Beach Renourishment in Jacksonville, Florida

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The beaches of Duval County, along Florida's "First Coast", enjoy a long and rich history that has been heavily influenced by coastal construction. There are about 16 miles of ocean beaches in Duval County, divided by the St. Johns River Entrance (**Figure A**). The six miles of beach north of the river are part of a large expanse of public parks and remain mostly undeveloped. In contrast, the ten miles of beach south of the river are mostly developed and urban in nature. These include the 1.0- and 1.5-mile shorelines of the Mayport Naval Station and City of Jacksonville's Hanna Park, closest to the river entrance, and 7.5-miles of urban shoreline referred to collectively as "The Beaches". From north to south, this includes the Cities of Atlantic Beach, Neptune Beach, and Jacksonville Beach. These three local governments maintain separate budgets and governance but each share common services with the City of Jacksonville via an intra-local agreement. For more than 100 years, the beach cities have been an important and heavily utilized recreational amenity for the citizens of Duval County (**Figure B)**.

The Duval County coastline has been profoundly changed by navigation improvements built at the St. Johns River Entrance. These include construction of two rock jetties by the U.S. Army Corps of Engineers beginning in 1879 which were subsequently sand-tightened in the early twentieth century (**Figure C**). Dredging and removal of sand deepened the river entrance from 15 feet to over 47 feet. The length of the north and south jetties is about 3 miles and 2.5 miles, respectively. As a result of sand impounded against the north jetty, the natural inlets north of the River Entrance have shifted north and one has nearly closed, and new islands have formed and overlapped old ocean shorelines. On the other hand, the jetties -- combined with persistently deeper channel dredging and the resulting changes to the ebb tidal shoal -- act as a littoral barrier that deprive the southern beaches of their natural sediment supply and have caused The Beaches to erode. This erosion, probably combined with imprudent development upon the natural dunes, prompted coastal residents and businesses to construct timber bulkheads as early as the 1910's and 1920's during the Florida land-boom.

After storms in 1925 and 1932, most of these bulkheads were replaced by concrete seawalls (**Figure D**). Widespread coastal armoring combined with a chronic sediment deficit resulted in a gradual deflation and narrowing of the beach profiles throughout southern Duval County, from the 1920's through the 60's and 70's (**Figure E**). The nor'easter of 1962 -- followed by the passage of Hurricane Dora in 1964 -- extensively damaged the beaches and coastal communities (**Figure F**). The Corps began placement of sand dredged from the River Entrance to the 1-mile shoreline of Mayport Naval Station, just south of the inlet, in 1963. But the coastal damage was severe enough to warrant congressional authorization of the Federal Shore Protection Project (SPP) along the entire southern 10 miles of the Duval shoreline, south of the St. Johns River Entrance. The authorized project consists of a 60-foot wide construction berm at an elevation of +11 ft, MLW. The original 1965 authorization included federal fiscal participation for 10 years, which was later

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extended to 50 years. The Corps' authorizing design document was adopted in 1975. Initial project construction placed about 3.7 million cubic yards (cy) of sand on the beaches between 1978 and 1980, including sand from maintenance dredging. During the following 35 years, there were five principal renourishment events along portions of the southern, urban shoreline (in 1985-87, 1991, 1995, 2005, and 2011) along with periodic placement of maintenance dredged sand along the northern project shorelines of Mayport Naval Station and Hanna Park, just south of the inlet (about every 3 to 5 years). These efforts combined with a dune fencing & vegetation program initiated by the City of Jacksonville circa 1994 resulted in a remarkable recovery of Duval's beaches, including initial establishment of the sand dunes which exist today. **Figures G through I** visually compare beach conditions in Atlantic Beach and Jacksonville Beach in the early 1970's prior to project construction with those observed in 2010 and 2011.

In September 2016, construction of the 6th scheduled renourishment of the SPP began. On October 7, Hurricane Matthew impacted Duval County with devastating effects to the local beaches. Hurricane Matthew caused substantial erosion to both the beach berm and approximately 8 miles of non-federal sand dunes. Despite loss of the seaward half, the existing dunes mostly held and prevented otherwise certain widespread flooding and additional damage to the Jacksonville Beaches (**Figures J and K**). Areas without dunes experienced a much higher incidence of storm surge inundation into the upland relative to those areas where dunes were present or constructed prior to the storm. Further, areas where the ongoing federal project had been completed prior to Matthew experienced far less dune and beach erosion than areas yet to be renourished. By late summer 2017, the Corps and City had completed the post-Matthew beach renourishment including fast-track re-construction of 5.5+ miles of the non-federal dunes. This included direct sand placement of about 1,069,000 cubic yards of beach and dune sand, and installation of over 600,000 dune plants. Of the total sand volume, about 874,000 cubic yards was placed to the beach berm template and the remaining 195,000 cubic yards was placed as dune repair. About 3 miles of dune could not be fully repaired (**Figure L**).

In September 2017, within one week of the last sea-oat's planting, the project was hit by Hurricane Irma, a storm which was similar in intensity to Hurricane Matthew. The prior dune reparations held up fairly well – particularly where the recently renourished berm took the majority of the storm's erosional force. Thanks to last minute sand closure of the few breaches left in the re-built dune, there was no flooding to the Jacksonville Beaches as was experienced during Hurricane Matthew. The 3 miles of dunes that were not rebuilt after Matthew suffered further damage, including localized breaching and upland inundation. About 1/3'rd of the new dune vegetation was destroyed – some by erosion, but much by wind (**Figures M and N**).

The 7th principal renourishment of the project began in November 2018 along 8.5 miles of Duval shoreline including the City of Jacksonville (Hanna Park), Cities of Atlantic Beach, Neptune Beach, and Jacksonville Beach. The activity restored sand eroded from the project by Hurricane Irma. Dredging and beach fill placement of about 868,000 cubic yards of sand were placed to the project for berm and dune construction. Of this volume, approximately 777,850 cy was placed to the beach berm template, and the remaining 90,150 cy was placed as dune repair. Sand for the initial construction of the project and all subsequent renourishments was dredged from the project's offshore sand borrow area which is located about 8 miles east of the coastline in water depths of about 55 feet. Following fill placement, approximately 340,000 dune plants were installed to mitigate storm damages and plant newly constructed dunes. All work was completed by late summer 2019 (**Figure O**).

The total cost to renourish the federal project and mitigate damage related to Hurricanes Matthew and Irma was about $39 million. For typical beach renourishment projects, costs are shared between the Federal Government (61.6%), State of Florida (18%), and the City of Jacksonville (20.4%). However, damages resulting from Hurricane Matthew and Irma were eligible for Federal Flood Control and Coastal Emergencies (FCCE) funds resulting in a Federal cost share of about 66.8% (~$26.1 million). Included in the total project expenses is $7.5 million paid by the City of Jacksonville in order to repair the non-federal dunes, constructed at 100% City cost. Because the engineered dune repairs were completed in response to a declared disaster, the City received State (FDEP, FDEM) and Federal (FEMA) reimbursements which brought the City's ultimate net expenditure to less than $4 million, or about 10% share of the total project costs.

The 8th and most recent renourishment of the project was constructed from April to October 2024 to restore the shoreline eroded by Hurricanes Ian and Nicole during the fall of 2022. The renourishment extended along 8.6 miles of Duval shoreline including the north end of Hanna Park (which had not been renourished since initial construction in 1978/80), and the entire shorelines along the Cities of Atlantic Beach, Neptune Beach, and almost all of Jacksonville Beach. The 2024 project excluded two 2,000-ft long segments (one in Hanna Park near the north end of the project, and one at the far south end of the project) for purposes of marine turtle nest relocation. Planning for the 2024 project construction was complicated because, for the first time, the renourishment spanned the entire length of the project shoreline – from the north end of Hanna Park to the south end of Jacksonville Beach; and, both the adjacent shorelines of Mayport Naval Station (to the north) and Ponte Vedra Beach (to the south) were being concurrently renourished by separate contracts and contractors. As such, there was no place to relocate marine turtle nests, which occur here from 15 April through 31 October. So, the two 2000-ft long "no-construction" gaps were established as nest-relocation areas. Additional sand volume was placed immediately adjacent to both gaps in order to "drift in" to the gap areas, by natural wave action, after construction. Beach renourishment at Duval County, along with all of northeast Florida, is allowed during the summer marine turtle nesting season (with special conditions & relocations) because the marine turtle nesting density is considerably less than that along Florida's central and southern east coastline.

Historically, dune protection was a non-Federal component of the project and came at 100% non-Federal cost. In 1992, the Corps (Jacksonville District) proposed sand fencing and dune vegetation (principally to mitigate losses of wind-blown sand that deposited upon the upland). Higher authority approved these features, but only if conducted at non-federal cost. However, in 2023, the Corps adopted responsibility for dune protection along the entirety of the renourished beach under the Federally authorized Duval County SPP. At that time, the Duval project was among the first in Florida to have the dune feature integrated to the Corps of Engineers' project scope. As such, the 2024 project included fill placement on both the dune and berm under the Federal contract. Approximately 1,417,700 cubic yards of sand (1,293,896 cy pay volume) was placed on the beach for dune and berm construction. The berm elevation was raised to account for ongoing sea level rise. The renourishment sand was again dredged from the project's offshore sand borrow area, 8 miles east of the coastline. Following sand placement, 506,000 dune plants were installed on the newly constructed dunes to mitigate storm damage. The beach renourishment was completed by August 2024 and dune replanting by October 2024 (**Figures P and O**), supplemented by an additional 100,000+ dune plants installed by the Corps in spring 2025.

The 2024 renourishment project cost to mitigate damages related to Hurricanes Ian & Nicole was about $36 million (construction) plus $3.5 million for engineering design, surveys, supervision and monitoring. Similar to the 2018 project, the 2024 project was eligible for FCCE funds due to erosion damage resulting from Hurricanes Ian and Nicole. This warranted the 2024 renourishment to be paid at 100% Federal cost, including the newly federally-adopted dune repairs.

The project was originally authorized for 10 years of Federal participation from the date of initial construction (1978). In 1992, the project authorization was extended to 50 years after initial construction, which implied an end year of 2028. The Water Resources Development Act (WRDA) of 2022 granted an additional 12 years to the project authorization, extending it to 2040. The project is typically renourished every 5 to 6 years, which may result in up to three additional renourishment projects between 2025 and 2040, with federal cost-share of between 61.6% (for a normal renourishment) and 100% (for qualifying FCCE significant storm events such as Hurricanes Matthew, Irma, Ian, and Nicole). It is possible that a future WRDA authorizes further extension of historic SPPs, such as Duval County, at the end of the 12 year extension – to be determined. If not, Duval County will need to consider a new start USACE Coastal Storm Risk Management feasibility study, which typically takes three years and $3 million to recommend a project through a Chief's Report, and several more years to authorize through a WRDA bill and subsequent congressional appropriations for construction. A new feasibility study may not lead to re-authorization of the current Duval County SPP extents or renourishment volume and interval due to the projects' current healthy condition (and presence of a seawall that is now buried underneath the project's dune). Another alternative is funding and managing the project 100% at the local and state level, with potential post-storm damage support from the Federal Emergency Management Agency (FEMA), Florida Department of Environmental Protection (FDEP), and Florida Department of Emergency Management (FDEM). The Corps has stated that the project will remain eligible for federal renourishment pursuant to significant qualifying storms (through FCCE), after the project authorization ends in 2040; but this remains to be seen in the future.

The City of Jacksonville (COJ) is the project's non-federal sponsor and the FDEP permittee (i.e., COJ holds the project's State permit for construction). Between renourishment construction events, COJ typically conducts the annual beach tilling, and environmental and physical monitoring required by the State permit and the federal US Fish & Wildlife Service (USFWS). Since 1995, these activities, along with engineering design support, have been conducted by COJ's coastal engineering consultant (Olsen Associates, Inc., now merged into Foth Infrastructure & Environment LLC) and the 501-C volunteer organization of the Beaches Sea Turtle Patrol (BSTP). Project features such as dune walkovers and stormwater outfalls are not part of the project. These are the responsibility of the local upland entities; viz., Mayport Naval Station, Hanna Park (COJ), and/or the Cities of Atlantic, Neptune, and Jacksonville Beach..

As noted above, the normal (non-storm) cost-share for project design & construction is 61.6% federal (Corps of Engineers) and 38.4% non-federal (COJ). Typically, 46.89% of the non-federal (COJ) cost is reimbursed by the State of Florida (FDEP) through competitive grants managed by the FDEP Beach Management Program. The 46.89% cost-share by the State is principally determined by the amount and distribution of public beach parking. Essentially all of the project shorefront south of Mayport Naval Station (which is a 100% federal cost) is eligible for full 50% State reimbursement excepting the southern ½-mile of Jacksonville Beach (which features limited public beach parking) per the most recent census in May 2023. Thus, the computed State cost-share is 46.89% of the total non-federal project costs.

All of the lands upon which the Duval SPP is renourished belong to the State of Florida. Prior to initial project construction in the late 1970's, per State requirements, an "Erosion Control Line" (ECL) was adopted that fixed the boundary between upland ownership and the State of Florida. The ECL is basically located at the seawall that is now buried beneath the project's dunes, or otherwise well landward of the existing dunes where there is no seawall. As such, construction easements for project renourishments are not required, because the lands are owned by the State and the State's FDEP permit provides consent of use for the sand renourishment construction.

The offshore sand borrow areas are in federal (US) waters and managed by the Bureau of Ocean Energy Management (BOEM). As such, for each renourishment event, a lease agreement is required between BOEM, the Corps of Engineers, and the City of Jacksonville. This agreement allows for extraction of sand from the federal seabed for placement to the Duval SPP.

Closing. With over 45 years of successful renourishment, the Duval SPP is one of the three oldest federal beach nourishment projects in the state of Florida (along with Miami Beach and Fort Pierce). A natural byproduct of highly successful long-term beach projects can be waning of public awareness regarding the original (and continued) need for beach nourishment. Failure to renourish the beach and to repair the dunes after storm impacts would ultimately lead to a return to the eroded beach conditions as illustrated in photographs from the 1960's and 1970's. In Duval County, for example, one might be hard pressed to find an average beachgoer who is aware that the remnants of a rip-rap armored seawall (known by long-time beach locals & surfers as the "rocks and the rats") are buried underfoot by the overwhelmingly healthy dune system. With continued renourishment of the federal project and maintenance of the dune system, hopefully a history lesson is the only education they'll receive on the subject.

Photo Credit -- Many of the photographs included in this article are from the Beaches Area Historical Society, Jacksonville Beach, FL. Other photographs include those from Erik Olsen (1978) and the staff of Olsen Associates, Inc (now Foth), Max & Emma Dickinson (Atlantic Beach), and the Corps of Engineers Jacksonville District.

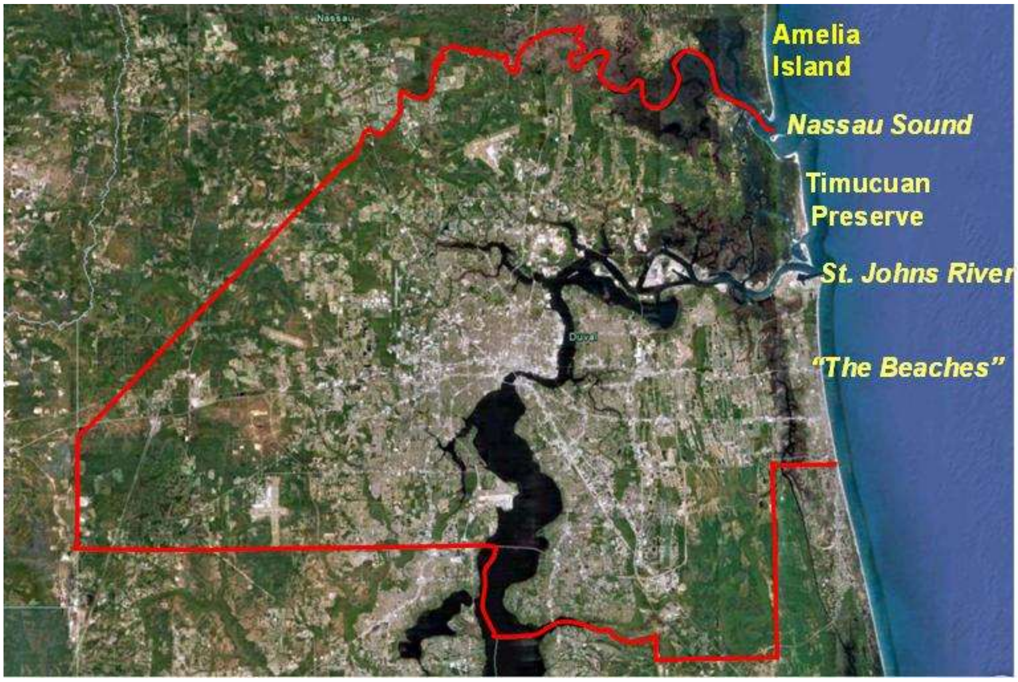

Figure A: 2010 aerial photograph of Duval County, Florida.

Figure B: Shortly after the expansion of the railroad into Jacksonville Beach and the construction of Atlantic Blvd. (Florida's first paved highway) the beaches became a major recreational destination. *<upper left>* c. 1910. *<upper right>* The boardwalk along Jacksonville Beach, c.1920-30. *<lower left>* Easy road access to the beaches made auto racing a popular activity. *<lower right>* The Blue Angels at a 1950 air show in Jacksonville Beach. Note the seawall/bulkhead fronting the first row of buildings in the 1910, and subsequent, photographs.

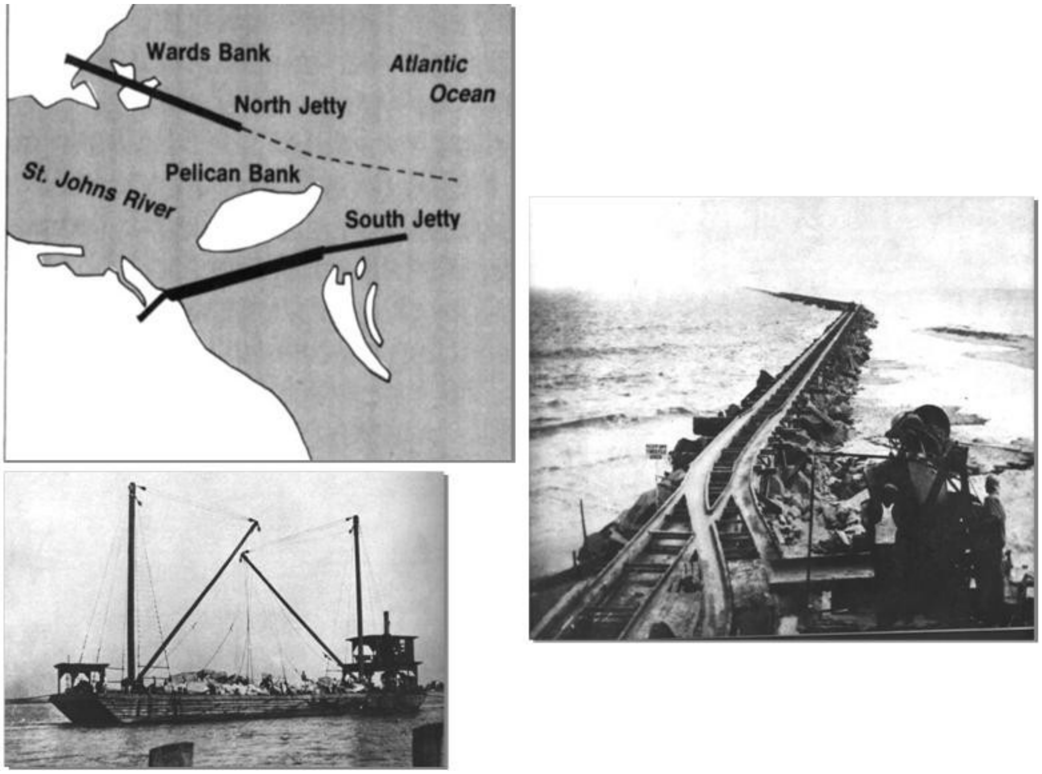

Figure C: Construction of the jetties at the entrance to the St. Johns River, 1880 through 1895. Foundation boulders were placed by barge and the jetty construction was completed by rail.

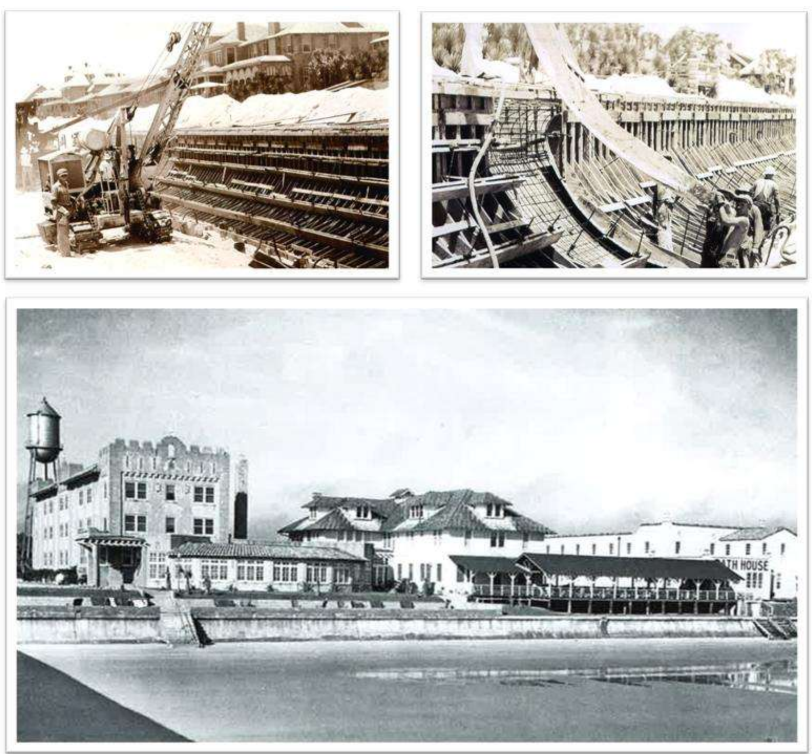

Figure D: Seawall construction along Atlantic Beach in the 1930's.

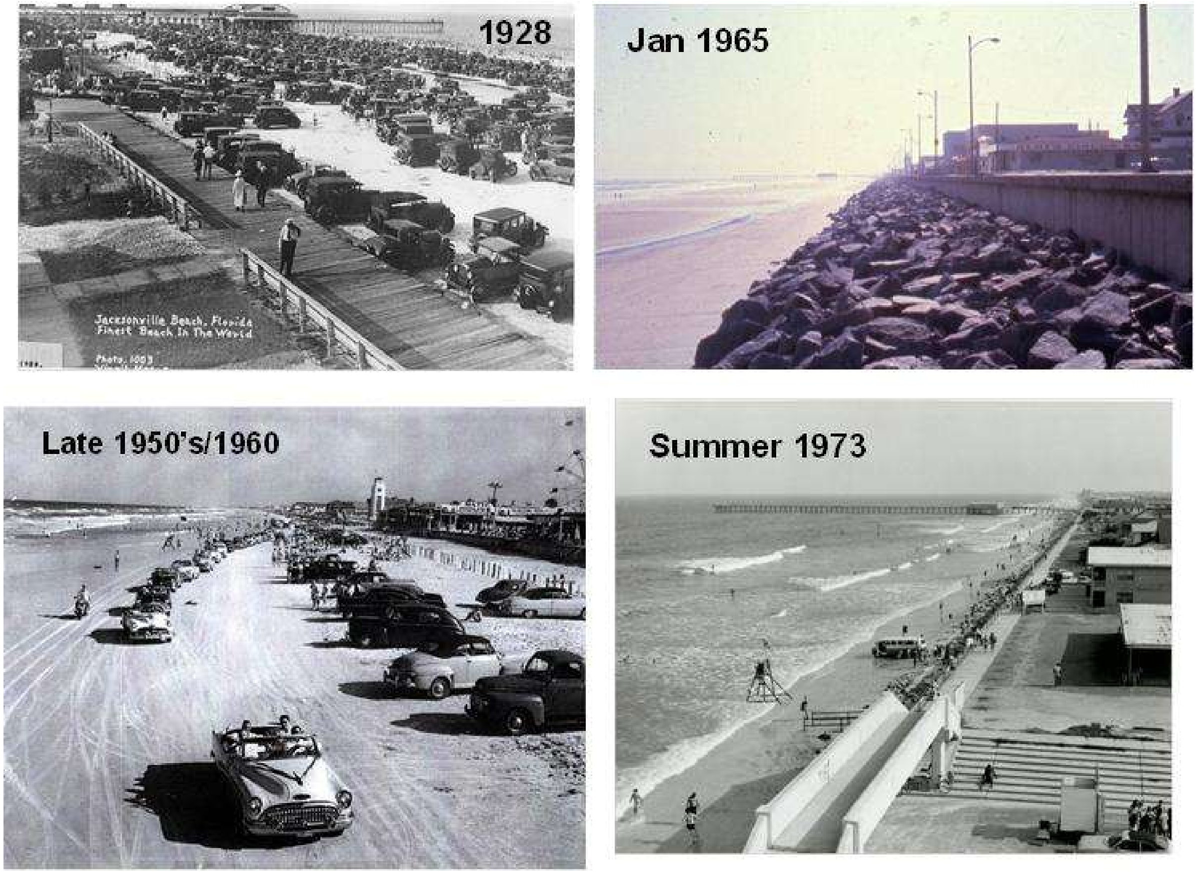

Figure E: Construction of the jetties at Mayport contributed to a lack of sediment supply for the downdrift (south) beach leading to a gradual lowering and contracting recreational beach. The problem was readily apparent by the early 1960's and continued until the initial nourishment project in 1978.

Figure F: Typical storm damage from the 1962 nor'easter and Hurricane Dora, 1964.

Figure G: Atlantic Beach, Florida prior to initial construction of the Federal Shore Protection Project <*upper right and left*> and in March 2010 <*lower* photo>. All photos illustrate conditions in Atlantic Beach.

Figure H: Jacksonville Beach, Florida in 1962 prior to initial construction (and Hurricane Dora) <*upper photo*> and in February 2011 <*lower photo*>. Photos illustrate conditions in the vicinity of Beach Blvd. facing north, at the same location.

Figure I: Jacksonville Beach, Florida 1973, prior to initial construction <*upper photo*> and in February 2011 <*lower photo*>. Both photos illustrate conditions at the same location from atop the Lifesaving Corps Tower in Jacksonville Beach, facing south.

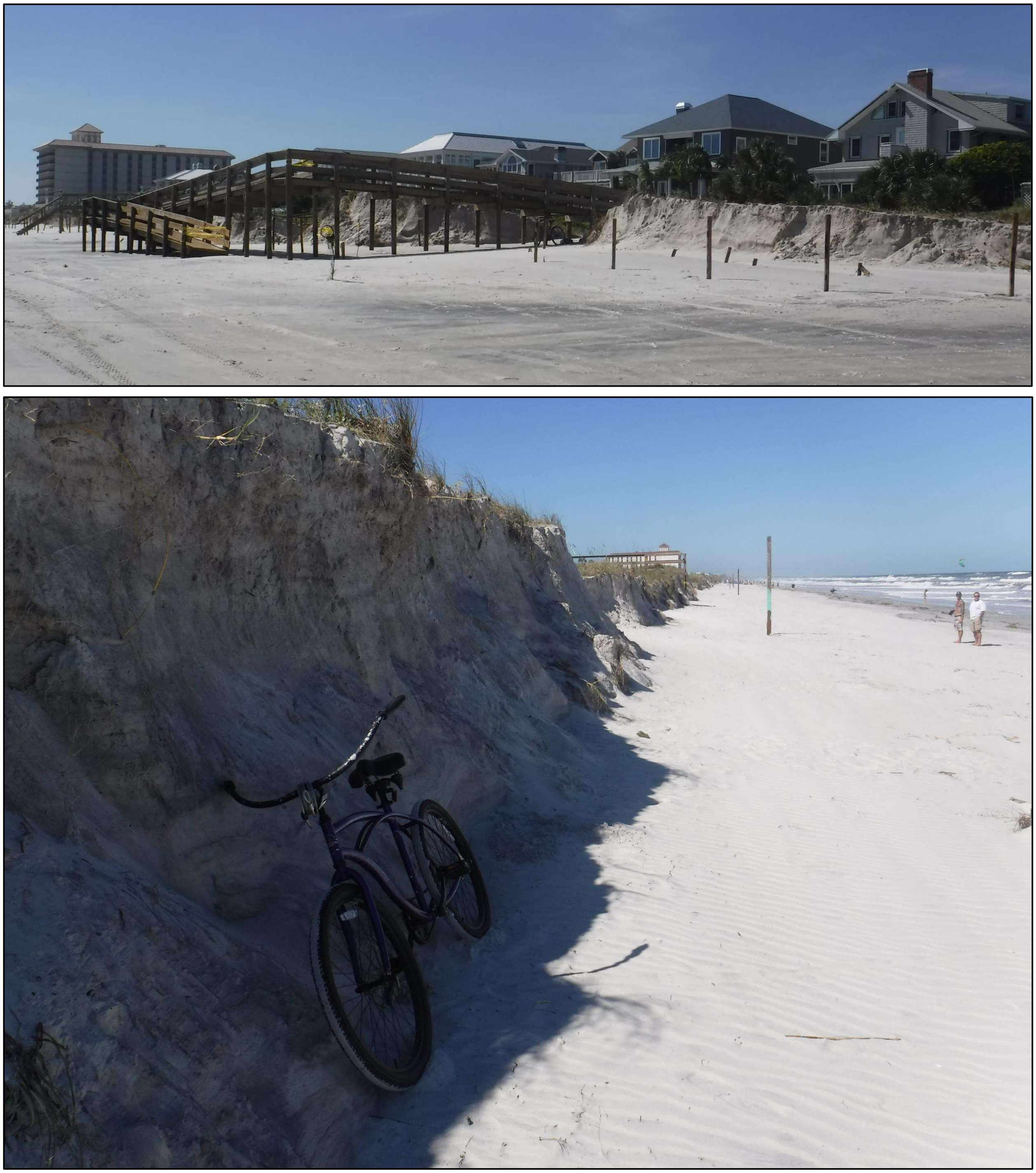

Figure J: Post-Matthew conditions: at 3rd St. in Atlantic Beach, October 2016 <*upper photo*> where the dune was previously located about 30 ft seaward of its depicted location; and, at Pine St. in Neptune Beach, October 2016 <*lower photo*>. Though there was no complete loss of dune along the Neptune Beach shoreline, the dune was heavily scarped along the entirety of this area.

Figure K: Post-Matthew conditions: at 14^{th} Ave. North in Jacksonville Beach, October 2016 <*upper photo*>; Beach Blvd. in Jacksonville Beach, October 2016 <*middle photo*> depicting the remaining dune buffer present in the area after the impacts of Hurricane Matthew; and, south of 25^{th} Ave. South in Jacksonville Beach, April 2017 <*lower photo*>. The Jacksonville Beach shoreline suffered both heavy scarping as well as total loss of the dune in some areas.

Figure L: Post-Construction conditions along Atlantic Beach at the end of the northern fill segment, June 2017 <*upper photo*>. Post-Construction conditions along Jacksonville Beach, June 2017 <*lower photo*>. The Beaches Cities provided and erected the PVC posts and ropes to reduce public disturbance of the newly constructed dune reparations.

Figure M*:* Beach erosion and storm damage from Hurricane Irma, north Atlantic Beach – where post-Matthew dune repairs could not be previously constructed. September 2017.

Figure N*:* Hurricane Irma damage along areas where the dune was repaired after Hurricane Matthew (Atlantic-Neptune-north Jax Beach) <*top 4 photos*>. Hurricane Irma damage to dunes along south Jacksonville Beach where dune was not wholly repaired after Hurricane Matthew <*bottom photo*>.

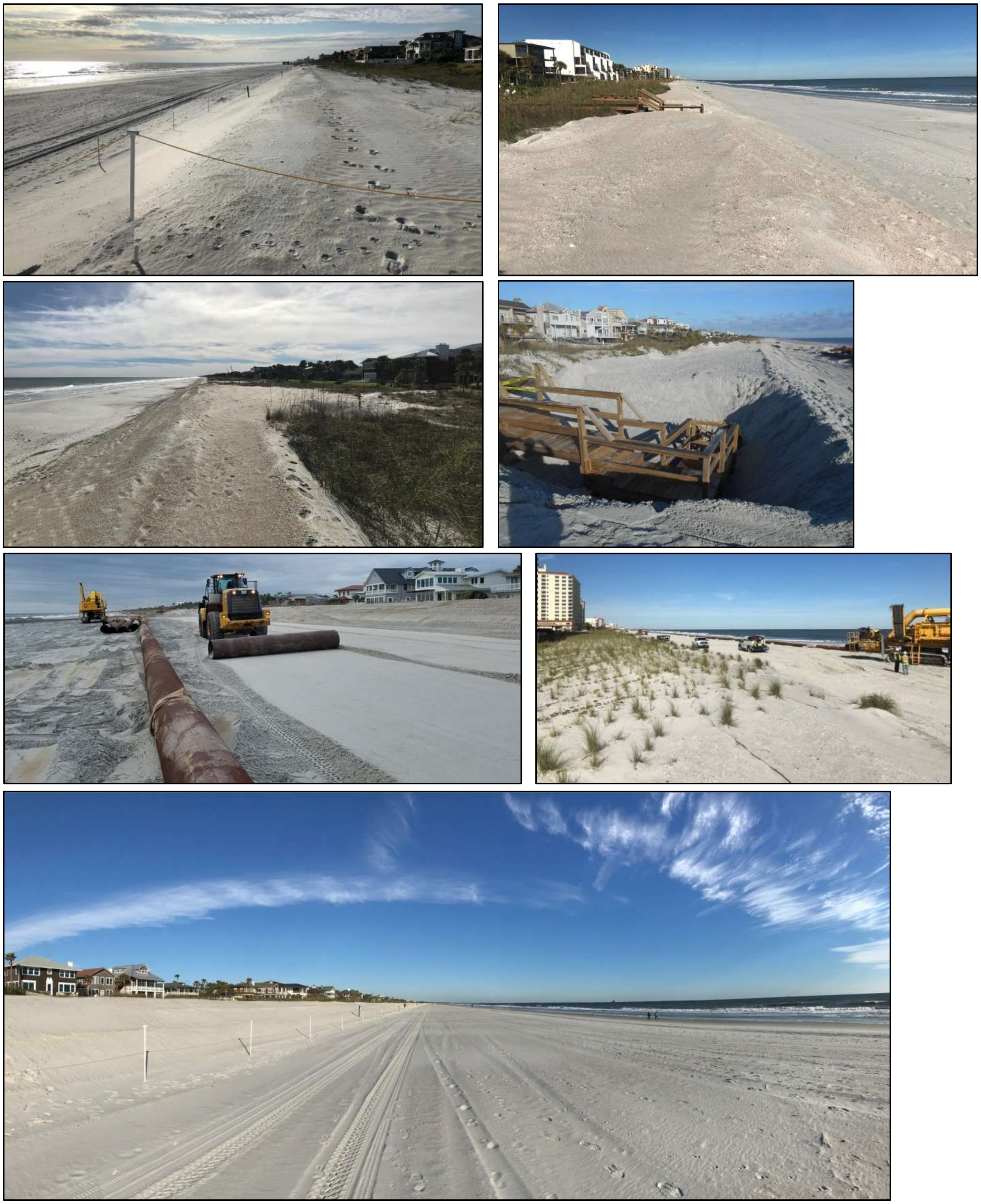

Figure O*:* Dune and beach repair from the 2018/19 renourishment after Hurricane Irma, prior to dune vegetation planting. (Sand placed along the walkovers at north Atlantic Beach, photo above, was graded out after initial placement, around the sides and base of the walkovers.) Photo dates: November 2018 through January 2019.

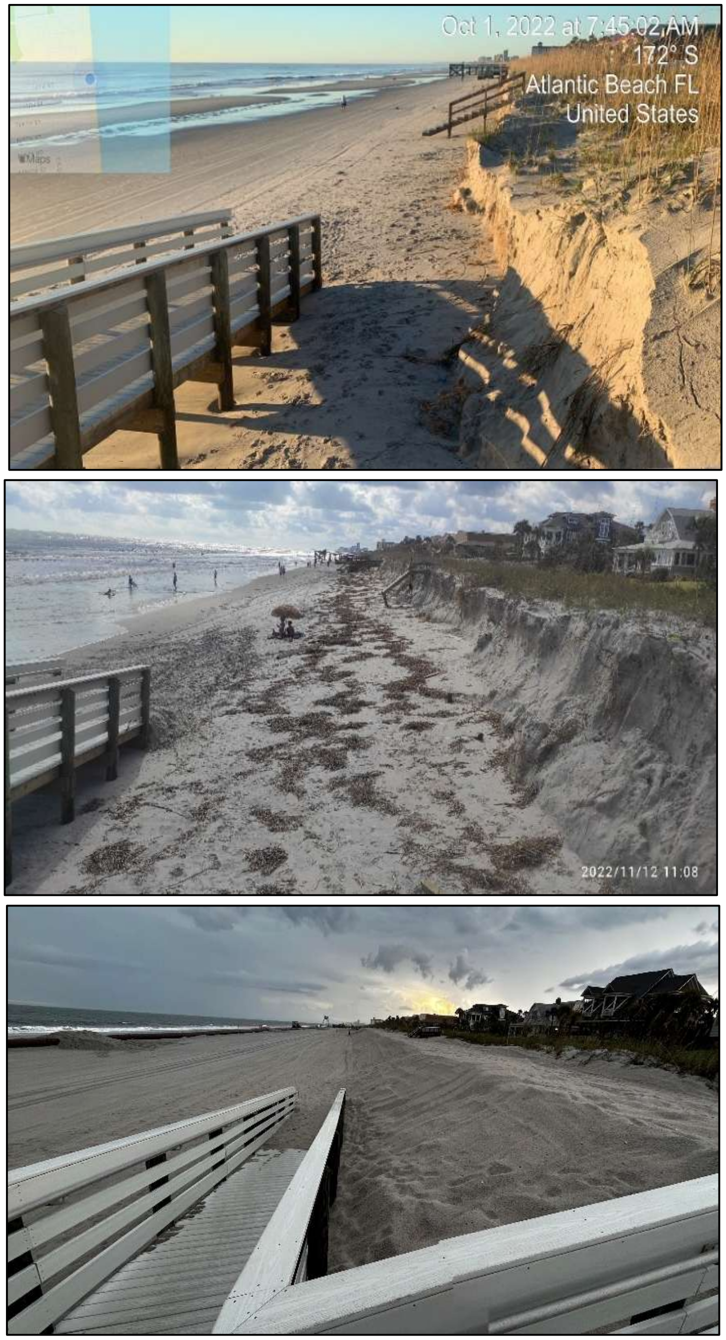

Figure P*:* Pre- and post- dune and beach repair from the 2024 renourishment; identical location & photo view at 12th St. Atlantic Beach.

- Post-hurricane Ian (October 2022) <*top*>,
- Post-hurricane Nicole (November 2022) <*center*>, and
- Post-2024 renourishment (August 2024) < *bottom*>.

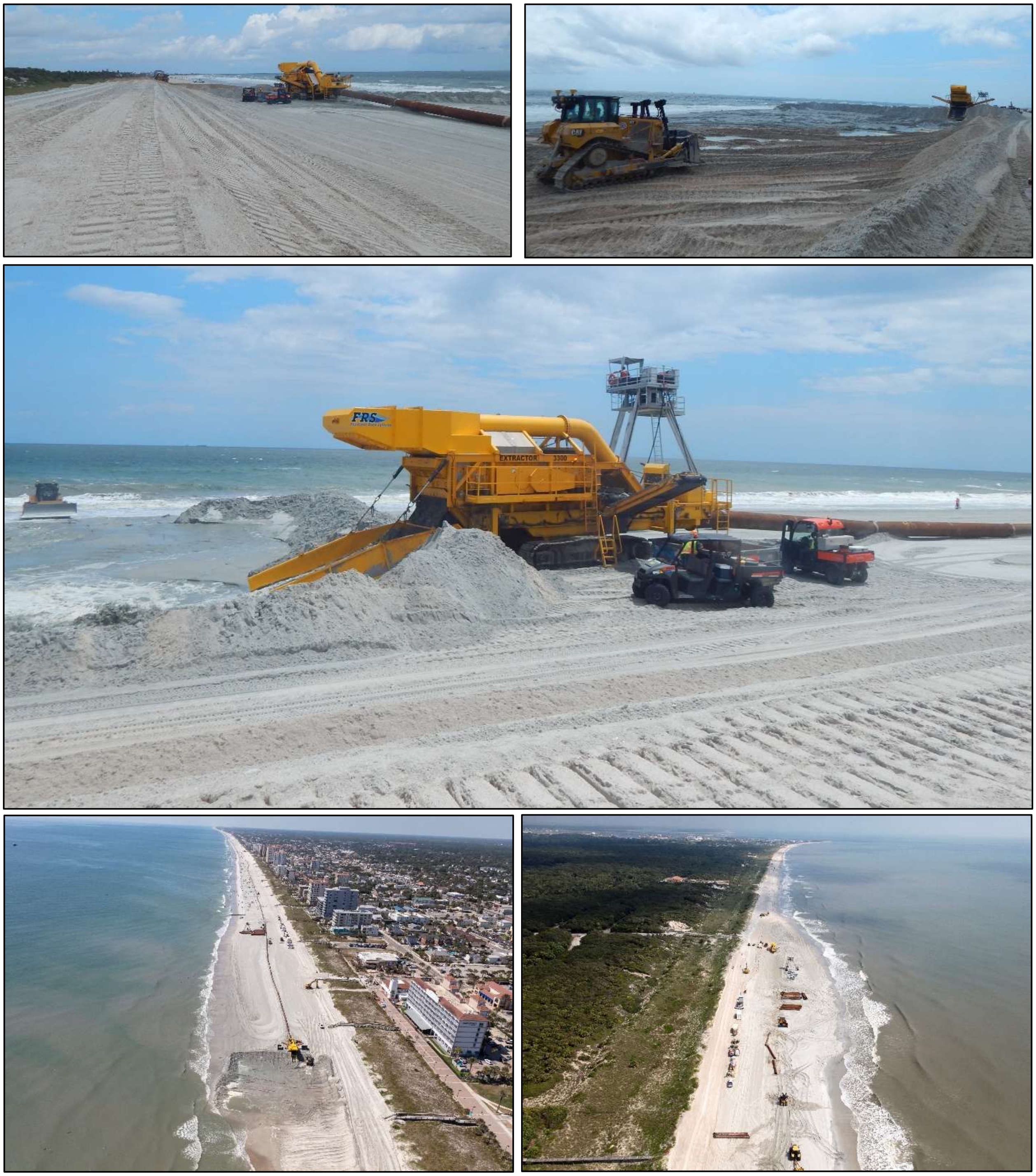

Figure Q*:* Active construction of the 2024 renourishment with extractor releasing sand slurry, bulldozers constructing beach profile, and Coastal Research Amphibious Buggy (CRAB) surveying the constructed stations. Vicinity of Hanna Park on 15 August 2024 < *top three photos*>. Aerials of active construction in vicinity of North Jax Beach facing south on 12 June 2024 < *bottom left*> and Hanna Park facing north on 8 August 2024 <*bottom right*>, courtesy of USACE Jacksonville District.