II. ENVIRONMENTAL SETTING

A. Location

Sites 7K-C-394 and 7K-C-396 are two of seven archaeological sites located in the eastern half of Area 4, one of several proposed wetland replacement and borrow pit areas under investigation by DelDOT for the SR 1 corridor project in Kent County (see Riley et al. 1994). Area 4 is located just northeast of Dover Downs, north of the city of Dover, along Kent County Route 88, as shown on the Dover East U.S. Geological Survey (USGS) 7.5-minute quadrangle (see Figure 2).

B. Physiography and Topography

The project area is within the Atlantic Coastal Plain physiographic province, which is generally characterized by low-lying, nearly level topography. The Coastal Plain was formed by the deposition of material transported from beyond the Fall Line, and it is characterized by masses of sands and gravels of marine or fluvial origin. Both project sites are located along Muddy Branch, a small, marshy creek that flows eastward, joining Green Creek and then Simon's River, which empties into Delaware Bay. Site 7K-C-394, the Alexander Laws Farm, is situated on nearly level ground, with an elevation of 20 to 21 feet, approximately 500 feet northwest of Muddy Branch. Site 7K-C-396 occupies a low rise adjacent to Muddy Branch, including both the hilltop, up to 500 feet from the creek, and sloping ground adjacent to the wetlands on the Muddy Branch floodplain.

C. Soils

Both sites are located on Sassafras loam soils, 2 to 5 percent slope. The surrounding soils are also predominantly of the Sassafras series. These soils are formed on very old sandy sediments and are moderately productive for agriculture (Mathews and Ireland 1971). Beneath the plowzone on portions of both sites LBA investigators encountered a layer of yellowish brown, relatively loose silt. The silt is probably loess, wind-deposited sediment, similar to deposits noted in many parts of Delaware and the Maryland Eastern Shore (Foss et al. 1978; Ward and Bachman 1987).

D. Paleoenvironment

Given the widespread evidence of human occupation of the Middle Atlantic Coastal Plain beginning as early as the late Pleistocene, a reconstruction of the area's environmental history should consider at least the last 12,000 to 15,000 years. The primary factors to be considered in a local paleoenvironmental reconstruction are changing climatic conditions and sea levels which, in turn, influenced the local distribution of floral and faunal resources.

During the late Pleistocene, a series of massive continental glaciers advanced and retreated over much of North America. Because vast amounts of water were incorporated into these ice sheets, the sea levels were 300 to 500 feet lower than at present. The late Pleistocene was not only slightly cooler than the present, but was also characterized by higher levels of precipitation (Carbone 1976).

The generally accepted marker for the end of the Pleistocene is the beginning of the glacial retreat immediately following the Valders substage maximum, which has been dated radiometrically to about 10,500 years before the present (Bryson et al. 1970). As the sea levels rose with the release of the glacial meltwater, the ancestral Susquehanna River Valley and the Delaware River Valley were drowned, and the rising water eventually formed the estuarine environments of the Chesapeake Bay and the Delaware.

While data indicate that sea level has been rising continuously during the past 12,000 to 14,000 years, the rate of marine transgression over the Coastal Plain has varied considerably. In the millennia immediately following the glacial maxima, sea levels rose relatively rapidly, while in the most recent millennia, sea levels have been rising at a rate of somewhat less than one foot per century (Edwards and Merrill 1977).

The biogeographical patterns of the Middle Atlantic Coastal Plain for the late Pleistocene have not yet been definitively reconstructed. Detailed paleoenvironmental syntheses have been completed for the Shenandoah Valley (Carbone 1976) and the Upper Delaware Valley (Dent 1979). These studies are useful for understanding regional paleoenvironmental conditions; however, a reconstruction of local conditions should also consider applicable pollen cores. For Delaware, Custer (1984, 1986) relies heavily on Carbone's (1976) work and discusses paleoclimatic history in terms of an episodic model wherein abrupt, rather than gradual, changes in climate influenced the regional biogeography. A summary of the paleoenvironmental history, based on Custer's (1984, 1986) statewide synthesis, is presented in Table 1.

Recent geological and palynological studies of four bay/basin features in central Delaware provide a detailed look at paleoenvironmental conditions in the vicinity of the project area (Webb et al. 1989). These studies showed that water levels were high in Delaware in the late Pleistocene, leading to the deposition of sediments in these basins at rates of up to 20 cm per year. Sometime between 9000 and 4000 BC, water levels fell and these ponds dried up, leading to a discontinuity in the depositional sequence. After 4000 BC, water levels rose and deposition resumed. Pollen recovered from these sediments was dominated by spruce, pine, and birch, showing that the environment around 9000 BC was sub-Arctic. After deposition resumed in 4000 BC the pollen was dominated by oak and buttonbush (a wetland shrub), both major species in historic ecosystems. These data do not exactly correspond to Carbone's model for the Shenandoah Valley (see Table 1). Carbone posits a dry period beginning about 8500 BC, which closely matches the new Delaware data, but he estimated that it ended by 6500 BC, in contrast

TABLE 1

PALEOENVIRONMENTAL EPISODES, DELAWARE COASTAL PLAIN

EPISODE	DATES	GENERAL CHARACTERISTICS
Late Glacial	10,000-8000 BC	Mosaic of different vegetational communities; open grasslands within coniferous forests; deciduous elements present in wetland areas; bay/basin features open and active; animals include cold-adapted megafauna (musk ox, mammoth, mastodon), peccaries, white-tailed deer, caribou, elk.
Pre-Boreal/ Boreal	8000-6500 BC	Reduction of open grassland and spread of forest dominated by pine and northern hardwoods; extinction of Pleistocene megafauna and reduction of habitat for grazing species.
Atlantic	6500-3100 BC	Full appearance of modern environment with warm, moist conditions; continental climate with marked seasonal differences; widespread dominance of mesic oak-hemlock forests; modern faunal communities.
Sub-Boreal	3100-800 BC	Warm, dry climate (mid-postglacial xerothermic) at the beginning of the episode, followed by gradually increasing moisture and cooling temperatures; spread of grasslands and reduction of oak-dominated forests.
Sub-Atlantic	800 BC-present	Cooling reduced the moisture stress of the Sub-Boreal, leading to essentially modern conditions; upland forests include a mix of coniferous and deciduous species; reduction of sea level rise permits florescence of estuarine environments in coastal areas.

to the 4000 BC date from Delaware. However, both models posit a long dry period in the early Holocene, followed by wetter conditions, and this general agreement may be more important than the differences in dating.

E. Modern Environment

Essentially modern environmental conditions were reached approximately 1,000 years ago, that is, during the Sub-Atlantic episode. Some minor climactic fluctuations have taken place since that time, but it is generally agreed that modern distributions of flora and fauna closely approximate those of the past thousand years. The only major changes have been the result of agriculture, land clearance, and other human activity, and the introduction of some Old World species.

At the time of European contact most of Delaware was covered with deciduous forest. This was a productive environment providing a variety of plant and animal resources for the human inhabitants. Oak was the dominant tree, with some loblolly and Virginia pine, hickory, and chestnut. Poorly drained areas supported a mixed forest of pin oak, willow oak, red maple, sweetgum, blackgum, and many smaller trees. A diverse mammalian community occupied these forests, with the wolf, puma, and black bear as the dominant predators and the white-tailed deer the most common large herbivore. Other species that provided important food sources for humans include turkey, groundhog, squirrel, raccoon, opossum, rabbit, and porcupine. Tidal marshes were a particularly important resource, providing fish, shellfish, turtles, and many plant foods.

Site 7K-C-394 is located in an active agricultural field. There were apparently problems with seasonal inundation at this location, because remains of a drainage ditch were discovered on the site during the Phase II investigations and a larger, modern drainage ditch is located only 200 feet away. Site 7K-C-396 is located in active agricultural fields and in a wooded buffer between the plowed fields and Muddy Branch. The woods consist of medium sized hardwoods, indicating that the site has been cleared at least once.