

APPENDIX D:

GEOMORPHOLOGICAL REPORT

Draft

**PHASE II GEOARCHAEOLOGICAL FIELD INVESTIGATIONS
OF SITE 7-NC-E-152,
AIRPORT AND CHRUCHMANS ROADS INTERSECTION
IMPROVEMENT PROJECT,
NEW CASTLE COUNTY, DELAWARE.**

For

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Introduction

The Delaware Department of Transportation (DelDOT) Airport and Churchmans Roads Intersection Improvement Project impacts prehistoric site 7-NC-E-152, in New Castle County, Delaware. The proposed impact corridor affects high ground adjacent to the Christina River. Earlier investigations of the site area demonstrated the presence of prehistoric archaeological materials, including prehistoric lithic artifacts, within plow-disturbed surface, and subsurface contexts.

Phase II investigations were conducted to further evaluate site formation processes, content and context, during early June 2002. This supplemental study employed excavation of supplemental shovel tests (N=27), and test excavation units (N=25). Geoarchaeological investigations focused upon evaluation of the overall site landform, including evidence of site taphonomy as detailed in test-excavation unit profiles. This report represents efforts to document the geomorphological and archaeological characteristics of the site sediments. Landform history, site formation, and the relative content and context of archaeological components will be addressed.

Site Setting

Site 7-NC-E-152 is situated in the southern outskirts of the City of Wilmington, New Castle County, Delaware. This section of county falls within the Coastal Plain physiographic region, within ~8 km south and east of its contact with the Piedmont physiographic region. The site occupies an upland terrace adjacent to the tidal marsh/floodplain of the Christina River, a fourth-order stream. The Christina River is a relatively small and low discharge stream. It drains the northwest section of the county west of the Brandywine River and north of the Chesapeake and Delaware Canal. To the north and west the upper reaches begin in the Piedmont, where local elevations range from 100-400 ft. Iron Hill, located ~8 km SW of the site, ranges to 340 ft in elevation and is flanked by the Christina River (USGS 1993).

The site is situated about 12 km upstream from the confluence of the Christina River with the Brandywine River at the city of Wilmington, where both streams join the tidal Delaware River. The Christina River is typical of local drainage systems within the Coastal Plain and has a broad, drowned mouth and associated fine-grained, organic-rich tidal marsh. Although the river channel exhibits a meandering sinuous channel, where tidal conditions dominate lateral channel migration has likely diminished or ceased. With increased elevation the extent of tidal influences diminish upstream, and associated tidal marshes become thinner and narrower. Tidal marshes extend at least 4 km upstream of site 7-NC-E-152 (USDA-SCS 1970).

Coastal Plain topography in southern New Castle County forms a relatively flat surface that slopes gently towards the Delaware River and ranges in elevation from sea level to ~100ft amsl. This plain is mainly Pleistocene in age (Groot and Jordan 1999) and has been dissected by a trellised drainage system. Uplands within the Coastal Plain constitute interfluves within this drainage system.

The site occurs along a well-drained, coarse-textured, strath terrace along the south wall of the Christina River valley, between 20-25 ft above sea level (asl). Exposures at the site revealed cross-bedded cobbles, gravel and sand that graded upwards to unconsolidated, silty sand nearer the surface. This fining-upward sequence of fluvial and near-shore gravels, sands and

silty-sands were deposited by alluvial processes that occurred during the Pleistocene, and are considered to be depositional facies of the Columbia Formation (Groot and Jordan 1999). The net result of these depositional processes was the concentration of gravel resources within the Coastal Plain that were exposed by the incision and development of subsequent drainage systems. Gravels are mapped at the site location (USDA-SCS 1970), and modern sand and gravel mining operations are found upstream of the site location adjacent to the Christina river valley (USGS 1993). Prehistorically, these coarse-grained deposits may have represented an important lithic material resource.

On site, the upper ~80 cm of near-surface deposits exhibited advanced soil formation (pedogenesis). The archaeological component was recovered within the upper mantle of these pedogenically altered sediments. Soil development within this setting reflected parent material, drainage conditions, and surface residence time. Soils mapped for this site location included components of the Sassafras Series; a moderately-to-severely eroded, fine, loamy mixed, mesic Typic Hapludult (a gray-brown Podsol) (USDA-SCS, 1970).

Methods

Riparian resources are often recognized as key factors in archaeological site selection. Discovery of archaeological sites near water resources is often contingent upon the preservation conditions of host landforms, and the discovery techniques employed during site survey. Geoarchaeological investigations within alluvial landforms often focus on a systematic reconstruction of depositional history as indicated by the stratigraphy of site sediments. Field work included assessments of general surface topography, as well as subsurface characteristics provided by test exposures that included sediment, soil and archaeological characteristics.

Sedimentological characteristics are most useful in determining conditions of landform formation, and soil characteristics are most useful in determining conditions of post-depositional changes, both natural and cultural (Waters 1992, Foss et al 1995). Important distinctions exist between sediments and soils: soils are pedogenically-modified sediments; sediments include unweathered and unconsolidated deposits and are not soils, even when derived from former eroded soils (Hassan 1978; Ferring 1986, 1992). Soils develop in sediments through processes of weathering (transformation, translocation, and removal of both physical and chemical components), and additions of new physical and chemical components (both geo- and biochemical), through infusions of new sediment, organic matter, precipitation, and atmospheric gasses (Birkeland 1984, Holliday 1990).

The relative development and preservation of sedimentological, pedological and archaeological characteristics within any stratum are strongly influenced by its residence time in a near-surface environment. An actively aggrading landform environment favors preservation of sediment characteristics (including archeological sediments). A relatively stable environment (with little net accumulation of sediment) favors long-term pedogenic weathering and possible accumulation of anthropogenic debris, sometimes in a midden-like surface soil. Actively degrading (or eroding) conditions may result in truncation of surfaces, selective erosion and displacement of both alluvial and archeological sediments, a general deflation of the stratigraphic record, and accumulation of a surface lag of archaeological materials. Surface residence time also a determining factor in the relative affects that non-cultural disturbance processes may

impart upon a site, such as animal burrowing and tree root formation.

Sediment and soil characteristics were recorded for a series of profile exposures. These included observations of lithology (texture) of each distinct stratum as well as bedding, sorting, and the contacts (boundaries) between strata. Elevation differences were measured as depths below ground surface at each individual exposure. Each exposure was also surveyed in relation to a site datum.

Post-depositional weathering and soil formation characteristics were recorded following standard soil descriptive terminology developed by the United States Department of Agriculture, Soil Conservation Service (USDA-SCS 1974). These included descriptions of texture, color, mottling, structure, consistency, inclusions, intrusions, and transferrals. Soil horizon nomenclature follows Birkeland (1984:7), and the U.S. Department of Agriculture Soil Survey Manual (USDA-SCS 1993). Soil horizon designations represented modern conditions.

Results

A primary goal of this investigation was to evaluate the context of archeological resources within the project area. Secondly, the project aimed to investigate the depositional history of the project area to formulate a model of landform history to aid in assessment of site significance. The phase II investigation resulted in excavation of shovel tests and test excavation units within the project corridor (Figure: KSK site map). Sedimentological, pedological and archaeological characteristics of several test unit exposures were recorded (Units 9, 11, 13, 15 and 16). Descriptions of Units 9 and 16 are detailed in Figure GEO-1.

The site occupied a gently sloping and wooded upland terrace, flanked to the northeast by Churchmans road (State Route 58), and elsewhere by wet bottomland associated with an intermittent tributary of the Christina River. Tree growth and stratigraphy suggested that this area had been cleared and utilized for agricultural use during the recent past. Aerial photographs indicated the site area to be mostly cleared of trees prior to 1970 (USDA-SCS 1970).

Sedimentology of the site was dominated by a fining-upward sequence of relatively ancient fluvial and near-shore gravels, sands and silty-sands deposited by alluvial processes that likely occurred during the Pleistocene. Much of the variance in local topography likely resulted from long-term erosion of the surrounding landscape that included head ward expansion of tributary drainages, sheetwash of disturbed surfaces, and possible eolian erosion and redistribution of surface fines. Test units demonstrated some intrasite variability in deposits, especially concerning gravel content. Surface sediments were consistently mixed, and fine-grained. Some inclusions of colluvial (sheet wash) sediments derived from eroded upslope locations were evident, the most recent of which included materials derived from the nearby elevated roadbed. Eolian (wind-derived) deposits were not in evidence, although if present were likely incorporated into the mixed plowzone. Early historic land clearing practices likely contributed to surface disturbances, erosion and colluvial deposition.

Site pedology indicated development of a relatively well drained and old forest soil (Alfisol) that had undergone repeated surface disturbance within the recent past. Typically it consisted of two distinct surface horizons: an Ap1 that included additions of colluvium derived from the eroded roadbed, and an Ap2 that included the plow-disturbed surface and near surface

of the archaeological site. Subsoil horizons included a plow-truncated BE horizon (a leached and eluviated weathering zone), a dense Bt horizon (a repository for much of the fine sediments and chemical elements leached from the overlying Ap and BE horizons), and a BC horizon (transitional to unweathered basal sediments). Visible intrusions included voids constructed by root and animal activity that had filled in with overlying sediments; for example it was common to find narrow extensions of Ap sediment to intrude into the BE horizon.

Across most of the site archaeological evidence was primarily found within the disturbed, second plow zone (Ap2 horizon) and near-surface (BE horizon) contexts. Relative distributions of artifacts were variable, with several loci of evident concentrations (primarily lithic debris dominated by debitage and fire-cracked rock). Few contrasting soil matrices with distinct organic staining indicative of sub-plowzone features or buried surface horizons were noted in association with archaeological components within the BE and upper Bt subsoil horizons: advanced, subsequent soil weathering (including leaching of fine sediments and oxidation of organic materials) may have obliterated obvious color-based evidence of any but the most recent, subplowzone cultural features. Bioturbation associated with root and animal burrowing was commonly noted within subplowzone horizons that exhibited archaeological evidence; these processes likely were accounted for some vertical displacement (primarily downward) of sediments (including artifacts) within the landform.

Summary

In summary, the site landform consisted of a sequence of distinctive and very old fluvial sediments that exhibited long-term weathering characteristics, capped with an artifact-rich, plow-disturbed surface horizons that apparently included additions of colluvial (sheet wash) sediments. Soil development suggested long-term stability. This landform likely existed throughout most or all of the Holocene (last 10-12,000 yr BP). Intrusive, sub-plowzone features were not clearly in evidence, although artifact content and relative context both within and below plowzone suggest some general integrity at least along the horizontal plane. Artifact content indicates that initial occupation of this landform occurred during the Archaic period, when the local riparian environment was substantially different from modern. Sea level was substantially lower during the time period associated with the Archaic and the nearby Christina River was likely non-tidal and actively meandering.

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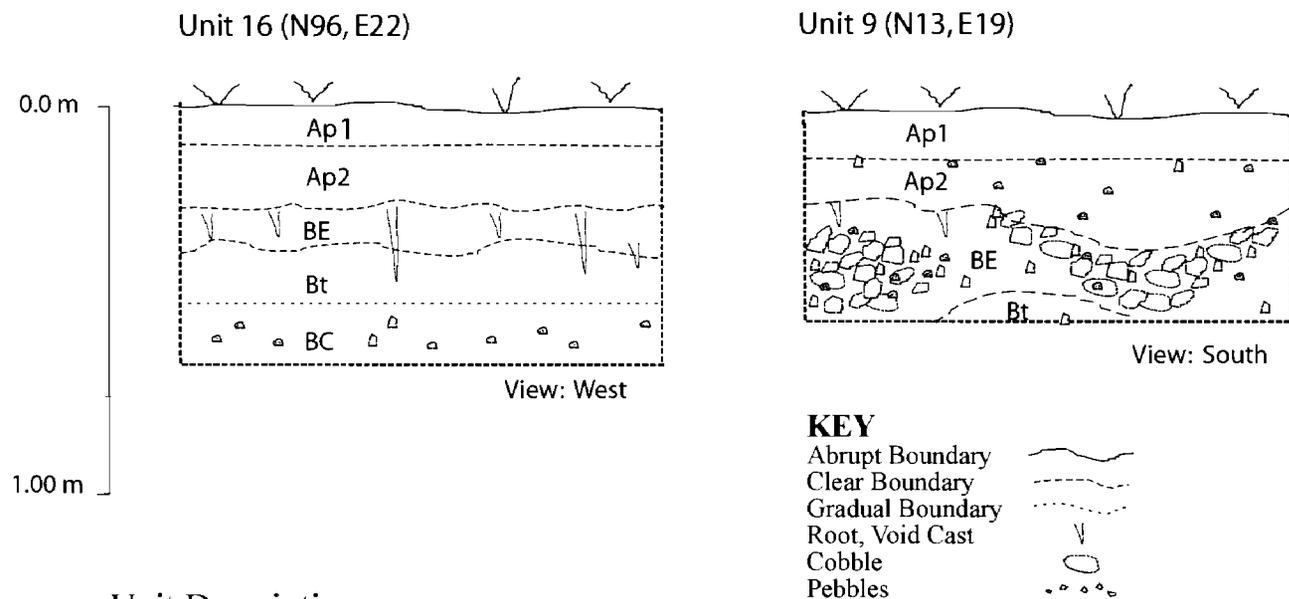
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Figure Geo-1
 Site 7-NC-E-152
 Representative Unit Profiles



Unit Descriptions

- Ap1 Dark grayish brown (10YR4/2) sandy loam, weak fine-to-medium subangular blocky structure; many very fine to large roots; very friable.
- Ap2 Dark brown (10YR4/3) sandy loam, weak fine-to-medium subangular blocky structure; common very fine to medium roots; friable.
- BE Pale brown (10YR6/3) sandy loam to loamy sand, with occasional pockets of iron-cemented fluvial gravels; weak fine-to-medium prismatic breaking into weak coarse platy structure; common infilled root and insect voids; few very fine to fine roots; very firm.
- Bt Yellowish brown (10YR5/4) and brownish yellow (10YR6/6) sandy loam; weak fine-to-medium prismatic breaking into moderate very fine platy structure; few infilled root and insect voids; few very fine roots; firm.
- BC Yellowish brown (10YR5/4) sandy loam (10% gravel) with common medium distinct gray (10YR6/1) and strong brown (7.5YR5/8) mottles, and few fine prominent yellowish red (5YR4/6) mottles, moderate medium prismatic structure; very few very fine roots; firm.