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Great South Bay beyond Sailors Haven Marina, Fire Island National Seashore

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Submarine Groundwater Discharge to Great South Bay

An investigation of aquifers beneath Great South Bay adjacent to Fire Island National Seashore and Long Island is being conducted to assess the importance of groundwater discharge as a potential source of excess nitrogen delivery to the bay. Over 125 miles (200 kilometers) of geophysical survey data were collected in Great South Bay in 2008. The survey system, which was sensitive to electrical properties of the water- saturated sediments beneath the bay, was used to image the fresh- saline groundwater interface below the bay's bottom. In addition, intensive groundwater sampling was performed at sites along the shore of Patchogue Bay that were representative of the developed Long Island shoreline. A shore- perpendicular transect of samples from temporary, small- diameter wells was collected here. Sample sites extended 100 feet (30 meters) out from the beach, and down to 30 feet (9 meters) below the sediment surface. The samples revealed a zone of groundwater in glacial material that was fresher than bay water up to 26 feet (8 meters) thick that extended >100 feet (>30 meters) offshore, sealed off from bay water above by buried salt marsh deposits (peat) in the shallow subsurface. Seepage meters deployed at the Patchogue site revealed discharge of up to 6.4 inches (16.2 centimeters) per day at low tide, at a distance of 15 feet (4.5 meters) from shore. Submarine groundwater within 100 feet (30 meters) of the shore, both fresh and salty, was high in ammonium and methane, and generally low in nitrate, nitrite, and dissolved oxygen. Dissolved gas data from submarine groundwater samples indicate loss of up to 40 percent of the land- derived nitrate load in groundwater prior to discharge. Two sites on Fire Island were sampled in April and May of 2009. At one site (Kismet) groundwater that was fresher than surface water was only present within about 23 feet (7 meters) of the shoreline, indicating different geological conditions than at Patchogue. The second site (Watch Hill) showed similar conditions to Patchogue, with reduced-salinity groundwater approximately 20 feet (6 meters) thick extending up to 230 feet (70 meters) into the bay beneath buried marsh deposits. The low- salinity offshore groundwater at Watch Hill is present beneath the marsh deposits in sand layers that originated from overwash of Fire Island during storms or as deposits associated with old inlets, rather than in glacial sands such as those at Patchogue. Dissolved oxygen was generally low at both Fire Island sites; chemical analysis of the Fire Island samples is ongoing. Based on these results, the onshore and offshore shallow geology of the Great South Bay shorelines appears to control the width and chemistry of the groundwater flow and discharge zones beneath the bay.