Bald Head Island, N.C.

Beach Monitoring Program

Monitoring Report No. 21 (May 2022 to May 2023)

Prepared for:
Village of Bald Head Island

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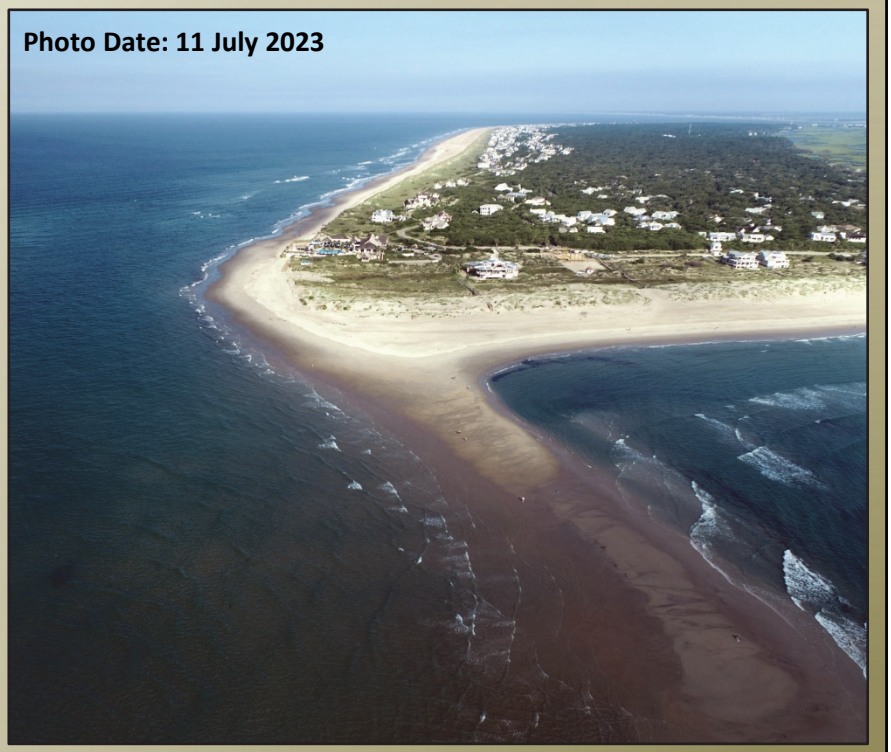

August 2023

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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 December 2022 – March 2023. Federal surveys show approximately 1.3 Mcy of sand during that operation were dredged with placement along South Beach pursuant to the terms of the Wilmington Harbor Sand Management Plan (WHSMP). The estimated "final" in-place fill volume measured was somewhat less (by 10-15%). Oak Island will be the recipient of the next tentatively scheduled 2025 beach disposal operation in accordance with the continued implementation of the present day WHSMP. As a result, the Village is planning for a locally constructed project in our about 2025 or 2026. 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 on South Beach.

It is anticipated that the next Village sponsored project (in 2025 or 2026) will seek to place approximately 1 Mcy total along two (2) sections of shoreline located at the opposite ends of South Beach. The easternmost segment of approximately .5 Mcy is intended to briefly address the chronic erosion that's been occurring for a number of years in the vicinity of the Shoals Club at Cape Fear. On the western end of South Beach an additional .5 Mcy fill will address the filling of the terminal groin template as well as the section of shoreline extending throughout the limits of the sand tube groinfield. Subsequent to fill placement, it is currently planned to remove and replace sandtube groins which have reached the end of their effective life. The groinfield was last replaced in its entirety in 2019 concurrent with the Village renourishment project. It will need to be readdressed similarly with the next Village project. For purposes of constructing the tentatively upcoming 2025 or 2026 (1 Mcy) Village renourishment project, a pre-existing (but depleted) borrow site at Jay Bird Shoals needs to be expanded to the north.

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 2023, terminal groin project performance – based upon post-construction monitoring – has been both as intended – and as predicted.

Between November 2000 and March 2023, Bald Head Island had received up to 9.9 Mcy, mol of sand from the initial widening/deepening and six (6) subsequent maintenance dredging operations for the Wilmington Harbor Navigation Project entrance channel. Including the 2019 project, the Village has placed another 3.2 Mcy 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 13.1 Mcy since 2000 at those two locations – with South Beach todate receiving 97% or more of the total.

Conversely, the *gross* volumetric sediment *loss* over a November 2000 to May 2023 (post-disposal) monitoring timeframe is conservatively computed at -8,801,300 Mcy, or approximately 391,168 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," major 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 westernmost segment of the island's littoral system has had to adjust to the quasi-stabilizing effect of the terminal groin at that location in existence only since 2015. Along South Beach per se, there has historically existed 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. As of May, 2023, within the 22,755 ft of shoreline influenced by sand episodically placed since 2000, up to 4,282,500 cy remain in the littoral system (measured above elevation -16 ft. NGVD 29). This *includes* the most recent beach disposal project completed in early 2023 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 2023 survey data show a net shoreline volumetric gain of approximately +18,400 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 changed only by about +12,600 cy. Between November 2008 and May 2023, the total change had been +381,100 cy. Most of the volume increase had been caused by post-storm accretion of the Cape Fear spit shoreline fronting 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. Although a 2021 federal disposal project placed fill within 2,000 ft. mol. of the Shoals Club and Cape Fear, erosion has continued to the point that the Club was required to install a sandbag revetment seaward of the property in May/June 2022. That revetment requires continuing maintenance due to episodic beach profile lowering at that location and the effects of storms.

In 2022, 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 12 monitoring period (May 2022 to May 2023), the fourth year following the 2018/19 project excavation, the entire permitted borrow site gained +16,300 cy (inclusive of the exclusion and buffer zones). As of May 2023, there is theoretically +1,380,000 Mcy of material located within the *permitted borrow site limits* above the permitted cut elevation (-22 ft-NGVD). Most of that material is *not* however practically available for dredging at this time. Hence, an extension of the original JBS borrow site limits will be required to act as a fill source for the next Village beach fill project in 2025 or 2026.

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. In 2021, a pre-project fisheries monitoring plan was submitted for purposes of addressing regulatory agency concerns. In April 2022, the Village acknowledged certain regulatory "concerns" may not be resolved in the near future. Subsequently, the Village authorized work intended to expand the Jay Bird Shoals borrow site for purposes of providing a sand source for the next Village sponsored fill event – when federal beach disposal is contractually redirected to Oak Island. A pre-consultation meeting for the borrow site expansion was performed in July 2023.

An important secondary precept of the spring of 2019 beach fill project constructed by the Village was to allow for the concurrent replacement of the sand tube groinfield which had become damaged over time. During the spring 2023 federal channel maintenance project, the groin field in its entirety was again covered by beach fill.

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 USACE 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 (as project sponsor) commissioned the formulation of a Section 203 Report which proposed 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. In June 2023, the Wilmington District, USACE initiated a Scoping meeting for the Wilmington Harbor 403 Study/EIS.