

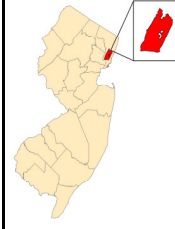


Heavy Metal Gradients in the Hackensack River Estuary: A Baseline for Improving Ecosystem Health

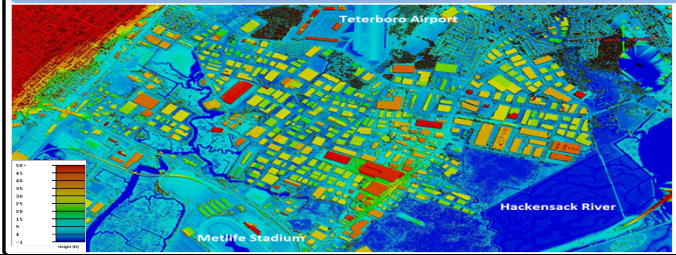
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New Jersey Meadowlands Commission (NJSEA),
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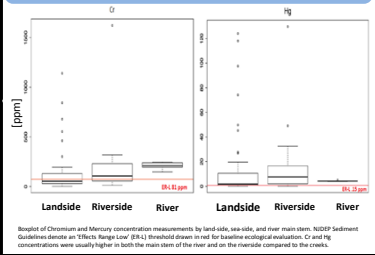
Hackensack Meadowlands District Location Map



Post Superstorm Sandy Sediment Sampling Locations



Landside, Riverside, River Comparison



Abstract:

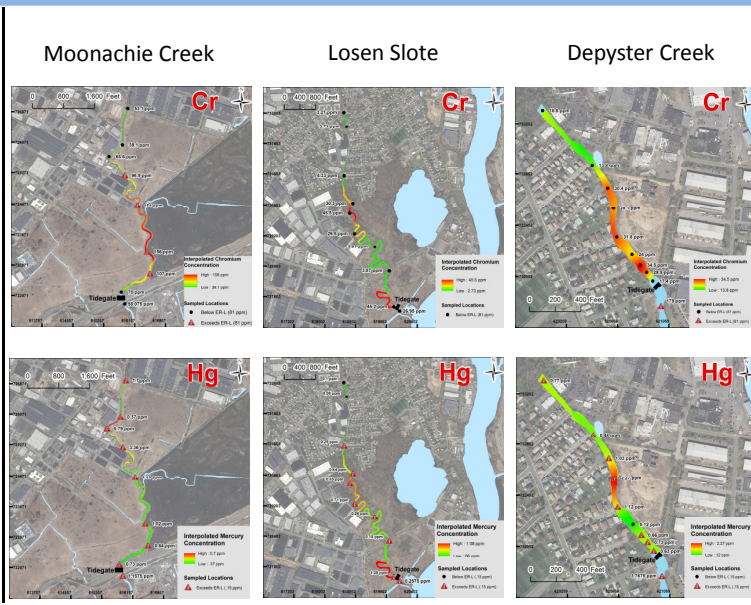
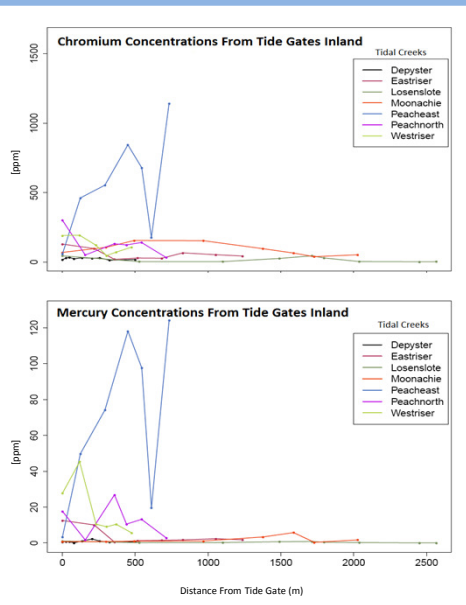
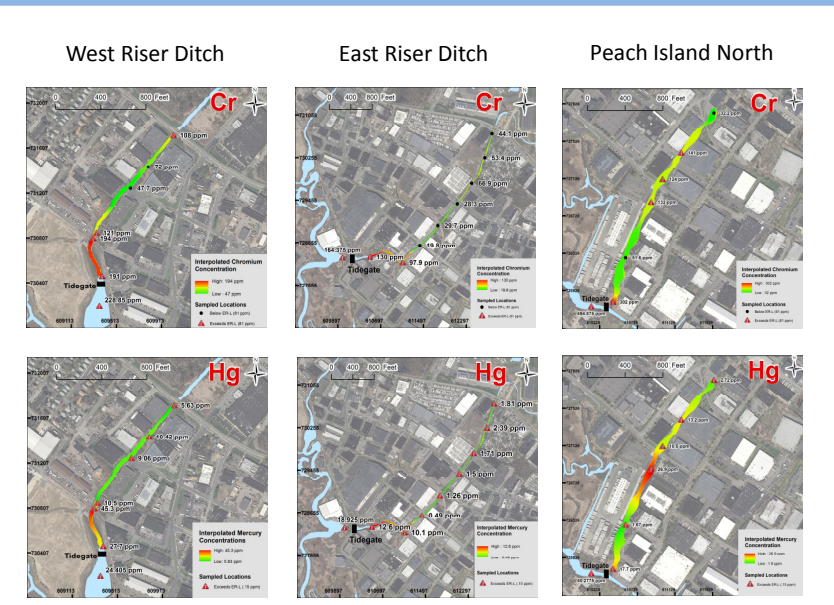
Parts of the towns of Little Ferry, East Rutherford, Moonachie, and Carlstadt (Bergen County) are located in a low-lying basin of the Hackensack River Estuary with an elevation of about 1.5 feet above sea level. During Super-storm Sandy, flood waters from the sea surge moved over berms and tide gates and up tidal creeks and storm drainage network pipes reaching residential areas and industrial sites. Water levels rose up to 38 inches above street level and areas remained flooded for more than seven hours. Deployed sensors registered a sharp increase in water turbidity as the flood waters receded. Contamination by heavy metals—in particular by chromium and mercury—is well documented in this area. An assessment of metal concentrations (Cr, Cu, Fe, Hg, Mn, Ni, Pb, and Zn) in the sediments of seven tidal creeks in the area of the Hackensack River Estuary was conducted to establish a post-Sandy metal contamination baseline. The concentrations of Cr, Hg, Mn, and Ni showed a negative gradient from the tide gates moving inland. Overall, samples from the sea-side of tide gates had higher metal concentrations than the landside. Peach Island Creek East showed consistently higher metal concentrations than the other six creeks and was therefore used as a case study to examine the spatial relationship between historic land uses and contaminants over time. This study establishes post-Sandy baselines for metal contaminants in the Meadowlands ecosystem.

Materials & Methods:

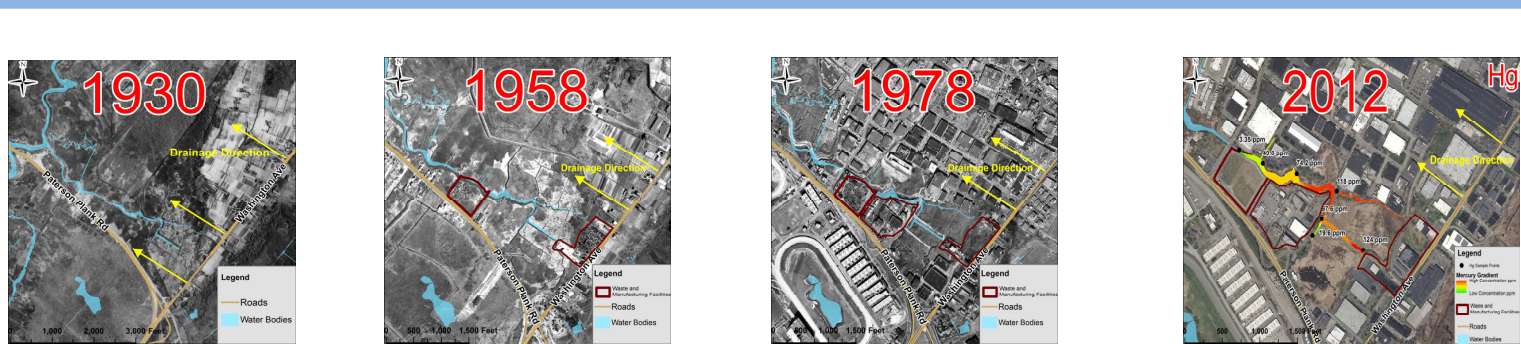
A total of 82 locations from 7 tidal creeks and the main stem of the Hackensack River along the towns of Moonachie, Carlstadt, and Little Ferry were sampled between March 4th and April 2nd, 2013. The average length of the creeks was 3000 feet. A total of 53 samples were taken every 450 feet up tidal creeks from the tide gates (land-side). Four samples were taken on the river-side of the tide gate at each creek (River-side) and finally, five locations from the main stem of the Hackensack River (River) were sampled starting at Berry's Creek Canal and every 4000 feet up-river to the western spur of the NJ Turnpike. In all cases, triplicate sediment samples were taken at low tide using a Nisco Sving Sampler. Samples were poured into a labeled sampling bag and stored in a cooler. GPS coordinates were recorded at each sampling location using a Trimble 5700 with Real Time Kinematics (RTK) capability. Back in the laboratory, triplicate samples from each location were combined into one composite sample and stored in 4L degree C freezers. Sediment samples were digested using a Berghof Microwave Digestion System. Samples were digested in duplicate along with a blank sample, and a National Institute of Standards and Technology (NIST) Standard Reference Material (SRM) 1944 were included in each digestion set. Samples were analyzed Chromium and Mercury. The metal analysis was completed using a Varian Atomic Absorption Spectrometer (SpectraAA220FS): cold vapor techniques for Hg and Flame technique for the rest of Cr. Only results for Mercury and Chromium were shown in this study.

Results:

A. Mercury and Chromium Gradients



B. Peach Island Creek East: Land Use Over Time



- 1930: Wetlands, Mosquito Ditches, Farmland
- 1958: Wetlands, Mosquito Ditches, Waste facilities, Automobile junkyards
- 1978: Wetlands, Waste and manufacturing facilities, Light industrial/warehousing, Sports and entertainment
- 2012: Wetlands, Superfund Sites, Light industrial facilities, Sports and entertainment

Discussion:

Concentrations of Hg exceeded the ER-L criteria in all creeks and at all sampling locations (N=53) with the exception of two sampling locations in Losen Slote creek. Only in the proximity of tide gates did Chromium concentrations exceed the ERM criteria in all creeks but for Moonachie and Losen Slote. Overall, the concentrations Hg and Cr showed a negative slope up the creeks with the exception of Peach Island East which showed a positive slope. Peach Island Creek showed greater than tenfold the amount of Hg and Cr compared to the other six creeks. Overall the concentrations of heavy metals were higher at the River side and River sampling locations compared to the Landside locations. Higher metal concentrations in creeks were associated with the proximity to historical land uses in the form of chemical recycling depots, automobile junk yards and industrial manufacturing facilities.

Acknowledgments

We would like to thank additional Meadowlands Environmental Research Institute staff: Jin Young Shin and Yefim Levinsky for project support, sampling, and chemical analysis of the sediments used in this spatial report.

