Sediment Transport Processes in the Lower Passaic River Study Area

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Lower Passaic River-Newark Bay Project Delivery Team Meeting
New York, NY
Introduction

• Ongoing RI/FS of the Lower Passaic River Study Area (LPRSA)

• Some contaminants partitioned suspended and bed sediments; fate and transport of these contaminants depend on fate and transport of sediments

• Supports ongoing development of hydrodynamic, sediment transport, and contaminant fate and transport model of the Lower Passaic River (LPR) and Newark Bay (NB)

• Data-based assessment of sediment transport processes in the LPR
Estuarine Circulation Schematic

**High Tide**
- Ocean Water
- Salt Front
- Ocean
- Estuarine Turbidity Maximum (ETM), an area of high Suspended Solids Concentrations (SSC) and high sedimentation

**Low Tide**
- Ocean Water
- Salt Front
- Ocean

River Discharge
Sampling Data

- Fall 2009, targeted low river flow deployment from Oct. 10, 2009 to Dec. 16, 2009
- *In-situ* measurements
  - Currents
  - Suspended Solids (surrogate measurement)
  - Temperature
  - Salinity
  - Depth
  - Profiles every 12 minutes
- Sampling locations
  - RM 1.4, 4.2, 6.7, 10.2, & 13.5
  - Dundee Dam
- Data collected by Bob Chant, (Rutgers University) and Chris Sommerfield (University of Delaware), at RM 1.4 from Sep. 16, 2008 to Mar. 10, 2009
Transport Processes – Tidal Pumping

Fall 2009 Data

Passaic River, RM 1.4

Surface

Towards Upstream

Towards Downstream

Velocity (m/s)

Oct-15 Oct-16 Oct-17

Flood

Ebb

Bottom

Towards Upstream

Towards Downstream

TSS (mg/L)

Oct-15 Oct-16 Oct-17

Flood

Ebb
Transport Processes – Tidal Amplitude

Chant 2008-2009 Data

Passaic River, RM 1.4

Daily Average Flow at Little Falls
Tidal Range at RM 1.4

Flow (cfs)

0.5 1 1.5 2 2.5 3 3.5 4

Tidal Range (m)

Sep-16 Oct-14 Nov-11 Dec-09 Jan-06 Feb-03 Mar-03

Bottom
Surface

Daily Average TSS (mg/L)
Transport Processes – Discharge & ETM

Fall 2009 Data

Passaic River, RM 6.7

ETM located upstream of RM 6.7

ETM Movement

ETM washed downstream
Solids Fluxes – Fall 2009 Data

Data at RM 1.4

15-min Flow at Dundee Dam
Tidal Range at RM 1.4

Daily Flood/Ebb Flux
Daily Net Flux

Cumulative Net Flux

Upstream

Downstream

Flux (MT/m)
Cumulative Flux (MT/m)

Flow (cfs)


Solids Fluxes – Chant 2008-2009 Data

Daily Average Flow at Dundee Dam
Tidal Range at RM 1.4

Data at RM 1.4

Cumulative Net Flux

Cumulative Flux (MT/m)

Flux (MT/m)

Upstream
Downstream

Daily Flood/Ebb Flux
Daily Net Flux

Sep-16 Oct-14 Nov-11 Dec-09 Jan-06 Feb-03 Mar-03

Sep-16 Oct-14 Nov-11 Dec-09 Jan-06 Feb-03 Mar-03
Solids Exchange with Newark Bay

Fall 2009 Data

Chant 2008-2009 Data

Passaic River, RM 1.4

Upstream

Downstream

Daily Net Flux (MT/m)

Daily Discharge at Dundee Dam (cfs)
Summary

Sediment transport in the Lower Passaic River show expected dependencies and processes

- Tidal pumping
- Tidal range
- Estuarine circulation
- Estuarine turbidity maximum (ETM)
- Discharge

Exchange with Newark Bay is an important process

- Net sediment flux is directed upstream from Newark Bay into the Lower Passaic River up to river flows ~2000 cfs
- Gross flux from Newark Bay into the Lower Passaic River observed under all monitored river flows (<6000 cfs)

Data from both the Fall 2009 and 2008-2009 periods suggest net infilling of the Lower Passaic River during these periods

- With solids from both Newark Bay and Dundee Dam when river flow is <~2000 cfs
- With solids predominantly from Dundee Dam when river flow is >~2000 cfs

Data from Spring-Summer 2010 deployment expected to further define the transport processes in the Lower Passaic River as well as Newark Bay

- Targeted high river flow and low river flow deployment with discharge ranging from 150 cfs to 10,000 cfs.
- Moorings in both of “The Kills”, mouth of Hackensack River, and two locations in Newark Bay in addition to the Lower Passaic River locations