Bald Head Island, N.C.

Beach Monitoring Program

Monitoring Report No. 18 (May 2019 to May 2020)

Prepared for:
Village of Bald Head Island

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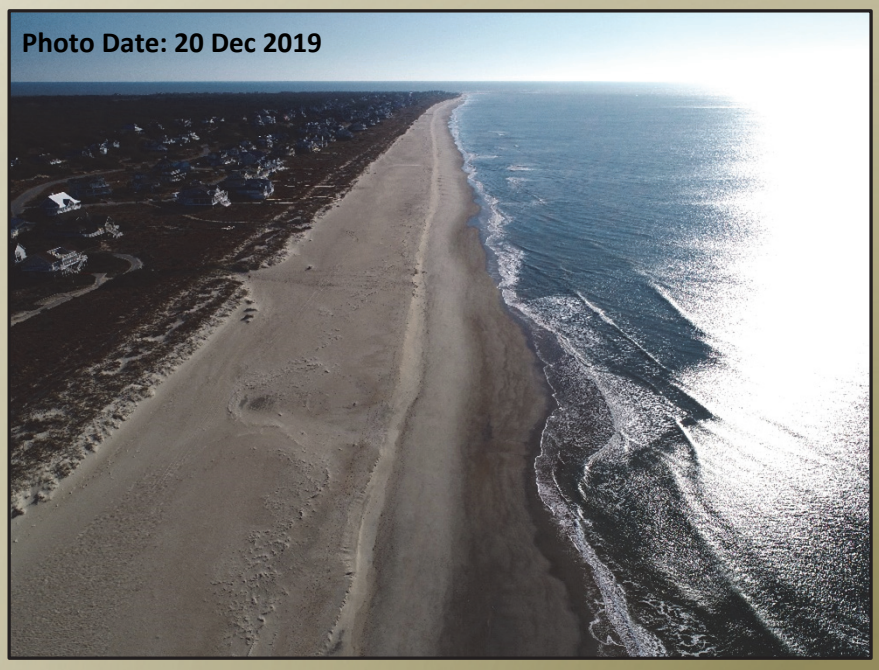

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EXECUTIVE SUMMARY

The most recent Wilmington Harbor Inner Ocean Bar maintenance dredging of Bald Head The most recent Wilmington Harbor Inner Ocean Bar maintenance dredging of Bald Head Shoal Channel Reach 2, and the Smith Island Channel segment was initiated in the summer months of May/June 2018. Approximately 1.15 Mcy of sand excavated during that operation were placed at Oak Island pursuant to the terms of the Wilmington Harbor Sand Management Plan (WHSMP). Subsequent to federal beach disposal on Oak Island, Bald Head Island will be the recipient of the next two *future* beach disposal operations in accordance with the continued implementation of a present day WHSMP. Prior to that time (with the next Bald Head Island disposal not scheduled until the spring of 2021) the need to offset annual erosional losses at South Beach on Bald Head Island, as well as to maintain the updrift fillet of the terminal groin constructed in 2015, necessitated that the Village design and permit a 1 Mcy *interim* beach fill project. The latter was constructed between 13 January 2019 and 22 March 2019. The project borrow site was Jay Bird Shoals. The final fill volume was 1.1 Mcy due to the addition of a Post-Florence FEMA Claim for documented storm related losses from the *engineered beach* in September 2018 (Olsen 2018).

As part of the assessment for the 2019 beach renourishment project to be 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 have been typically manifest in chronic rates of erosion and a consistent northerly 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 beach fill 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 2020, terminal groin project performance – based upon monitoring – has been both as intended – and as predicted.

Between November 2000 and April 2020, Bald Head Island had received about 7.0 Mcy, mol of sand from the initial widening/deepening and four (4) subsequent maintenance dredging operations for the Wilmington Harbor Navigation Project entrance channel. Including 2019, the Village has placed another 3.2Mcy 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 10.2 Mcy since 2000 at those two locations – with South Beach receiving some 90% or more of the total.

Conversely, the *gross* volumetric sediment *loss* over the November 2000 to May 2020 (post-fill) monitoring timeframe is conservatively computed at -7.703 Mcy, or approximately -394,800 cy per year – on "average". This "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," major storm events (such as Hurricanes Florence and Dorian), 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 been 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 placed since 2000, some 2.992 Mcy remain in the littoral system (measured above elevation -16 ft. NGVD 29). This includes the 1.1 Mcy beach fill recently constructed in early 2019.

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 in November 2008. Since that time, it is observed 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 2020 survey data show a net shoreline loss of approximately -88,600 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 accreted by almost 150,000 cy – due to sand accumulation associated with the spit. Between November 2008 and May 2020, the total change has been +350,500 cy. Again, most of this volume has been associated with accretion of the Cape Fear spit facing Onslow Bay.

Typically, episodic configurations of the Cape Fear spit deemed beneficial to East Beach have resulted in a high rate of erosion and duneline recession along the easternmost section of South Beach – directly seaward of the Shoals Club facility. For example, between 2000 and 2020, the average MHWL erosion rate at this general location has been over -20 ft/yr – due to sand losses either directly or indirectly associated with Hurricane Dorian in 2019.

In 2020, the Village was required by Permit to again perform 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. The same borrow site was also used for the 1.10 Mcy beach constructed in 2018/19. During the Year 10 monitoring period (March 2019 to May 2020), the first year following the 2018/19 project excavation, the entire permitted borrow site gained +133,600 cy (inclusive of the exclusion and buffer zones). As of May 2020, there is approximately +1,150,500 cy of material available within the permitted borrow site limits above the permitted cut elevation (-22 ft-NGVD).

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 (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 would not be 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 several channel maintenance/sand bypass operations have occurred – most with increasing volume. This is primarily due to an increased rate of sediment transport along West Beach caused by a continuing reconfiguration of the Point. As a result, the Village has been forced to seek means of bypassing sand northward of the influence of the breakwaters. This has required a modification of the permits associated with maintenance dredging of the channel.

In the spring of 2019, the Village resubmitted permit applications accompanied by indepth geotechnical studies and environmental analyses necessary to develop a long term (and large scale) borrow site located within Frying Pan Shoals. The purpose of such a borrow site is to both ensure compliance with Permit conditions necessitating the maintenance of the updrift fillet associated with the 2015 terminal groin project and to provide a long-term 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, all beach quality channel maintenance material excavated is to be placed at Oak Island.

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 disposal project, the groin field in its entirety will again be 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 of monitoring is on underway. It has been tacitly agreed that depending upon the results of the Year 2 report, the Village's responsibility for continued monitoring may end.

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 has formally submitted comments to the record which address deficiencies in the project analyses and which requests clarification to impacts addressed or unaddressed by the consultant prepared report.