The Coastal Research Center

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NEW JERSEY'S DISTINCTIVE PUBLIC UNIVERSITY

Mayor Palombo and Township Committee
Township of Upper
P.O. Box 205
Tuckahoe, New Jersey 08250

September 11, 2018

Dear Mayor Palombo and Committee Members:

The Stockton University Coastal Research Center (CRC) surveyed the municipal shoreline September 4 & 5, 2018 to document changes for the 3rd quarter (summer) of 2018. This analysis compares the recently collected data with the data from March and June of 2018. The survey comparisons provide data to evaluate seasonal shoreline and sand volume changes, current beach conditions and engineered beach performance. Data collected at the six-oceanfront beach profile locations cover the municipal beaches from Seaview Avenue to 1st Street. This coverage includes the changes in the US Army Corps of Engineers (USACE) engineered beach in Upper Township but not those occurring on State property at Corson's Inlet.

The 2018 spring storm series took a significant toll on the northern beaches in Strathmere, but the problem continued to become more alarming between the June 8th to Sept. 5th survey interval particularly at Williams and Seaview Avenue sites (UT-5 & UT-6). The four locations to the south saw normal summer sand accumulations on the beach as the berm became larger at the expense of the sandbars located offshore. In fact, the UT-1 site at 1st Street saw 9.53 $yds^3$/ft. deposited on the beach above the zero elevation line, while 12.88 $yds^3$/ft. were removed below the zero elevation line. Similar results occurred at UT-2 and UT-4, while UT-3 gained sand across the entire profile. The crisis is confined to the beach between the State Park/Seaview Avenue and Williams Avenue where shoreline retreat amounted to 173 feet.

These six quarterly monitoring sites are as follows:

| | |
|---|---|
| UT-1 | First Street at the border with Sea Isle City (NJBPN site #120) |
| UT-2 | 2400 Commonwealth Avenue |
| UT-3 | Jasper Avenue |
| UT-4 | Tecumseh Avenue |
| UT-5 | Williams Avenue (NJBPN site #121) |
| UT-6 | Seaview Avenue at Corson's Inlet |

The aerial photo (figure 1) below taken on April 21, 2018, two weeks following the fourth storm in this winter's late series of events. View is looking south from above the Ocean City southern spit towards Strathmere and shows Corson's Inlet shoreline as well as the oceanfront beaches extending south to near the Sea Isle City border. The calm ocean wave climate did nothing to reduce the sand loss rate as the next photo shows (figure 2). The retreat in the shoreline repeats conditions seen multiple times previously as subsidiary tidal channels develop along the base of the beachface and concentrate tidal current flow at the beach. As each wave breaks on the beach the net current transport is either south toward the Tecumseh Ave. site or northwest into Corson's Inlet. It does appear that the sand spit in the State Park grew substantially longer between April and September.

**Figure 1. The aerial photo above shows conditions on April 21, 2018, following the last of the winter storm series. This photo shows the tip of the southern Strathmere spit truncated after the storms but new sand has already welded to the beach along both the Ocean City and Strathmere inlet shorelines (Photo by Ted Kingston).**

**Figure 2. By August 30, 2018 the beach loss at Seaview and Seacliff Avenues was to the seaward toe of the dunes. Storm activity September 9th most likely made the situation worse.**

In spite of the winter storms, the southern beaches recovered with sand deposited on the beach derived from offshore. The shoreline stability is apparent from Tecumseh Avenue south and from the September 2018 air photograph in figure 2 above, the shoreline retreat ends just south of Williams Avenue.

Table 1 shows the sand volume and shoreline change values calculated for each of the six monitoring sites. It shows the values for the period from March 2018 to June 2018. Individual shoreline (feet) and sand volume ($yds^3$/ft.) changes displayed along with an average volume change between sites. The average volume change multiplied by the distance between sites determines a net cell volume change. Summation of the net cell volume changes produces a total net sand volume change for the Strathmere oceanfront beaches.

**Table 1.**
**Sand Volume and Shoreline Position Changes at Six Strathmere Survey Sites**
**June 2018 to September 2018**

| Profile | Shoreline Change (feet) | Volume Change ($yds^3$/ft) | Avg.Volume Change ($yds^3$/ft) | Distance Between (feet) | Net Volume Change ($yds^3$) |
|---|---|---|---|---|---|
| ***Southern Township Boundary*** | | | | | |
| **UT-1** | -4 | -3.4 | | | |
| | | | 0.2 | 1,410 | 240 |
| **UT-2** | -13 | 3.7 | | | |
| | | | 9.9 | 2,938 | 29,092 |
| **UT-3** | 26 | 16.1 | | | |
| | | | -1.0 | 2,297 | -2,269 |
| **UT-4** | -42 | -18.1 | | | |
| | | | -27.1 | 1,323 | -35,851 |
| **UT-5** | -173 | -36.1 | | | |
| | | | -27.0 | 911 | -24,554 |
| **UT-6** | -74 | -17.8 | | | |
| | | | | 0 | |
| ***Northern Township Boundary*** | | | | | |
| | | | **Total Volume Change =** | | **-33,342** |

A similar table showed, a cumulative sand volume loss of -183,513 cubic yards for the spring season. In spite of the critical situation seen at Seaview Avenue, the net loss was relatively small between June and September (-33,342 cubic yards), which was concentrated well north of Tecumseh, past Williams and Seaview Avenues to the State Park. The remaining sites generally gained sand on the beach itself while losing material offshore (UT-1, -2 and -4). UT-3 at Tecumseh Avenue gained sand both on the beach and offshore indicating the locus of southerly transport from erosional effects due to Corson's Inlet's shoreline impacts.

***UT-1, First Avenue (NJBPN #120).***

This site positioned near the boundary between Sea Isle City and Strathmere, has a 32-year survey history making it essential to incorporate into the Township study. The region has a history of frequent storm breaches and overwash across Commonwealth Avenue prior to the state and local beach nourishment project. Following the federal project, the dune crest height is 15 feet NAVD88, while width at the toe is approximately 160 feet. The beach width extends another 300 feet seaward to the MHW line with a berm crest height of approximately 5-6 feet NAVD88.

Between June and September this location saw a very significant berm produced that included the addition of 9.53 $yds^3$/ft. in sand volume on the beach. There was little addition to the dunes, but grass plants propagated

down the seaward dune slope as the wide beach continued to provide wave protection. Offshore the bar trough became deeper as material moved onto the beach or further south into Sea Isle City. The offshore loss was 12.88 $yds^3$/ft. between June and September and -19.94 $yds^3$/ft. between March and September.

**Photo on left taken on June 8, 2018 shows continued foredune growth and colonization of grass seaward. A summer beach berm developed over the spring and created a wider dry recreational summer beach.**

**Photo on the right taken Sept. 5, 2018 shows substantial vegetation density increases with a wide, dry beach seaward.**

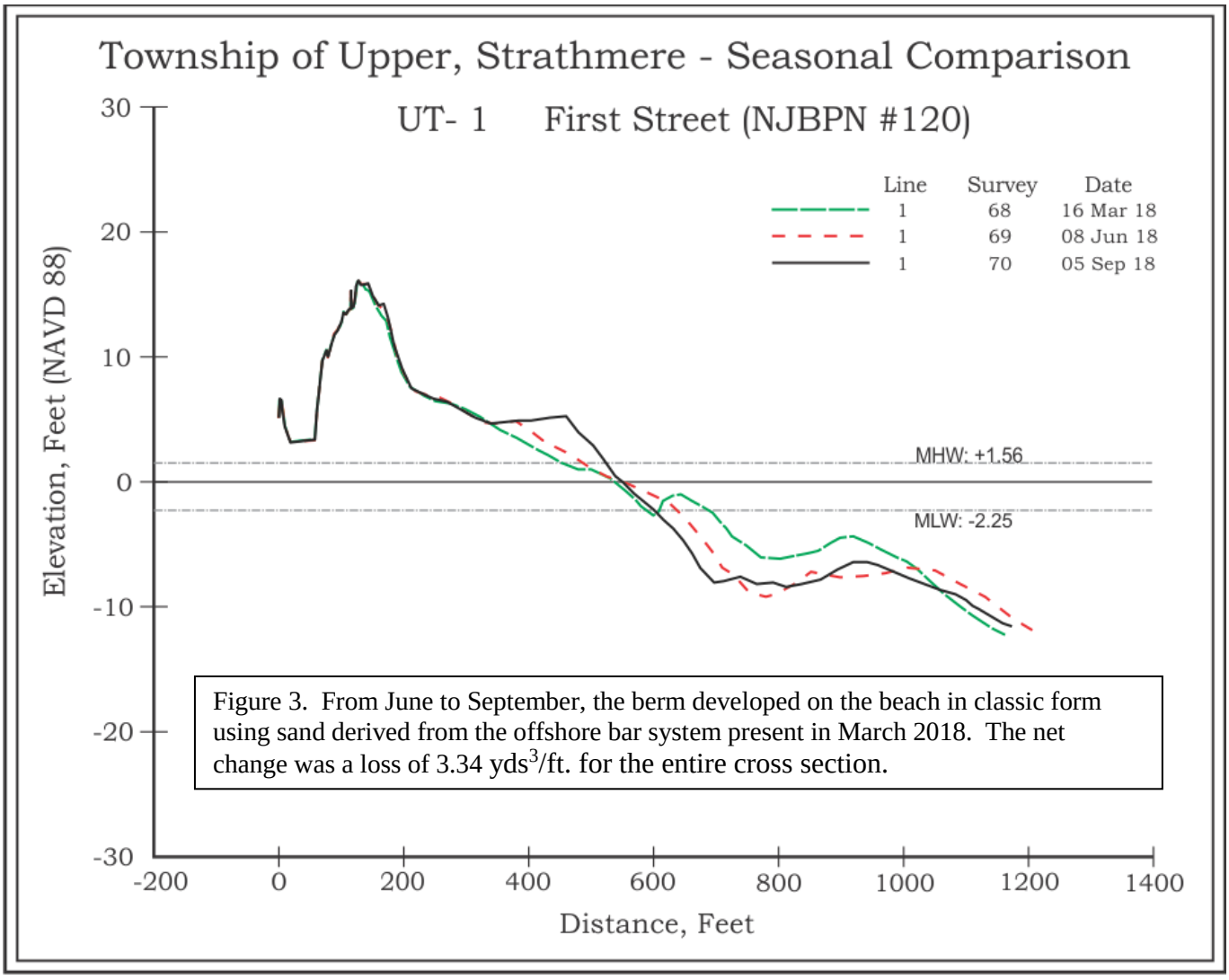


Figure 3. From June to September, the berm developed on the beach in classic form using sand derived from the offshore bar system present in March 2018. The net change was a loss of 3.34 $yds^3$/ft. for the entire cross section.

***UT-2, Located at 2400 Commonwealth Avenue.***

The site is located along the southern undeveloped eastern side of Commonwealth Avenue across the road from 2400 Commonwealth Avenue. Historically this region has been more resilient than First Avenue with no documented episodes of dune breaching or overwash during the CRC monitoring for the Township. The state, local and federal beach nourishment efforts have significantly enhanced the beach and dune. Current dune crest elevation is 15 feet NAVD 88 and 160 feet in width at the toe. The beach extended an additional 300 feet seaward from the dune toe to the MHW line. The summer accretion added a substantial berm to the beach as sand moved onshore. The bar system followed the beachface growth by moving landward almost 100 feet.

**Photo on the left taken June 8, 2018, shows continued sand accumulated on the foredune and colonization of beach grass across the developing feature to the seaward toe. Beach remains wide enough to support continued dune growth.**

**Photo on the right taken Sept. 5, 2018 also shows extensive vegetation growth and its spread to the toe of the dune. The beach width remains excellent.**

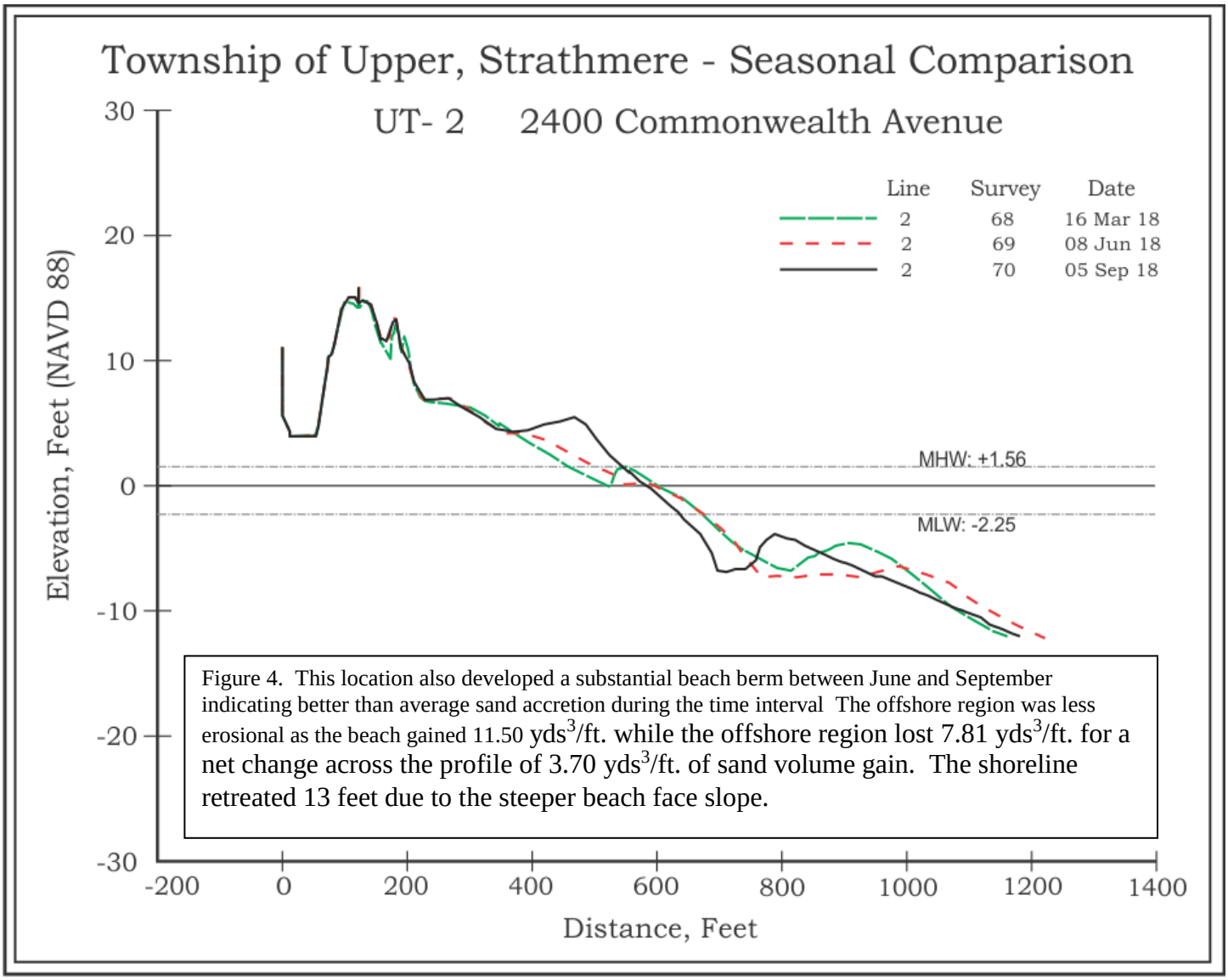


Figure 4. This location also developed a substantial beach berm between June and September indicating better than average sand accretion during the time interval The offshore region was less erosional as the beach gained 11.50 yds$^3$/ft. while the offshore region lost 7.81 yds$^3$/ft. for a net change across the profile of 3.70 yds$^3$/ft. of sand volume gain. The shoreline retreated 13 feet due to the steeper beach face slope.

***UT – 3, Jasper Avenue.***

This site is located at Jasper Avenue, where development of the properties on the eastern side of Commonwealth Avenue tapers off. Once the site of frequent storm breaches in the dunes, this site now has a significant advanced level of shore protection. This summer the deep offshore bar trough filled in becoming a uniform slope seaward to the end of the profile data. The trough represented the majority of the accumulated sand this season. While the beach did not accumulate more than 0.46 yds$^3$/ft., a sizable berm did appear, but the 15.86 yds$^3$/ft. deposited offshore made this the most accretional site of the six.

**Photo on the left taken June 8, 2018 shows continued foredune growth. Colonization of beach grass had spread across the seaward slope onto the upper beach where a new foredune ridge showed early signs of development (upper right). The beach is wide, stable to slightly accretive and provides an abundant source of aeolian sand, allowing continued dune growth and expansion.**

**Photo on the right taken Sept. 5, 2018 from the foredune ridge crest shows abundant dune development on the open beach over 100 feet further seaward. The mid-beach is becoming a new foredune location should development continue.**

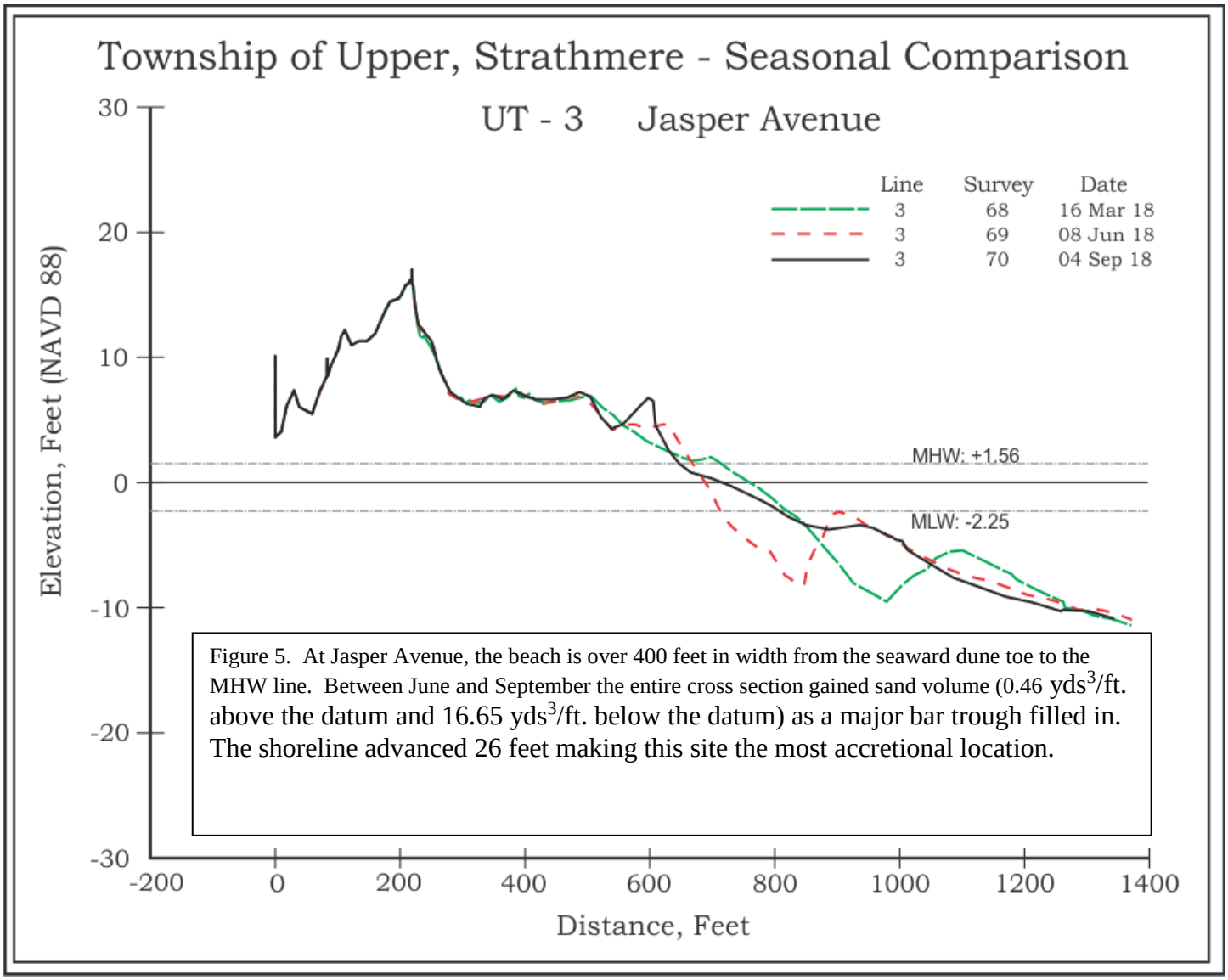


Figure 5. At Jasper Avenue, the beach is over 400 feet in width from the seaward dune toe to the MHW line. Between June and September the entire cross section gained sand volume (0.46 $yds^3$/ft. above the datum and 16.65 $yds^3$/ft. below the datum) as a major bar trough filled in. The shoreline advanced 26 feet making this site the most accretional location.

***UT – 4, Tecumseh Avenue.***

This site, set one block north of the Sumner Avenue groin to measure its impact, now buried, provides data on the transition in the beach orientation and taper to the influence of Corson's Inlet tidal dynamics on the northern beaches. The timber bulkhead jogs landward south of Sherman Avenue one block south of Sumner Avenue, because of a natural setback in the shoreline. Prior to initial beach nourishment storm surge and waves would reach and frequently overtop the exposed bulkhead at Tecumseh Avenue.

This site gained minimally on the beach (1.27 $yds^3$/ft.) while losing 18.09 $yds^3$/ft. offshore as the large bar present in March diminished in size to the point of vanishing completely by September. The sand volume appears to have moved elsewhere along the shoreline, not landward adding to the beach in large measure.

**Photo above shows the foredune and beach on June 8, 2018 following the spring season. New dune fence installed continued to accumulate sand. Beach grass flourished and colonized the seaward slope onto the upper beach. This wide beach continued to support dune growth and expansion with initial development of a new foredune through aeolian processes underway (mid-right photo)**

**Photo above shows the same view on September 4, 2018 shows vegetation density improvements with dune development appearing to be occurring on the mid-beach zone 100 feet seaward of the present foredune fencing.**

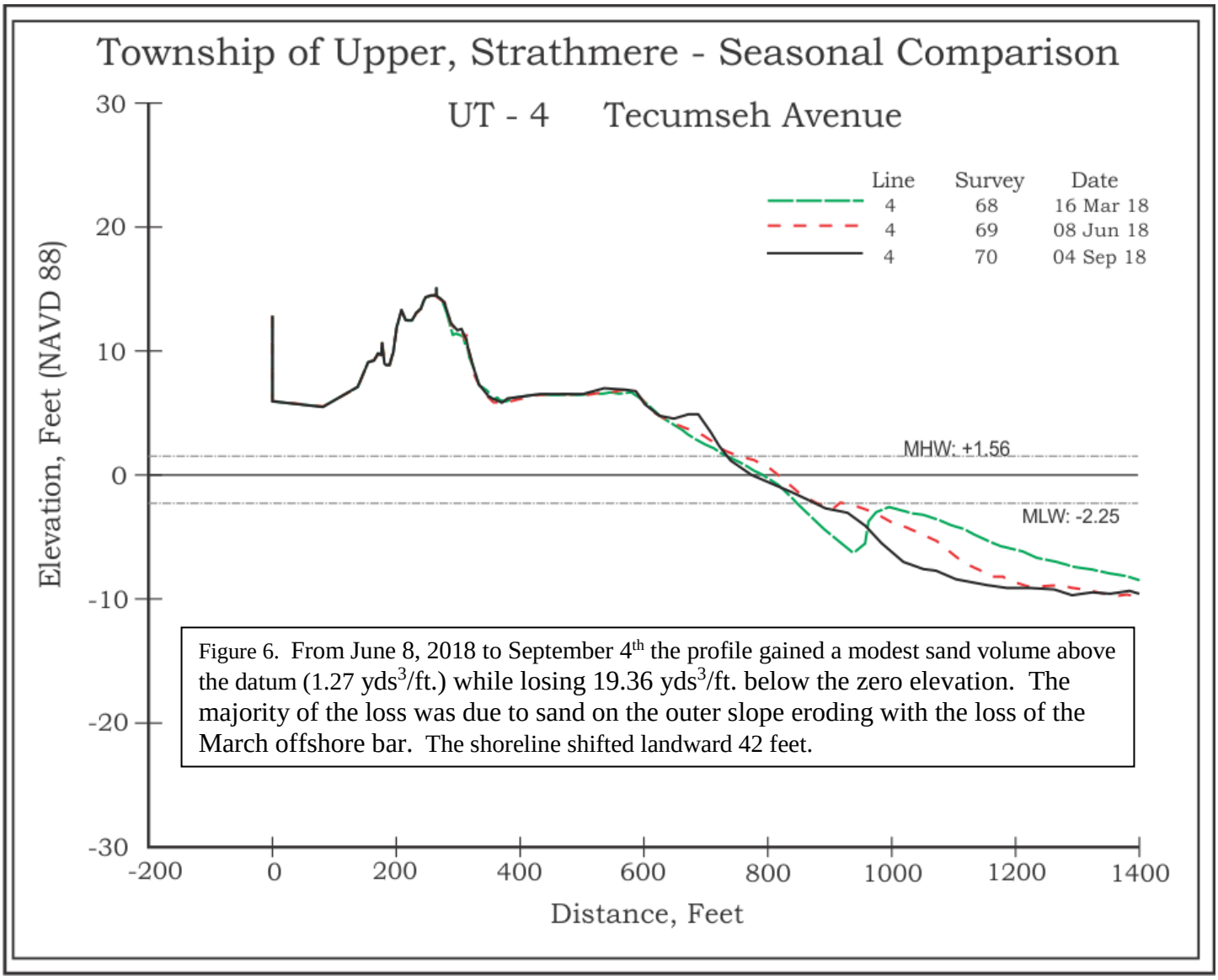


Figure 6. From June 8, 2018 to September 4th the profile gained a modest sand volume above the datum (1.27 $yds^3$/ft.) while losing 19.36 $yds^3$/ft. below the zero elevation. The majority of the loss was due to sand on the outer slope eroding with the loss of the March offshore bar. The shoreline shifted landward 42 feet.

***UT – 5, Williams Avenue (NJBPN #121).***

Monitoring started here in 1986 as part of the NJBPN program, now included in the municipal monitoring project. This site is located near the southern limit for direct inlet influences. Sand intermittently accumulates on this beach naturally as tidal delta bars shed off adjacent ebb shoals migrate landward under favorable conditions and attach to the shoreline. This provides periodic influxes of sand through natural processes to this region. As a result, the beach is typically wider, supports modest natural dune growth and as a result has received limited fill volumes during beach nourishment.

On other occasions, tidal currents augment wave erosion and cause rapid shoreline retreat as sand moves rapidly elsewhere in the absence of storm events. This summer the beach retreated 173 feet making loses quite significant. While the aerial photograph in figure 2 seems to indicate that the loss volume rapidly diminishes south of the profile line (Tecumseh Avenue was not affected), the loss continued north including Seaview Avenue. Photography does show sand accumulating in the State Park area north of development in Corson's Inlet, and the profile sites to the south have seen offshore bar troughs fill in. The net loss here is not storm related, but due to subsidiary tidal channels developing in bar troughs near the inlet and migrating landward to be adjacent to the beachface toe. Every wave breaking on the beach is also subject to tidal flow in the ebb- or flood-direction. This produces rapid sand transport either into the inlet or south to Tecumseh Avenue where it deposits in the bar troughs.

There are few options available to halt this process, the sand transfer option can slow the rate of sand loss, but means relatively constant attention until the satellite tidal channel closes off with new offshore sand deposits.

**Photo above shows the wide beach and well developed dune at Williams Ave. The foredune feature continued to accumulate sand and expand through aeolian processes while beach grass colonized the landward slope and**

**Photo on the right taken Sept. 4, 2018 makes the beach retreat appear less than critical. There is still over 250 feet of dry beach to the berm crest, but the 173-foot berm retreat signals continued losses. For now the dune is safe.**

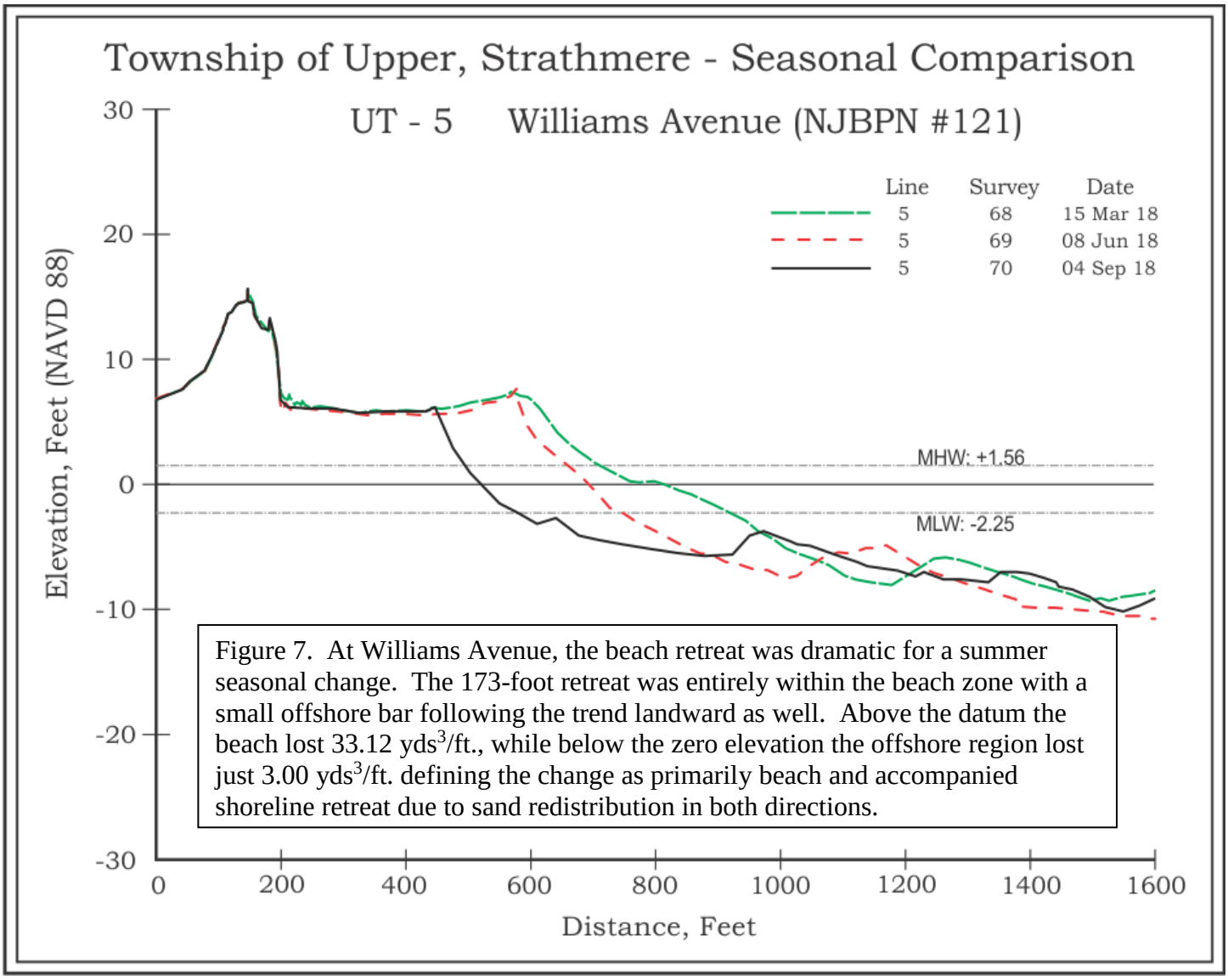


Figure 7. At Williams Avenue, the beach retreat was dramatic for a summer seasonal change. The 173-foot retreat was entirely within the beach zone with a small offshore bar following the trend landward as well. Above the datum the beach lost 33.12 $yds^3$/ft., while below the zero elevation the offshore region lost just 3.00 $yds^3$/ft. defining the change as primarily beach and accompanied shoreline retreat due to sand redistribution in both directions.

***UT – 6, Seaview Avenue near the Park Boundary.***

This site, located adjacent to Corson's Inlet makes it vulnerable to rapid beach changes from inlet dynamics and northeast storms. To mitigate these losses, the State project created a wide bump out in the beach width here. The recently completed federal project dune and beach system template was narrower. As of December 2017, the dune crest elevation was at 15 feet NAVD88 and approximately 200 feet wide at the toe. However, the dry beach width eroded and the width from the dune toe to the MHW line fluctuated during the study interval from approximately 180 feet in March to just under 100-feet by June 2018. A wide shallow platform at the zero datum extended 140 feet in December 2017, while a secondary sand bar positioned about 200 feet from the shoreline was emergent at low tide.

By June 8, 2018, severe scouring had occurred nearshore and began to erode the beach removing -16.11 $yds^3$/ft. of sand above the datum. A trough cut to -7 feet NAVD88 developed where the shallow platform existed in December 2017 and March 2018. The shoreline retreated nearly -181 feet from the loss of this shallow platform by June and another 74 feet by Sept. 4$^{th}$.

The suggested sand transfer from the southern accretional beach berm, and placed as sand piles at the base of the scarp along this section is a stopgap solution to eventual closure of the tide channel immediately at the base of the beachface. Changes to the bar system within the ebb-tidal shoals is required to place sand between the main channel and this beach to stop the loss rate.

**Photo above taken on June 8, 2018, shows the dune remained relatively stable through spring while sand pushed inland along the inlet shoreline. As this process continued the beach width, seaward of the dune decreased, increasing the vulnerability of the dune to future storm events and the beach to inlet tidal current erosion.**

**Photo above taken on Sept. 4, 2018 demonstrates the loss of the dune fencing and the trimming of the seaward dune slope into an erosional scarp since June. The beach width looking toward the inlet has also been reduced to a minimum.**

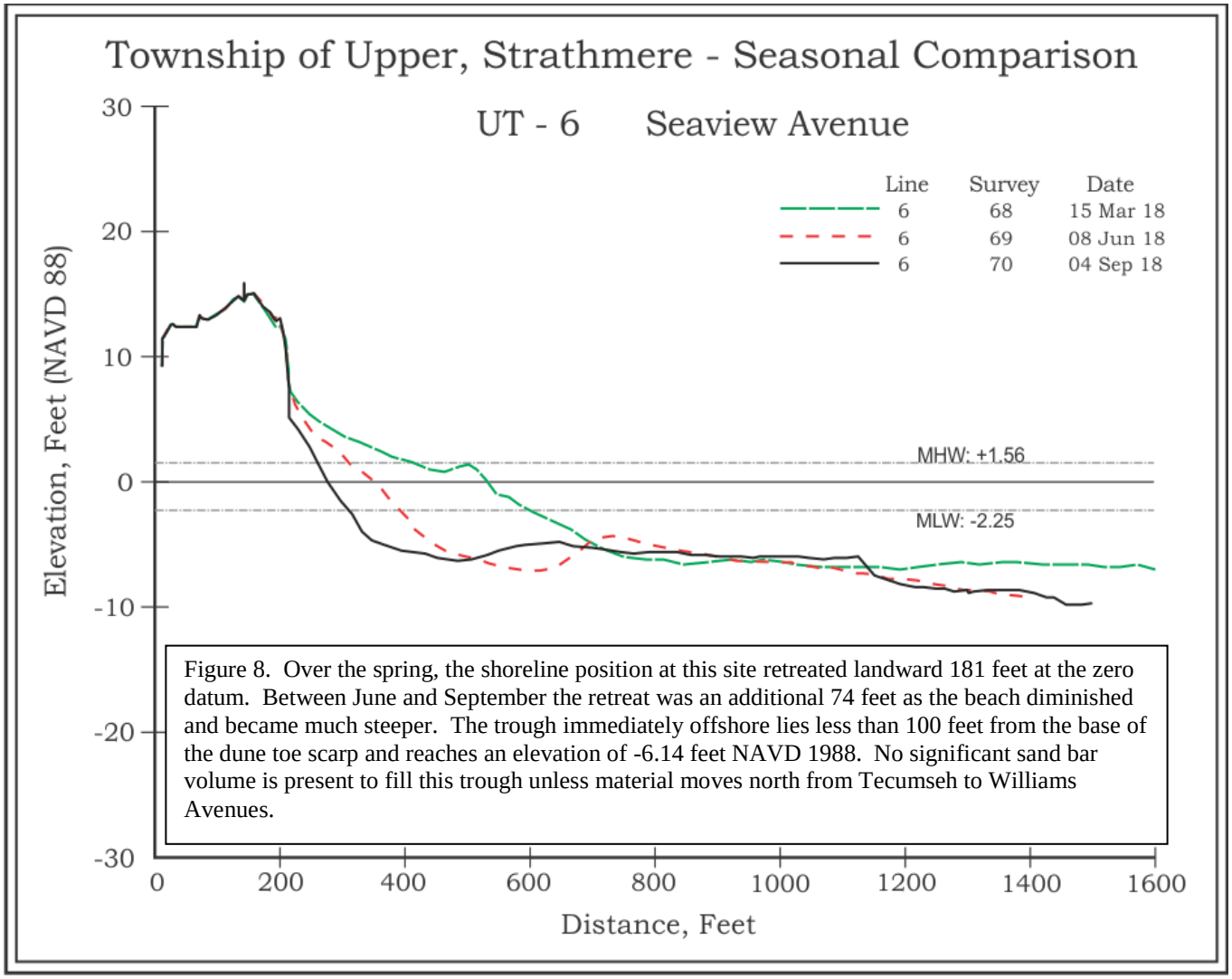


Figure 8. Over the spring, the shoreline position at this site retreated landward 181 feet at the zero datum. Between June and September the retreat was an additional 74 feet as the beach diminished and became much steeper. The trough immediately offshore lies less than 100 feet from the base of the dune toe scarp and reaches an elevation of -6.14 feet NAVD 1988. No significant sand bar volume is present to fill this trough unless material moves north from Tecumseh to Williams Avenues.

**Summary:**

The winter storms ended prior to the June 8, 2018 survey. No events occurred between June and the September 5, 2018 survey date. Since then a mild period of northeast winds set up on the 9th and 10th of September which likely made the Seaview Avenue situation worse. The approach of a major hurricane Florence, is also likely to contribute to further erosion unless the hurricane swells move into New Jersey beaches with a pronounced southeast approach direction. Such an approach would drive sand north along the Strathmere beach and perhaps act to fill in the tidal trough generating the beach erosion seen at Seaview to Williams Avenue.

The only inexpensive solution would be to move sand from beaches with a surplus at the berm, hauling it to the zone with the pronounced scarp in the dunes and creating a series of sand piles that would provide added material to the beach as they erode and protect the scarp from normal wave run-up and additional erosion of the dune. Storms would easily defeat this option due to the extremely narrow beach and extreme northeast exposure of the Seaview Avenue shoreline. It could slow the rate of loss pending natural channel closure with offshore bar sand deposits.

The CRC will conduct the winter quarterly survey in early December. This survey should provide an indication as to the nature of scouring seen at the north end. Please contact the Coastal Research Center with questions.

Sincerely,

Stewart Farrell

Dr. Stewart Farrell
Executive Director
Coastal Research Center