PREVIOUS RESEARCH

Phase I Survey

The Leipsic Site was originally identified during Phase I surface reconnaissance conducted in early 1988 due to an alignment shift of the proposed right-of-way for State Route 1 (Bachman, Grettler, and Custer 1988). A scatter of prehistoric cultural materials was discovered on the site of 7K-C-194A between two previously identified sites (7K-C-194 and 7K-C-195) on the north side of the Leipsic River (Plate 1). The scatter included a shell-tempered ceramic sherd, a quartz unifacial tool, jasper cores, lithic debitage, and fire-cracked rocks. The limits of the surface scatter covered approximately 200 x 400 ft. (about two acres). The variety of cultural materials at the site, and its location at a stream confluence between two other sites tentatively identified as base camps, suggested the potential for subsurface features and cultural remains that could provide information significant to a better understanding of settlement and subsistence patterns during prehistory. For these reasons, Phase II testing at the site was recommended.

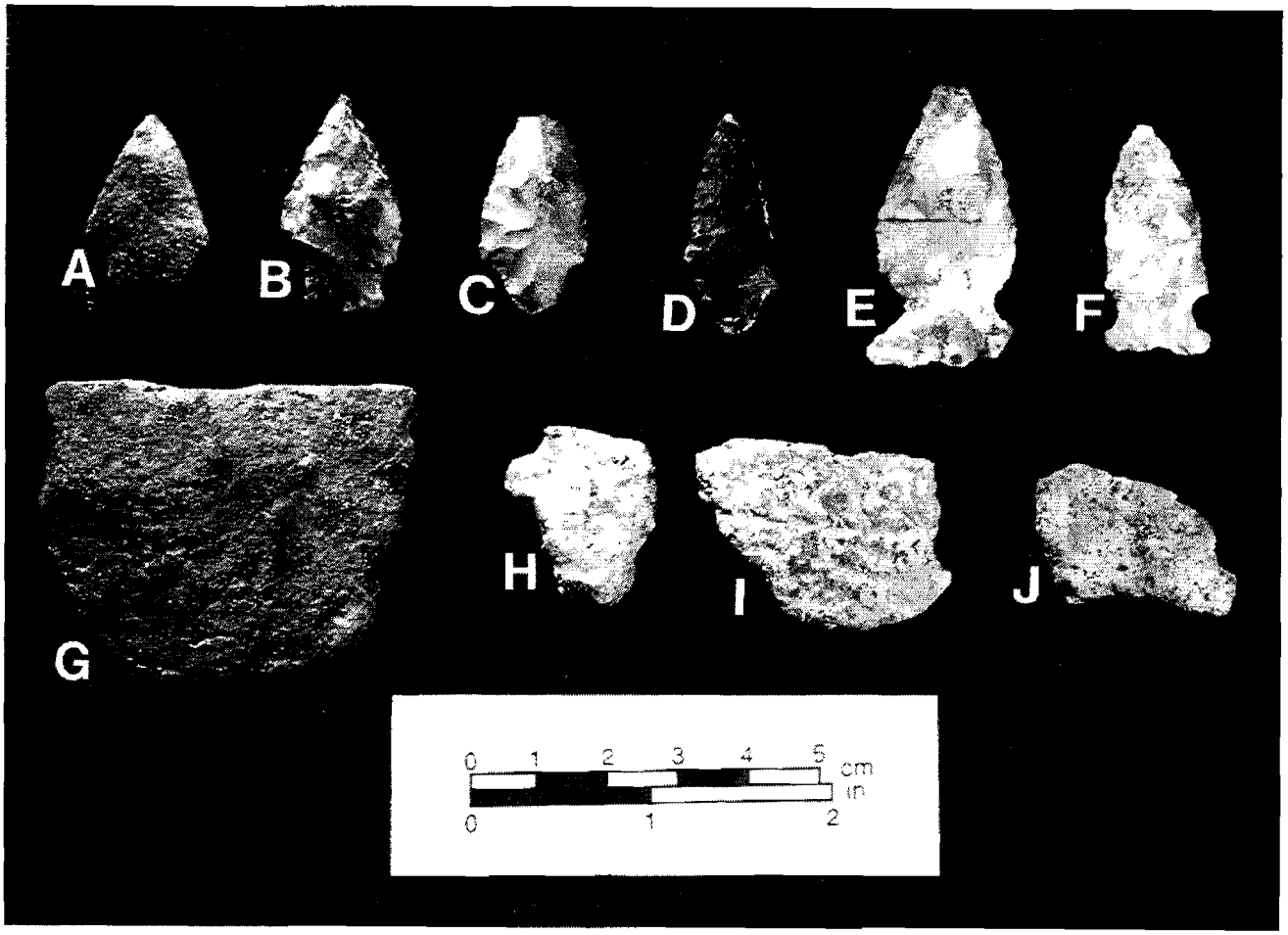
Phase II Test Excavations

Phase II testing of the site conducted during the fall of 1989 and the winter of 1990 consisted of 20 shovel test pits, 1 m x 1 m test squares at 10 meter intervals across the site, and additional squares necessary to expose features (Figures 9 and 10, Plate 3) (Riley, Bachman, et al. 1994). Soil profiles at

the site (Figure 11) generally contained a fairly deep plow zone, averaging 27 cm in depth, underlain by a subsoil consisting of a thinner stratum of yellow-brown silty sands (B1 Horizon) and beneath that a stratum of pebbly coarse red-brown sands with little silt or clay (B2 Horizon). Artifacts were recovered from both plow zone and subsoil contexts, and included stemmed and notched points from the Woodland I Period (Plate 4A-F), a piece of a large argillite biface (Plate 4G), and diagnostic ceramic sherds such as Marcey Creek (Plate 4H), Coulbourn (Plate 4I), and Wolfe Neck (Plate 4J) wares. Several features were also located, and a sample was partially or fully excavated revealing the presence of semi-subterranean house pits, hearth areas and related features, and possible storage pits. In addition to stone tools, ceramic sherds, and fire-cracked rocks, the features also contained carbonized wood and

PLATE 4

Phase II Artifacts



A and G – Argillite	B-F – Jasper	Point and ceramic types noted in text

nut hulls, and charred seeds. Based on the presence of artifacts in intact subsoil contexts, house and storage pit features, and diagnostic artifacts from various Woodland I Period cultural complexes, the Leipsic Site was thought to be a multi-component macro-band base camp. Furthermore, because the available data on this site type in Delaware is sparse, the site was determined to be significant and eligible for listing on the National Register of Historic Places as part of the Middle Leipsic River Valley Archaeological District. Therefore, full data recovery excavations were recommended as one mitigation alternative.

Phase III Research Design, Field and Laboratory Methods

One of the major research questions to be addressed by Phase III investigations was the role of the Leipsic Site in local settlement patterns. Investigation of prehistoric settlement patterns is an important research question identified by the state plan for the management of prehistoric archaeological resources (Custer 1986). Current models of Woodland I Period settlement systems in the Delaware Coastal Plain (Custer 1984; 1986; 1989) note that base camps provide the residential focus for prehistoric settlement. From these residential bases, prehistoric groups made a series of forays to outlying

procurement sites where they hunted and gathered the resources needed to sustain the populations living at the base camps. In most of these models, the settlement at the base camps has traditionally been viewed as relatively sedentary and consisting of multiple nuclear families. The presence of pit houses and subsurface storage features is seen as an indication that the occupations of the sites spanned a significant portion of the year, if not the entire year. However, recent research at other similarly dated sites in the Delaware River Valley (Watson and Custer 1990) has suggested that Woodland I groups may not have been as sedentary as previously thought. Therefore, another goal of Phase III research was to determine the duration of the prehistoric settlement at the site.

In order to understand the duration of the habitation of the Leipsic Site and its role in regional settlement patterns, it is necessary to understand the internal structure and organization of the "household clusters" that comprise the site. A "household cluster" is defined simply as a house structure with its associated storage, refuse, and other features (Winter 1976). The feature clusters excavated during Phase II excavation at the site showed that a large number of these household clusters were present at the site, and many of the features that comprise the clusters overlapped with one another (Figures 12 and 13). The overlapping of the features complicates their identification and excavation; however, the cross-cutting relationships of the features allowed the development of an internal chronology for the site that was supplemented by analysis of diagnostic artifacts and radiocarbon dates.

In order to analyze these feature clusters it was necessary to strip the site's plow zone and carefully map the exposed features so that their cross-cutting relationships could be noted before their excavation. Complete excavation and screening of the plow zone was not necessary due to the disturbed nature of the plow zone soils. However, it was also necessary to have a sample of the artifacts from the plow zone soils in order to better understand the activities which took place at the site. Consequently, it was necessary to develop a sampling design for selecting the portions of the site where excavation and screening of plow zone soils, beyond that which was done during the Phase II excavations, would take place.

Based on the artifact and feature distributions shown in Figures 14 and 15, areas of high and low densities of plow zone artifacts and sub-surface features were mapped and combined to define four sample strata which are listed in Table 1 and mapped in Figure 16. Table 1 also notes the number of 1 m x 1 m plow zone units excavated during the Phase II research. These sample strata were considered

TABLE 1

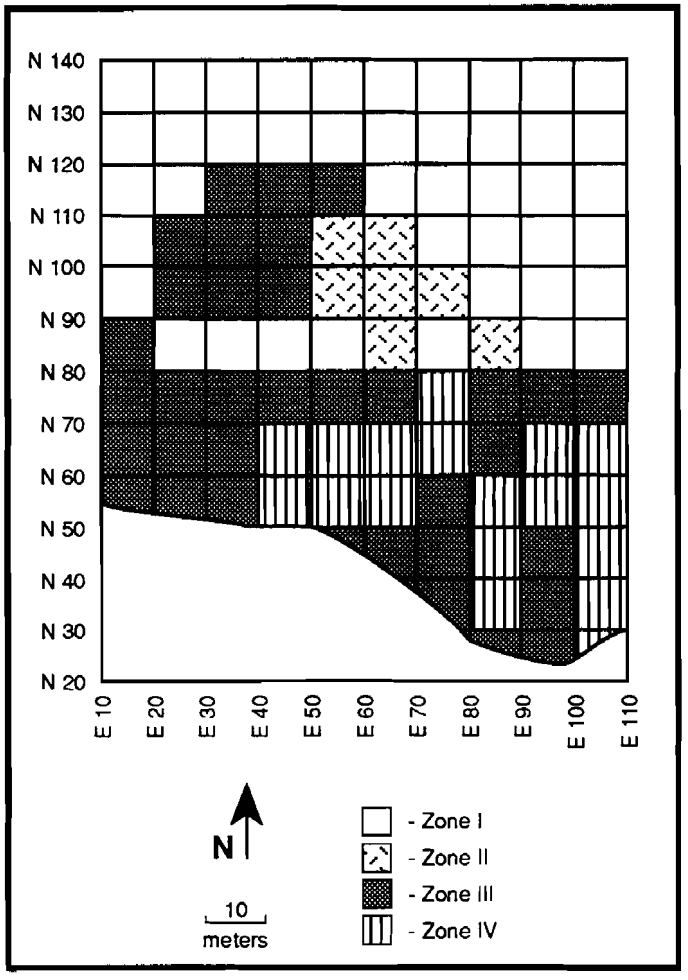
Sample Strata

Zone	Plow Zone Artifact Density	Feature Density	Number of Units Dug in Phase II Research
I	Low	Low	53
II	Low	High	7
III	High	Low	34
IV	High	High	14

to mirror differential spatial use of the site by its prehistoric inhabitants, with the intensity of use increasing moving from Zone I to Zone IV, and movement of artifacts by erosion. Because they represented different use of the site, each area needed to be sampled individually before stripping of the plow zone.

FIGURE 16

Sample Strata for Plow Zone Excavations



At the completion of the Phase II research, the excavated and screened plow zone squares accounted for 1% of the site's surface area. However, when considering sample size, the **number** of sample units per sample strata, rather than the sampling fraction, is the more important consideration (Blalock 1960). Sampling simulations have also shown that sample sizes of 50-60 units provide precise and accurate estimates of the parameters studied (Custer 1992).

With these considerations in mind, there was no need to dig any more plow zone units in Zone I because the Phase II excavations had also generated a sample of more than 50 units. Furthermore, these units had been shown to have low frequencies of artifacts within them. In Zone II, it was necessary to excavate approximately 21 additional units to yield a total of 28 units. Although this number is less than 50, Zone II is not that large, and Phase II testing showed that there were few artifacts in this area. The additional 21 units selected for this zone were chosen so that there were three additional units excavated for each of the seven 10 m squares that comprised the zone (Figure 16). This sample provided a larger sample of artifacts and dispersed the sample units throughout the zone.

TABLE 2
Summary Catalog of Lithic Artifacts from Plow Zone Test Excavations

Artifact Type	Quartzite	Quartz	Chert	Jasper	Rhyolite	Argillite	Ironstone	Chalcedony	Other	TOTAL
Flakes	434 (111)	1439 (442)	849 (244)	3000 (1305)	140 (8)	77	10	245 (43)	22 (2)	6216 (2155)
Utilized flakes	18 (9)	112 (45)	43 (23)	137 (81)	--	--	--	30 (7)	--	340 (165)
Flake tools	10 (5)	59 (25)	35 (17)	101 (49)	2 (1)	--	2 (1)	13 (5)	1	223 (103)
Paleo-Indian points	--	--	2	3	--	--	--	--	--	5
Archaic points	--	1 (1)	--	1	--	1	--	--	--	3 (1)
Woodland I points	--	4	2 (1)	16 (4)	--	4	2 (1)	2	--	30 (6)
Woodland II points	1	--	1	--	--	--	--	--	--	2
Early stage biface rejects	--	8 (3)	8 (8)	11 (10)	--	--	--	--	--	27 (21)
Late stage biface rejects	2	6 (2)	6 (1)	9 (3)	--	2	--	--	--	25 (6)
Miscellaneous stone tools	6 (1)	5 (2)	3 (1)	2 (2)	--	--	--	2	1	19 (6)
Shatter	32 (4)	737 (43)	26 (1)	75 (8)	--	2	--	2	1	875 (56)
Cores	1	13	3	24 (2)	--	--	--	--	--	41 (2)
Total	504 (130)	2384 (563)	978 (296)	3379 (1464)	142 (9)	86	14 (2)	294 (55)	25 (2)	7806 (2521)

- artifact count
(#) - artifacts with cortex

25 groundstone tools
1362 fire-cracked rocks (53 kg)

In Zone III, it was recommended that an additional 16 units be excavated to bring the total number excavated in the zone to 50. These units were distributed so that there was one additional unit in half of the 32 10 m units that comprised the zone. In Zone IV, it was recommended that an additional 50 units be excavated. These units were distributed in areas adjacent to the block excavations around the features.

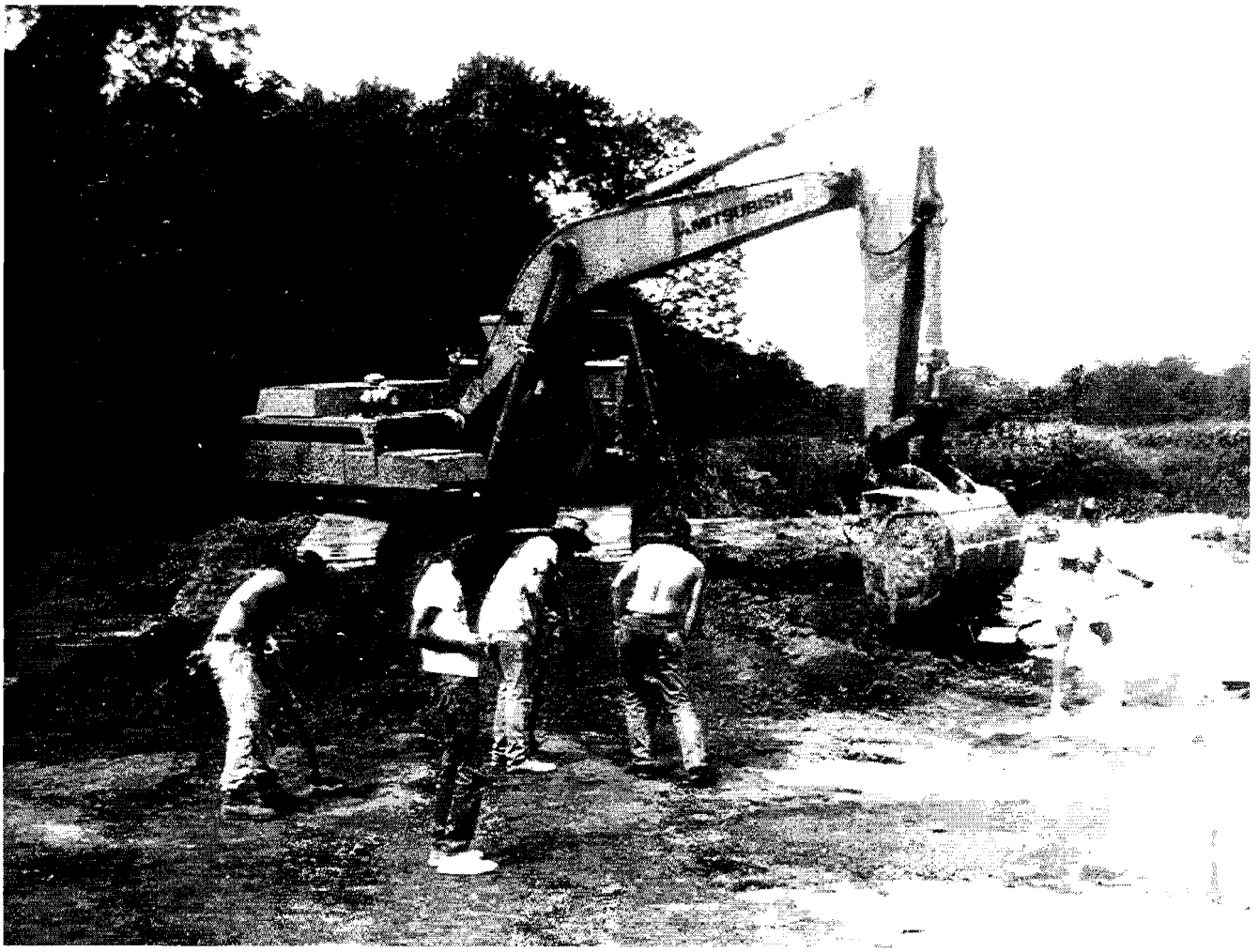
Once the enhanced 1 m x 1 m plow zone unit excavation sampling of Zones I through IV had been completed, specific areas within Zones III and IV were found to contain clusters of stone tools as well as areas of concentrated debitage. Since these previously unidentified clusters were considered to be significant archaeological data within the plow zone context, a series of block areas were excavated made up of contiguous 1 m x 1 m units (Figure 17). A total of 506 1 m square units were excavated. A summary of the excavated data is included in Table 2. With the conclusion of the 1 m x 1 m plow zone unit excavations, the portion of the site within the final right-of-way was prepared for mechanical stripping of the plow zone.

In addition to identifying activity areas, the plow zone sampling was intended to identify any buried landscapes at the site. A series of spoon-auger tests was also employed for this purpose. No buried landscapes were identified at the site.

The maximum overall area within the right-of-way to be stripped was estimated to be 300 ft. by 300 ft. A Caterpillar #225 treaded backhoe excavator fitted with a 72 in. toothless grading bucket and a standard ten-wheel dump body truck were used. The mechanical plow zone stripping was initiated along the N140 line at the north end of the site (Figure 18). Field personnel using flat shovels followed the excavator's progress (Plate 5) and a smooth clear surface of reddish-yellow subsoil was exposed.

PLATE 5

Stripping the Leipsic Site With a Backhoe

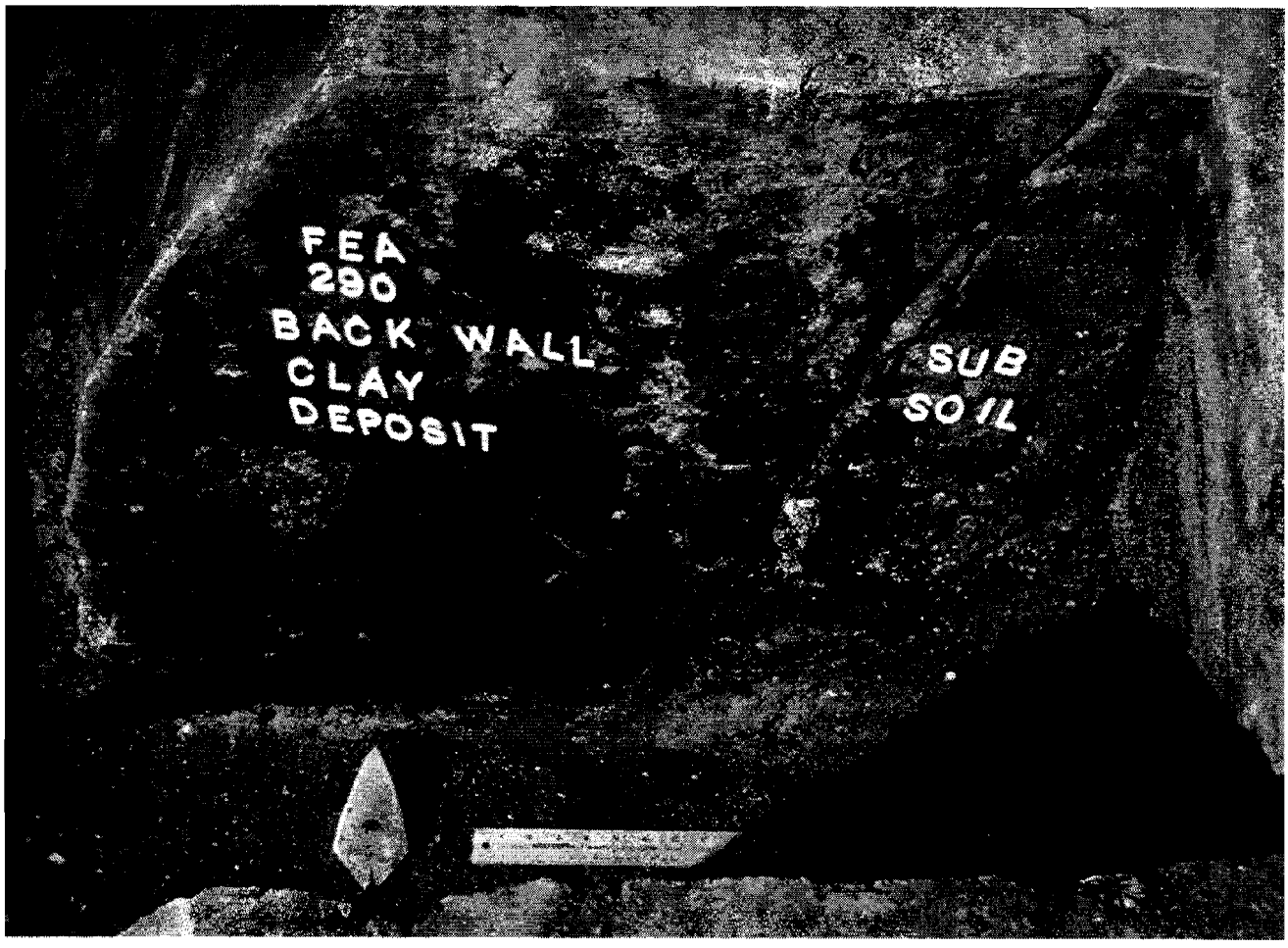


In this region of the site, an occasional moist oval soil stain was encountered at the surface of the subsoil, just below the plow zone, indicating that a prehistoric soil pit feature was present. Plate 6 shows the difference between feature soils and undisturbed subsoil in a profile view.

Excavation of these features revealed that very few diagnostic artifacts were present in this part of the site that could provide temporal or cultural context. Testing of the plow zone south of this area to approximately grid line N90 indicated that diagnostic artifacts were also rare in this part of the site. Therefore, in an attempt to conduct data recovery in the most efficient way, approximately one-third of the Leipsic Site, the area between the N90 and N140 grid lines, was left unstripped (Figure 18, Plate 2). This decision was based on the results of the previous sampling which indicated that the features in this area would be similar to those in stripped areas of the site and would not provide unique information or information pertinent to the temporal/cultural context. Therefore, data recovery efforts were concentrated on cultural features located south of the N90 grid line.

PLATE 6

Feature Soil Contrasted with Undisturbed Subsoil



Plow zone stripping south of N90 proceeded as previously described in order to expose features in the subsoil beneath the plow zone. The soil stains were outlined with a trowel, sequentially numbered, photographed, drawn in plan view, and covered with tightly stretched black polyethylene film to prevent exposure to the adverse effects of sunlight, oxygen and evaporation. The black polyethylene, cut into pieces about three times the size of the feature and held down with spikes, became laminated to the subsoil after the first rainfall. At a later date, when the black polyethylene was peeled off to expose features for hand excavation, the surface was moist, fresh, and largely free of bacteria. It should be noted that the best results were to have one piece of polyethylene per feature. Short of applying herbicides, the application of black polyethylene sheets was a resounding success.

Plates 7 and 8 show excavations of features at the Leipsic Site. All soil from each of the features was either dry screen sifted through 1/4-in. mesh or subjected to water-driven flotation. Lithic debitage measuring less than 1/4 in. was collected from the flotation heavy fraction, counted, and

PLATE 7

Overview of Feature Excavations

classified by raw material. All lithic items measuring greater than 1/4 in. were added to the lithic catalog from dry-screened feature soils and are included in those totals. Standard column soil samples for particle size, pollen, phytolith, and flotation analysis were taken. Geomorphological analysis including column samples, purposeful sampling of interesting soils, and detailed particle size analysis of the immediate site environment was also carried out in order to better understand the site's depositional context and local paleoenvironments. Coring of the surrounding freshwater wetlands and analysis of pollen from these cores were undertaken to study local paleoenvironments (Appendix I).

All artifacts were washed and marked following the procedures developed by the Delaware State Historic Preservation Office. All tools and a sample of debitage were processed for blood analysis to determine the raw materials processed with the tool edges. Low power edge wear analysis was undertaken for all tools. The edge wear analysis was conducted to help clarify the activities which took place at the site. Debitage was cataloged by raw material, presence/absence of cortex, size, and refits

PLATE 8

Excavating Preserved Bark from a Pithouse Feature

to cores and bifaces. Ceramic sherds were cataloged by standard cultural-historical types and analyzed for functional and technological variability. Latex molds of cordage impressions on ceramics were made to analyze perishable industries of the site's prehistoric inhabitants.

Analyses of spatial distributions of artifact categories and inferred activity areas, summaries of all specialized analyses, and a synthesis of the results and their implications for regional and local prehistoric adaptation are presented in this report.