ABC’s of Freshwater Wetland Design

Assessment: Data Collection & Concept

Balance: Design & Modeling

Construction
Background
# Background - Stakeholders

<table>
<thead>
<tr>
<th><strong>Client</strong></th>
<th>New Jersey Turnpike Authority</th>
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<tbody>
<tr>
<td><strong>Project</strong></td>
<td>NJTA Interchange 6 to 9 Widening Program</td>
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<td><strong>Lead Agency</strong></td>
<td>New Jersey Dept. of Env. Protection (NJDEP)</td>
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<td><strong>Prime Consultant</strong></td>
<td>AECOM</td>
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<td><strong>Subconsultant</strong></td>
<td>Amy S. Green Environmental Consultants, Inc.</td>
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<td><strong>Feasibility Study Consultant</strong></td>
<td>The Louis Berger Group, Inc.</td>
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Site Overview

- Monroe Township, Middlesex County, NJ
- Millstone and Cranbury Rivers
- 400+ acre site with 157 acres designated for creation/enhancement
- Predominately modified agricultural fields
- Several cultural resource sensitive areas cannot be disturbed
Assessment – Data Collection

ABC's of Freshwater Wetland Design
Assessment – Concept Design

- Site constraints
- Flood Hazard permits
- Mitigation credits
- DEP approval

Concept Design
Balance – Flood Modeling

- Floodplain delineation
- Flood volume calculations
- Floodway constraints
- Ditch modifications
- Flood Hazard Area Permit

Flood Modeling
Balance – Flood Volumes

Balance – Floodway Constraints
Balance – Ditch Modifications
Balance – Water Budgets

- 14 inter-connected wetlands
- Groundwater and surface water interactions
- Existing tile drains to be plugged
- Regulatory criteria – wetlands and vernal pools
**Balance – Water Budget Equation**

\[ \Delta S = [P + S_i + G_i] - [ET + S_o + G_o] \]

\( \Delta S \) = change in volume of water storage in a defined area over time

- **P** = precipitation
- **S_i** = surface-water inflow
- **G_i** = ground-water inflow
- **ET** = evapotranspiration
- **S_o** = surface-water outflow
- **G_o** = ground-water outflow

**Calculated on a Daily Time Step**
Precipitation, Surface-Water, & ET

- \( P \) – NOAA Hightstown 2W Gage
- \( S_i \) – runoff, antecedent soil moisture, CN
- \( S_o \) – iterative calculation of \( \Delta WSL \) corresponding to a rise in WSE over designated overflow point
- ET – Hargreaves Samani
Groundwater Inflow and Outflow – Dupuit’s Equation

\[ q' = \frac{1}{2} \times K \times \frac{(h_1^2 - h_2^2)}{L} \]

- \( q' \) = flow per unit width (ft\(^2\)/d)
- \( K \) = hydraulic conductivity (ft/d)
- \( h_1 \) = head at origin (ft)
- \( h_2 \) = head at \( L \) (ft)
- \( L \) = flow length (ft)

**Calculated on a Daily Time Step**
Balance – Water Budget Calibration

Measured Versus Simulated Ground Water Elevation Under Proposed Conditions
Wetland I - Representative Average Year

- Average Ground Elevation
- Simulated GW
- Saturation - 18 Below Avg. Ground Elev
- Existing Ground Elevation
- Observed GW
- Rainfall (in)

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Thank You!

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