Buxton Beach Nourishment to Improve Coastal Resiliency and Disaster Recovery
Dare County, North Carolina
Project Background

- Chronic erosion at \(~10\) cy/ft/yr
- Resulting over 900,000 cy of sand deficit
- NCDOT frequent emergency repairs
- Loss of beach habitats
- Lack of storm protection and coastal resiliency
Purpose and Need of the 2017-2018 Beach Nourishment

- Protect NC Hwy 12 and Infrastructure
- Augment the regional sand supply
- Provide higher storm protection
- Provide additional beach habitat for threatened and endangered species
- Maintain access to National Seashore
- Maintain the tax base of the community

Maximum Project Length = 15,500 Linear Feet
Maximum CHNS Length = 11,000 Linear Feet
Maximum Volume = 2,600,000 Cubic Yards
2017-2018 Project Overview

- Project length = 15,500 ft (~2.9 miles)
- Nourishment Volume = 2.6 MCY
- Average fill density = 168 cy/ft
- Berm Crest at +7 ft NAVD
- Offshore borrow area within state waters
- Hydraulic and Hopper Dredging
- Construction Cost = $22,150,000 ($8.52/cy)
- 8 Months of construction with multiple weather and mechanical delays
Before & After Nourishment

September 2014

April 2018
Before & After Nourishment

September 2014

April 2018
Success, Lessons, and Future Work

- First beach nourishment using offshore borrow area near Cape Hatteras
- Withstood March 2018 Northeasters, Hurricanes Florence (Sept 2018) and Michael (Oct 2018), Dorian (Sept 2019) since project completion
- Accomplished project purpose and goals (protect NC 12)
- **Few to none** FEMA claims by oceanfront property owners after storms
- Completed within budget and without environmental incidents
- Combination of factors caused construction delays
- Summer construction proved to be crucial
- Deteriorated groins at the south end have little capacity to hold sand and require restoration
Nourishment Volume Remaining as of August 2020

- **2017-2018 Placed**
  
  R2 (NPS) = 1.7 MCY  
  R1 (Buxton) = 0.9 MCY  
  Total = 2.6 MCY

- **As of August 2020**
  
  R2 (NPS) = 36%  
  R1 (Buxton) = 3%  
  Total = 24% Remaining
Main Reasons for Higher-Than-Normal Erosion Rate

- Existing shoreline offset which accelerates erosion
- Normal nourishment sand spreading at the project boundaries (ie – End Loss)
- Four named hurricanes impacted the project area in September 2017 during construction
- A series of nor’easter impacted the project area in March 2018 after project completion
- Recent Hurricanes *Florence* and *Dorian* impact
- Sand shifted offshore beyond −24 ft NAVD due to the existence of a trough in deep water
- Deterioration of the groins at the south end of the project
Incident-Related Sand Loss
Hurricane *Florence* – September 2018

- Closure Depth = -24 ft NAVD
- Pre- and Post-Storm Profiles
  - Hurricane *Florence* Impacted the Buxton project area on 13-14 September 2018
  - Maximum surge ~2 ft
  - Maximum wave height ~30 ft
  - FEMA Major Disaster Declaration on 7 Oct
  - Pre-storm survey in June
  - Post-storm survey on 22-24 October
- Adjustment for Background Erosion
Net Sand Loss Caused by Hurricane Florence = 303,732 cy*

* Total loss 341,900 cy (22 cy/ft) subtracts the “background erosion” of 38,168 cy (between June and October) as requested by FEMA
Incident-Related Sand Loss
Hurricane *Dorian* – September 2019

- Closure Depth = -24 ft NAVD
- Pre- and Post-Storm Profiles
  - Hurricane *Dorian* Impacted the Buxton project area on 6 September 2019
  - Maximum surge ~4 ft
  - Maximum wave height ~27 ft
  - FEMA Major Disaster Declaration on 4 Oct
  - Pre-storm survey in June
  - Post-storm survey on 24-27 November
- Adjustment for Background Erosion
Net Sand Loss Caused by Hurricane *Dorian* = 164,690 cy*

* Total loss 212,400 cy (13.7 cy/ft) subtracts the “background erosion” of 47,710 cy (between June and November) as requested by FEMA
Beach Conditions on 21 September 2020 after Nor'easter

Photo/Video Source: Epic Shutter Photography
Beach Conditions on 9 October 2020

- Buxton Village **lost** 873,300 cy (73 cy/ft/yr)
- Entire project area **lost** 1,965,000 cy (50 cy/ft/yr)
- Upcoast 4,500 ft **gained** 60,200 cy (5.2 cy/ft/yr)
- Downcoast 5,000 ft **gained** 480,000 cy (38 cy/ft/yr)
- More exposed and further deteriorated groins

**Notes:** Volumes were collected and compared between project completion in February 2018 and the most recent beach condition survey in August 2020.
Beach Conditions on 9 October 2020

- Re-exposed sand bags
- Dune escarpments
- Overwash to oceanfront properties
- Rhythmic topography along shore
Historical Projects in CHNS and Buxton

- Dune enhancement by sand fencing and vegetation (1930s)
- Construction of Hwy 12 (1950s)
- **Beach nourishment in 1966 – 312,000 cy**
- Repair/realignment of Hwy 12 after storms (1970s)
- **Beach nourishment in 1971 – 200 to 300,000 cy**
- **Beach nourishment in 1973 – 1,300,000 cy**
- Installation of groins (1970s)
- Periodic dune rebuilding and repairs of Hwy 12 after storms (1980s to 2000s)
- Repairs to dunes and Hwy 12 after Hurricanes Irene (2011) and Sandy (2012)
- **Beach nourishment 2017-2018 – 2.6 MCY**
- **Beach renourishment 2022 – 1.5 MCY**
Maintenance Project Planning and Designing

- Purpose and goals
- Project Scale = 1,500,000 cy
- Offshore borrow area within state waters
- CAMA, USACE, and NPS permits required
  - NPS Sediment Management Framework
- FEMA’s NEPA process
- Combining FEMA post-storm restoration project with County’s scheduled maintenance project
- Summer 2022 construction for safety and economic concerns