EXECUTIVE SUMMARY

A monitoring survey was conducted at the Tupper Ledge Disposal Site (TLDS) as part of the Disposal Area Monitoring System (DAMOS). The July and September 2005 field efforts consisted of bathymetric and sediment-profile imaging surveys designed to evaluate the physical distribution of the dredged material and assess the status of the benthic community relative to ambient sediment conditions.

The TLDS is an infrequently used dredged material disposal site located in the waters of eastern Maine, specifically in upper Union River Bay, approximately 5 km (3 miles) south of Ellsworth, Maine. [The NAD83 coordinates for TLDS are: Center: -68.4469, 44.4692; NW: -68.4501, 44.4714; SW: -68.4501, 44.4669; SE: -68.4438, 44.4669; NE: -68.4438, 44.4714.] Union River Bay drains the Union River and is connected to Blue Hill Bay and the Gulf of Maine to the south. The last disposal activity at TLDS occurred during April 2003 and a prior survey of the disposal site was conducted in September 2003. The 2003 survey found a new disposal mound (Mound B) and that the benthic recolonization was fairly advanced, but the presence of sulfur-reducing bacterial colonies and sediment banding indicated some organic enrichment and hypoxia. The 2005 bathymetry and SPI surveys were conducted to further evaluate and monitor the recovery of the site.

The bathymetric survey was initiated on 18 July 2005 aboard the R/V *Seahawk* and completed on 19 July 2005. Water depths at TLDS ranged from 12 to 15.5 meters (39-51 feet). Two disposal mounds were evident at TLDS. The deepest portion of the survey area was located northeast of the site where depths reached 18 meters (59 feet). The shallowest point, outside the site, rose to about 3 meters (9.8 feet) below the water surface across a shoal in the northeast corner of the survey area. Up to 0.5 meters (1.6 feet) of consolidation appears to have occurred over the disposal mounds.

The sediment-profile imaging survey was initiated 8 September 2005 aboard the *F/V Shanna Rose* and completed 9 September 2005. All the sediments at the disposal site stations were composed of high water content, low shear strength, fine-grained mud ($\geq 4\ \Phi$). Small-scale boundary roughness at the sediment surface ranged from 0.6 to 3.5 cm and the majority (75%) of the small-scale topographic roughness features was caused by burrowing/feeding activities of the resident macrofauna resulting in burrow openings or mounds/pits at the sediment-water interface.

The dredged material present at all stations within the disposal site boundary was characterized by the presence of either high water-content reduced mud, a chaotic cross-sectional fabric with consolidated blue clay, the presence of wood chips, or rock and cobble. While there was no evidence of low dissolved oxygen in the overlying water or subsurface methane generation at the time of the survey, subsurface laminations indicative of past

hypoxic or anoxic events could still be detected at many of the stations surveyed at both disposal site and reference areas.

The mean apparent RPD values at the stations with past evidence of dredged material ranged from 0.7 to 2.8 cm. Only one station (I22) had evidence of any sulfur reducing bacterial colonies of *Beggiatoa* (occur only in low oxygen conditions) present at the sediment surface. This station and eleven others from the disposal site and five stations outside the disposal site had evidence of sulfur reducing bacteria in the 2003 survey (ENSR, 2004). Only four stations (Stations O-01, O-02, I17, and I21) of all those with dredged material present, had no evidence of any Stage 3 taxa (head-down, deposit-feeding invertebrates). Station I17 had rocks covered by a mantling of mud particles so camera penetration was poor at this location and no determination of infaunal successional stage could be made. Evidence of infaunal deposit feeding activities to depths greater than 10 cm was found at approximately half of the stations surveyed within the disposal site, with structures ranging from subsurface megafaunal burrows to feeding voids and vertical burrow structures.

The objective of the SPI survey was to assess the benthic community status within the site relative to reference conditions. Bioequivalence or interval testing was used with a null hypothesis that presumes the difference between the reference area and disposal mound is great (inequivalence). The test indicated that the true difference between the mean RPD values from the reference areas and mean RPD values from the disposal site was within 1 RPD unit (cm), and therefore the group means were equivalent within our definition of "ecologically meaningful". The test also found the true difference between the successional stage rank values from the reference areas and disposal mounds was within 1 unit, and therefore the group means were equivalent within our definition of "ecologically meaningful".

Union Bay, including the Tupper Ledge Disposal Site, is still undergoing periodic hypoxia/anoxia events. Evidence for these hypoxic/anoxic periods included the persistence of laminated sediments in the reference areas, relatively shallow apparent RPD values, and the relatively small distances below the sediment-water interface at which the sub-surface laminations were detected.