# EXECUTIVE SUMMARY

In accordance with the environmental monitoring plan associated with the Providence River and Harbor Maintenance Dredging Project, the first of two planned sediment plume tracking and assessment surveys was completed over the Rhode Island Sound Disposal Site (RISDS) in April 2004. The survey effort was sponsored by the Disposal Area Monitoring System (DAMOS) Program, administered by the US Army Corps of Engineers, New England District (NAE). Survey operations over RISDS were completed on 8, 9, and 10 April, tracking individual sediment plumes generated by the disposal of maintenance material dredged from the Sabin Point Reach of the federal navigational channel.

Sediment samples were collected at the dredging site for geotechnical and geochemical characterization during the barge filling process prior to each disposal event. The maintenance material was primarily comprised of silts and clays, and exhibited a water content in excess of 200%. Upon disposal of this material at RISDS, oceanographic equipment aboard two survey vessels obtained a variety of measurements related to sediment plume formation and subsequent transport (current speed and direction, physical characteristics of the receiving water, turbidity, etc.) for a period of 3.5 hours following each event. A series of optical and acoustic remote sensors were employed for the collection of digital data, while hydrocasts were obtained for determination of total suspended solids (TSS) concentrations and toxicity.

A Seabird SBE-32 Carousel System equipped with a conductivity, temperature, and depth (CTD) probe, as well as a series of water sampling bottles, served as the primary instrument on a vessel that continually profiled the water column to measure turbidity. A second vessel was equipped with a downward-looking acoustic Doppler current profiler (ADCP) to examine the relative concentration of entrained sediments within the water column and collect cross-sectional data related to the overall morphology, transport rate, and diffusion of each disposal plume. In addition, a bottom-mounted ADCP mooring and an optical backscatter sensor (OBS) string were deployed in close proximity to the target disposal point to provide information pertaining to movement of the water mass and relative turbidity before and after each disposal event.

Dredged material was placed at Disposal Point B within the northeast quadrant of RISDS on 8 April (Plume 1) and 10 April (Plume 3), and Disposal Point A within the northwest quadrant of the disposal site on 9 April (Plume 2). When initially formed, each plume was characterized as a discrete column of suspended sediment with the size and suspended sediment concentration dependent upon the dimensions of the disposal barge and volume of dredged material disposed. The sediment plumes formed after each disposal event were detectable within the water column both optically and acoustically for a period of three to four hours.

The portion of the plume exhibiting the highest concentration of suspended sediments, or centroid, was the primary target of water sampling operations. Although the height of the centroid above the seafloor was a product of oceanographic conditions at the time of the survey, it was often detected at levels 2 to 5 m above the seafloor both immediately following plume formation and for several hours thereafter. Turbidity measurements made at or near the plume centroid twenty minutes following disposal displayed low light transmittance values at various depth intervals within the water column and TSS concentrations ranging from 24 to 64 $mg \cdot L^{-1}$, strongly contrasting with the ambient seawater, which exhibited background TSS values of 2.0 to 2.9 $mg \cdot L^{-1}$.

All three plume surveys were conducted during a period of flood tide that varied in duration due to differences in the times of disposal. Water column currents over RISDS displayed minor differences in velocity and direction, with the bulk of the water mass flowing to the west or northwest on each of the three days. As a result, the sediment plumes were transported to the west or northwest in response to the water column currents. In general, turbidity levels decreased rapidly within one hour of disposal through both diffusion and particle settlement, exhibiting TSS values $< 10$ $mg \cdot L^{-1}$ near the centroid of each plume. Despite the rapid reduction in suspended particulate matter, each sediment plume remained a distinct feature in the water column and was detectable in both the acoustic backscatter and transmissometer data. The influx of ambient seawater and particle settlement over the next 2.5 hours resulted in suspended sediment load reduction near the centroid over time. At 3.5 hours post-placement, the turbidity within the centroid was at or approaching background levels once again.

The sediment plumes tracked during the April 2004 survey operation did leave the confines of the disposal site during the survey, but typically displayed TSS concentrations within the centroid that were comparable to background levels. Residence time within RISDS varied from 75 to 120 minutes, depending upon the target disposal point utilized, as well as the direction and magnitude of water column currents. Although the data collected as part of this survey suggests the movement of a detectable sediment plume beyond the site boundary is of little environmental significance, it does indicate that refinement of the model calculations used to predict plume behavior at RISDS and subsequent re-distribution of target disposal positions within RISDS could increase plume residence time.

Discrete water samples were obtained at or near the plume centroid 40, 60, and 120 minutes post-placement as part of the Plume 1 and 2 surveys for toxicity analysis. After a 96-hour exposure to waters collected from the plume, neither the mysid (*Americamysis bahia)* nor juvenile silverside (*Menidia berylina*) test organisms exhibited a lethal response. This was the anticipated outcome given the source of the sediment (Sabin Point Reach) and the amount of dilution that occurs within the water column during the formation of the sediment plume and its subsequent advection by ambient currents.