Sedimentation Modeling for a Proposed Undersea Gas Pipeline

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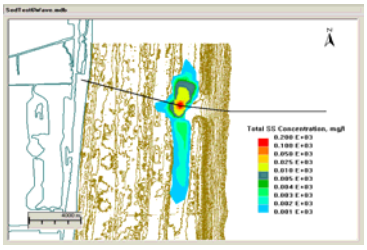

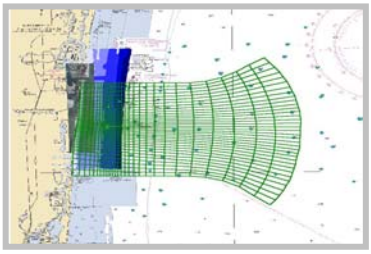

Situation

The purpose of this study was to estimate the sedimentation resulting from Horizontal Directional Drilling (HDD). The HDD was to be carried out for a proposed 54 mile interstate natural gas pipeline extending from the Exclusive Economic Zone (EEZ) boundary between the United States and the Bahamas, interconnecting with the Florida Gas Transmission system in Broward County, Florida. Sedimentation would occur in the areas surrounding the HDD exit locations.

Approach

The three dimensional hydrodynamic module (HDM) and sediment transport module (STM) of GEMSS® (Generalized Environmental Modeling System for Surfacewaters) was used to model the transport and fate of the drilling fluid and mud discharge. The modeling effort consisted of identifying the region of impact (ROI) around the entrance and exit locations of HDD. The ROI was then discretized into the GEMSS® model grid with increasing resolution towards the mud discharge locations. The model grid consisted of open boundaries on three sides and bound by the Florida coast on the fourth. Meteorological data were obtained from Miami International Airport to accurately model the hydrodynamic patterns in the region. Due to the lack of field measured data, the calibration effort was limited. However, a search of publicly available data provided site specific information which helped verify the model results.

The drilling process was to be carried out continuously over a period of 52 days during which 100, 446 cubic yards (76, 797 m^3) of drilling fluid would have been released. A 1 m drilling hole would then result in a drilling fluid exit velocity of 0.0218 meters per second. The drilling fluid consisted of a mixture of water (94.8%), bentonite (3.2%; particle size up to 75 µm) and limestone (2.0%; particle size up to 4700 µm). The STM module was run with this fluid discharge in conjunction with the HDM module. The STM module accounted for the discharge plume and processes such as settling/deposition, erosion/scouring, flocculation, and slope failures.

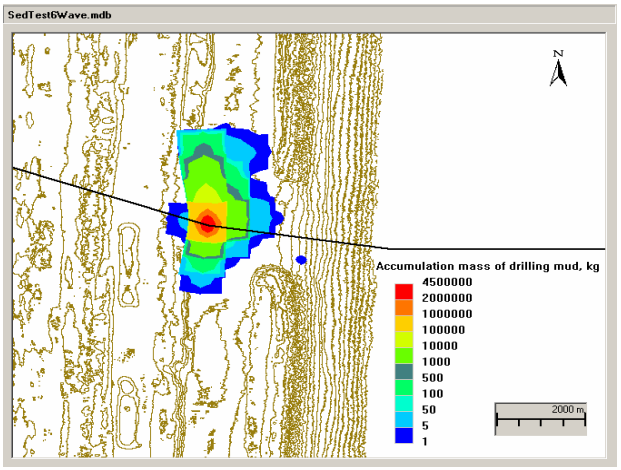

Figure 1 Accumulation of drilling mud near the discharge site

Results

The sedimentation modeling of the drilling discharge estimated the sediment footprint covering an area of approximately 22 hectares (2.2 x 105 m^2). The maximum thickness of the sediment footprint was 26 cm. Some of the smaller bentonite particles traveled up to 5 km outside the model domain once suspended while almost all of the limestone particles stayed and settled around the discharge location.