Estimation of the settling velocity of suspended sediment in the Passaic River, NJ R/6640-003

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Research Summary

A thorough understanding of sediment transport in estuaries is crucial to the management of multiple societal issues ranging from commercial fisheries to contaminant transport and harbor maintenance. In New Jersey, contaminated sediments in the Passaic River and Newark Bay are the result of long periods of industrialization and manufacturing. Contaminants such as dioxin, heavy metals, organic chemicals and pesticides adhere strongly to suspended sediments in the water column and put the Passaic River on the EPA's National Priorities List. Although much of polluting activity has abated, contaminated sediment continues to be transported out of the Passaic River. Transport pathways of the contaminated sediment are controlled by hydrodynamics and by particle dynamics. Although many aspects of the hydrodynamics in these waterways have been characterized by state funded projects (NJDEP, NJDOT) our knowledge of the particle dynamics in the system is lacking.

While the general forms of the equations that predict suspended sediment transport are well understood, the key inputs to these equations remain elusive. One of the most important, but difficult to measure, parameters is the rate at which suspended particles fall through the water. Suspended particles in estuaries are complicated aggregates of mineral and organic materials with different sizes, densities, porosities and degrees of stickiness. These characteristics of aggregates can change on very short time scales depending upon changes in tidal and riverine currents, among other factors. Because of the fragility of aggregates, they must be measured *in-situ* to obtain accurate estimates of their sizes and densities. A variety of methods have been applied to determine aggregate sizes *in situ,* including the Sequoia Science Laser In Situ Scattering Trans-missometer (LISST), which will be used in this study.

This project will determine the relationship between the aggregate size and the settling velocity of suspended aggregates in Newark Bay and the Passaic River. Once this relationship is known, the settling velocity may be determined for any given aggregate size. The second key result of this project will be the determination of the relationship between median aggregate size in the water and ambient conditions, such as the salinity, turbulent shear, and proximity to the bottom. Thus, these two relationships together allow prediction of the settling velocity of aggregates depending upon the local conditions in the water column. Because aggregate sizes in this system are known to exceed 500 microns (the maximum limit that the LISST can measure), size measurement of these particles also requires an optical imaging device such as a digital floc camera (DFC). The DFC will prove to be of great utility for similar measurements of other waterways in New Jersey in the future. Characterization of the particle dynamics in Newark Bay and the Passaic River will greatly improve the prediction of sediment transport using numerical models in these systems.