THE LARGEST WILDLIFE REFUGE RESTORATION PROJECT IN EASTERN U.S.

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Prime Hook National Wildlife Refuge

- Established in 1963
- 10,132 acres, primarily wetlands
- In the 1980’s, the two central units – Unit II and Unit III – were converted to freshwater impoundments
- Tidal water was restricted by water control structures at north and south
- Culverts between Unit II and Unit III
2011

2010 was a quiet storm year, until Irene in 2011

Post-Sandy

New breaches 4 total now

2013 aerial imagery courtesy of Atkins Global
Prime Hook NWR Restoration Project

**RECOVERY**
- Stabilize the shoreline

**RESILIENCY**
- Rebuild the ecosystem that can sustain a functioning marsh
Project Team - Recovery

U.S. Fish & Wildlife Service

National Wildlife Refuge System

ER&M
ECOLOGICAL RESTORATION & MANAGEMENT

US Army Corps of Engineers

TI Coastal Services, Inc.

Norfolk Dredging Company
Since 1899

DelDOT

NOAA Fisheries | Greater Atlantic Region
Project Team - Resiliency

[Logos of various companies]
Recovery…

- Army Corps of Engineers
  - Design
  - Project Oversight
- Norfolk Dredging
  - TI Coastal – Surveying
- ER&M
  - Sand Fence and Beach Grass Planting

- Started - October 2015
- Completion – March 2016
Typical Section
October – Prior to Construction

Image Source: USFWS
November

Image Source: USFWS
February

Image Source: USFWS
Resiliency

amec foster wheeler
Hydrodynamic Modeling

Atkins Global & USFWS developed hydrodynamic model for wetland complex

- Circulation, flushing/residence time, salinity
- Delft3D
- Delaware Bay from Trenton, NJ to Atlantic Ocean

Hydrology Alteration scenarios

- Focused model runs on all breaches closed, WCS and eastern Fowler Beach Rd removed
- Main conveyance channel to improve circulation
- Secondary branching tidal channels added
Resiliency Project

- Improve tidal circulation by creating conveyance channel network
  - ~21 Miles of channels
- Remove 2 water control structures
- Plant 18 acres of salt marsh vegetation on backbarrier
- Remove 1,800 feet of Fowler Road
- Treat 1,000 acres of Phragmites (twice)
# Channel Dredging

## Volumes Per Channel

<table>
<thead>
<tr>
<th>Alignment</th>
<th>Channel Type</th>
<th>Unit Location</th>
<th>Linear Length (ft)</th>
<th>Width (ft)</th>
<th>Max Depth (ft)</th>
<th>Dredge Volume (CY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel A</td>
<td>Primary</td>
<td>Unit II &amp; III</td>
<td>26,032</td>
<td>51</td>
<td>-4.0</td>
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</tbody>
</table>

**Totals**: 112,392 (CY) 535,755

**Note**: Dredge quantities are estimates based on available survey data. Actual dredge quantities may vary.
Channel Design

A) Primary Channels (Design)

B) Secondary Channels (Design)

C) Tertiary Channels (Design)
Dredge Boats
Dredging...
Dredging in progress...
Channel Survey...
Unit II & III Hydraulic Connectivity
Water Control Structures
Beach Planting
NOTE:

DATUM OF THIS SKETCH IS THAT OF THE DELAWARE STATE PLAN GRID NAD 83/91
BASED ON MEASUREMENTS MADE ON MARCH 2016.

GOOSE FENCE INSTALLED IN THE LOWER MARSH PLANTING ZONE AT THE DIRECTION
OF THE USFWS. THE PERIMETER FENCE PROTECTS AGAINST SWIM UP ATTRACTION AND
MACRO ALGAE, AND FENCE INSTALLED THROUGH THE MIDDLE OF THE AREA BREAKS
UP GEESE LANDING ZONES.

<table>
<thead>
<tr>
<th>AS-BUILT QUANTITIES</th>
<th>QUANTITY</th>
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<tbody>
<tr>
<td>SPARTINA PATENS</td>
<td>225,000</td>
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<tr>
<td>SPARTINA ALTERNIFLORA</td>
<td>140,000</td>
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<tr>
<td>GOOSE EXCLUSION FENCE</td>
<td>9,900 LF</td>
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<table>
<thead>
<tr>
<th>ELEVATION LINES</th>
<th>LENGTH (FL)</th>
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<tbody>
<tr>
<td>BACK DUNE PLANTING ZONE</td>
<td>6,900's</td>
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<tr>
<td>SALT MARSH PLANTING ZONE</td>
<td>9,100's</td>
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<tr>
<td>TRANSITION LINE</td>
<td>6,410's</td>
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</table>
Challenges
Airboat ride!!
Aerial Tour!!!
Here comes the birds!
Thank You.