LPR Bathymetric Data Collection: Current Status and Future Work

LPRSA RI/FS PDT Meeting
10 September 2008
Multi-beam Survey Snapshots
Multi-beam Survey and Topography
## Historic Bathymetric Surveys in the LPR

<table>
<thead>
<tr>
<th>Date</th>
<th>Extent (RM)</th>
<th>Performed by</th>
</tr>
</thead>
<tbody>
<tr>
<td>November 1989</td>
<td>0 to 15</td>
<td>Topo-Metrics, Inc for USACE</td>
</tr>
<tr>
<td>March/April 1995</td>
<td>0.5 to 8.2</td>
<td>Ocean Surveys, Inc for TSI</td>
</tr>
<tr>
<td>November 1996 April 1997</td>
<td>0.5 to 6.9</td>
<td>Ocean Surveys, Inc for TSI</td>
</tr>
<tr>
<td>June 1999</td>
<td>0.9 to 6.9</td>
<td>Ocean Surveys, Inc for TSI</td>
</tr>
<tr>
<td>August 2001</td>
<td>0.9 to 6.9</td>
<td>Ocean Surveys, Inc for TSI</td>
</tr>
<tr>
<td>July 2002</td>
<td>0 to 8.0</td>
<td>TVGA Consultants for USACE</td>
</tr>
<tr>
<td>November 2004</td>
<td>0 to 17.4</td>
<td>Rogers Surveying, Inc for USACE</td>
</tr>
</tbody>
</table>

From EPA, Feb. 2007
Goals/Objectives of the Bathymetric Survey

- Provide current, comprehensive bathymetry of the LPRSA to support RI/FS investigations
- Replicate previous single-beam tracklines for comparability
- Perform bank-to-bank multi-beam survey
  - mapping/visualization of surficial debris
  - identification of features including pilings, bulkheads, and bridge abutments.
- Perform single-beam survey of the area extending from the uppermost reach of the multi-beam survey to as close to Dundee Dam as practicable
- Intent is to perform periodic, repeat surveys
2007 Bathymetric Survey

- **Single-beam Survey**: RM 0.5 – 8.2 & RM 14.3 – 16.5
  - Survey conducted 8/20/07 – 8/29/07
  - Transects approximately every 100 feet
  - Soundings every 0.5 feet
  - Equipment:
    - Survey Vessel: 16 ft aluminum vessel with 40 HP 4 stroke motor
    - Primary Positioning: Trimble 5700 rover GPS receiver with Zephyr antenna.
    - Data Collection System: Odom Echotrac Mark III echosounder with 8° transducer

- **Multi-beam Survey**: RM 0.0 – 14.3
  - Survey conducted 9/7/07 – 9/22/07
  - Target of 50% overlap (200% coverage)
  - Equipment:
    - Survey Vessel: 25 ft aluminum hulled vessel with twin 175 HP outboard motors
    - Primary Positioning: Leica Systems GPS 1200 RTK rover/receiver with a CDMA cell phone modem and Applanix POSMV 320 attitude sensor.
    - Data Collection System: Reson 8101 SeaBat at +/- 240 kHz with a 210° beam angle
Single-beam Survey - Tracklines
Future Surveys

– Periodic comprehensive surveys
  • Multi-beam
  • RM 0 – 12
  • Resurvey selected single-beam tracklines (~12)

– Periodic, opportunistic surveys following high flow events
  • Focused on smaller area(s)

– Methodology and implementation will be consistent with 2007 survey
  • Plan will be submitted in UFP-QAPP format
  • 2007 survey reviewed, approved by EPA
A preliminary look at bathymetry in the context of:

– Historical dredging activity
– Salt wedge dynamics
– Hydrology
Physical Setting Prior to River Development (early 19th century)

- Passaic - shallow meandering river
- Newark Bay – shallow estuary
## Extensive Historic Dredging in the LPR

<table>
<thead>
<tr>
<th>River Mile *</th>
<th>Channel Depth (feet)</th>
<th>Channel Width (feet)</th>
<th>Years Dredged</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM2.2 to RM4.3</td>
<td>20</td>
<td>300</td>
<td>1949 (USEPA, 1995) 1884, 1916, 1921, and 1937 (Iannuzzi et al. 2002)</td>
</tr>
<tr>
<td>RM4.3 to RM6.9</td>
<td>20</td>
<td>300</td>
<td>1949, 1950 (USEPA, 1995) 1913, 1919, 1933, and 1950 (Iannuzzi et al. 2002)</td>
</tr>
<tr>
<td>RM7.9 to RM15.2</td>
<td>10</td>
<td>200</td>
<td>Record of dredge maintenance not available</td>
</tr>
</tbody>
</table>
Longitudinal Depth Profile - Newark Bay up the Passaic

Estimated Profile of River Bottom

Water Depth (feet)

Newark Bay

Mouth of Passaic

river mile

1835

1940

R. Chant, 9/07
Since the 1940s – construction, constraining, infilling
Longitudinal Depth Profile 1835-2000

R. Chant, 9/07
How has channel changed over time? Is channel form approaching equilibrium?
Interaction of Bathymetry and Salt Wedge Dynamics

Density Driven Circulation

Ocean

Salt water

River

Fresh Water

Turbidity Maximum

R. Chant, 9/07
Interaction of Bathymetry and Salt Wedge Dynamics

![Graph showing the interaction of bathymetry and salt wedge dynamics between 1835 and 1940. The graphs display the change in salt and fresh water distribution along the river mile.](image-url)
Hydrology Record and Bathymetric Surveys

Survey dates shown as vertical lines
Goals of Bathymetric Analysis

– Assessment of the interannual variability of deposition and erosion
– Characterization of long-term trends
– Evaluation of impact of large flow events
– Look for potentially erosional areas
– Update of sediment budget based on new data
– Careful consideration of uncertainty
Bathymetric Analysis Tasks

- Compare sequential bathymetric surveys
  - Depth-difference comparisons of surfaces
  - Cross-sectional comparisons
  - Evaluate relative to flow record

- Evaluation of uncertainty
  - For a given survey
  - Between surveys
  - Between methods

- Look for potentially erosional areas
  - Plot historic bathymetry to characterize sedimentation rates, channel form
  - Employ weight of evidence
    - Coring data, including contaminant profiles, grain size, etc
    - Radionuclide data
    - Geomorphology

- Verify sediment budget estimates, including uncertainty
- Integrate with numerical modeling effort
- Support development of water column sampling program