Numerical Modeling Simulation of the Impact of Source Controls on Site Recovery in Dead-End Tidal Waterbodies

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Background/Objectives. Gowanus Canal and Newtown Creek are two dead-end tidal waterbodies in New York City with contaminated sediments resulting from the impact of groundwater and non-aqueous phase (NAPL) discharges and other sources. Gowanus Canal, located in the borough of Brooklyn, has a long industrial history, which includes three Manufactured Gas Plant Sites, as well as oil processing facilities, tanneries, sawmills, lumberyards, and coal yards. Newtown Creek, located on the border of Queens and Brooklyn, is also a NAPL impacted site with a variety of current and historical potential sources of contamination from groundwater and the presence of NAPLs in adjacent upland sites such as former manufactured gas plants (MGPs), petroleum-handling facilities, refineries, pipelines, and bulk terminals, aluminum plants, and other industrial facilities. Both sites also receive varying amounts of combined sewer overflow (CSO), private and municipal storm water, and treated groundwater discharges. Because the ongoing and legacy sources continue to impact recently deposited sediments, it is important to understand how the characterization and control of these sources are necessary for the success of potential sediment remediation. The objective of this study is to evaluate the available data and develop a numerical model to simulate the effect of municipal sources on the recovery of sediment concentrations following in-creek remediation.

Approach/Activities. A time-varying one-dimensional model, based on conservation of contaminant mass in the longitudinal flow direction of the tidal waterbodies was developed to perform transient evaluation of future contaminant concentrations resulting from the control or lack of control of various sources on potential sediment remediation in the Creeks. The contaminant model uses the results from detailed hydrodynamic, sediment transport and groundwater models as well as source characterization data. Several scenarios were simulated to understand how future sediment concentrations will be impacted by the controls considered for the various municipal discharges.

Results/Lessons Learned. Geochemical evaluation of the current surface sediment data in the tidal waterbodies indicates that the concentrations of contaminant in the sediments cannot be explained by on-going municipal discharges from storm water and CSOs. Failure to control the discharge of seeps, groundwater contamination and the upwelling of NAPL from the sub-surface of the sediments will significantly affect any remediation implemented in the tidal waterbodies. Current concentration of PAHs and PCBs in CSO discharge will not result in recontamination of remediated sediment surface above potential clean up goals and site background. Overall, the analysis indicates that failure to adequately quantify all the significant sources of contamination to the waterbodies will result in an incomplete conceptual site model, and will significantly affect the future recovery of any sediment remedy implemented at these sites.