CAP EROSION AND FLOODING ANALYSES IN THE LOWER PASSAIC RIVER

Nicholas B Kim (nkim@hydroqual.com), James Fitzpatrick, Honghai Li, Tarun Singh, Carolyn Zeiner*, and Scott Thompson*

HydroQual, Inc., 1200 MacArthur Blvd., Mahwah, NJ 07430
(p) 201-529-5151, (f) 201-529-5728
*Malcolm Pirnie, 104 Corporate Park Drive, White Plains, NY 10602
(p) 914-694-2100, (f) 914-641-2455

To reduce human health and ecological risk related to the contaminated sediment in the Lower Passaic River (LPR), the USEPA is evaluating taking an early action for the sediments of the lower 8.3 miles of the LPR. Several alternatives involve dredging and capping of the lower 8.3 miles. A three-dimensional hydrodynamic-sediment transport model was developed to evaluate cap stability as well as flooding associated with placement of cap/armor material in the LPR.

A model calibration was performed using field survey data collected in the summer of 2004; data included water surface elevations, current velocities, and temperature and salinity. Model validation was conducted using the storm surge data of Hurricane Donna in 1960, and the observed surge elevations were well reproduced by the model at various locations in the modeled area. The FEMA 100- and 500-year events were also used for model validation.

During the cap stability/erosion analysis, cap materials from two different sources were evaluated. It was found that sands from the Ambrose Channel, which is located at the entrance to NY-NJ Harbor near Sandy Hook, were highly erodible and thus not suitable for use as a sand cap in the LPR. Instead, it would be necessary to utilize sands from an upland borrow source with a larger grain size distribution, which are heavier and less subject to the forces of erosion experienced in the LPR. There are, however, areas within the river where it will be necessary to place protective armor (rock cobble) over the sand cap so as to prevent erosion of the cap. This occurs in regions of the river which experience high bottom water velocities with accompanying high bottom shear stress.

The flooding analysis was performed to evaluate potential flooding effects due to the reduction in water depths related to the placement of a sand cap and/or armor stone. Analyses were conducted for 100- and 500-year flow and surge conditions under three alternative capping/ armoring designs, including different pre-dredging components. Model simulations under different capping/armoring scenarios during the four extreme events (flows and storm surges) were evaluated and provided the most optimal capping/armoring scenario to minimize the volume of pre-dredging required to accommodate the cap and armor, such that they would cause no additional flooding in upstream locations.