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OUTER BANKS SHORELINE MANAGEMENT

2022 Avon Beach Nourishment

Project Update — July 27, 2022 **Issue No. 3**

Construction Summary

Great Lakes Dredge & Dock Co. (GLDD) completed the 1 million cubic yard Avon Village beach nourishment project, with the last load delivered by the dredge *Liberty Island* around 11:00 p.m. on Tuesday, July 26, 2022. The project included nourishing two and a half miles (13,200 feet) of oceanfront from Due East Road to the southernmost boundary of Avon (near National Park Service ORV Ramp 38) and constructing a new frontal dune (6 feet above the dry-sand beach) south of the Avon Pier. The dredge *Ellis Island* delivered the first load at 1:40 p.m. on Sunday, June 19, 2022. Through the strategic use of two dredges, GLDD completed the project in 38 days, including an 8-day pause from June 30, 2022, through July 7, 2022. Overall, work progressed faster than expected, minimizing interruptions for oceanfront property owners, residents, and beachgoers.

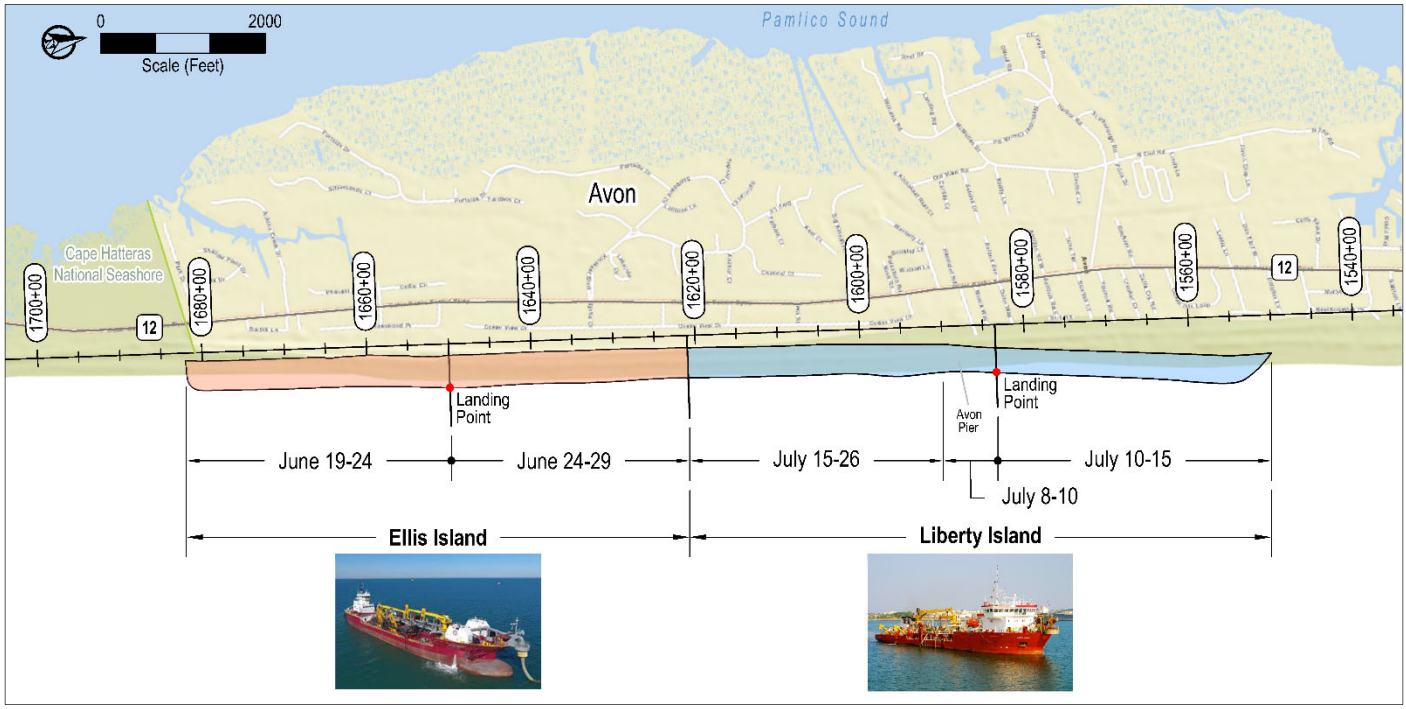
Photo taken during the last day of pumping at 7:00 p.m., July 26, 2022. The final load was delivered shortly before midnight that evening.

The *Liberty Island* had completed the 4,000-foot northern section from the Avon Pier to Due East Road by Friday afternoon, July 15, 2022.

Two Dredges and Two Submerged Pipelines

GLDD elected to start the Avon nourishment with America's largest hopper dredge, the *Ellis Island*, on Sunday, June 19, 2022. The *Ellis Island* used a submerged pipeline that was placed at station 1650+00 on the oceanfront near the public beach access at Greenwood Place. The dredge first pumped south for five days and completed nourishment of ~3,200 feet of oceanfront from the landing point to the southern boundary of the project near NPS ORV Ramp 38, and then started pumping north on Friday, June 24, 2022, and completed a ~2,000-foot section from the landing point to the oceanfront near Pampas Drive by Wednesday, June 29, 2022.

Work was paused for eight days until the arrival of the second hopper dredge, the *Liberty Island*, on Friday, July 8, 2022. The *Liberty Island* used a second submerged pipeline located approximately 500 feet north of the Avon Pier. The dredge first pumped south for two days through the pier, and then the pumping direction was flipped toward the north until the northern project boundary at Due East Road was reached on Friday, July 15, 2022. The final section between the pier and Pampas Drive was nourished between July 17, 2022, and July 26, 2022, to complete the project volume of 1 million cubic yards.



Great Lakes Dredge & Dock Co. at the home stretch during the last two days of pumping.

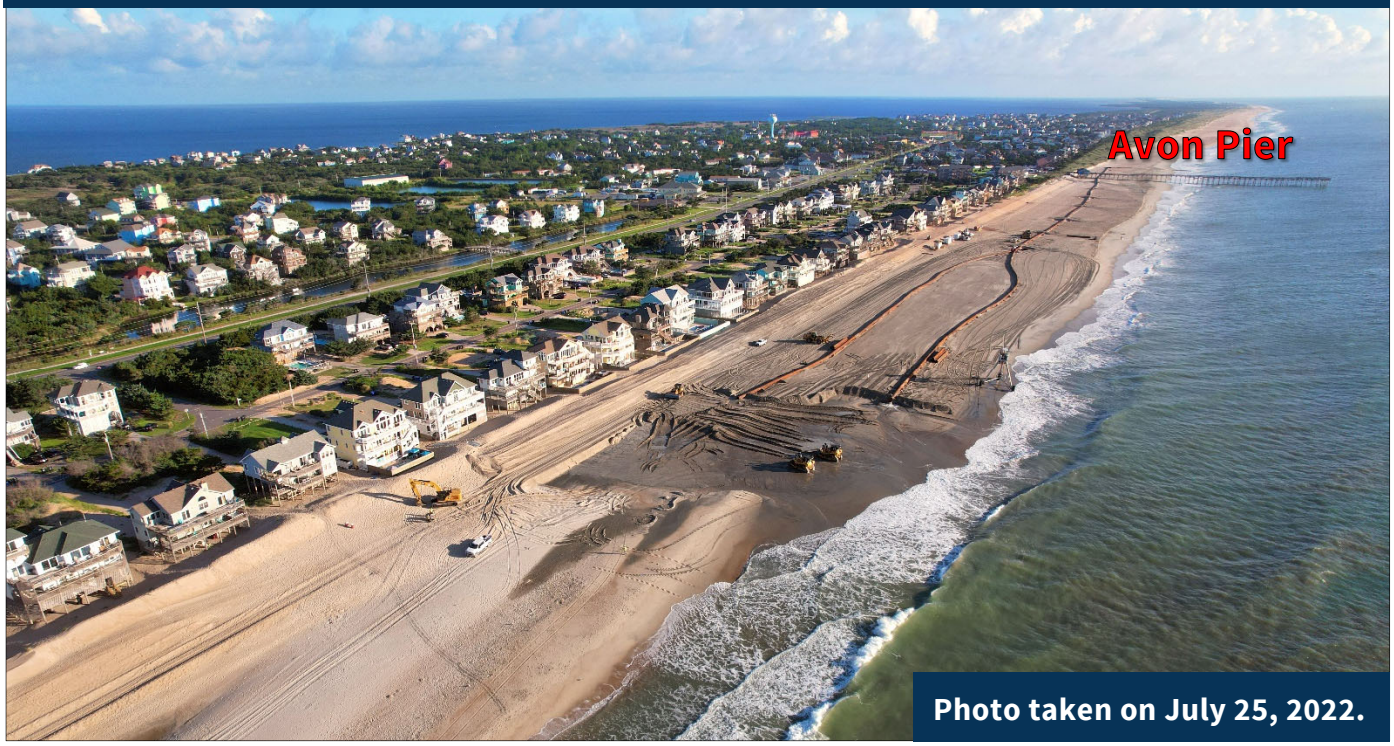


Photo taken on July 25, 2022.

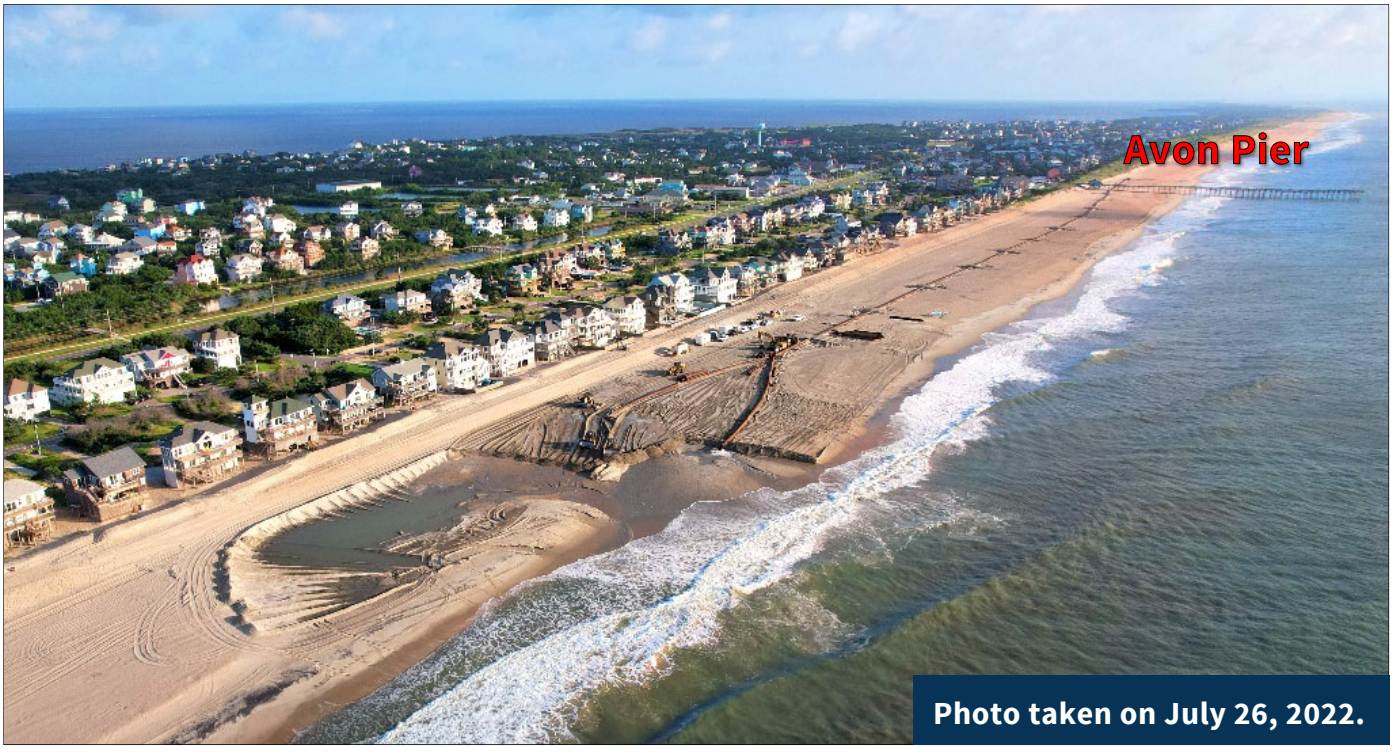
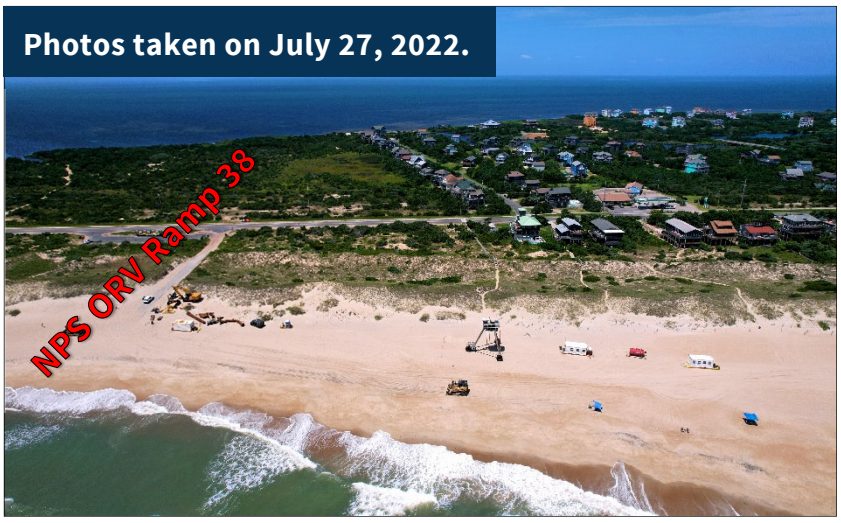


Photo taken on July 26, 2022.

Demobilization Activities

Demobilization began immediately after the last load of nourishment sand was placed on the beach. The newly nourished beach was graded, smoothed, and opened to the public on the morning of July 27, 2022. GLDD disassembled the shore pipes, consolidated them onto the beach near Yucca Street overnight, and is in the process of transferring them to the section of beach near NPS ORV Ramp 38. Equipment and shore pipes will be transported through Ramp 38 and demobilized out of Avon Village by truck over the next two weeks. Weather permitting, the subline landing (~500 feet north of the Avon Pier) is expected to be removed from Avon and relocated to Buxton this weekend.

Photos taken on July 27, 2022.

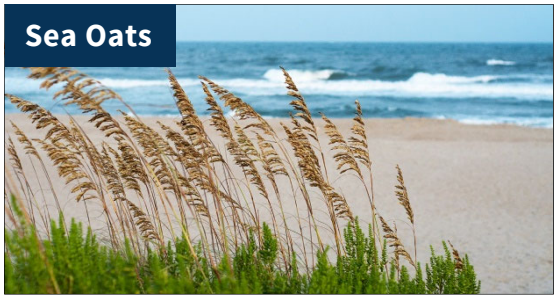


Sand Fencing and Vegetation

Sand fencing and vegetation are components of the Avon beach nourishment project, and form part of the overall dune management plan. Dare County has contracted Coastal Transplants (based in Bolivia, NC) to install sand fencing and plant vegetation along the section of oceanfront south of the Avon Pier where the initial dune was constructed. To comply with the North Carolina Coastal Area Management Act (CAMA) permit conditions, such work will be conducted outside of sea turtle nesting season (**after November 15, 2022**).

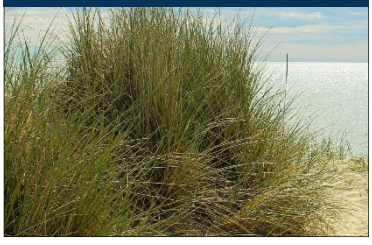
Sand fencing will be installed on the newly constructed dune crest as close to the stable vegetation line as practical. Native, salt tolerant plants (such as sea oats, Bitter Panic, or American Beachgrass) will be planted on the newly constructed dune crest and frontal face along the section south of the Avon Pier.

Sea Oats



Bitter Panic

American Beachgrass



Beach-Fill Equilibration and Natural Dune Growth

Nourishment sands are mostly placed on the subaerial portion of the beach, building a wide initial dry-sand berm and forming beach slopes that are steeper than the natural beach face. This construction method aims to ensure the safety of land-based equipment (i.e., bulldozers and front-end loaders); conveniently, it also results in construction efficiency and cost savings. Following initial sand placement, natural forces, such as waves and currents, will move sand offshore and adjust the newly constructed berm to its natural shape. This process is known as beach-fill equilibration. Fill templates at Avon used an average berm elevation of approximately 7 feet above the mean sea level, matching the pre-nourishment berm with the expectation that minor storm events would produce wave overtopping and allow washover on the berm. This approach has been used in many other job sites along the East Coast. It has proved optimal because it creates a natural beach and inshore morphology with minimal formation of escarpments as the fill equilibrates.

Rhythmic variations in beach width were characteristic in Avon before nourishment (generally linked to variations in the longshore bar). The initial fill from the nourishment has produced a relatively uniform berm width over long stretches of oceanfront. However, over the next 1 to 2 years, the project area is expected to exhibit similar rhythmic topography as the nourishment sand adjusts to natural coastal forces.

The oblique aerial image on the left shows rhythmic topography along the project area before nourishment, indicating the future planform equilibration after nourishment. The photo on the right shows a wider dry-sand beach and a relatively uniform berm width immediately after nourishment.

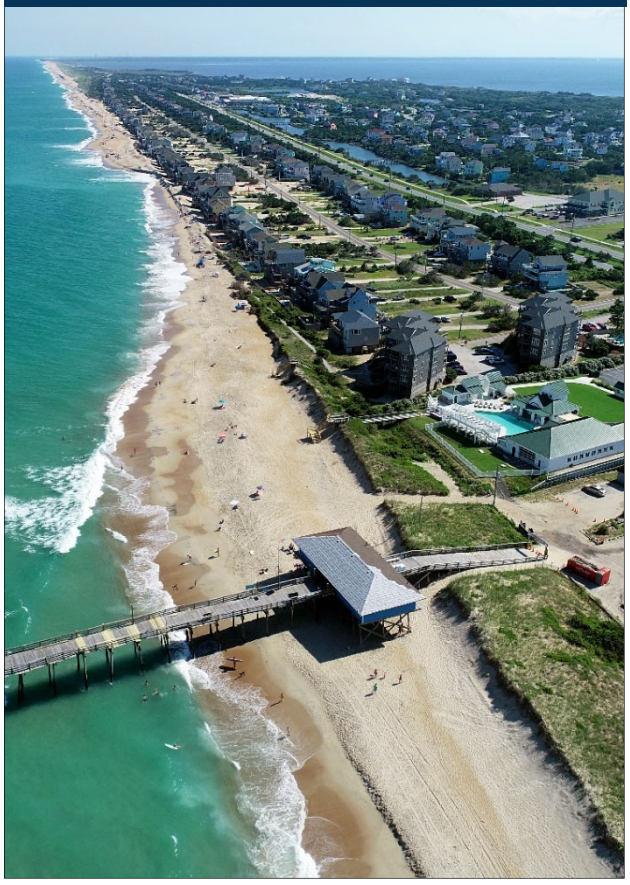
Before Nourishment: July 15, 2020

After Nourishment: July 26, 2022

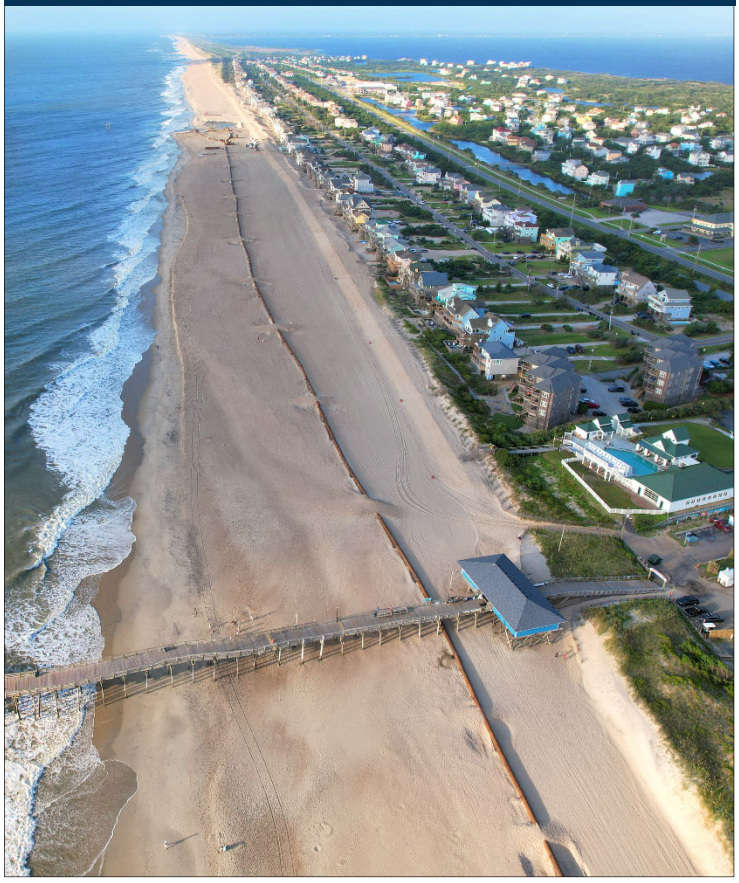
An important feature of beach-fill equilibration after nourishment is dune growth via natural wind forces. This process is also known as "aeolian transport." As the section of the beach north of the pier had existing mature dune features before nourishment, an initial dune was *only* constructed along the section south of the Avon Pier where there was essentially no dune or where the dune volume was lower than that of the average project area. The purpose of integrating an initial dune is to provide storm protection along the highly eroding area and to protect N.C. Highway 12. It also establishes relatively uniform standards to enhance dune growth and coastal resiliency in this area.

The wide dry-sand beach constructed by nourishment provides a new sand source for aeolian transport and will make natural dune growth possible for both the existing dune and the newly constructed dune. Sand fencing to be installed and vegetation to be planted after nourishment will concentrate sand along the back beach, further enhancing the foredune. After nourishment, the dune is expected to grow higher in elevation and wider at the dune base.

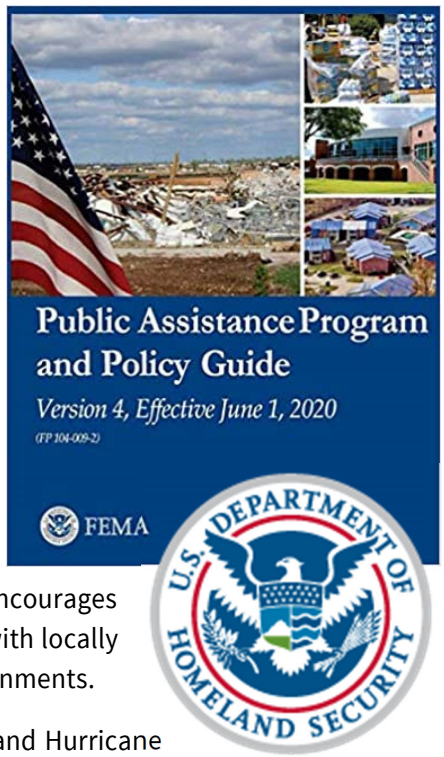
Before Nourishment July 15, 2020.



After Nourishment July 26, 2022.



Path Forward – County Maintenance and FEMA Assistance



The Federal Emergency Management Association (FEMA) provides a Public Assistance Program to assist state and local governments so that communities can quickly respond to and recover from major disasters or emergencies declared by the President. Through this program, FEMA provides supplemental federal grant assistance for eligible expenses, including debris removal, emergency protective measures, and the restoration of disaster-damaged publicly owned facilities.

To qualify for this assistance, FEMA requires the project owner (Dare County) to establish a monitoring and maintenance program involving periodic renourishment with imported sand to preserve the original design of an engineered beach. Per the agency's policy guide, FEMA would not only reimburse construction costs to replenish the sand loss but would also reimburse communities for the "soft costs" (e.g., pre- and post-storm surveys, planning, permitting and environmental studies, design, construction administration, post-project monitoring, sand-fencing, and vegetation, etc.). FEMA also encourages communities to combine the restoration of sand loss due to declared disasters with locally funded beach maintenance to achieve cost savings for both FEMA and local governments.

For example, Hurricane *Florence* impacted the Outer Banks in September 2018 and Hurricane *Dorian* impacted the area in September 2019. Both storms were declared major disasters for North Carolina. The 2.9-mile Buxton project area completed an initial nourishment in February 2018, just in time to be eligible for FEMA's restoration fund to replenish the volume losses caused by *Florence* and *Dorian*. Over $7 million of funds were approved by FEMA and will be reimbursed to the county after the ongoing Buxton renourishment project is completed. The Avon project area was not eligible for such funds in the past, but following the completion of the 2022 beach nourishment, the 2.5-mile Avon project area has become eligible for such assistance if a future natural disaster (e.g., hurricane) is declared and sand losses are confirmed by pre- and post-hurricane beach condition surveys.

Dare County, as the project owner, has established a beach monitoring and maintenance program for the first five years after project completion (i.e., 2023 to 2027). The purpose of the post-project monitoring is to track the physical condition of the beach after nourishment, quantify sand volume changes and determine whether a maintenance renourishment is needed. Annual beach monitoring will be conducted before hurricane season to establish the baseline condition for each year. If a severe storm occurs, a post-storm survey will be conducted, and its results will be compared with the pre-hurricane season survey to calculate storm-related sand losses. Based on the historical erosion rate in this area, Dare County has scheduled the maintenance in the county's Beach Nourishment Financial Model. The county anticipates the first maintenance renourishment project would be needed in summer 2027 under normal conditions.

For updates and additional information visit MoreBeachToLove.com.