AGENDA

Welcome and Introductions (10 Min.)
NYC Tidal Marsh Assessment (25 Min.)
Brief Q&A (5 min.)
Mapping Vulnerable Wetlands (25 Min.)
Brief Q&A (5 min.)
Discussion (25 Min.)
Wrap-up (5 Min.)
WEBINAR MODERATOR

Kimberly Roth,
Environmental Analyst,
Wetlands Programs
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Chris Haight works for the NYC Department of Parks and Recreation in the Natural Resources Group as a Project Manager for Wetland and Riparian Restoration. Chris manages two EPA funded projects that assess the condition and vulnerability of natural and restored salt marshes in NYC. Chris has previously worked as a research assistant for the Marine Biological Laboratory’s TIDE Project, a large-scale salt marsh fertilization experiment, in the Plum Island Estuary of Massachusetts. Chris has a B.A. from Connecticut College in Environmental Studies and M.A. in Conservation Biology from Columbia University.
NYC Tidal Marsh Assessment: Condition, Vulnerability and Opportunities for Restoration & Advancement

Christopher Haight¹, Marit Larson¹ Rebecca Swadek¹, Ellen K. Hartig¹, Nicole Maher², Stephen Lloyd², Lauren Alleman², and Helen M. Forgione³

NYC Parks - Natural Resources Group ¹
The Nature Conservancy ²
Natural Areas Conservancy ³
25 NYC Tidal Marsh Complexes for Assessment

<table>
<thead>
<tr>
<th>WETLAND COMPLEX</th>
<th>ID #</th>
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<tbody>
<tr>
<td><strong>BRONX</strong></td>
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<tr>
<td>Pelham Bay Hutchinson River Outer</td>
<td>BQ1.1</td>
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<tr>
<td>Pelham Bay Hutchinson River Inner</td>
<td>BQ1.2</td>
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<td>Pelham Bay Cove</td>
<td>BQ2</td>
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<tr>
<td>Pelham Bay Turtle Cove Outer</td>
<td>BQ3</td>
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<td>BQ4</td>
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<td>Pugsley Creek</td>
<td>BQ5</td>
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<td>Udall's Cove</td>
<td>BQ6</td>
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<td>Alley Creek Outer</td>
<td>BQ7.1</td>
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<td>BQ7.2</td>
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<tr>
<td>Idlewild Park Outer</td>
<td>JB 1.1</td>
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<tr>
<td>Idlewild Park Inner</td>
<td>JB 1.2</td>
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<td><strong>BROOKLYN</strong></td>
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<tr>
<td>Spring Creek</td>
<td>JB 2</td>
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<td>JB 3</td>
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<tr>
<td>Four Sparrow</td>
<td>JB 4</td>
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<td><strong>STATEN ISLAND</strong></td>
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<tr>
<td>Arlington Marsh</td>
<td>SI1</td>
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<td>Saw Mill Creek Outer</td>
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<tr>
<td>Saw Mill Creek Inner</td>
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<tr>
<td>Neck Creek Outer</td>
<td>SI3.1</td>
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<td>SI3.2</td>
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<tr>
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<td>SI4.1</td>
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<td>William T Davis Inner</td>
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<td>Richmond Creek</td>
<td>SI5</td>
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<td>Fresh Kills</td>
<td>SI6</td>
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<tr>
<td>Lemon Creek Outer</td>
<td>SI7.1</td>
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<tr>
<td>Lemon Creek Inner</td>
<td>SI7.2</td>
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**Project Goals**

- Evaluate current salt marsh conditions
- Assess vulnerability (*to SLR, etc.*)
- Identify opportunities for protection, advancement & restoration
- Prioritize restoration & protection opportunities
Field and Model Components

- Mid-Atlantic Tidal Wetlands Rapid Assessment Method (Mid-TRAM)
- Salt Marsh Ecological assessment (NACSMA)
- 6 Site Specific Intensive Monitoring (SSIM) locations
- Detailed Marsh Loss analysis (1974 - 2012)
- Sea Level Affecting Marshes Model (Warren Pinnacle, NYSERDA)
• Warren Pinnacle Consulting, Inc. ran Sea-Level Affecting Marshes Model (SLAMM)

• **4 Sea Level Rise scenarios**: based on downscaled global climate models for NY State (ClimAID)

• **4 Time Horizons**: 2025, 2055, 2085, 2100

• **Uncertainty/Likelihood Layers**: composites of many simulations using the probability distributions of the input parameters to represent the range of uncertainty in the modeled parameters and measured data. (elevation, SLR, TSS, accretion, etc.)
Beware the Siren Song of Maps and Models

Odysseus and the Sirens

Simple models generate beautiful maps with a specific outcome. Don’t mistake an output map for a predicted future at any particular time point.
SLAMM Uncertainty layers

Likelihood of Coastal Marsh 2085: Idlewild Marsh (Inner & Outer)
Potential marsh gain & loss (derived from SLAMM)

Likelihood of Coastal Marsh 2085: Idlewild Marsh (Inner & Outer)

Vulnerability metric:
- Current marsh boundary
- Potential marsh migration (greater than 75% likelihood)
- Potential marsh loss (less than 25% likelihood)
Condition Index

- Marsh Area
  - Calculate z-score
  - Marsh Area score
- % Developed
  - Calculate z-score
  - % Developed score
- Site Richness
  - Calculate z-score
  - Site Richness score
- Total Cover
  - Calculate z-score
  - Total Cover score
- Low Marsh Soil Strength
  - Calculate z-score
  - Low Marsh Soil Strength score
- Breeding Bird Count
  - Calculate z-score
  - Breeding Bird Count score
- Bare Peat Coverage
  - Calculate z-score
  - Bare Peat Coverage score
- Panne/Pool Trend
  - Calculate z-score
  - Panne/Pool Trend score
- Ditch Density
  - Calculate z-score
  - Ditch Density score

Average z-score
Conditions Index
Z-score Standardization of Data

A common and useful standardization approach to adjust for differences in variance and measurement units. This allows us to place variables on equal footing to one another.

\[ z = \frac{x - \mu}{\sigma} \]

\( \mu \) = Mean
\( \sigma \) = Standard Deviation
Calculating the Vulnerability Index

- Potential Gain from migration
  - Calculate z-score
  - Potential Gain score

- Potential Loss to SLR
  - Calculate z-score
  - Potential Loss score

- Marsh Area
  - Calculate z-score
  - Marsh Area score

- Waterward Trend
  - Calculate z-score
  - Waterward Trend score

- Edge Density
  - Calculate z-score
  - Edge Density score

- Percent High Marsh
  - Calculate z-score
  - Percent High Marsh score

- Average z-score

Vulnerability Index
Saw Mill Inner (SI2.2) – Saw Mill Creek Marsh, Staten Island

Marsh Area
Percent Developed
Native Species Richness
Total Vegetative Cover
Low Marsh Soil Strength
Salt Marsh Breeding Bird Count
Bare Peat Coverage
Trend in Pool Size
Ditch Density
Total Score

Z Score
Condition
Higher Condition
Lower Condition

Potential Marsh Loss to SLR
Potential Gain from Migration
Trend in Waterward Marsh Loss
Edge Density
Percent High Marsh
Total Score

Vulnerability
Lower Vulnerability
Higher Vulnerability
**Idlewild Outer (JB1.1) – Idlewild Marsh Preserve, Queens**

**Conditions**
- Marsh Area
- Percent Developed
- Native Species Richness
- Total Vegetative Cover
- Low Marsh Soil Strength
- Salt Marsh Breeding Bird Count
- Bare Peat Coverage
- Trend in Pool Size
- Ditch Density
- Total Score

**Vulnerability**
- Marsh Area
- Potential Marsh Loss to SLR
- Potential Marsh Gain from Migration
- Trend in Waterward Marsh Loss
- Edge Density
- Percent High Marsh
- Total Score
Identification & prioritization of restoration opportunities

- Optimize number of potential inland migration acres in future
  - Acquisition of adjacent marsh parcels
  - Removal of barriers to migration

- Optimize long term viability of existing marshes
  - Increase elevation of marsh surface to add elevation capital
  - Restoration of waterward marsh that has retreated from the 1974 Tidal Wetlands Inventory line
Marsh Advancement (migration) Barriers

The chart shows the square feet of various marsh areas affected by migration barriers. The areas are categorized by barriers such as roads, other barriers, and parking lots. The pie chart in the inset provides additional data on different types of barriers and spaces.
Elevation Enhancement

Photo: Patty Doer, TNC-NJ
Rebuild to extent of 1974 water lines
Prioritization of Restoration Opportunities – in progress

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Photo: N. Maher (TNC)
Nancy Lin is the Wetland Circuit Rider Coordinator and created the Circuit Rider Program in 1995. Since 1988 Nancy has overseen the outreach and training for MassDEP's Wetlands and Waterways Program, as well as writing and managing grants that forward wetlands/waterways programmatic goals. As a certified Professional Wetlands Scientist (PWS), Nancy has developed, produced and implemented many of the Program's technical, regulatory and general outreach/training efforts. You can reach Nancy at 617.556.1109 or nancy.lin@state.ma.us.
Alice Smith works for MassDEP as an Environmental Analyst. She holds a Master's Degree in Environmental and Water Resource Management from Yale School of Forestry and Environmental Studies and a B.S. in Electrical Engineering from the University of Rhode Island. You can reach Alice by phone, 617.292.5854, or by email: alice.smith@state.ma.us.
Mapping Vulnerable Wetlands For Stormwater Management Planning

NEIWPCC Webinar, December 10, 2015
Nancy Lin and Alice Smith, MassDEP
Stormwater Management Planning Tools For Towns

MassDEP developed GIS Maps to demonstrate how a “Healthy Watershed” approach to planning for compliance with stormwater regulations can be cost effective.
Vulnerable Wetlands

“The very smallest (headwater) streams and wetlands that do not have a permanent surface water connection to larger water bodies yet are still vital parts of the ecosystem.”

Center for Watershed Protection
NHESP Certified and Potential Vernal Pools
Critical Areas

Outstanding Resource Waters

Bathing Beaches

Shellfish Growing Areas

Public Water Supplies
Loss of Vulnerable Wetlands Impact

- Groundwater Recharge
- Stream Flow in Dry Weather
- The Health & Biodiversity of Aquatic Habitat
- Pollution Attenuation incl. Phosphorus & Nitrogen

08.31.2005
Over 90% of the MA Population Gets Some of It’s Drinking Water From Headwater Streams

Percent population that gets some of its drinking water directly or indirectly from streams that are seasonal, rain-dependent or headwaters

Streams
Percent Population
NoData

Percent Population
0%
1 - 20%
21 - 50%
51 - 90%
91 - 100%
Headwater Streams – Graphic Layer for GIS
Stormwater Planning Tools
USGS Stream and Wetlands with MADEP Hydrography and Wetland Overlays

Legend
- Subwatershed outline
- Stream Centerline
- FarthestExtent of Reach
- Headwater Streams
Overlapping Stream Reaches are Subtracted
NHESP Certified and Potential Vernal Pools
Vernal Pool Clusters: Graphic Layer for GIS Stormwater Planning Tools

Vernal Pool Clusters:
1. The presence of two or more vernal pools;
2. Good connectivity, few obstacles to migration;
3. Within 400 m of each other
Critical Areas Under Wetlands Protection Act Regulations

Public Water Supply Watershed

Legend:
- DAP Approved Zone 1a (Internal Use Only)
- Critical Wetland Protection Areas (with Contact Info)
- Outstanding Resource Waters (2007 RWG Standard)
- Area of Critical Environmental Concern
- Cape Cod National Seashore
- Protected Shoreline
- Public Water Supply Watershed
- Metro Public Water Supply
- Stagnant Protected River
- Wildlife Refuge
- SWPs
Town Index Map

Map of TOWN OF SHARON - NEPONSET RIVER SUBWatersheds
WITH FEDERALLY-LISTED IMPAIRED WATERS

Legend:
- Listed Impaired Water Bodies
- USGS Issued 1:25,000 Hydrography
- Neponset River Watershed
- Neponset River Subwatersheds
- Town Boundaries
- Water Quality Data
- Waters requiring a TMDL
- Waters requiring a TMDL

Subwatershed of Interest

Map of MASSAPOAG LAKE SUBWATERSHED
WITH FEDERALLY-LISTED IMPAIRED WATERS

Legend:
- Waters listed as impaired
- Waters impaired by a pollutant
- Waters not impaired by a pollutant
- Waters requiring a TMDL
- Waters requiring a TMDL
- Waters not impaired

January 2013
USGS Topographic Maps

USGS Topographic Quadrangle Images with Shaded Relief—December 1995, June 2001

MassDEP Hydrography (USGS-based) MassDEP Hydrography (1:25,000) – March 2010
http://www.mass.gov/itd/hydro25k. This layer is an enhanced version of the older U.S. Geological survey 1:25,000 Hydrography datalayer. It is a hybrid of data from USGS Digital Line Graphs (DLGs), scanned mylar separates obtained from the USGS, digitized hydrographic features from paper USGS 1:25,000 Topographic Quadrangle maps and data extracted from the MassDEP Wetlands datalayer. It is maintained by the MassDEP GIS Program.
Community Boundaries (Towns) from Survey Points
MassDEP Hydrography (1:25,000) – June 2004 (last update February 2014)
MassGIS produced a statewide datalayer of the approximately 2500 sub-basins as defined and used by the USGS Water Resources Division and the Mass Water Resources Commission, and as modified by Executive Office of Environmental Affairs (EOEA) agencies. These sub-basins were aggregated together to make the 28 basins of the Major Basins Datalayer. This datalayer is maintained by MassGIS and the MassDEP GIS Program. For information regarding this data layer, contact the MassDEP GIS Program at (617) 292-5500.
Subwatersheds in the community are assigned names in the database.
MassDEP 2012 Integrated List of Waters (305(b)/303(d))

List of Impaired Waters  MassDEP 2010 Integrated List of Waters (305(b)/303(d)) – November 2011  http://www.mass.gov/itd/wbs2010

The MassDEP Division of Watershed Management 2010 Integrated List of Waters data layer represents the combined reporting elements required under the Federal Clean Water Act, sections 305(b) and 303(d). Under that Act, each state must administer a program to monitor and assess the quality of its surface waters and provide periodic status reports to the U.S. Congress, the U.S. Environmental Protection Agency, and the public. For questions regarding the programmatic content of these data contact Arthur Johnson (508-767-2873) or Richard McVoy (508-767-2877) in the MassDEP Watershed Planning Program.
This data layer was received from the Town Engineers and Highway Departments. The yellow dots are mapped drainage data and provided it to MassDEP for this project. Questions on the creation of the data should be directed to the towns.
A title, legend and scale are added to the Town Index Map to identify the symbols used and improve readability.
What are data driven pages?

An index layer is used to produce multiple output pages using a single layout. Each page shows the data at a different extent. The extents are defined by the features in the index layer.

- Enable Data Driven Pages
  - Index Layer
    - Data Frame: Layers
    - Layer: Neponset River Subwatershed in
      - Name Field: name_long
      - Sort Field: name_long
      - Sort Ascending: checked
  - Optional Fields
    - Rotation: none
    - Spatial Reference: none
    - Page Number: none
    - Starting Page Number: 1

OK | Cancel
Additional Map Types were developed for Each “Subwatershed of Interest”
Map Type 1 - Orthophotos with Index of Ecological Integrity and Outfalls

Map 1a

Map 1b

Map 1c
Map Type 2 – 2011 Digital Orthophotos with Hydrologic Group A,B Soils and Outfalls

Map 2a

Map 2b

Map 2c
Massachusetts Index of Ecological Integrity (IEI) is defined as the ability of an area to support biodiversity and the ecosystem processes necessary to sustain biodiversity over the long term.
CAPP: Conservation Assessment and Prioritization System

Massachusetts Index of Ecological Integrity

This page contains maps for each city and town in Massachusetts pertaining to the November 2011 comprehensive statewide CAPS analysis.

Quicklinks:
- NALCC
- FRAGSTATS
- CAPS
- HABITAT

- Developed by UMass Over Many Years.
- Landscape Level Model Basis for MassDEP’s Monitoring & Assessment Strategy
  http://www.umass.edu/landeco/research/caps/data/iei/iei.html
- Calculates a Value for Every 30 m2 Point in Landscape – called “IEI”
MassDEP Hydrography (USGS-based, 1:25,000)
Town Mapped Stormwater Outfalls
MassDEP Wetlands show the proximity of protected resources to stormwater discharges.
Subwatershed Map Type 1 - IEI

Base Map Overlays
1. Vernal Pools,
2. Vernal Pool Clusters,
3. Headwater Streams
Subwatershed Map Type 1 - IEI

Base Map Overlays

Critical Areas

1. Zone II,
2. Wellhead Protection
3. Outstanding Resource Waters
4. Bathing Beaches, etc.
Base Map Overlays

Land Uses with Higher Pollutant Loading Rates

- Industrial,
- Commercial,
- Multi-family residential
- Single family residential, etc.
With Hydrologic Soil Groups A and B
Map Type 2 – 2011 Digital Orthophotos with Hydrologic Group A and B Soils

Map 2a

Map 2b

Map 2c
Map Type 1 – How to Use the Maps

Map 1a

Map 1b

Map 1c
Map Type 2 – How to Use the Maps

Map 2a

Map 2b

Map 2c
LID Stormwater Planning Should:

**DISCONNECT** From End of the Pipe Stormwater Management Systems.

**DISTRIBUTE** Treat Stormwater at Source.

**INFILTRATE** Stormwater On-Site.
1. Preserve all healthy, unfragmented wetlands and restore degraded wetlands.

2. Preserve open space in areas of high ecological integrity.

3. Adopt local policies, incentives, and regulations to direct new development to existing infra-structure and improve inadequate drainage systems (roads, water and sewer lines).
4. Protect or Restore vegetated buffers around wetlands – (at least 100’ if possible!);
5. **Use low impact development techniques** that reduce, infiltrate & evaporate stormwater volume to remove pollutants, replenish stream base-flow, and minimize flooding and erosion.

7. No new discharges to or treatment in wetlands, and avoid 100-foot buffer zones for best pollutant removal (remember 50’ setback minimum, but the farther the better!);

8. Set back or treat existing discharges to wetlands, especially near public water supplies.
9. Avoid direct discharges near vernal pools that can pollute habitat and lengthen hydroperiods thus impacting vernal pool populations;
10. Treat for pollutant of concern and consider soil conditions – remember, not all discharges are created equal (A&B soils best for infiltration, alternate treatment for soils with poor drainage);
Contact Information

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MassDEP Wetlands Program  
Email: Nancy.Lin@state.ma.us

Alice Smith  
MassDEP Wetlands Program  
Email: Alice.Smith@state.ma.us

Reference citations and links for Vulnerable Wetland video presentations and data sources can be found on the MassDEP website at

DISCUSSION

New England Wetlands Webinar Series
2nd Thursdays: January 14, 2016

Assessment Methods
Featuring: Maine Natural Areas Program

Call for Presenters for Spring in early January.

Interested in Presenting?

Questions and Comments?
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kroth@neiwpcc.org
P: 978-349-2525