Bald Head Island, N.C.

Beach Monitoring Program

Monitoring Report No. 19 (May 2020 to May 2021)

Prepared for:
Village of Bald Head Island

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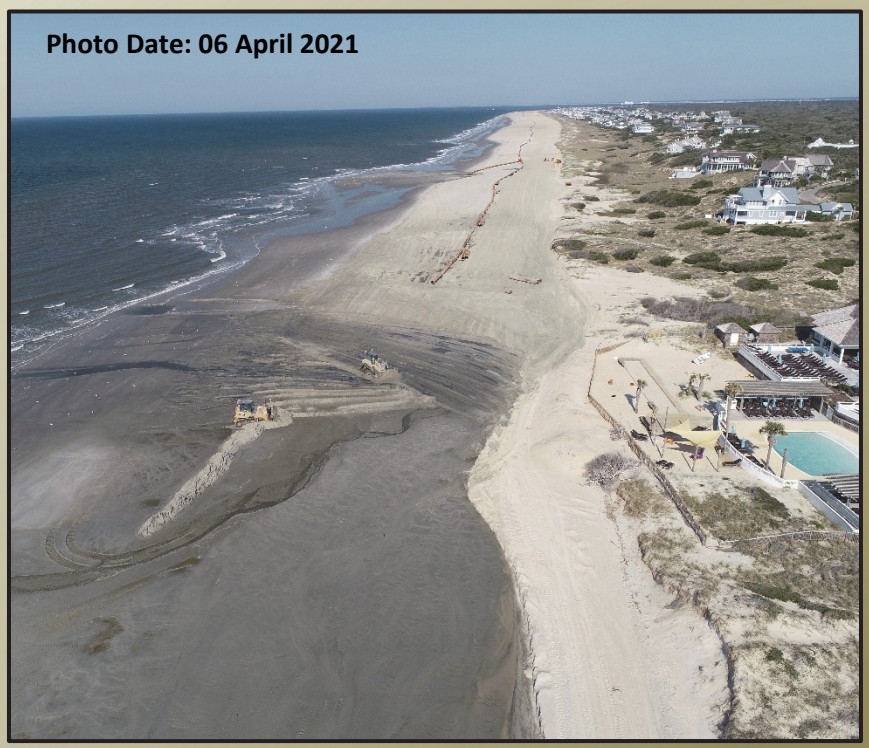

July 2021

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EXECUTIVE SUMMARY

The most recent Wilmington Harbor Inner Ocean Bar maintenance dredging of Bald Head Shoal Channel Ranges 1 and 2, and the Smith Island Channel range was performed in the months of January - April 2021. Federal surveys show approximately 1.6 Mcy of sand during that operation were placed along South Beach pursuant to the terms of the Wilmington Harbor Sand Management Plan (WHSMP). Bald Head Island will likewise be the recipient of the next *future* beach disposal operations in accordance with the continued implementation of the present day WHSMP. The last sand placement project constructed by the Village was between 13 January 2019 and 22 March 2019. The borrow site for that project was Jay Bird Shoals. The final fill volume (in-place) was 1.1 Mcy which included the addition of a Post-Florence FEMA Claim for documented storm related losses from the *engineered beach* in September 2018 (Olsen 2018). The limits of that fill extended eastward only to Sta. 146+00.

As part of the assessment for the 2019 beach renourishment project constructed at South Beach by the Village, it was determined that numerous sand tube groins had reached the end of their effective life and that replacement was warranted. Permits allowed for both an extension of time beyond April 1st for *both removal and replacement* of all remaining thirteen (13) sand tube groins (and underlayments). The work was initiated on/about 13 February and Substantially Completed by 22 March 2019. A *Post-Construction Report,* formulated to document the 2018-2019 project, details all elements of work performed by both contractors (Olsen 2019).

By about 2013, the results of a comprehensive annual beach monitoring program initiated in 2000 by the Village of Bald Head Island yielded the conclusion that sand placement alone could *not* successfully offset navigation channel impacts to the west end of South Beach which had been typically manifest in chronic rates of erosion and a consistent northerly post-fill recession of the shorefront. Accordingly, the Village was ultimately forced to "change the existing dynamic" by constructing a single terminal groin designed to complement the placement of future beach fills at the persistent South Beach erosional "hot spot". The project was permitted to be constructed in two phases – with Phase 2 being optional. Simplistically, the structure was designed to serve as a "template" for fill material placed eastward thereof on South Beach. The Phase 1 1,300 ft. long terminal groin (completed in Nov. 2015), was designed however as a "leaky" structure (*i.e.* semi-permeable) so as to provide for some level of continued sand transport to West Beach and portions of the Point (located both westward and northward of the groin stem). Through May 2021, terminal groin project performance – based upon post-construction monitoring – has been both as intended – and as predicted.

Between November 2000 and April 2021, Bald Head Island has received about 8.6 Mcy, mol of sand from the initial widening/deepening and five (5) subsequent maintenance dredging operations for the Wilmington Harbor Navigation Project entrance channel. Including the 2019 project, the Village has placed another 3.2Mcy of sand along the West Beach and South Beach shorelines. Accordingly, in the net Bald Head Island has experienced a total estimated sand placement volume of approximately 11.8 Mcy since 2000 at those two locations – with South Beach receiving 97% or more of the total.

Conversely, the *gross* volumetric sediment *loss* over a November 2000 to November 2020 (pre-disposal) monitoring timeframe is conservatively computed at 8.036 Mcy, or approximately 401,800 cy per year – on "average". This annualized "loss" addresses the continuous section of Bald Head Island shorefront extending from the marina entrance to the Cape Fear spit. The assignment of an *average annual* long-term rate of sand loss at Bald Head Island however, has *not* necessarily been a meaningful indicator of navigation project impact. Such an average rate is often temporally biased by periods of beach fill equilibration, groinfield "effectiveness due to reconstruction," recent storm events (such as Hurricanes Florence, Dorian and Isaias), the occurrence of episodic destabilization dredging events in close proximity to the island, as well as other physiographic phenomena temporally affecting annualized quantities of alongshore sediment transport – from Bald Head Island. In addition, the island's littoral system continues to adjust to the quasi-stabilizing effect of the terminal groin in existence only since 2015. Along South Beach per se, there has existed historically a "nodal point" some 7,000 ft. eastward of the terminal groin (approx. STA 116+00). At or close to the nodal point, the directionality of *net littoral transport* on an annual basis changes from West (toward the groin) to East (toward Cape Fear). *Note* – depending on wave climatology, the condition and exposure of the sand tube groinfield, as well as other factors, the effective location of the nodal point can vary slightly along South Beach from year to year. Currently, within the 22,755 shoreline influenced by sand episodically placed since 2000, up to 3.75 Mcy remain in the littoral system (measured above elevation -16 ft. NGVD 29). This *includes* the 1.6 Mcy beach disposal project recently completed in early April, 2021 by the Wilmington District, USACE.

Although not directly impacted by long-term navigation channel improvements and maintenance of the Cape Fear River entrance, the Village Council elected to initiate monitoring of the East Beach shorefront at Bald Head Island beginning in November 2008. Since that time, it is documented that East Beach can undergo strong seasonal variations of beach width and profile volume to a large degree dependent upon storm frequency and intensity, as well as the ever-changing configuration of the Cape Fear spit. For example, the most recent May 2021 survey data show a negligible net shoreline volumetric change of approximately 400 cy (above elevation -16 ft NGVD). throughout the 6,000 ft East Beach shoreline lying northward of Cape Fear over the last 12 months. In the prior year, it had eroded by almost 89,000 cy – due to

storm impacts. Between November 2008 and May 2021, the total change had been +350,100 cy. Most of the volume increase had been associated with recent post-storm accretion of the Cape Fear spit shoreline facing Onslow Bay.

Typically, periods of episodic accretional configurations of the Cape Fear spit deemed beneficial to East Beach have corresponded to a high rate of erosion and duneline recession along the easternmost section of South Beach – directly seaward and westward of the Shoals Club facility. For example, between 2000 and 2020, the average MHWL erosion rate at that general location has been over -20 ft/yr – due to sand losses either directly or indirectly associated with the configuration of the Cape Fear spit formation. The most recent (2021) federal disposal project placed fill within 2,000 ft. mol. of the Shoals Club and Cape Fear. This sand source may serve to reduce the most recent erosional cycle evident at the easternmost of South Beach.

In 2021, the Village performed monitoring of the Jay Bird Shoals borrow site utilized to construct the non-federal 1.85 Mcy beach fill sponsored by the Village in 2009/10 and the 1.10 Mcy beach constructed in 2018/19. During the Year 11 monitoring period (May 2020 to May 2021), the second year following the 2018/19 project excavation, the entire permitted borrow site gained 77,300 cy (inclusive of the exclusion and buffer zones). As of May 2021, there is approximately 1.23 Mcy of material located within the permitted borrow site limits above the permitted cut elevation (-22 ft-NGVD). Much of that material is *not* however practically available for dredging at this time.

After an extension of the two marina entrance channel jetties in 2015, temporarily reduced shoaling within the navigation channel resulted in a corresponding reduced volume of disposal sand being place along the Row Boat Row shoreline. Although the Village had planned to continue to proactively bypass sand from the south jetty fillet (located at the distal end of West Beach) to the Row Boat Row shorefront, it became clear that the existing four (4) low level timber groins were not capable of providing an acceptable level of shoreline stabilization at that location.

Hence, near the end of the 2017 monitoring period, the Village initiated construction of two (2) shore parallel detached rock breakwaters located north of the marina entrance seaward of the Row Boat Row shoreline. The placement of breakwaters between existing groins northward of the marina entrance was intended to combine the attributes of each of the two types of stabilization structure so as to reduce the rate of sediment transport from the eroding shoreline caused principally by ferry/barge generated waves. The subject expanded shore stabilization project (detached breakwaters *and* existing groinfield) was designed to have a sand fill prior to construction. The source of the fill was the exiting Bald Head Creek borrow area. A previously permitted Bald Head Creek borrow area was dredged in early 2017 by Marcol Dredging. Some 26,000 cy were placed at Row Boat Row prior to breakwater

implementation. Since that time multiple channel maintenance/sand bypass operations have occurred – most with increasing volumes dredged. Typically, dredging is required twice a year on average. This is primarily due to an increasing northerly rate of sediment transport along West Beach caused by a continuing reconfiguration of the Point. As a result, the Village has been forced to perform an increased frequency of bypassing of sand farther northward of the stabilizing influence of the breakwaters. This required a 2020 modification of the permits associated with the limits of allowable beach disposal seaward of Row Boat Row.

In the spring of 2019, the Village resubmitted permit applications accompanied by indepth geotechnical studies and environmental analyses intended to develop a long term (and large scale) supplementary borrow site located within Frying Pan Shoals. The purpose of such a borrow site would be to both ensure compliance with Permit conditions necessitating the maintenance of the updrift fillet associated with the 2015 terminal groin project and to provide an interim source of beach quality material sufficient to meet future South Beach renourishment requirements – when pursuant to the existing tenets of the Wilmington Harbor Sand Management Plan, beach quality channel maintenance material excavated would be placed at Oak Island. Permitting for this borrow site continues.

An important secondary precept of the spring of 2019 beach fill project constructed by the Village was to allow for the replacement of a sand tube groinfield which had become damaged over time. During the spring 2021 federal channel maintenance project, the groin field in its entirety was again covered by beach fill. That disposal project completed in early April 2021 placed 1.61 Mcy of sand between Sta.60+00 and Sta.121+00, mol. on South Bend.

The original Permits for construction of the terminal groin at Bald Head Island stipulated that if the permittee elected to dredge more than 250,000 cy from the Jay Bird Shoals borrow site after 2015, limited monitoring of the eastern end of Oak Island must be performed. Accordingly, in November 2018, the Village initiated the requisite monitoring at Oak Island (Caswell Beach). The first report of findings for Oak Island followed a November 2019 monitoring survey. A second year monitoring report was issued in December 2020. In early 2021 it was formally agreed by DCM and the USACOE that based upon the results of the Year 2 report, the *Village's responsibility for continued monitoring of Oak Island has terminated*.

In 2019, the Port of Wilmington, NC both sponsored and formulated a Section 203 Report which proposes a plan to deepen and widen (in places), the Federal navigation project, which extends from the Atlantic Ocean up the Cape Fear River to the Port of Wilmington. The Village of Bald Head Island formally submitted several series of comments to-the-record which addressed deficiencies in the project analyses and which requested clarification to impacts addressed, or unaddressed by the consultant prepared report.