Research and Monitoring to Support Project Design and Evaluation of Prime Hook NWR Restoration

Abiotic & Elevation

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Storming Back:
Restoration, Resiliency and Readiness at Northeast National Wildlife Refuges
The Prime Hook NWR and DE Coastal Programs Partnership

It all started back in ‘09 with the CCP
Little did we know 2100 was just a few years away
Things are happening, let's get some data!
Water Quality/Level Monitoring (2010-2014)

Water Level
Temperature
Conductivity

Near-real time telemetry
Water Quality/Level Monitoring (2014-Present)

Upgraded Equipment
Added DO Sensor
Relocate Sondes
Near Real-Time Network

https://stormcentral.waterlog.com/public/USFWS
On-line Data Access

### Prime Hook National Wildlife Refuge

#### Marsh & Water Monitoring Network

**Site Information**
- **Site Name:** Slaughter Canal Bridge
- **Latitude:** 38.897811
- **Longitude:** -75.20548
- **Description:** Data displayed in Eastern Standard Time

#### Data History
- **Data Range:** From 11/18/2018 to 11/26/2018

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Temperature (°F)</th>
<th>Conductivity (μS/cm)</th>
<th>Salinity (ppt)</th>
<th>Water Level (m/NVD03)</th>
<th>Dissolved Oxygen Percent Saturation (percent)</th>
<th>Dissolved Oxygen Concentration (mg/L)</th>
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</thead>
<tbody>
<tr>
<td>11/18/2018</td>
<td>11:00</td>
<td>48.8</td>
<td>2875</td>
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<td>5.86</td>
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</table>

*Note: Data shows trends and values for various environmental parameters.*
Fowlers Beach Road

Monthly Salinity (Avg/Min/Max)

Water Level (Avg/Min/Max)
Slaughter Creek

Monthly Salinity (Avg/Min/Max)

Monthly Water Level (Avg/Min/Max)
Capturing Storm Impacts

2015 Nor'Easter Influence on Water Levels

Water Level (meters, NAVD88)

09/01/2015 09/15/2015 10/01/2015 10/15/2015 10/31/2015

2015 Nor'Easter Influence on Water Levels

Water Level (meters, NAVD88)

09/01/2015 09/15/2015 10/01/2015 10/15/2015 10/31/2015
Nutrients

- Chlorophyll-A
- Pheophytin
- Total Dissolved N
- Total Dissolved P
Salinity Transects
Infrastructure Surveys
Impoundment Bathymetry

Figure 3. A) LiDAR DEM, B) Survey Elevations, C) Survey overlain on LiDAR DEM
Surface Elevation Tables
Modeling for Restoration Design

Collected Data
- Water Levels
- Bathymetry
- Salinity
- Elevations
- Sediments

Supplemental Data
- Tidal, LiDAR
- Meteorological
- Vegetation
- and More

Delft3D

Federal & State Staff/Experts
Consulting Engineers/Scientists

Verification of Outcomes
Alternatives Analysis

Restoration Design
Identifying Groundwater Discharge Locations
Tom McKenna, Delaware Geological Survey
Flow and Sediment Transport Study

Chris Sommerfield, University of Delaware
ADCP and TSS sampling
2014-2015 Findings (Pre-restoration)
2016 Findings (Restoration & Post)

**Broadkill River - BKR**
- Jan-Aug 2016
- Sept-Nov 2016
- SSC (mg/L)
- n=204 (2016) + n=235 (2016)

**Fowler Beach Road - FBR**
- Jan-Aug 2016
- Sept-Nov 2016
- SSC (mg/L)
- n=220 (2016) + n=226 (2016)

**Slaughter Canal Bridge - SCB**
- Jan-Aug 2016
- Sept-Nov 2016
- SSC (mg/L)
- n=252 (2016) + n=204 (2016)

**Petersfield Ditch - PFD**
- Jan-Aug 2016
- Sept-Nov 2016
- SSC (mg/L)
- n=164 (2016) + n=209 (2016)

**Broadkill River - BKR**
- Jan-Aug 2016
- Sept-Nov 2016
- SSC (mg/L)
- n=204 (2016) + n=235 (2016)
## The Future

<table>
<thead>
<tr>
<th>Parameter</th>
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<tbody>
<tr>
<td>Water Quality</td>
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<tr>
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