3.1 GEOLOGY AND SOILS

3.1.1 Introduction

The affected environment for geology and soils includes a characterization of the geologic and soil conditions within the study area. The Geology and Soils study area, depicted in Figure 1.6-1, is located within the Lower Atlantic Coastal Plain Physiographic Province in southeastern South Carolina. Geologic units underlying the Project site range in age from Late Cretaceous (98 million years ago) to Holocene (8,000 years ago to present) and are composed of stratified gravel, sand, silt, clay, and limestone (Campbell et al. 1996). In the study area, the Coastal Plain sediments extend from land surface to the base of the Middendorf/Cape Fear formation(s) at approximately 3,000 feet in depth. The coastal plain sediments are underlain by Triassic age crystalline basement rocks composed of diabase, basalt, or quartzitic sandstone depending on location (Corps 2006).

In the shallow subsurface of the Charleston area, to depths of approximately 230 feet below land surface, there are 11 sedimentary depositional units that record high stands of sea level during the last 40 million years. These units are bounded by interruptions in the sedimentation process and the processes of erosion resulting from the rise and fall of sea levels and are, for the most part, fossiliferous. The deposits are marine, marginal marine, and fluvial/estuarine in origin, and range in age from Eocene (36 million years ago) to Holocene (8,000 thousand years ago to present). From oldest to youngest, these deposits are the Harleyville, Parker's Ferry, and Ashley Formations of the Cooper Group; the Chandler Bridge, Edisto, and Marks Head Formations; the Goose Creek Limestone, the Daniel Island beds, the Penholoway Formation, the Ten-Mile Hill beds, the Wando Formation, and various late Pleistocene and Holocene alluvium, artificial fill, barrier island sands, and estuarine deposits (Campbell et al. 1996).

The USDA NRCS has mapped the soil distribution for Charleston County (NRCS 2014), and the soil description for the study area is Urban Land: Yauhannah-Yemassee-Ogeechee (NRCS 2014). The parent material of the soil is loamy fluviomarine deposits. The surface soil of the CNC consists of recent and/or Pleistocene sand, silt, and clay, all with relatively high organic content. Where dredged material from the Cooper River and Shipyard Creek have been used as fill, the surface materials are poorly sorted mixtures of sand, silt, and clay. The subsurface geology consists of varying amounts of fill material to depths of approximately 5 feet below land surface (bls). The fill is underlain by undifferentiated Quaternary age (0 to 1.6 million years ago) sand, silt, and clay of the Wando Formation to approximately 20 to 25 feet bls. These deposits contain discontinuous clay layers and lensatic sand, with multiple interbeds of 1 foot or less in thickness. The Quaternary deposits are underlain by undifferentiated Tertiary marine silt. The marine silt is fossiliferous, with significant phosphatic content. This silt is variable in thickness, between approximately 10 and 20 feet. The Ashley Formation (Tertiary) underlies the marine silt, unconformably in some places. Beneath the Ashley Formation is the Eocene-age Santee Limestone of the Cooper Group (CH2M Hill, Inc. [CH2M Hill] 2011).

Field evaluations identified multiple, low-lying areas that have developed hydric inclusions that were too small, or below, the mapping resolution (1:24,000) used by the NRCS for preparing soil maps. These small areas of hydric soils are likely the result of development, stormwater controls, and reworking of the natural drainage patterns.

3.1.2 Seismicity

Seismicity describes the relative frequency and distribution of earthquakes. Despite its intraplate tectonic setting, the Charleston region is a seismically active area (Corps 2006). The historic seismic record of the southeastern United States is dominated by the 1886 Charleston earthquake and its aftershocks. The 1886 event pre-dated instrumentation, but estimates of the magnitude of the earthquake based on Modified Marcalli Intensity (MMI) observations made by Dutton in 1889 range from 6.6 to 6.9 in magnitude; however, others have estimated the 1886 earthquake to have had a magnitude of 6.5 to 7.5. Despite its moderate magnitude, evidence of MMI X ground motion was observed within the 1886 meisoseismal zone (approximately 2,000 square miles), and almost the entire state of South Carolina was subjected to MMI VII ground motion. The 1886 Charleston earthquake had a felt area of approximately two million square miles. The region continues to experience small-magnitude earthquakes, and paleoseismic studies conducted within the area suggest a recurrence rate for moderate-magnitude earthquakes such as the 1886 event every 500 to 600 years.

Instrumental seismic monitoring has been ongoing in Charleston since November 1974, and observed seismic data have indicated that a dense cluster of earthquake epicenters is located in what is known as the Middle Place-Summerville Seismic Zone (MPSSZ). In 2001, 31 seismic events were recorded, which is an especially active year for earthquakes within the MPSSZ. During the period of November 1974 through December 2004, 292 earthquakes were recorded within the MPSSZ, with the largest being a magnitude 3.99 event on August 21, 1992 (Corps 2006).

3.1.3 Sand and Dirt Mines

South Carolina has approximately 540 active mine operating permits. There are an estimated 367 sand and dirt mines, with more than 100 of these mines located near the Charleston metropolitan area. In total, the state's mines make up approximately 10,863 acres. Operators currently have permits to mine an additional 13,000 acres across the state (Corps 2006). There are several operators within the Tri-County region (Berkeley, Dorchester, and Charleston) that can provide material to meet fill requirements of the Navy Base ICTF.