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Research Design

Phase III data-recovery investigations were conducted within a framework of research issues that could be addressed using data from the site. Field, laboratory, and data analysis methods were developed to provide the information needed to address these issues.

RESEARCH ISSUES

Culture Chronology

Reconstructing culture chronology is a critical first step in addressing research issues related to prehistory. The recovery of ceramics and diagnostic projectile points in the Phase II investigation indicated that questions related to culture chronology and occupational history could be addressed using information from the site. The number and type of diagnostic points indicated the degree to which the various prehistoric components were represented at 7NC-E-152. The single radiocarbon date processed from a feature context complemented interpretation based on the artifacts. Spatial analysis of the distribution of diagnostic artifacts also contributed to an understanding of the occupational history of the site.

Lithic Material Use

Data suggests that activities performed at Site 7NC-E-152 involved the use of a tool technology focused on the exploitation of locally available lithic raw materials, primarily those found in the underlying Columbia Formation. The cobble deposits of the Columbia Formation include quartz, quartzite, jasper, and small amounts of chert and ironstone. Quartz is also available in surface deposits in scattered locations in the Piedmont physiographic province north of the site, having weathered from bedrock. Quartzite and jasper are also found in southeastern Pennsylvania, in Cambrian formations of the Reading Prong physiographic province. A closer source of jasper is the Iron Hill quarry area, located approximately 14 kilometers (9 miles) to the southwest of the site. This region is known as the Delaware Chalcedony Complex. Chalcedony and Cecil County black flint are also part of the Delaware Chalcedony Complex. Custer and Hodny (1989) use percentage of artifacts with cortex as an indicator or the use of cobble versus outcrop sources (see also Custer 1982).

Ironstone represents a small proportion of the lithic material recovered at the site. The material is an iron-cemented sandstone found in Columbia Formation gravels. Known deposits of knappable quality material occur on the lower Elk River near the head of the Chesapeake Bay (Custer 1989). This region is approximately 38 kilometers (24 miles) southwest of Site 7NC-E-152.

Small amounts of argillite and rhyolite were found, both of which are materials that were widely traded, especially during the period between A.D. 1 and 600 (Custer 1989). Argillite is found in the Triassic Lockatong Formation, which extends across the middle Delaware Valley and the Piedmont province (Didier 1974). Rhyolite is found in the South Mountain Formation of south-

central Pennsylvania and northern Maryland (Stewart 1987). Steatite was also a component of the trade network.

The use of cryptocrystalline quartz, such as chert, jasper, and chalcedony, is highest at Woodland I period sites near outcrops of the Delaware Chalcedony Complex and even higher at Churchman's Marsh base camps (Custer and Hodny 1989). The lowest incidence of cryptocrystalline quartz use is at sites interpreted as cobble-reduction base camps and hunting/staging sites. The occupants of these sites may have used local cobble sources to produce expedient tools, whereas the occupants of base camps curated tools brought to the site from more distant locations (Custer and Hodny 1989).

Evaluation of the source locations of lithic materials used at Site 7NC-E.152 can provide information on lithic procurement strategies and patterns of mobility, including the degree to which the site's inhabitants utilized resources in the Piedmont. The use of non-local resources, such as rhyolite, provides evidence on the importance of trade and exchange. Characterization of reduction sequences employed for specific lithic materials and identification of specialized manufacturing techniques, such as bipolar knapping, will be used to evaluate how the nature and source of lithic materials may have influenced manufacturing.

Lithic Technology

Attribute studies of the recovered debitage and tool assemblages was undertaken in order to discern the nature of the manufacturing technologies the site occupants used. Research issues related to lithic technology include projectile point chronology and the use of expedient versus formal tool manufacturing.

Projectile Point Chronology. Evidence from the Middle Atlantic region indicates that stemmed, side-notched, and triangular points, once considered diagnostic of specific temporal periods, were in fact used throughout most of the prehistoric era. Prehistoric sites on Piney Island and at several other locations contained stratified Late Archaic and Transitional (Woodland I) period occupations, producing sequences of stemmed and side-notched points (Kent 1970, 1996). In an attempt to establish a chronological sequence, Kent developed a typology based on point attributes and evaluated the stratigraphic positions of the various types. The points reflected general trends, from straight tapered to expanding stem; however, there was considerable overlap in the temporal distribution of these points. Tapered stemmed points classified as Piscataway points were found in stratified contexts at the Pig Point Site (18AN50), located along the Patuxent River (Luckenbach et al. 2010). The points first appeared in the Late Archaic period and were used into the Early Woodland. Recent studies of stratified sites on the Susquehanna River indicate that the use of stemmed and side-notched points extends from the Late Archaic into the Woodland periods (Miller 1998; Miller et al. 2007, 2009).

Triangular points, long considered diagnostic of the Late Woodland (Woodland II) period, have been found in Archaic contexts at stratified sites in both the Delaware River Valley (Kraft 1975; Stewart 1998; Stewart and Cavallo 1991) and the Susquehanna River Valley (Custer et al. 1994; Miller 1994; Miller et al. 2009). A triangular point was found at Harry's Farm in Zone 4, characterized primarily via Kittatinny points and radiocarbon dated to 4980±110 B.C. (Kraft

1975:24). Stewart and Cavallo (1991:25–27) reported triangular points from Area D at the Abbott Farm in levels below radiocarbon dates of 4310±290 and 4410±110 B.P. The earliest triangular points at this site were found in contexts estimated on the basis of geomorphology as dating to 4000 to 4500 B.C. Lothrop and Koldehoff (1994) concluded, on the basis of shape and the high proportion occurring below the plowzone, that triangular points found at 28Gl210, located on a terrace overlooking a swampy floodplain, were Archaic in age. Three triangular points were recovered at the Oberly Island Site from a stratum dated to circa 4340 B.C. (Siegel et al. 1999). Early triangular points in the Northeast and Middle Atlantic regions have been classified as Beekman, Squibnocket, or Hunterbrook. Stewart and Cavallo (1991) concluded from a review of existing Delaware Valley data that Middle Archaic triangular points appear to be more common in the middle and lower portions of the valley. Luckenbach et al. (2010) recovered 22 triangular points from Late Archaic contexts at the Pig Point Site, where it was the predominant point type in this temporal period.

Stewart (1998) examined the Archaic triangles recovered at Abbot Farm for characteristics that would distinguish them from Late Woodland types. He identified a distinctive, asymmetrical basal treatment involving the removal of steep pressure flakes continuously along one face and longer, deeper pressure flakes from the central portion of the opposite face. He noted, however, that not all of the Archaic triangles had this treatment.

Katz (2000) compared Archaic triangular points from Abbott Farm and three sites along the Susquehanna River in Perry County, Pennsylvania (Miller et al. 2009), with Late Woodland triangular points from the Gropp's Lake Site in western New Jersey. He concluded that the Archaic points more frequently had straight bases and excurvate edges, smaller mean basal widths and depths, and smaller mean edge angles. Archaic points were also less likely to have basal grinding. However, these traits were not co-variable, so they could not be used to reliably distinguish Archaic and Transitional period triangles from Late Woodland triangles.

In contrast, broad-bladed points have been relatively tightly dated to the period between 3000 and 1800 B.C. at stratified sites in the Susquehanna River valley. Custer (1989) places their appearance in the Delmarva Peninsula at circa 2000 B.C. In the Churchman's Marsh area, Susquehanna, Savannah, and Lehigh/Koens Crispin broadspears were found at the Hawthorne Site, but were only four of the 75 points recovered. Broadspears were also found at Delaware Park and at a smaller site interpreted as a procurement camp (7NC-D-75).

The point assemblage at 7NC-E-152 contains a high proportion of tapered stemmed points, as well as four triangular points and a possible Susquehanna broadspear. The studies cited above provide information on the age distributions of these points, information useful in identifying the temporal occupations at the site.

Lithic Manufacturing Technology. Hypotheses relating variations in lithic technology to lithic material type and settlement strategy can be evaluated through analysis of the lithic assemblage. Binford (1979) characterized the intensity of lithic reduction and use along a continuum of expedient to curated technologies. Curated technologies are defined as including tools manufactured in advance of their use, maintained through a number of uses, transported from

locality to locality, and recycled to other tasks. Expedient tools are less formal and manufactured in response to a specific task (Binford 1979).

Archaeological studies commonly attempt to link settlement pattern and group mobility to variations in lithic technology (Bamforth 1991). However, the relationship is not clear-cut. Andrefsky (1994) argues that mobility/sedentism is less important in conditioning the type of tool manufacture than the availability of high-quality lithic material. Ethnographic studies indicate widespread use of simple flake tools by both mobile hunter-gatherers and sedentary agriculturalists (Gould 1980; Parry and Kelly 1987).

Lithic manufacturing technology for components represented within the APE can be assessed through the analysis of lithic debitage and the frequency of cores, bifaces, and utilized flakes. The assemblage will be characterized in terms of the relative importance of bifacial tool versus flake tool manufacture, and evaluated relative to settlement strategy and mobility. The presence and type of cortex and the prevalence of heat treatment will also be considered. The importance of blade production and bipolar technologies will be determined, and evidence of resharpening and recycling will be assessed.

Site Formation and Intrasite Patterning

The artifact assemblage recovered from and recorded for a given collection level across the area of investigation does not necessarily correlate with the natural and cultural processes that lead to their original deposition. Depending on a variety of factors, such as duration of occupation and continuous or periodic site use, significant temporal components of a site may be continuous through one or more of the vertical collection levels. Conversely, short-term use of a site area may result in a thin accumulation of cultural materials.

A number of research postulates related to intrasite patterning have been developed inductively from ethnoarchaeological research. Ethnographic studies suggest that camps have household, communal, and special activity areas (O'Connell et al. 1991). Since activities often focus on hearths, the number of hearth-associated assemblages, if contemporaneous, could indicate the number of family groups occupying a site. The organization of activities may provide some information on social organization if, for example, single-task activity areas are assumed to represent task groups and multi-task areas are assumed to represent household groups.

O'Connell (1987) suggests that there should be different patterns of activities between foragers and collectors, as Binford defines (1980). Camps of foragers, who move between resource locations relatively frequently, should be organizationally undifferentiated and seasonally redundant. In contrast, both characteristics should be highly differentiated in collectors, who establish long-term base camps and use satellite camps for logistical forays. He notes that identifying these site characteristics requires large-scale exposures. His ethnographic research indicates that due to frequent secondary disposal of larger items, small refuse items are more likely to be informative with respect to the patterning of activities.

O'Connell (1987) lists the archaeological assumptions associated with the interpretation of intrasite patterning: that activities are spatially segregated; that activities typically produce

characteristic co-variant sets of artifacts; and that artifacts and other refuse associated with an activity are deposited at or very near their place of use. As O'Connell et al. (1991) state, it must be assumed that activities are differentially distributed within a site and that there is a consistent quantitative relationship between performance of the activity and deposition of artifacts. O'Connell (1987) cites challenges to these assumptions based on ethnographic observations. His own study of the Alyawara found that some activities are associated with hearths, roasting pits, and structures, but that other activities were more likely to be relocated based on weather, visitors, and other events. His ethnographic research indicates that due to frequent secondary disposal of larger items, small refuse items are more likely to be found at the location of their use. He concluded that researchers cannot infer that objects found together were used together for the same activity in the past.

Keeley (1991) cites factors that affect deposition, including disposal considerations (cleanup, tossing, etc.); length of site occupation and timing of an activity within the occupation; and retooling of hafted artifacts. He summarizes the literature on disposal, noting that the size of tool affects its probability of disposal near point of last use, since smaller pieces are more likely to escape cleanup. Cleanup is more likely around intensively used areas, such as hearths. He agrees with O'Connell (1987) that the actual loci of activities is likely only represented in small tool fragments or resharpening flakes from the tools used there. Keeley (1982, 1991) also argues that tools that have been hafted are dropped where they are replaced in the haft, not where they were used. Unhafted or briefly used, tools are more likely to be abandoned near locations of last use. O'Connell (1987) defines general expectations in artifact patterning within sites—large clusters of refuse representing household areas with adjacent secondary refuse and special activity areas.

O'Connell et al. (1991) observe that size-sorting of artifacts occurs as a result of refuse clearing, which tends to move larger artifacts more than small (see also Gifford-Gonzales et al. 1985). Stevenson's (M. Stevenson 1991) model of size-sorting defines a drop zone that occurs on the periphery of exterior hearths or other activity centers, and a displacement zone that forms beyond the drop zone (see also Binford 1978, 1983). Artifacts in the displacement zone consist of those dispersed via expedient clearing, trampling, and scuffage. Toss zones, which occur beyond the displacement zone, represent expedient disposal of large or immediately disruptive pieces.

Gifford-Gonzales et al. (1985) distinguish between expedient and systematic refuse disposal. Expedient disposal results in the formation of toss zones. In contrast, secondary deposits from systematic cleanup are expected to occur on the site periphery and might contain a higher proportion of small items than refuse from expedient cleanup. These patterns would become more distinct the longer a site was occupied (Gifford-Gonazles et al. 1985). Rate of refuse disposal is a factor, as is stage in occupational history.

O'Connell et al. (1991) note that Hazda activity areas were cleared of refuse by sweeping, hearths were periodically cleared of ash, and secondary refuse formed along the edge of the activity area in circular or subcircular concentrations. Larger items were more likely removed; smaller items were more often trampled into the ground.

The studies discussed above indicate that post-depositional behaviors such as trampling and scuffage affect horizontal and vertical distribution of artifacts (Hivernel and Hodder 1984). The shorter-term the occupation, the less such factors would be expected to affect artifact distribution. One result of trampling is vertical and horizontal size sorting of artifacts. Stevenson (M. Stevenson 1985, 1991) notes that larger artifacts are more susceptible to movement as a result of foot traffic (see also Stockton 1973). O'Connell (1987) observes via ethnographic studies that larger items migrate farther from use. Some trampling studies indicate smaller items go deeper (Gifford and Brehensmeyer 1977). However, Gifford-Gonzales et al. (1985) identified no size/weight effect for vertical movement.

Gregg et al. (1991) performed statistical analysis of artifact distribution data at Hazda Camp 14 before and after simulated disturbance. The results indicate a gradual loss of resolution of absolute spatial locations, while the general integrity of the assemblage composition and pattern was retained.

This determination is critical, since site reoccupation can alter structural integrity of assemblages (M. Stevenson 1991). One result may be "smear and blend," creating assemblages in which distributions and associations may be the accumulated result of different, superimposed occupations. Statistical methods for evaluating intrasite patterning assume that a single occupation is present (Kroll and Isaac 1984). However, it is possible, if not likely, that any site represents multiple superimposed occupations over a span of some hundreds of years.

Given the important research questions that potentially can be addressed through intrasite patterning, the use of finer-scale (50-x-50-centimeter [20-x-20-inch]) EUs was employed at Site 7NC-E-152. However, the numerous factors that displace artifacts from their location of use must also be considered.

Plowing may affect the integrity of an archaeological site in altering both the horizontal and vertical distribution of artifacts. Numerous studies have been published that consider the effects of agricultural activities on the integrity of the archaeological record.

Experimental studies have attempted to demonstrate the effects of plowing on the horizontal distribution of artifacts. Lewarch and O'Brien (1981) performed an experimental study utilizing over 6,000 artifacts in three horizontal patterns that differed in size, shape, and density. Each pattern was subject to two treatments consisting of one and three passes of an 18-inch disk plow. The experiments produced maximum longitudinal displacements (in the direction of plowing) in individual artifacts of 1 to 16 meters (3.3 to 52.5 feet) and maximum transverse displacements (perpendicular to the direction of plowing) of 2 to 8 meters (6.6 to 26.2 feet), with no significant difference between the two treatments. The experiments also supported the proposition that larger artifacts are displaced horizontally to a greater degree than smaller objects. However, changes in pattern boundaries were generally less than 2 meters, indicating that artifact concentrations are likely to be preserved.

Odell and Cowan (1987) seeded 1,000 weighed and measured artifacts, all of which were painted bright blue to remove effects of collector bias on the experiment. The field was then plowed and disked and allowed to stand through a period of rain. Artifacts at the surface were mapped, but

were collected only for the last two repetitions. The plowing and mapping was repeated 12 times over a period of approximately two years. The mean distance for horizontal displacement of artifacts for the 12 experiments ranged from 1.12 to 3.56 meters (3.7 to 11.7 feet). Standard deviations were relatively high, ranging from 1.1 to 3.88. As in the Lewarch and O'Brien (1981) experiments, the greatest movement was in the direction of plowing. In contrast to the earlier experiments, however, Odell and Cowan's experiment results show no significant difference in the horizontal distance of movement for large versus small items. Plowing effectively doubled the size of the site, while reducing artifact density. Most significantly, Odell and Cowan's experiments indicate that aggregations of artifacts could be identified in surface collections after plowing, despite the fact that the seeded artifacts had been uniformly distributed. These spurious aggregations occurred with data combined from all 12 surface collections and were only statistically significant when the grid size for analysis was reduced to 2-meter (6.6-foot) squares from the original 3-meter (9.9-foot) squares.

Experiments reported in Trubowitz (1978) involved salting a prehistoric site with washers, bricks, and ceramic drain tiles. After two or more plowing events, the experimenters found that the maximum displacement was 9.6 meters (31.5 feet), although some of the tiles had not moved at all. The average displacement was 1.6 meters (5.17 feet), with a standard deviation of 1.7 meters (5.54 feet). Trubowitz concluded that plowing does not significantly disturb the relationships among artifacts.

Roper (1976) evaluated lateral displacement by measuring the distance between fragments of bifaces broken during plowing. Distances ranged from 0.2 meters (0.7 feet) to as much as 10 meters (32.8 feet). Displacement was greatest in the direction of plowing. Roper concluded that plow displacement is not as significant a disturbance factor as had been thought.

Another demonstrated effect of plowing is to move smaller objects downward more than larger objects. In the experiment described above, Lewarch and O'Brien (1981) found that larger artifacts were recovered from the surface following plowing in a much greater proportion than smaller objects. However, the size effect did not differ significantly between the treatment involving one pass of the plow and the treatment involving three passes. The size effect was also smaller for larger initial artifact populations. In contrast, Stevenson (C. Stevenson 1980) concluded that smaller objects accumulate in the upper 10 centimeters (3.9 inches) of the plowzone after weighing and measuring artifacts from 10-centimeter level excavations within the plowzone of a Late Woodland hamlet.

Knoerl and Versaggi (1984) outlined the potential effects of plowing at various analytical levels. At the attribute level, plowing may create additional edge-damage. However, this damage can generally be distinguished from wear traces. Artifacts may be broken by plow blades. Episodes, defined as consisting on non-random associations of artifacts, may be dispersed through plowing, although the authors argue that their centers remain distinct. Feature destruction is defined as the most serious effect of plowing, although the importance of data from subplow contexts has been repeatedly demonstrated. In terms of management policy, the authors conclude that plowing has a variable but predictable impact on archaeological data, and the impact also depends of the level of archaeological analysis.

In summary, although plowing clearly affects the distribution of artifacts, in addition to partially destroying subsurface features, plowing does not appear to completely destroy the archaeological patterning on upland surface sites (see also Ammerman 1985; Roirdan 1982). Overall, researchers concluded that general patterns of artifacts were preserved. Indeed, the effects of multiple reoccupations of a site may have a more serious effect on spatial patterning than does plow disturbance.

Site Function and Regional Settlement Patterns

Site 7NC-E-152 is part of a settlement system associated with nearby Churchman's Marsh. As discussed in Section 3.1, above, considerable archaeological work has been accomplished in the region, including the development of settlement pattern models. Site types defined for the region include macroband and microband base camps, staging/processing areas, and procurement sites.

Custer's (1989, 1994) model for the Archaic period is based on a seasonal fusion/fission model of social organization that is prominent in the ethnographic literature of hunter-gatherer populations. Large groups of kinship-related families occupy macroband base camps in resource-rich localities and disperse into smaller microbands during lean seasons. Sites interpreted as procurement camps result from periodic forays of task groups from both types of base camps.

Custer (1982, 1989) argues that the major change in Woodland I settlement is the focus of base camps on permanent sources of surface water, likely as a result of environmental changes involving a warmer, drier climate. Although the relationships among site types were the same as in the Archaic period, Woodland I macroband camps were much larger than those of the Archaic period. The variety of activities increased at macroband camps and decreased at procurement camps. The model reflects increased sedentism, which is also supported in the presence at base camps of storage features, as well as stone and ceramic containers. Three Woodland I occupations in the Churchman's Marsh area—Clyde Farm, Newport, and Delaware Park—have been interpreted as macroband base camps.

The Woodland II settlement pattern in the Churchman's Marsh area shows continuity with the Woodland I pattern (Custer 1982, 1989). Woodland II base camps are in the same locations as Woodland I camps and show no shift to areas of extensive arable land, as would be expected from populations focusing on agriculture (Custer 1989). The camps do not have multiple house patterns, storage features, or midden areas indicative of farmsteads or villages (Custer 1989; Stewart et al. 1986). None of the dated features at the Delaware Park Site dated to the Woodland II period. However, triangular points classified as Levanna and thin, plain, and fabric-impressed sherds indicated the likelihood of Woodland II occupation (Thomas 1981). Custer (1989) has interpreted the Woodland II occupation as a macroband base camp, but without dated features the information relevant to site function is limited. Microband and procurement sites have been identified, but are not as well known for this period.

The macroband/microband model represents social organization based on seasonal fissioning of the hunter-gatherer group, a pattern commonly found in the ethnographic data. However, the interpretation of the social group composition for occupants of sites based on archaeological data is problematic. Macrobands did not necessarily produce large sites; these sites may simply represent repeated, spatially overlapping encampments. Conversely, small, low-density artifact

scatters are not necessarily indicative of microband camps, but may instead represent special-purpose camps task groups occupied. Clear intrasite patterning and chronological control would be required to distinguish multiple occupations by single microbands from a contemporaneous group of microbands comprising a macroband. However, patterning of hearths or houses that might provide evidence related to group organization is rare in the Middle Atlantic region. The difficulty in distinguishing between macroband and overlapping microband occupations has been acknowledged as a result of the excavation of large, dense sites, such as the Leipsic, Snapp, and Pollack Sites (Petraglia et al. 2002). Petraglia et al. (2002:18–42) note that data from these sites revealed a wide range of chronological indicators and a fair degree of feature overlap that supported arguments against their interpretation as structured macroband base camps.

Results of the analysis of intrasite patterning could provide information on whether Site 7NC-E-152 represents numerous, short-term reoccupations, long-term occupation by small groups, or less frequent occupation by larger groups, thus placing the site within the general framework of existing settlement pattern models.

Subsistence

Very little data related to subsistence was available at Site 7NC-E-152. Charcoal-rich features with seeds or nutshell were not identified at the site. The only artifacts related to food procurement and processing are points and mortars, along with knives, scrapers, and points exhibiting evidence of use for butchery and meat cutting. Thus, research issues related to subsistence could not be addressed.

FIELD METHODS

Phase III data-recovery investigations were limited to the boundaries of the project's revised final preferred alternative roadway improvement design, and encompassed only those portions of the site located between the base of the existing road berm in the east and the limits of the temporary construction easement (TCE) in the west (Figure 4.1). These boundaries encompass approximately 550 square meters (1,804.5 square feet) of the overall site area, as delineated during Phase II investigations, and include all or portions of artifact Clusters 1, 3, and 4. Portions of Cluster 1 and all of Cluster 2 fall outside the boundaries of the final preferred alternative design and would not be further impacted during construction activities.

Data-recovery fieldwork involved the excavation of additional 1-x-1-meter (3.3-x-3.3-foot) test units within the previously defined artifact clusters. At the behest of both DelDOT and DE SHPO representatives, the execution of this treatment plan was conducted in two distinct stages so that the results of the initial stage could be used to guide the number and placement of units in the second stage.

Field testing was conducted in compliance with the standards established in the Delaware State Historic Preservation Office's *Guidelines for Architectural and Archaeological Surveys in Delaware* (1993). All of the soils within the 1-x-1-meter units were manually excavated by natural levels, down to the top of the intact subsoil (B horizon). In Cluster 5, roadway fill was removed without screening and set aside prior to test unit excavation. Soils in the B horizon

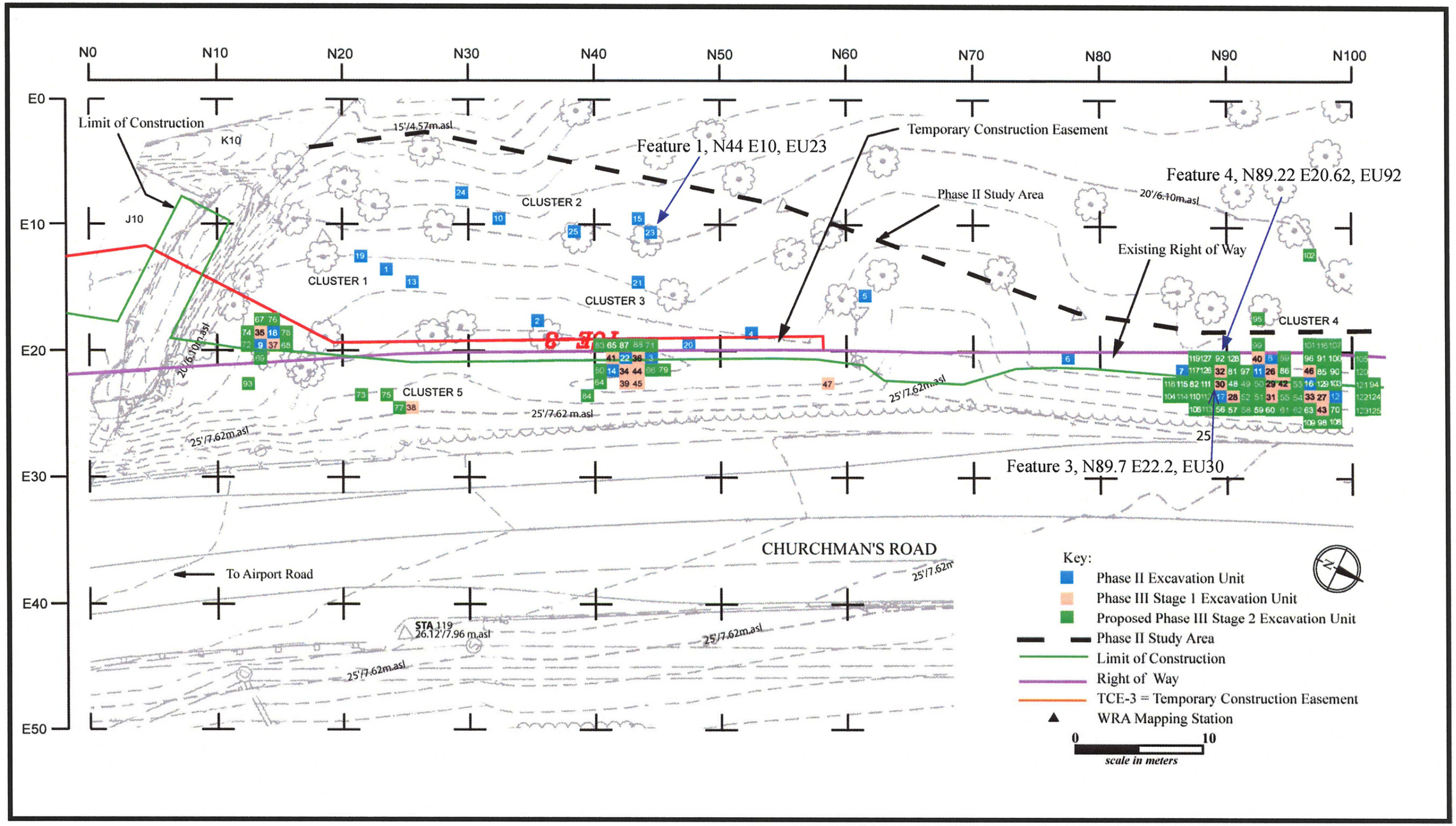

Figure 4.1 Location of Phase III Stage 1 and 2 excavation units.

were excavated in arbitrary 10-centimeter (3.9-inch) levels to a point at least 10 centimeters into sterile deposits. At least one unit within each cluster was excavated to a depth of at least 1 meter below current ground surface, to assist with the geomorphologic and taphonomic evaluations of site stratigraphy. All excavated soils were screened through ¼-inch hardware cloth. Recovered artifacts were placed in plastic bags labeled with precise horizontal and vertical provenience information. Standardized forms were used to record data relating to the depths, Munsell color and texture, and artifact content for each soil stratum. The resulting stratigraphic profiles were drawn and documented using black-and-white print and color-slide photographs. All excavated soils were screened onto plastic tarps and backfilled upon the termination of fieldwork.

Features were mapped in plan and cross-sectioned. Initially, the feature was bisected and half of the fill removed to identify internal stratigraphy. Up to 2 liters of the remaining fill was retained for flotation analysis. Descriptions of soil fill and the surrounding matrix were recorded in terms of texture and Munsell color, and photographs were taken in digital format. Plan views and profiles were drawn to scale. Charcoal from intact contexts was retained for radiocarbon dating.

Samples of soil from non-feature contexts were retained from the plowzone and subsoil of 21 units. The samples were collected to provide a control on the analysis of feature and excavation data. Soil samples from one unit in Cluster 1, one unit in Cluster 3, and two units in Cluster 4 were processed using flotation techniques. One sample was considered sufficient to represent the overall block excavation, with an additional sample from the larger block in Cluster 4 and no samples from Cluster 5, where overburden and disturbance may have affected the soils. Artifacts recovered from flotation were included in the excavation unit inventory. With the exception of small amounts of charcoal, no carbonized botanical remains were recovered from the non-feature contexts.

Provenience recording was accomplished through use of a Total Station laser transit. To avoid the cumbersome enumeration associated with the Universal Transverse Mercatur coordinate system established by surveyors, an arbitrary grid was implemented for the purposes of provenience designation and recording (see Figure 4.1). Grid north was approximately 25 degrees west of true north. Several datums within this arbitrary grid were placed in and around the excavated area. The Total Station instrument was used for placing EUs, as well as recording the opening and closing elevations of excavation levels. When encountered in situ, all tools, diagnostic objects, and other artifacts of note were point-plotted with the instrument.

In order to interpret site taphonomic factors and archaeological integrity, soil strata exposed within selected EUs were subjected to detailed geomorphological examination during the Phase II survey. Geoarchaeologist Dan Hayes of Hayes and Monahan, Inc., conducted and reported on the analysis. The findings of his inspection are detailed in the technical report contained in Appendix B.

LABORATORY METHODS

Artifacts recovered during this project were taken to KSK's Archaeological Laboratory facility in Pennsauken, New Jersey, for processing and analysis. The artifacts were later transferred to

the URS laboratory in Burlington, New Jersey, for completion of the laboratory and data analysis.

All artifacts were cleaned with water and allowed to air dry. Subsequent analysis of recovered materials consisted of documenting the raw material type, function, and, where possible, approximate age of each artifact, as well as the entering of all relevant analytical variables into a computerized database for eventual statistical characterization. Artifacts of different classes were analyzed and quantified in relation to sets of attributes appropriate to the type of cultural material, as well as the questions identified in the research design.

Following completion of the analysis, the artifact collection was prepared for curation in accordance with guidelines established by the Delaware Division of Historical and Cultural Affairs. Artifacts, field records, forms, photographs, and maps will be curated at the Delaware State Museum.

Prehistoric Lithic Artifacts

Material Types. Lithic raw material types were identified according to macroscopic characteristics, such as color and texture. Quartz, quartzite, jasper, and ironstone are most readily available from gravel deposits of the Columbia Formation, although outcrop deposits are also present in the region. For the purposes of this study, quartz is a white, translucent to opaque material, also known as milky quartz. Quartz crystal is pure quartz that is colorless and transparent. Rose quartz is a pink variety of quartz crystal; the color is a result of iron, magnesium, and titanium impurities. Quartzite is metamorphosed sandstone with a sugary appearance. Petraglia et al. (2002) note a continuum from quartz crystal through sugary-textured quartz and quartzite to fine-grained quartz sandstone. Ironstone is iron-cemented sandstone that is brown as a result of oxidation.

Jasper is iron-rich cryptocrystalline quartz. Jasper from the Newark Formation in the Iron Hill quarry area, located approximately 14 kilometers (9 miles) to the southwest of the site, is generally dark brown and opaque and has a higher iron content than many other jaspers in the Middle Atlantic (Miller 1982). Jasper from the Columbia Formation is light brown to yellow brown or red in color and is more translucent than the Iron Hill material. Thermal alteration results in a reddening of the material (Schindler et al. 1982). However, naturally red jasper is also found in the cobble deposits.

Cecil County black flint is cryptocrystalline quartz from the Newark Formation. It is translucent along thin edges, and is distinguished by "abundant magnetite, chromite, and possibly titanomaghemite crystals... crystals measure 0.2 mm and are visible to the unaided eye; under 25x magnification the crystals extend above the chert surface" (Lavin 1983:56). Cherts from the Columbia Formation gravels are a homogenous black to dark gray or light gray material. The cherts are generally opaque with a dull to shiny luster.

Classification. Debitage was classified according to stage in the lithic-reduction process. Artifacts classified as flakes exhibit one or more of the following morphological traits: a platform, bulb of percussion, ventral/dorsal surfaces, and/or proximal/distal ends. Flakes were

noted as being whole or fragmentary. Whole flakes and proximal flake fragments were categorized according to reduction stage. Decortication flakes represent the initial stage of tool manufacture, involving removal of cortex. Decortication flakes are defined as early cobble reduction flakes with large amounts of intact cortex. Early reduction flakes represent further reduction of the lithic material and are defined as flakes either from biface reduction or from cores. Biface-thinning flakes are flakes detached from a bifacially worked artifact, representing the final stage of tool manufacturing. Attributes for biface-thinning flakes include a bi-directionally retouched platform; a lipped platform; dorsal scars parallel to each other and perpendicular to the platform; a thickness of less than 5 millimeters (0.2 inches) that is relatively even from proximal to distal ends; a weak bulb of percussion; and a pronounced ventral curvature. Finishing flakes are smaller than biface-thinning flakes and represent the final stage of tool production. The flakes have a pronounced lip and most have feather terminations. Flakes without a bulb or platform were classified as flake fragments. Block shatter lacks distinct flake characteristics, such as a platform, bulb of percussion, ventral/dorsal surfaces, and proximal/distal ends. Shatter refers to pieces of lithic material incidentally broken off during the process of lithic reduction. Bipolar reduction flakes are detached from a core using bipolar reduction techniques and may have two bulbs of percussion and scaling/crushing at one or both opposing ends. Attributes recorded for debitage include the presence or absence of cortex, condition (whole or broken), and evidence of heat treatment.

Cores are nodules with faceted platforms from which specific kinds of useable flakes are removed. Cores are classified as freehand or bipolar. The presence or absence of cortex, condition (whole or broken), evidence of heat treatment, and weight was recorded for each core. Tested cobbles are lithic raw material fragments that have had only one to a few flakes removed for the purpose of assessing the quality of the material.

Bifaces are typed according to their stage of reduction (early, middle, and late). Early-stage bifaces are cobbles or large flakes that have had their edges bifacially trimmed and a small number of large reduction flakes detached. Middle-stage bifaces are initially thinned and shaped. The lenticular cross section—characteristic of a biface—is evident, but the edges are sinuous and areas of cortex may remain on one or both faces. Late-stage bifaces are essentially finished bifaces; they are well thinned and trimmed, and are symmetrical in outline and cross section.

Points are finished bifaces that have been modified for hafting. Points primarily functioned as projectiles and/or knives. Projectile points exhibiting diagnostic attributes are typed through comparison to known regional examples (Custer 2001; Ritchie 1971; Justice 1987). Variations within types may be the result of resharpening, post-depositional effects, or raw material quality. Therefore, differences may be related to cultural use and local material anomalies rather than a change in the characteristics of defined types over time. Attributes recorded for points include the presence or absence of cortex, condition (whole or broken), and evidence of heat treatment. Length, width, and thickness were measured for complete segments only.

Other tools types are identified on the basis of form and microwear analysis. Scrapers have broad working edges and moderate to steep edge angles, which is effective for performing scraping tasks. Scrapers include both end and side scrapers depending on the location of the

working edge. Spokeshaves have a concave edge used for fashioning shafts or tool handles from wood. Gravers have a small, sharp projection typically created by unifacial retouch of a flake or blade, and are and used to create grooves in wood or bone. An adze is a woodworking tool with the blade attached at a right-angle to the handle and is used to vertically shape wood.

Flake tools include retouched and utilized flakes. Utilized flakes are defined as flakes with edge damage resulting from expedient use. Utilized flakes are not considered to have been intentionally altered (i.e., retouched or modified) for a particular purpose. Retouched flakes exhibit a deliberate pattern of consecutive flake scars along one or more margins. Retouch flake scars are larger than those created in use.

Analysis of cobble tools includes categorization by raw material and identification of tool type. Lithic material type is recorded for cobble tools, along with artifact condition as whole or fragmentary. Battered, crushed, pitted, and/or abraded surfaces separate cobble tools from unmodified cobbles and manuports. Cobble tools include abraders, anvils, hammerstones, mortars, metates, and pitted cobbles. Hammerstones and anvils are tools used for lithic manufacturing. Mortars and metates are types of grinding stones. Pitted cobbles may have one or more pits on one or both sides and are generally interpreted as nutting stones.

Fire-cracked rock (FCR) and fire-reddened cobbles were identified as lithic material physically altered via the application of heat by a human agent. This artifact category consisted of cobbles used as heat retainers in the processing of foodstuffs for consumption (e.g., stone boiling or earth ovens/hearths). For the purposes of collection in the field and laboratory analyses, rocks exhibiting discoloration and showing planar and angular cracking were considered to be FCR (Stewart 1988). Cobbles that were discolored but not cracked were classified as fire-reddened cobbles. Both types of thermally altered stone were separated by material type, then counted and weighed by provenience.

Microwear Analysis. A total of 70 lithic tools were selected for the analysis of microtraces due to tool use and hafting in this study (Appendix D). The microwear analysis followed a combination of methods in the high-power approach of Keeley (1980), Vaughan (1985), and Juel Jensen (1988, 1994), as well as the low-power approach of Odell (1977) and Tringham et al. (1974). Of the 70 specimens examined under low-power magnification, 39 exhibit evidence of microwear, warranting further analysis using high-power magnification.

Microtraces are described by their edge scarring/rounding, striations, extent, texture, contour, brightness, and polish. Edge scarring/rounding characterizes damage to an edge and can indicate the hardness of the material being worked. It can be described as a large deep scalar, small deep scalar, large shallow scalar, small shallow scalar, large stepped, small stepped, and half-moon. Butchery, meat cutting, and hide-working tend to exhibit step-like microfractures. Striations can be used for the identification of tool motion and support evidence of the contact material. For example, striations are more common on bone-working than on wood-working implements. Striations on bone are often narrow and deep. In the case of bone sawing, parallel striations to the working edge are a distinguishing feature. Polish, supported by brightness, also describes the material worked. For example, polish that is described as fluid has often been associated with

meat cutting or fresh hide cleaning and polish described as hard is an indicator that bone or antler was been worked.

Prehistoric Ceramics

The analysis of prehistoric ceramics included the identification of temper, surface treatment, rim forms, and, if possible, vessel type. Where possible, ceramics were classified using standard regional typologies. Analysis of ceramic vessels has the potential to assist in identifying activities that occurred at the site (e.g., cooking and storage). However, most of the sherds recovered from Site 7-NC-152 were small and eroded and could not be assigned to a diagnostic type with any degree of confidence.

Historic Artifacts

Historic artifacts include ceramics, glass, metal, and miscellaneous other artifacts. Historic ceramics are characterized by paste, glaze, and decoration. Major categories include creamware, pearlware, whiteware, and red-bodied earthenware. Vessel function is inferred whenever possible, based on vessel shape and size. Makers' marks are recorded and identified, if present. Where the quality of the evidence permits, date and place of manufacture are specified for each vessel in the assemblage.

Glass containers are characterized by type, color, and element (body, rim, base). Whenever the quality and completeness of the vessel are sufficient, the date of manufacture and the function of the bottle are specified. Window glass is characterized by color.

Nails are classified by manufacturing process (wrought, die-cut, wire), and the function (common nail, roofing nail, brad, etc.) is specified for all complete pieces. Bricks are classified by manufacturing process, if possible. Manufacturers' marks are recorded, if present, and date and place of manufacture are specified when possible. Pipes are characterized by shape of the bowl and diameter of the bore hole. Decorations or makers' marks are recorded if present, and a date and place of manufacture are specified, if possible.

DATA-ANALYSIS METHODS

The information from laboratory analysis was entered into a Microsoft *Access* database. The database is designed to facilitate the generation of tables of artifact subassemblages from the site, as well as to generate data for mapping analysis.

Data analyses for this project are designed to produce data that could be used to address the research issues discussed above. The analyses provide information to document internal site variation, interpret site function, and facilitate intersite comparisons on a regional scale. The analyses involve the comparison of site components through statistical variables related to the artifacts recovered. Specific analyses are utilized in order to produce data to assist in the interpretation of the fundamental issues of site dating and function.

Eleven charcoal samples were recovered during the field investigations. Although it was initially anticipated that as many as four would be submitted for radiocarbon dating, only one of the samples was from a feature context (Feature 4). The others were from general soil contexts that did not have clear cultural associations. The Feature 4 sample was submitted to BetaAnalytic, Inc., for radiocarbon analysis. Because only one radiocarbon date could be secured, relative site chronology was established on the basis of the horizontal distribution of temporally diagnostic objects, such as projectile points and ceramic artifacts.

Mapping studies of artifact distributions were accomplished using *Surfer 8*, a commercial mapping software. The mapping efforts attempted to reveal relationships between identified artifact patterns and hypothesized patterns of prehistoric behavior through analysis of the distribution of specific artifact classes and raw material types. These graphic representations of artifact patterning can be used to map out functionally discrete activity areas within the site, or within specific artifact clusters, and to more fully evaluate site function. It was also possible to identify latent features that were not identifiable during the course of field investigations.