15 30 45 60 75 35′ % 23 24 23 21 22 22 (35) 723 20 / CHESAPEAKE BAY 18 22 24 26 18 28 EARTH SCIENCE ATLAS NO. 5 MAP 5-3 26 21 22 23 25 WATER CONTENT UNITED STATES — EAST COAST MARYLAND BY CHESAPEAKE BAY (72) PATUXENT RIVER AND VICINITY DARLENE V. WELLS, LAMERE HENNESSEE, Mercator Projection Scale 1:40,000 at Lat. 38° 24' North American 1927 Datum AND ROBERT H. CUTHBERTSON 1982 STATE OF MARYLAND DEPARTMENT OF NATURAL RESOURCES ROBINSON NECK MARYLAND GEOLOGICAL SURVEY KENNETH N. WEAVER, Director EXPLANATION CONTOUR INTERVAL 15% WET WEIGHT 28 20 26 WATER CONTENT and as the Pleistocene Kent Island Formation. Field observations indicate that, as these materials are exposed subaqueously, they are reinhabited by benthic infaunal organisms and slowly become resaturated with water as biogenic reworking progresses. In the characterization of the surficial sediments of the Chesapeake Bay bottom, the sedimentary environment is defined as consisting of the particulate matter (inorganic and organic) plus water. This assumes that the surficial sediments are 100% saturated with free water, water that is not bound in the internal structure of the clay minerals. The content of water (in percent) in the sediments is calculated as: The distribution of water content in the bottom sediments conforms to the Bay geometry and correlates with the distribution of sediment types. Finer grained sediments (SILTY CIAY and CIAYEY SILT) with high water content (60-80%) are generally located in the main chammel areas. Proceeding towards the shoreline, water content decreases to 20% or less for the SAND of the nearshore areas. In the Choptank River mouth, water content, on the average, is lower than in the main Bay, reflecting the coarser sediment types found within this area. Water Content % = $\frac{\text{weight of water (grams)}}{\text{wet weight of sample (grams)}} \times 100$ The weight of the water is determined as the difference between the wet weight and dry weight of the sample after drying at 65°C. In engineering studies, water content is expressed as a percentage of the dry weight of the sample instead of the wet weight as reported here. Table 1. Percent water measured in the different sediment size classifications. Water content is closely related to various physical and geotechnical properties of the sediment. Numerous investigations have shown that water content is directly proportional to porosity and organic carbon and inversely proportional to unit weight and grain size (Harrison, et al., 1964; Keller, 1974). Water content also provides a first approximation of the cohesiveness and erodability of sediments, and insight into the compaction history of the finer-grained muds (SILTY CIAYS, CIAYEY SILTS and CIAYS). Current velocity studies have shown that, within a given sediment type, the higher the water content the lower the current velocity needed to erode and transport the sediment. RANGE (%) H₂O MEAN (%)H₂O NUMBER Water content, as determined from the analysis of 653 samples, is strongly related to grain size (Table 1). Generally, SAND averages 27%, SHIT, 44% and CLAY, 75%, indicating that grain size is inversely correlated with water content. Within a given size class, the range of water content varies considerably. In the SAND and SLLT categories, the variation in water content is related to the various admixtures of finer or coarser grained particles within the sediment type. In the SLLTY CLAY, SILTY SAND, and CLAYEY SILT categories, the wide range in water content appears to be also related to other geologic processes, such as compaction. As finer grained sediments are buried, they undergo compaction and pore water is expelled. The actual decrease in water content with depth of burial depends not only on the grain size of the sediment but also on the overburden pressures and the length of burial time. 74.1-78.3% SAND-SILT-CLAY 17.8-77.6% 59.0% 38 Harrison, W., M. Lynch, and A. Altschaefel, 1964, Sediments of Lower Chesapeake Bay, with emphasis on mass properties: Jour. of Sed. Petrol., vol. 34, p. 727-755. Keller, G., 1974, Marine geotechnical properties: interrelationships and relationships to depth of burial: in A.A. Inderbitzen, ed., Deep Sea Sediments, Physical and Mechanical Properties: Plenum Press, New York, p. 77-100. The lower water contents observed in the CLAYEY SILT (31%), SILTY CLAY (32%), and SILTY SAND (19%) indicate sediments that have undergone burial. Extension of onshore geological formations suggest that these "low-water" sediments are exposures of "bedrock" where bedrock is defined as the pre-Holocene sediments. Some of these "bedrock" exposures have been tentatively identified as the Miocene Calvert and Choptank Formations, FUNDING PROVIDED BY THE U.S. ENVIRONMENTAL PROTECTION AGENCY, CHESAPEAKE BAY PROGRAM CONTRACT NO. R805965 AND DEPARTMENT OF NATURAL RESOURCES: CAPITAL PROGRAM ADMINISTRATION, ENERGY ADMINISTRATION, TIDEWATER ADMINISTRATION THROUGH THE OFFICE OF COASTAL ZONE MANAGEMENT, NOAA U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION HYDROGRAPHIC CHART 12264 27' 45" 30" 15" 26' 50" 7640