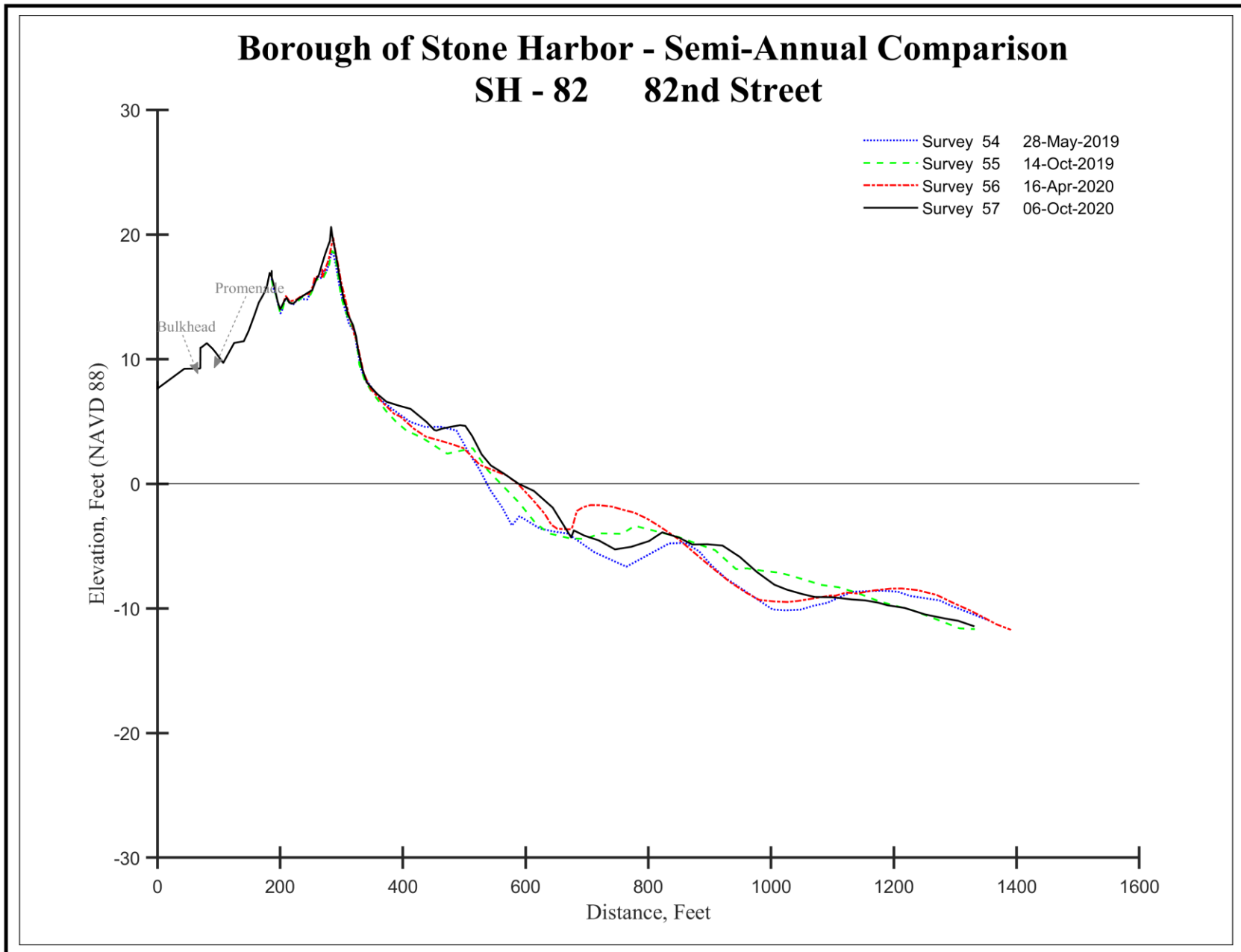


Figure 1d. The most interesting transition occurred between the presence of a nearby offshore bar as of April 2020 that moved onto the beach generating the higher berm and sand supply feeding into the dunes. This material addition was likely sourced from along the Avalon and Stone Harbor beaches to the north of the site.

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 92nd Street. The dune system consists of two ridges approximately 150 feet wide extending from the street end revetment to the seaward dune toe.

Sand appeared incrementally across the seaward dune slope and deposited as a berm on the beach by October 2020. Offshore sand transport to the beach was the probable method for accumulation.

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



Photo 2a – Photo taken October 14, 2019 shows dune growth, while wave action almost reaches the dune toe.



Photo 2b - Photo taken April 16, 2020 showing a slight improvement in dry beach width as summer began.



Photo 2c - Photo taken October 6, 2020 shows substantial dune growth and the wider expanse of dry sand beach following the summer accumulation.

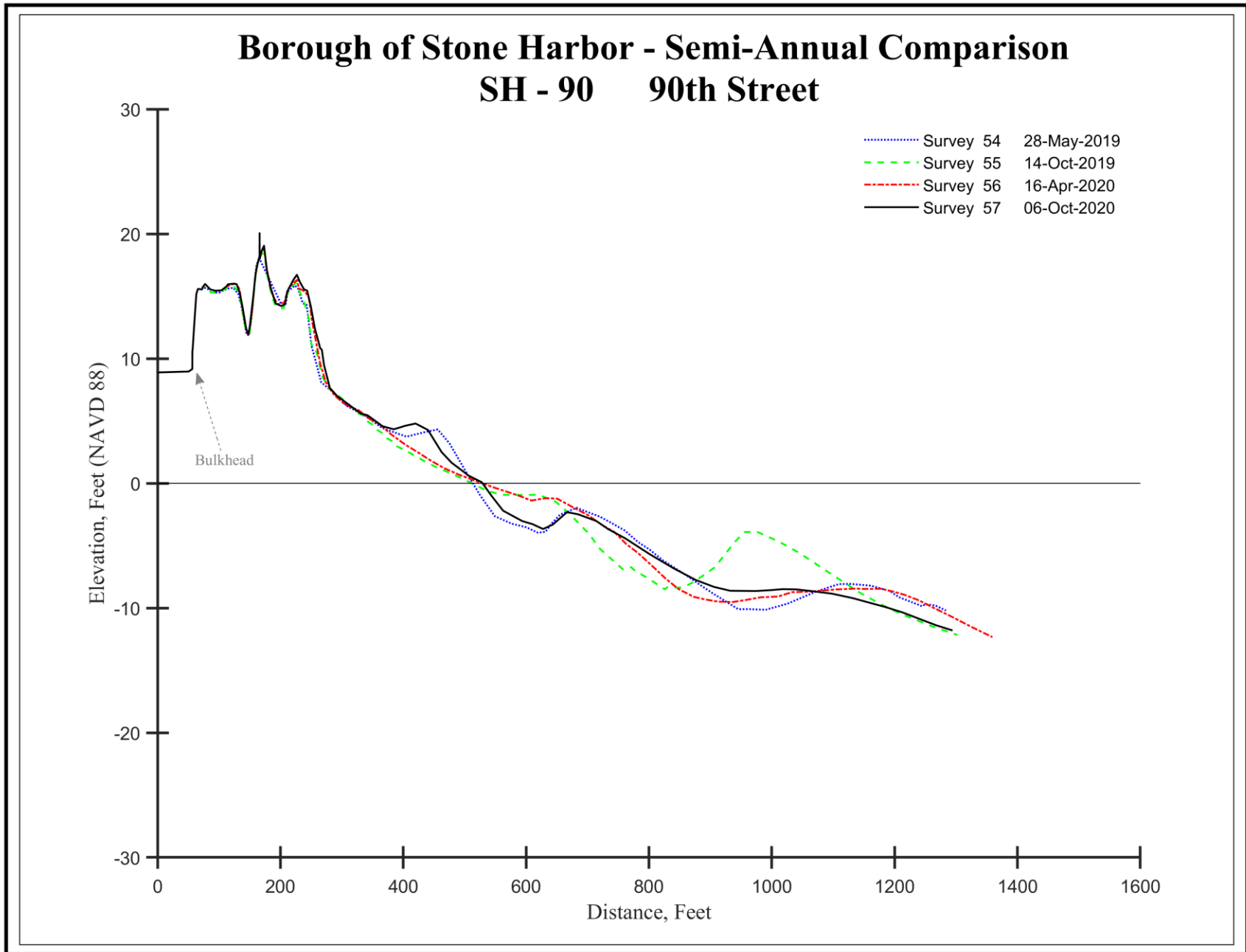


Figure 2d. Sand was added to the dune's seaward slope and a substantial berm was generated by October 2020 derived from offshore bar migration toward the shoreline. As of the Oct. 2020 survey another ridge of sand was migrating toward the beachface.

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.

Sand moved beyond the dune crest this year adding to the bulk, but not on the seaward slope. The beach remained at the initial position and configuration seen as of May 2019, but without the enhanced berm crest. Offshore sand was redistributed leading to a small loss across the profile.

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



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

Photo 3b – The April 16, 2020 photo presents a wider dry beach with sand added to the nearly buried sand fencing at the toe of the seaward dune slope.



Photo 3c – The photo taken October 6, 2020 along the access pathway. The beach continued to accumulate sand at the dune toe.

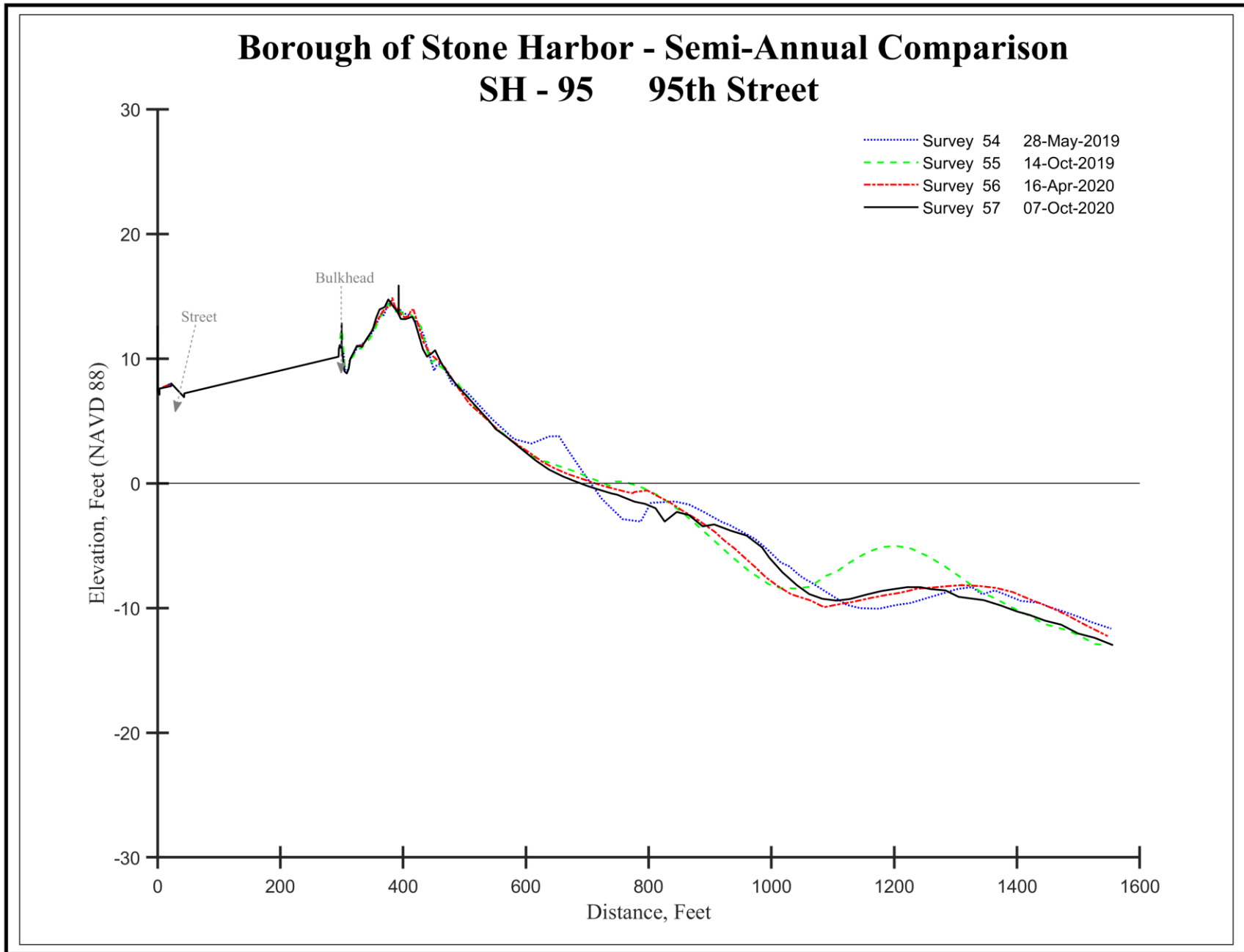


Figure 3d. Sand was added to the landward dune slope by Oct. 2020 and the small foredune at the fencing line increased in size. The beach remained at the same configuration as May 2019, but without an enhanced berm crest. Offshore the large bar, seen in October 2019 had moved landward as a series of ridges.

SH-103 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 state/federal work in 2017.

Behaving in similar fashion to SH-95, the beach configuration changed little except for no summer berm like that present in May 2019 present on the profile by October 2020. Some of the October 2019 offshore bar sand appears to have migrated onto the beachface slope by October 2020.

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



Photoplate 4a - 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.



Photoplate 4b - Photo taken April 15, 2020 shows sand filling in the lower section of the access pathway burying the fencing.



Photoplate 4c – Photo taken October 6, 2020 on the beach just seaward of the dune’s seaward slope that included the new foredune development.

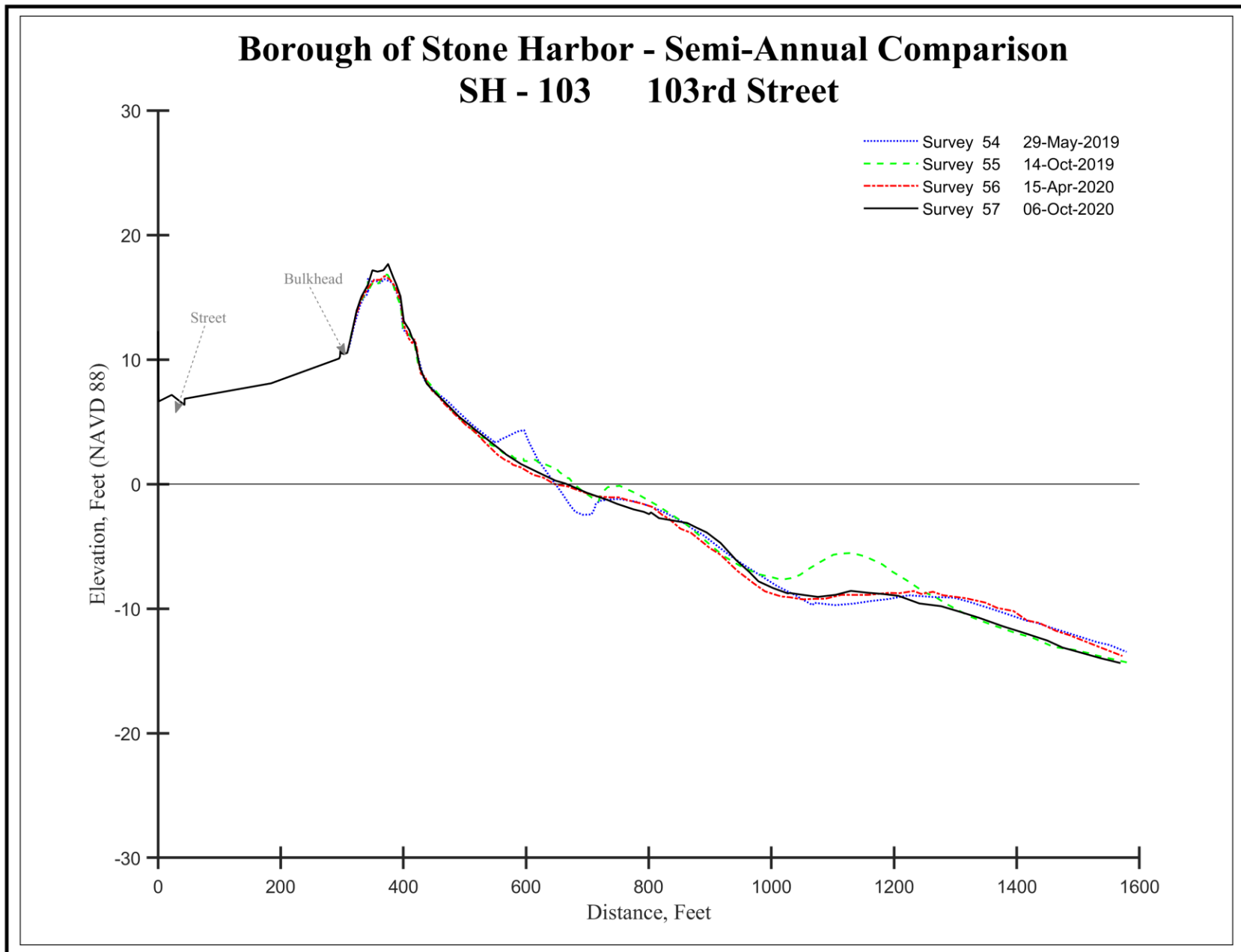


Figure 4d. The cross sections at 103rd Street show a similar pattern to that seen at 95th Street where the May 2019 berm was not reproduced by late summer 2020. Sand did migrate onto the beach in minor quantities adding to the dunes, but not to the beach itself.

SH-108 is located at the end of 108th Street and was placed near the middle of the groin cell. This site shares a pre-beach restoration 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.

Considerable sand volume was added to the dunes while the beach remained at the May 2019 configuration minus the berm crest seen in the May cross section. The offshore region provided the sand supply to the beach from the October 2019 bar arrangement seen.

Site SH-108 – 108th Street

(Photoplates 5a-5c)



Photoplate 5a – The October 14, 2019 photo shows the proximity of the high tide to the dunes on a narrow beach.

Photoplate 5b – The photo taken April 15, 2020 shows minor additions of sand near the dune toe, but a similar width beach to the water line.



Photoplate 5c – Photo taken October 6, 2020 shows improvement in beach width as sand was added to the upper part of the dry beach.

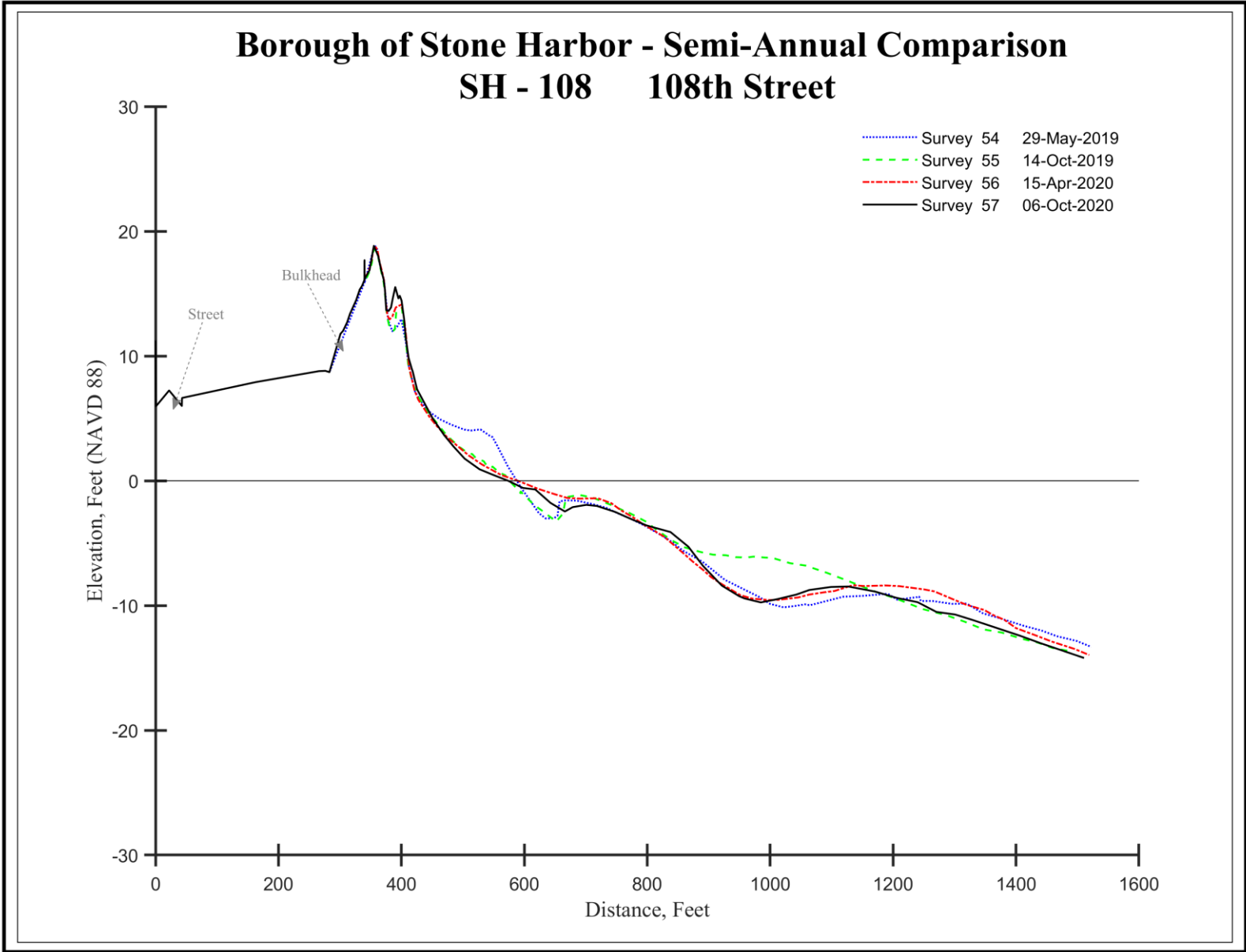


Figure 5d. Dune growth was substantial at the foredune location as all four surveys documented additional height and width to the feature. The generous berm present in May 2019 was not replicated subsequently, but the offshore bar ridge in October 2019 appears to have moved onto the beach as small ridges of sand.

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.

A berm crest on the beach together with a close-to-the-beach sand ridge offshore appears to have provided a stable beach profile between the dunes and the water's edge. The offshore region shifted by October 2019 to a more distant, low elevation bar system.

Site SH-112 – 112th Street

(Photoplates 6a-6c)



Photoplate 6a – The October 15, 2019 overlooking the accreting foredune encroaching onto the planted project dune slope. The fencing is buried with new sand from the beach that is colonized quite densely.

Photoplate 6b - Photo taken April 15, 2020 and shows large amounts of wind deposition around the existing plants.



Photoplate 6c – Photo taken October 7, 2020 where the seasonal plant growth has taken hold on the new sediment supplied by the wind.

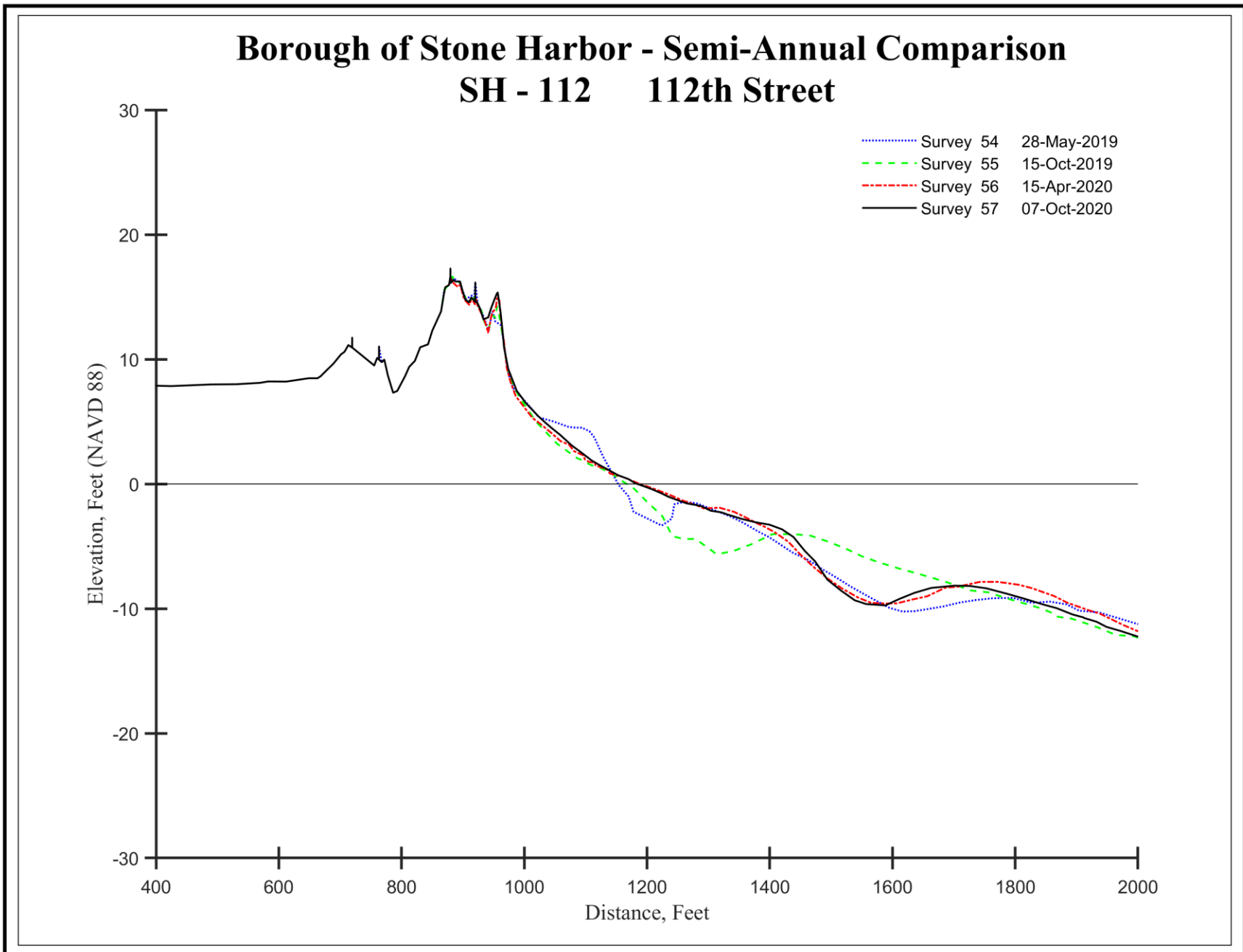


Figure 6d. The profiles at 112th Street continued the pattern where the beach slope and position maintained the same configuration following the addition of a berm from offshore sand supplies in May 2019. Continued cross-shore migration continued after October 2019 as the entire system stabilized with few changes in 2020.

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.

The site was unique in the generation of a late summer 2020 berm crest to pair with that found on the May 2019 survey. The dunes accumulated sand similar to other sites while the offshore region stabilized around small offshore bars as considerable distance from the water's edge.

Site SH-116 – 116th Street

(Photoplate 7a-7c)



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

Photoplate 7b – Photo taken April 15, 2020 showing continued sand deposition around fencing locations and a wide beach seaward .



Photoplate 7c – Photo taken October 7, 2020 provides a view of the wide dry beach and sand deposited among the dune plants at 116th Street.

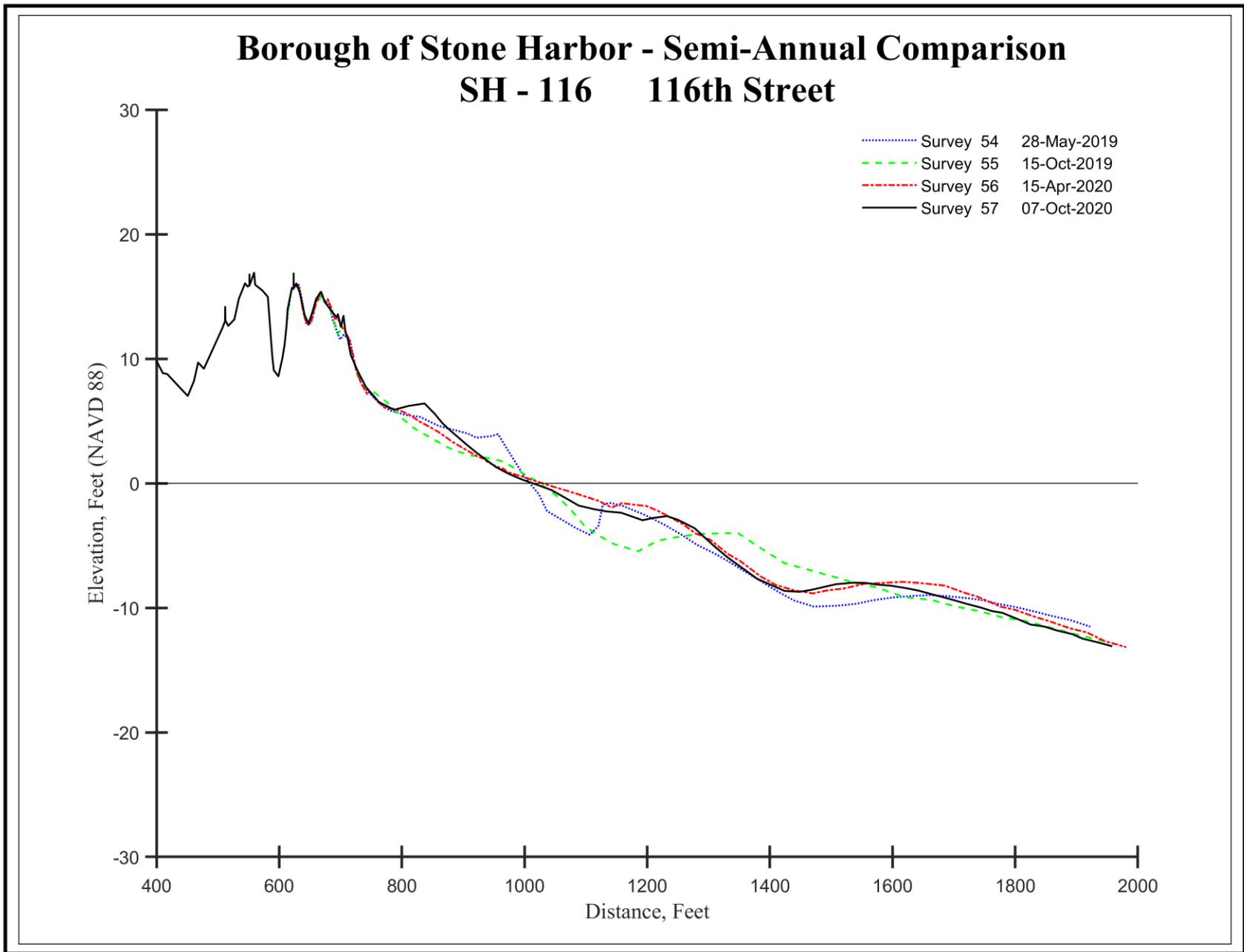


Figure 7d. The 116th Street location includes a double dune system that continues to capture wind transported material mostly on the seaward slopes. This site developed a prominent berm crest ridge in 2020 duplicating the one present in May 2019, but further landward. Offshore bar material provided the supply of sand.

SH-123 is located at 123rd Street south of the developed part of town and just north of the terminal groin. 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 Point. 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 7,600 feet from the terminal groin into Hereford Inlet.

The abrupt scarp cut into the dunes last fall was partially covered by a slope of dry sand that was wind transported to conceal about two-thirds of the eroded face of the dunes. Accumulation of sand on the beach above high tide also widened the profile. Offshore bar migration provided the necessary sand supply during both summer seasons.

Site SH-123 – 123rd Street

(Photoplate 8a-8c)



Photoplate 8a - Photo 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.

Photoplate 8b – Photo taken April 15, 2020 following a long interval of quite waves and wind transport placing sand at the scarp. Crest slumping also added sand to the slope.



Photoplate 8c – The photo taken October 7, 2020 illustrates the maximum impact natural wind deposition can have in restoration of dune erosion damage. The beach is wider at the close of the 2020 summer season.

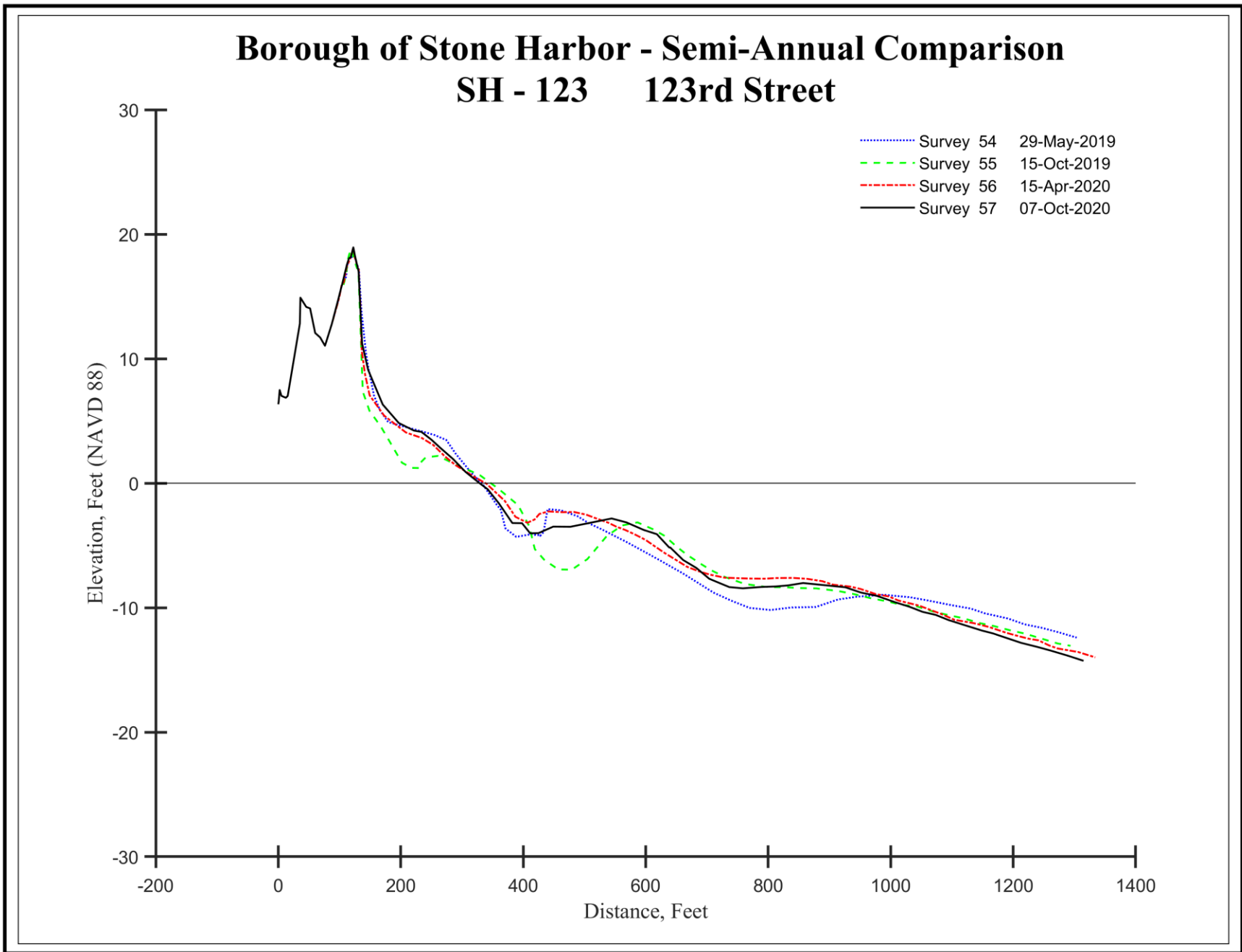


Figure 8d. 123rd Street site was eroded at the dune toe slope in May 2019 when sand commenced migrating onto the beach from offshore sources moderating the scarp and adding a dry sand slope toward the dune crest by October 2020. The bar sequence offshore was more variable than other sites, but still was adding sand to the beach.

Summary

The 2017 joint federal and NJ State project was the most recent effort adding sand to the Stone Harbor oceanfront. The weather conditions have favored beach stability during the sequence of surveys presented in this report. 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. The State of NJ, Div. of Coastal Engineering funded the southern segment of Stone Harbor's nourishment cycle because State or local funds may be expended moving sand from a CBRS.

The significant gain in volume (827,448 cubic yards) between October 2016 and October 2017 was documented in earlier surveys. During 2018, 46,562 cubic yards of sand were lost from the system. This represents about 5.6% of the sand supplied to the beaches. In 2019 87,848 cubic yards of sand were naturally added to the oceanfront beaches representing 10.6% of the 2017 effort. During the summer of 2020 the net loss was 77,229 cubic yards or 9.3% taken from the 2017 supply. In 2019 the Borough declined to allow the US Army Corps to excavate dune sand concentrated between 111th and 117th Streets plus adjacent areas to augment beach widths along the oceanfront. However, the survey work since the 2017 maintenance fill was complete indicates that the Stone Harbor oceanfront shoreline has done remarkably well in terms of sand losses and shoreline retreat.

Work continues among the interested communities is seeking final mitigation of the US Fish & Wildlife's determination that the 1982 Coastal Barrier Resource Act prohibits sand extraction from a coastal barrier unit for beach nourishment purposes. The Coastal Center is aware of a law suite filed by the National Audubon Society against the implementation of the Interior Secretary's letter regarding Hereford Inlet.

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 2020 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.

[Done to here](#)

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.

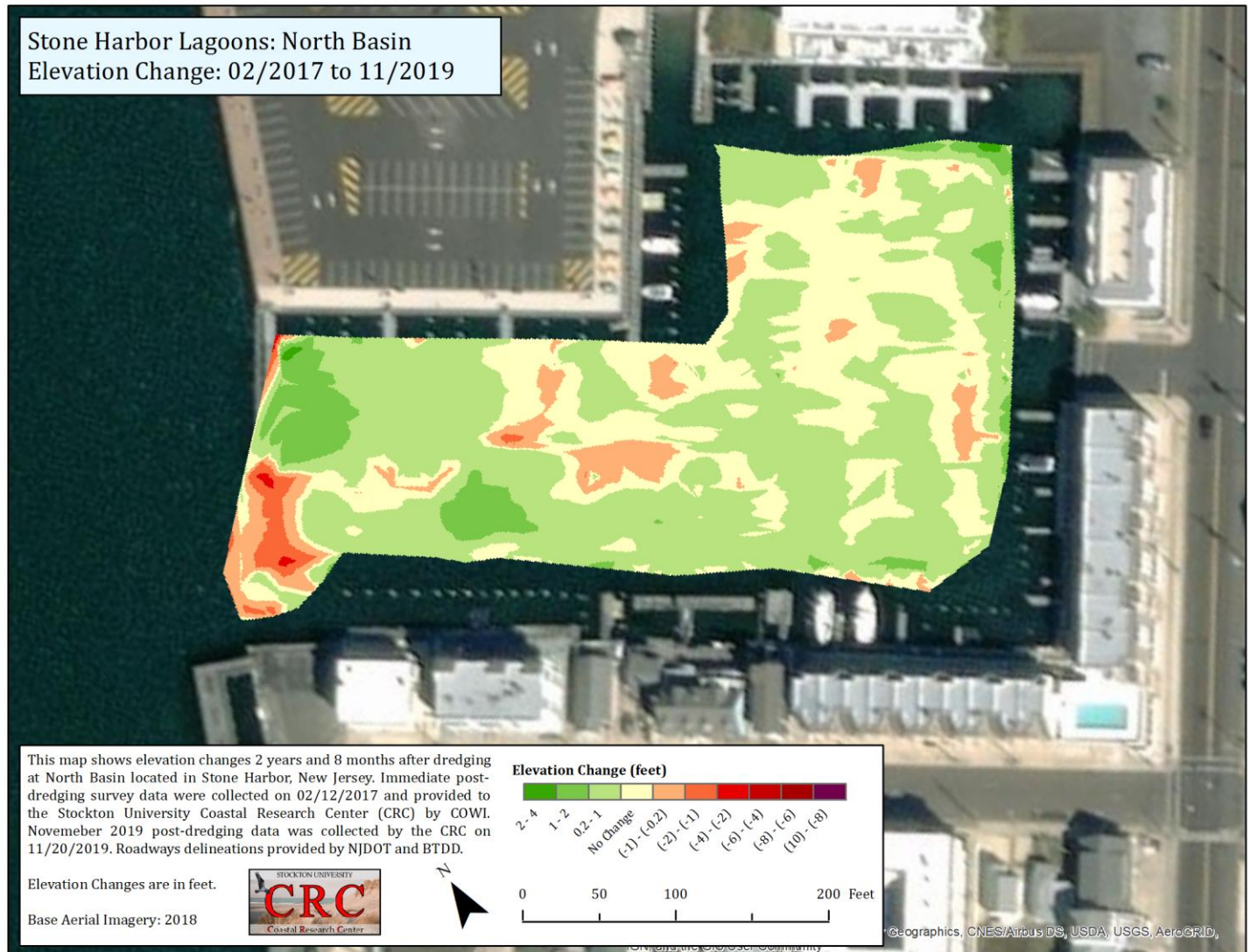


Figure 9a. This basin remains at or slightly shallower than it was immediately after dredging was complete. The entrance area is between 0.2 and 2.0 feet deeper in a narrow zone right at the point where tidal water enters the lagoon. The inner basin remains with about half the area as dredged and half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

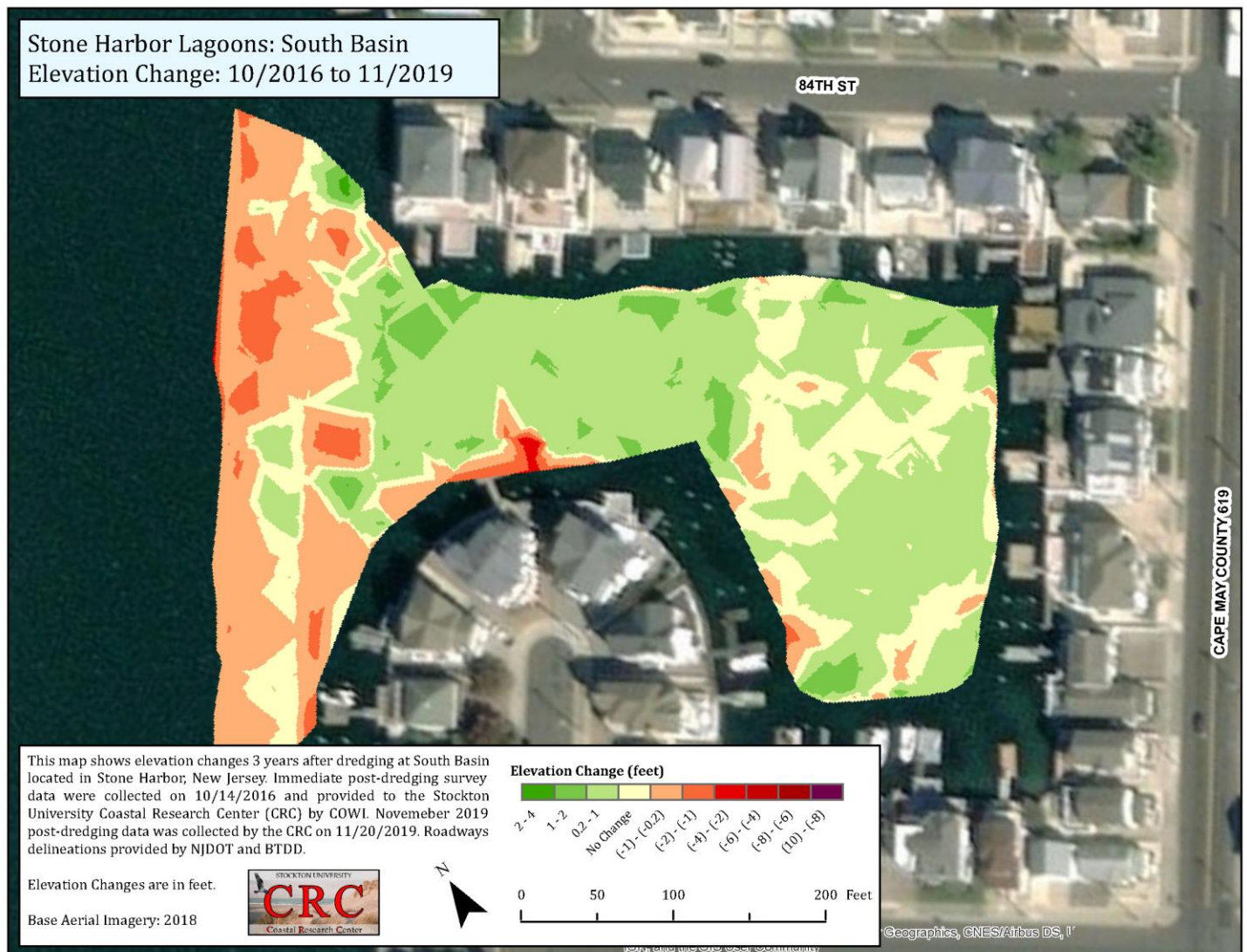


Figure 9b. South Basin has performed in similar fashion to the post-dredging changes seen in the North Basin. Between 0.2 and 1.0 feet of sedimentation since dredging has appeared over three years across the main channel and to a lesser degree, within the inner basin, while entry point erosion has created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

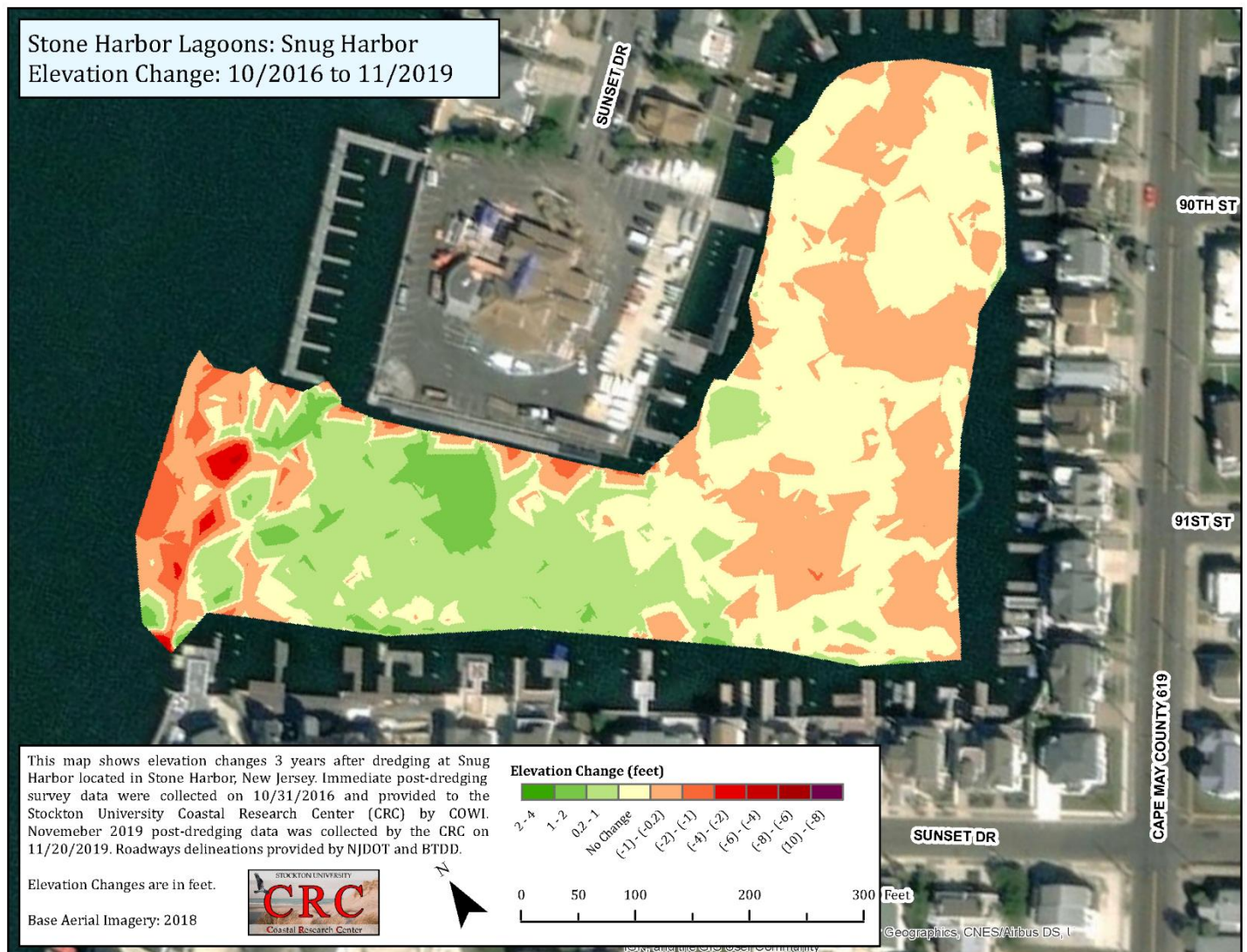


Figure 10. Snug Harbor shows between zero and 1.0 feet of deepening in the inner basin, while showing 0.2 to 2.0 feet of shallower areas within the entrance channel. A complex set of bands across the entrance show areas of deeper depths with patches of shallower areas. These range from -3.0 to zero to 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.

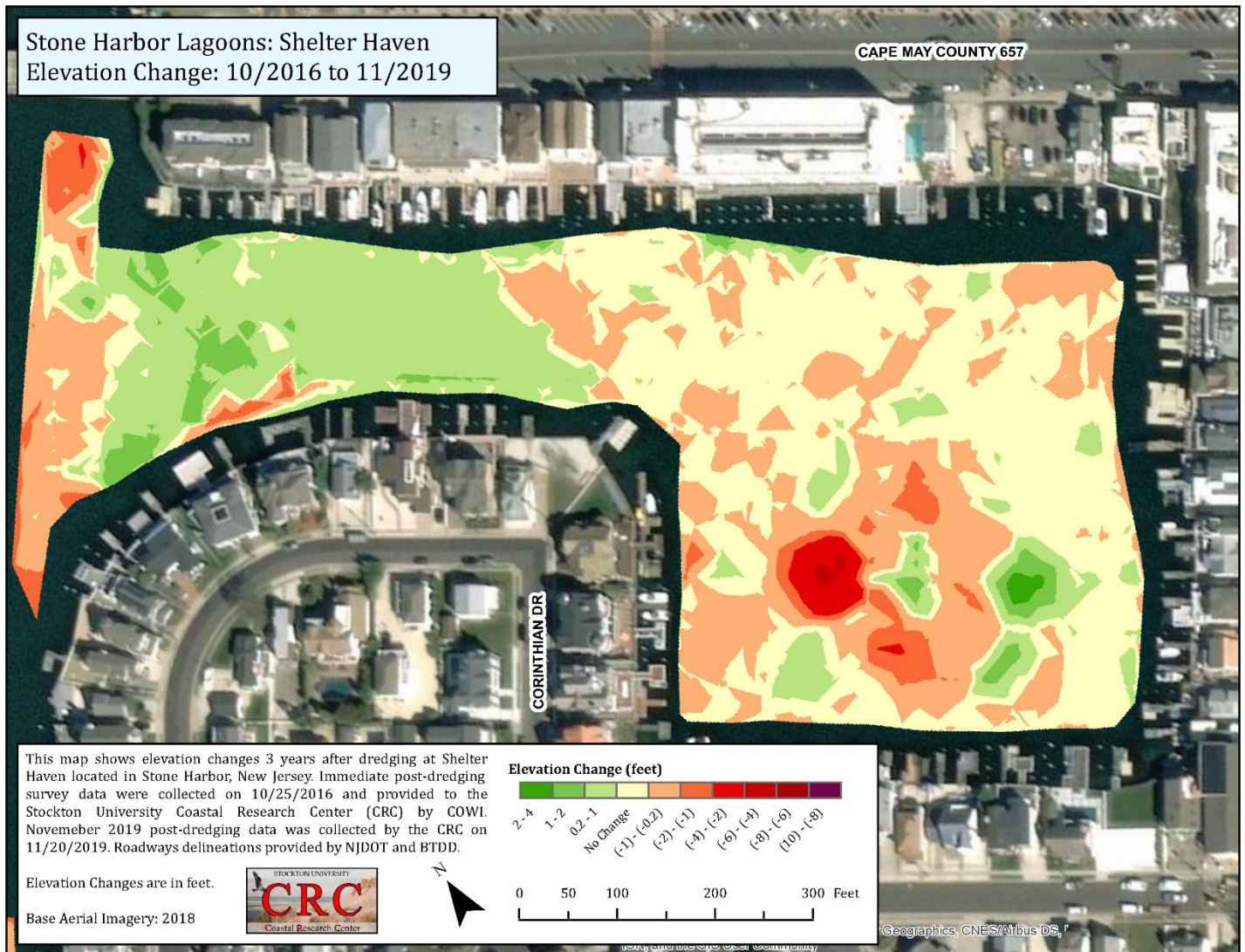


Figure 11. Shelter Haven is located just south of 96th Street and is similar in the pattern to the north where the inner basin is unchanged or marginally deeper, the entrance channel is up to a foot shallower and the entry point from Great Thorofare has seen sediment erosion at the point where the eastern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

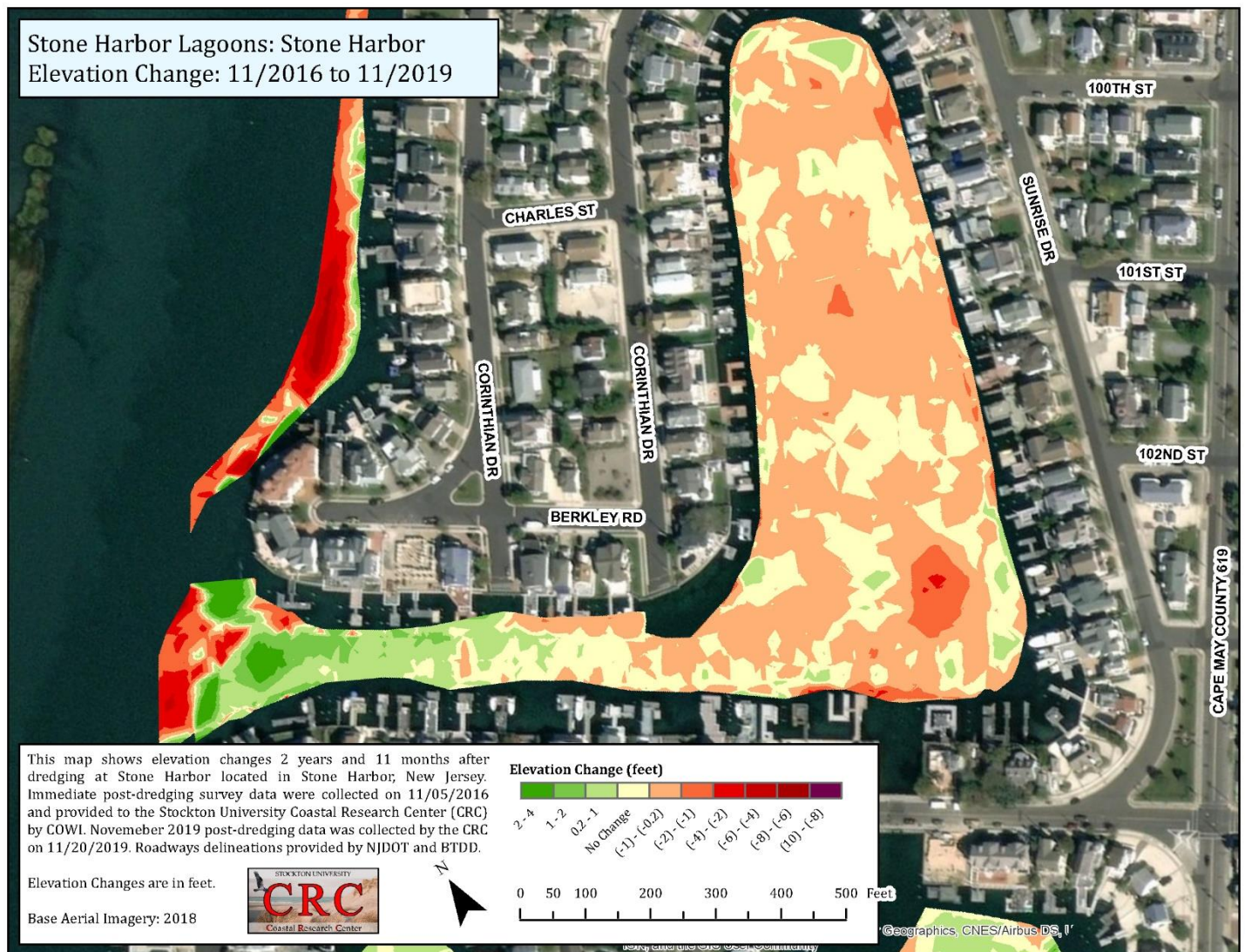


Figure 12. Stone Harbor Lagoon displays a consistent pattern associated with the northern basins where the inner basin has remained as dredged or become marginally deeper (-0.2 to -1.0 feet) while the entrance channel has become shallower since November 2016. Sediment erosion has impacted the entry point 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.

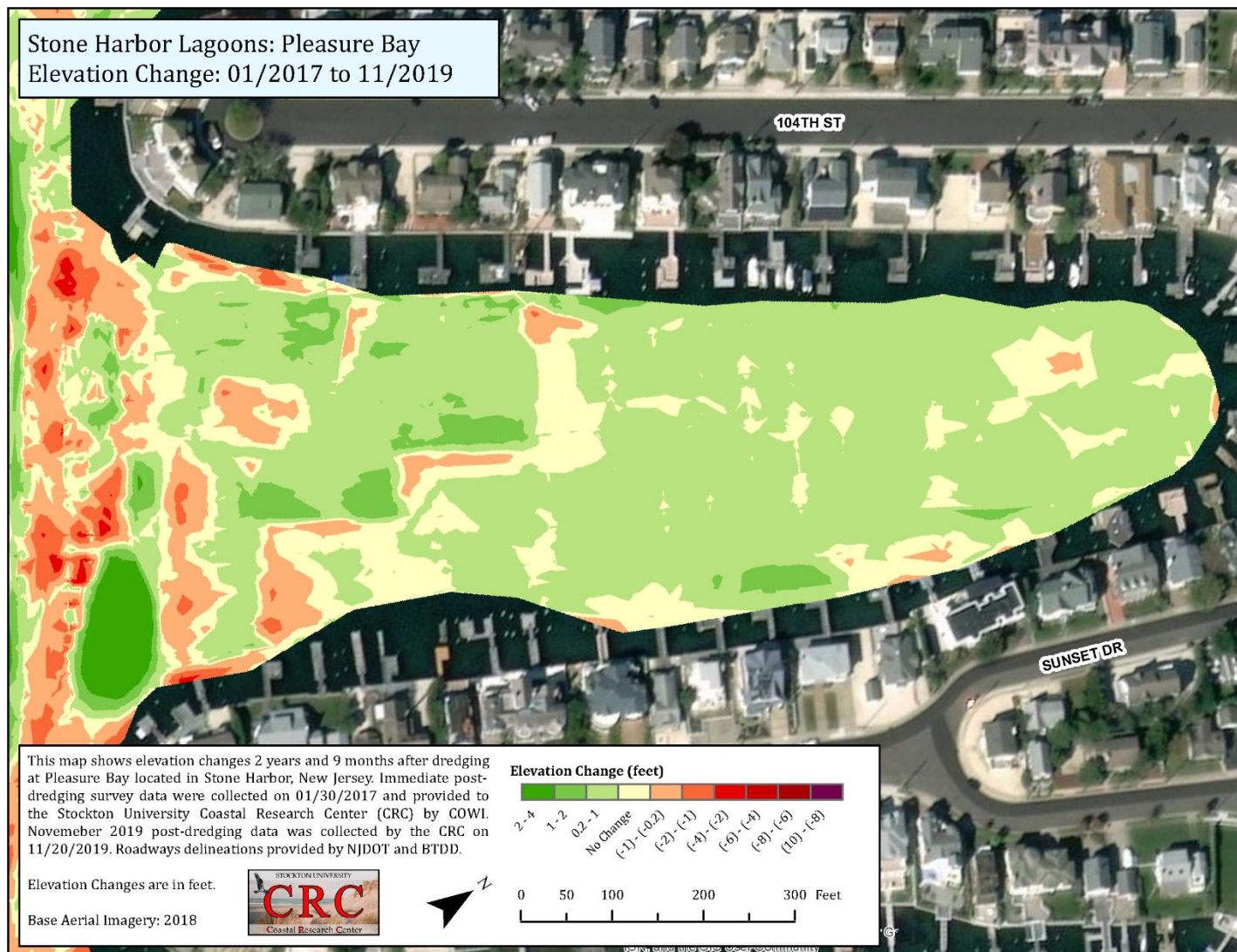


Figure 13a. Pleasure Bay is the westernmost lagoon of this pair, located south of 104th Street. This basin has become between zero and 1.0 feet shallower since March 2017. There is a scour located at the entry to Pleasure Bay that continues east to the entrance of Carnival Bay. The entry areas show spotty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

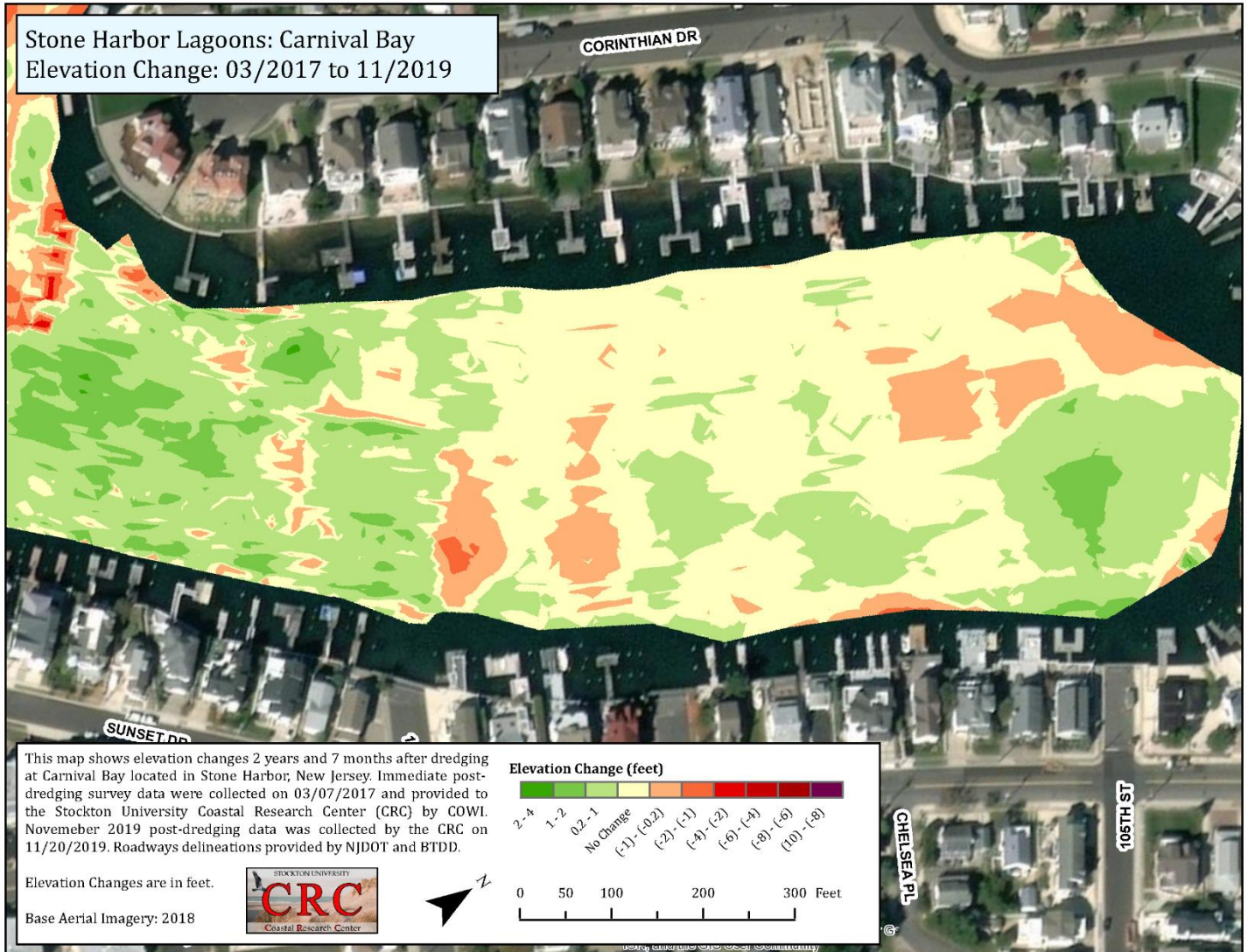


Figure 13b. Carnival Bay is east of Pleasure Bay and conforms to the same general configuration, but east of Corinthian Drive. The southern third is shallower while the remainder of the basin shows either no change or a pattern of zones of accretion and deepening. This area is at a maximum distance from 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.

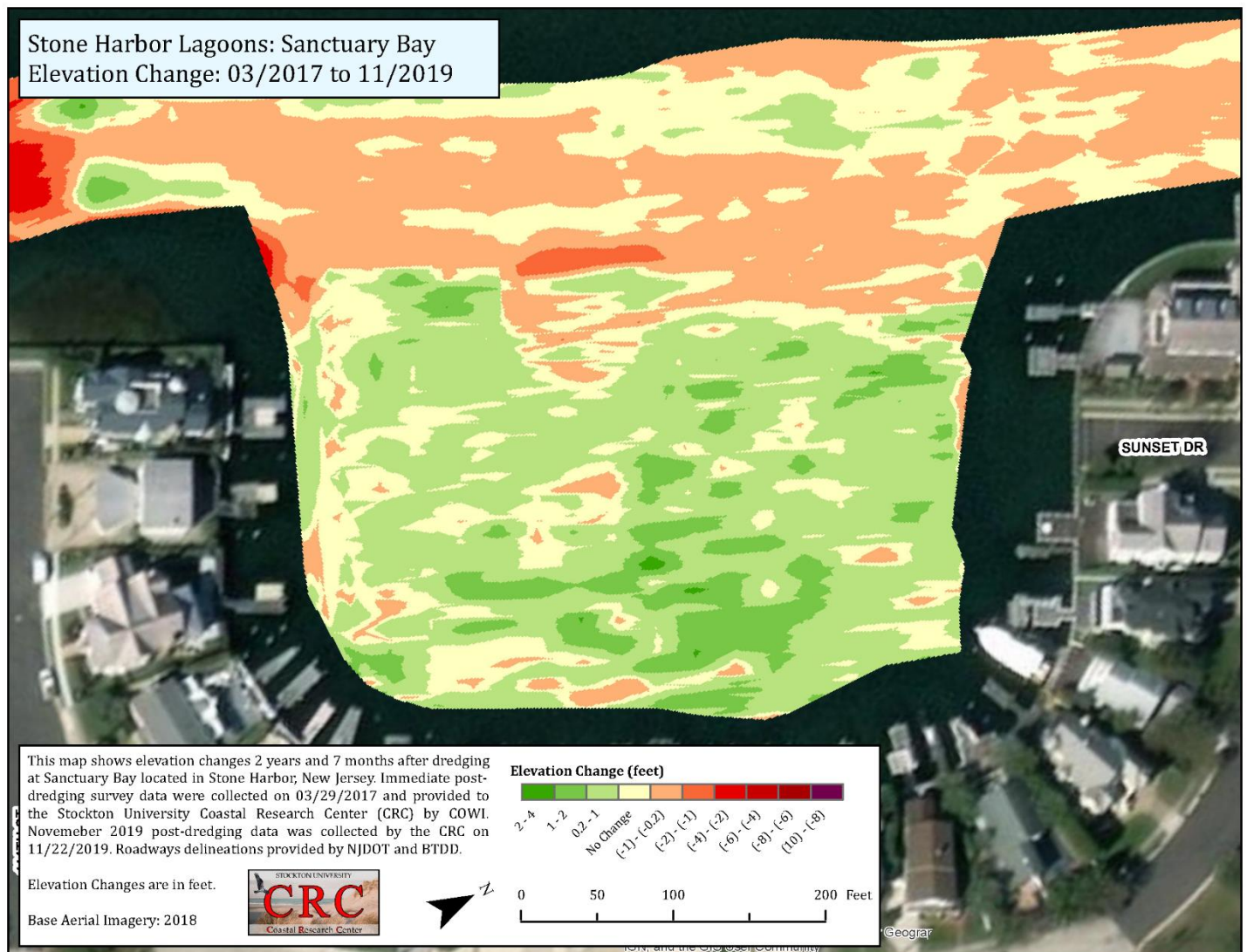


Figure 14. Sanctuary Bay lies east of the channel running south from the entrance to Carnival Bay and that exits at the bridge to North Wildwood. The excavated basin appears shallower by 0.2 to 2.0 feet in some spots, while the channel area is deeper by the same measure (0.2 to 2.0 feet). Substantial 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.

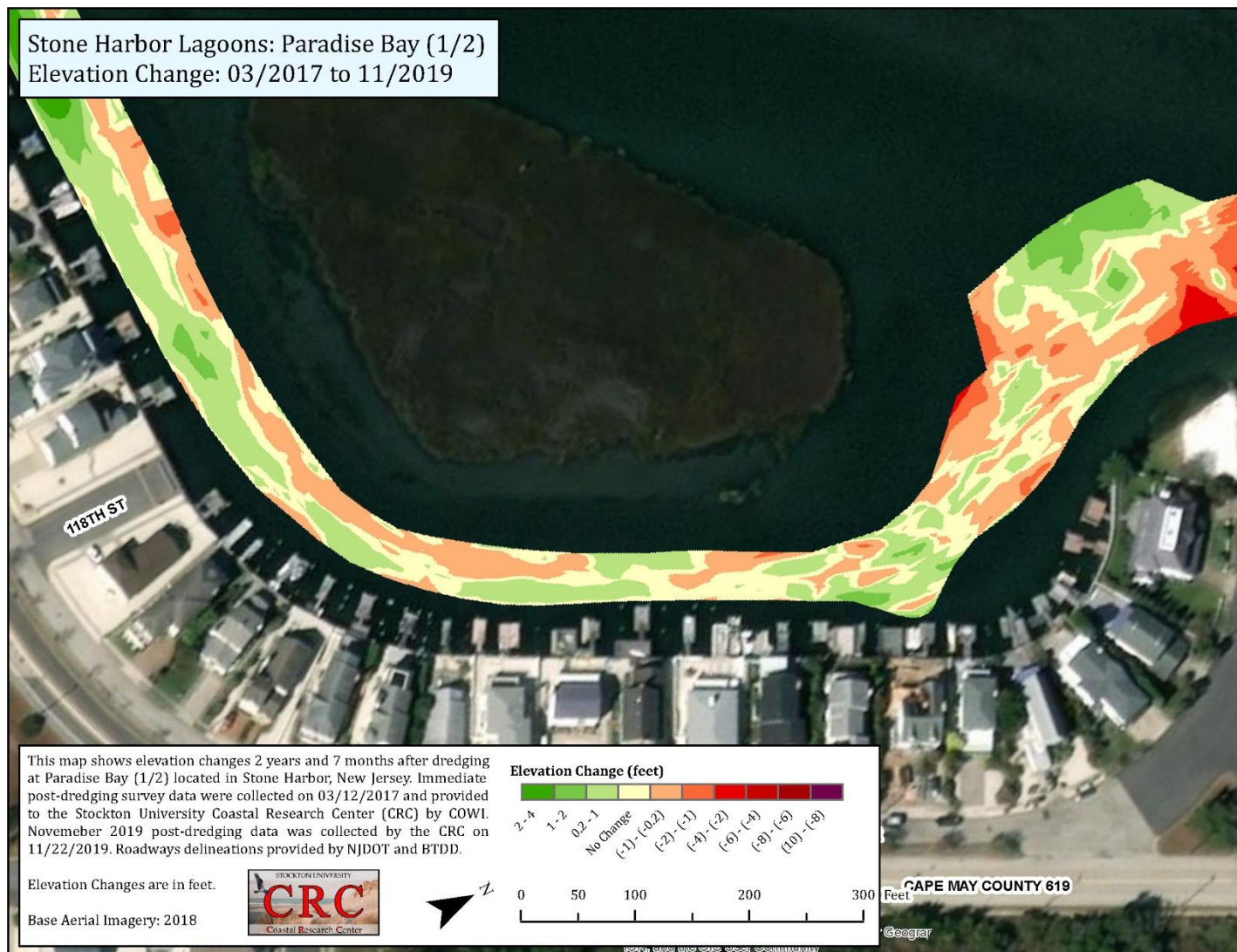


Figure 15a. The northern end of Paradise Bay is a dug channel between development and a marsh bay island to the west. There is spotty pattern of accumulation, no change and erosion since March 2017 when dredging was completed. The pathway south between marsh islands west of this channel is shallower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

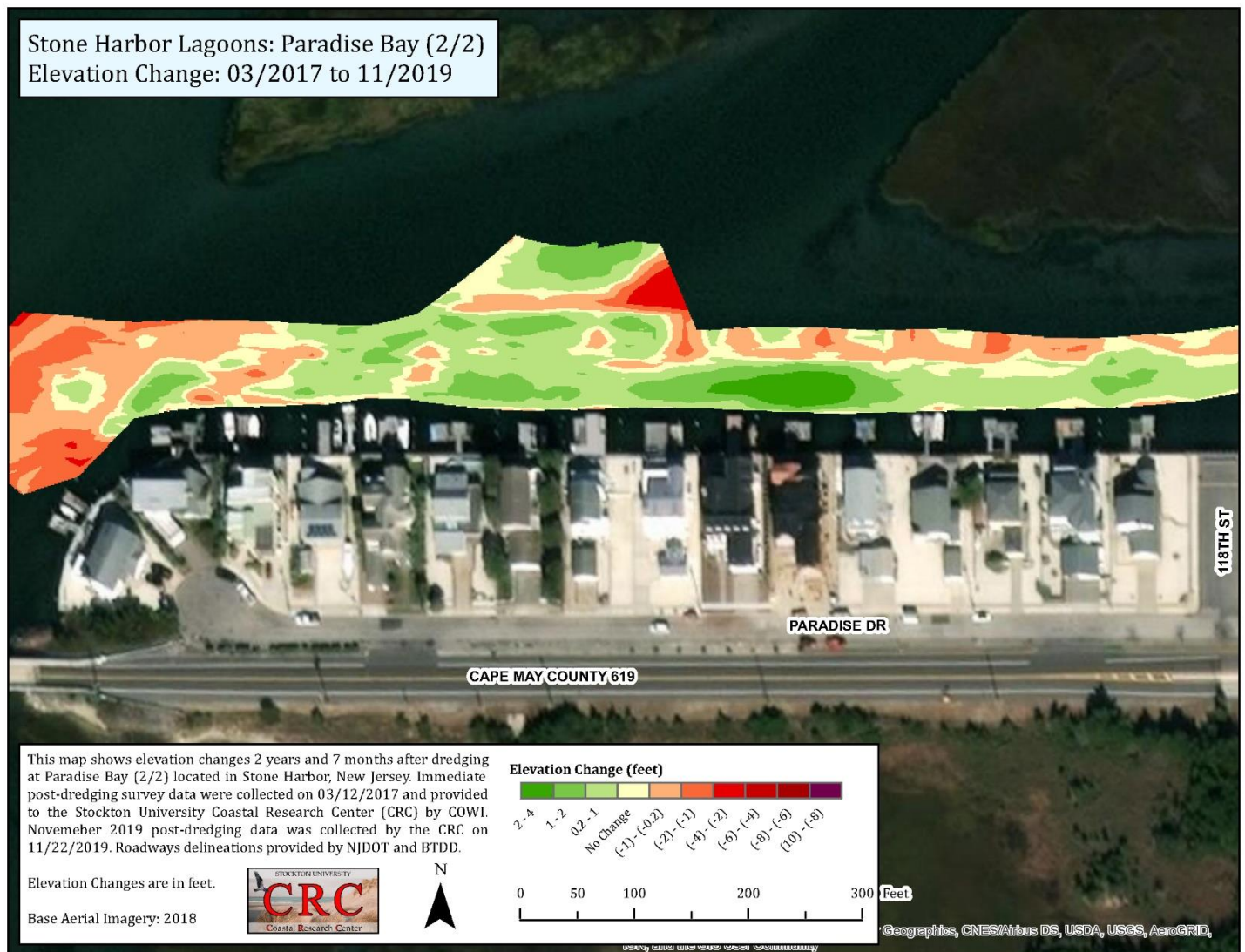


Figure 15b. The southern end of the Paradise Bay channel has accumulated sediment since dredging except for the entry back into Great Thorofare. The branch leading north between the marsh islands was surveyed but was barely navigable except within a few feet from the bay island to the right side going 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.