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October 5, 1995

PHASE III ARCHEOLOGICAL DATA RECOVERY AT THE BEEHIVE SITE (18HO206), HOWARD COUNTY, MARYLAND

Volume II of III

DRAFT REPORT

R. Christopher Goodwin & Associates, Inc.
337 East Third Street
Frederick, Maryland 21701

PREPARED FOR:

Maryland Department of Transportation
State Highway Administration
Project Planning Division
707 North Calvert Street
Baltimore, Maryland 21203-0717

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PHASE III ARCHEOLOGICAL DATA RECOVERY AT THE BEEHIVE SITE (18HO206), HOWARD COUNTY, MARYLAND

Contract Number AW 890-233-070

DRAFT REPORT

Christopher R. Polglase, M.A., ABD
Principal Investigator

by

Jeffrey H. Maymon, M.A., ABD, Kathryn J. Saul, M.A.,
Thomas F. Majarov, B.A., and Kathleen M. Child, B.A., Thomas W. Davis, Ph.D.,
and Christopher R. Polglase, M.A., ABD
(with contributions by Frank Vento, Ph.D., Margaret Newman, Ph.D.
Linda Scott Cummings, Ph.D., and Michelle Williams, M.A.)

R. Christopher Goodwin & Associates, Inc.
337 East Third Street
Frederick, Maryland 21701

October 1995

for

Maryland Department of Transportation
State Highway Administration
Project Planning Division
707 North Calvert Street
Baltimore, Maryland 21203-0717

APPENDIX I

UPDATED MARYLAND ARCHEOLOGICAL INVENTORY FORM

MARYLAND ARCHEOLOGICAL SITE SURVEY: BASIC DATA FORM

Maryland Department of Natural Resources
Division of Archeology

Maryland Geological Survey
2300 St. Paul Street
Baltimore, Maryland 21218

Site Number 18 HO206 / UPDATE

(Shaded areas are for Division of Archeology use only)

A. Designation

1. County: Howard
2. Site Number: 18HO206
3. Site Name: Beehive
4. Site Type (check all applicable):
   - X Prehistoric
   - ____ Historic
   - ____ Unknown
5. Maryland Archeological Research Unit Number: 7

B. Location

6. USGS 7.5' Quadrangle(s): Relay (1974)
   (Photocopy section of quad(s) on page 4 and mark site location)
7. UTM Coordinates at Center of Site Zone:
8. Easting:
9. Northing:
10. Physiographic Province (check one):
    - ____ Allegheny Plateau
    - ____ Ridge and Valley
    - ____ Great Valley
    - ____ Blue Ridge
    - ____ Lancaster/Frederick Lowland
    - ____ Eastern Piedmont
    - X Western Shore Coastal Plain
    - ____ Eastern Shore Coastal Plain
11. Nearest Water Source: Unnamed tributary of Shallow Run
12. 2nd Nearest Water Source:
13. 3rd Nearest Water Source:
14. 4th Nearest Water Source:

BASIC DATA FORM

C. Environmental Data

15. Closest Surface Water Type (check all applicable):

____ Ocean	X Freshwater Stream/River
____ Estuarine Bay/ Tidal River	____ Freshwater Swamp
____ Tidal or Marsh	____ Lake or Pond
	____ Spring

16. Distance from closest surface water: 20 meters (or 65.7 feet)

17. SCS Typology:

18. Topographic Settings (check all applicable):

X Floodplain	____ Hilltop/Bluff
____ Interior Flat	____ Upland Flat
____ Terrace	____ Ridgetop
X Low Terrace	____ Rockshelter/Cave
____ High Terrace	____ Unknown
____ Hillslope	____ Other:

19. Slope:

20. Elevation: 24 meters (or 80 feet) above sea level

21. Land use at site when last field checked: November 1994 Da

(check all applicable)

____ Plowed/Tilled	____ Extractive
____ No-Till	____ Military
X Wooded/Forested	____ Recreational
____ Logging/Logged	____ Residential
X Underbrush/Overgrown	____ Ruin
____ Pasture	____ Standing Structure
____ Cemetery	____ Transportation
____ Commercial	____ Unknown
____ Educational	____ Other:

22. Condition of Site (check all applicable): November 1994 Da

____ UNDISTURBED	DESTROYED	____ UNKNOV
	____ minor (0-10%)	
DISTURBED	____ moderate (10-60%)	
X Plowed	____ major (60-99%)	
____ Eroded	____ total (100%)	
____ Graded/Contoured	X % unknown	
____ Collected		
____ Vandalized		
____ Dredged		
____ Other:		

23. Additional Comments on Environment:

D. Description

24. Site Type A (check all applicable):

PREHISTORIC
X Lithics
___ Ceramics
___ Shell Midden
___ Unknown
___ Other:

HISTORIC
___ Cemetery
Domestic:
___ urban
___ rural
___ Educational
Industrial:
___ urban
___ rural
___ Military
___ Religious
___ Water Transportation
___ Unknown
___ Other:

___ UNKNO

25. Site Type B (check one):

X Terrestrial ___ Underwater ___ B

26. Cultural Affiliation (check all applicable):

PREHISTORIC
X Unknown

___ Paleoindian
___ Archaic
___ Early Archaic
___ Middle Archaic
X Late Archaic
___ Woodland
___ Early Woodland
___ Middle Woodland
___ Late Woodland

___ CONTACT

HISTORIC
___ Unknown

17th century
___ 1630-1675
___ 1675-1720
18th century
___ 1720-1780
___ 1780-1820
19th century
___ 1820-1860
___ 1860-1900
20th century
___ 1900-1930
___ post 1930

___ UNKNO

27. State Plan Themes: ___

28. Site length: 213 meters (or 700 feet)

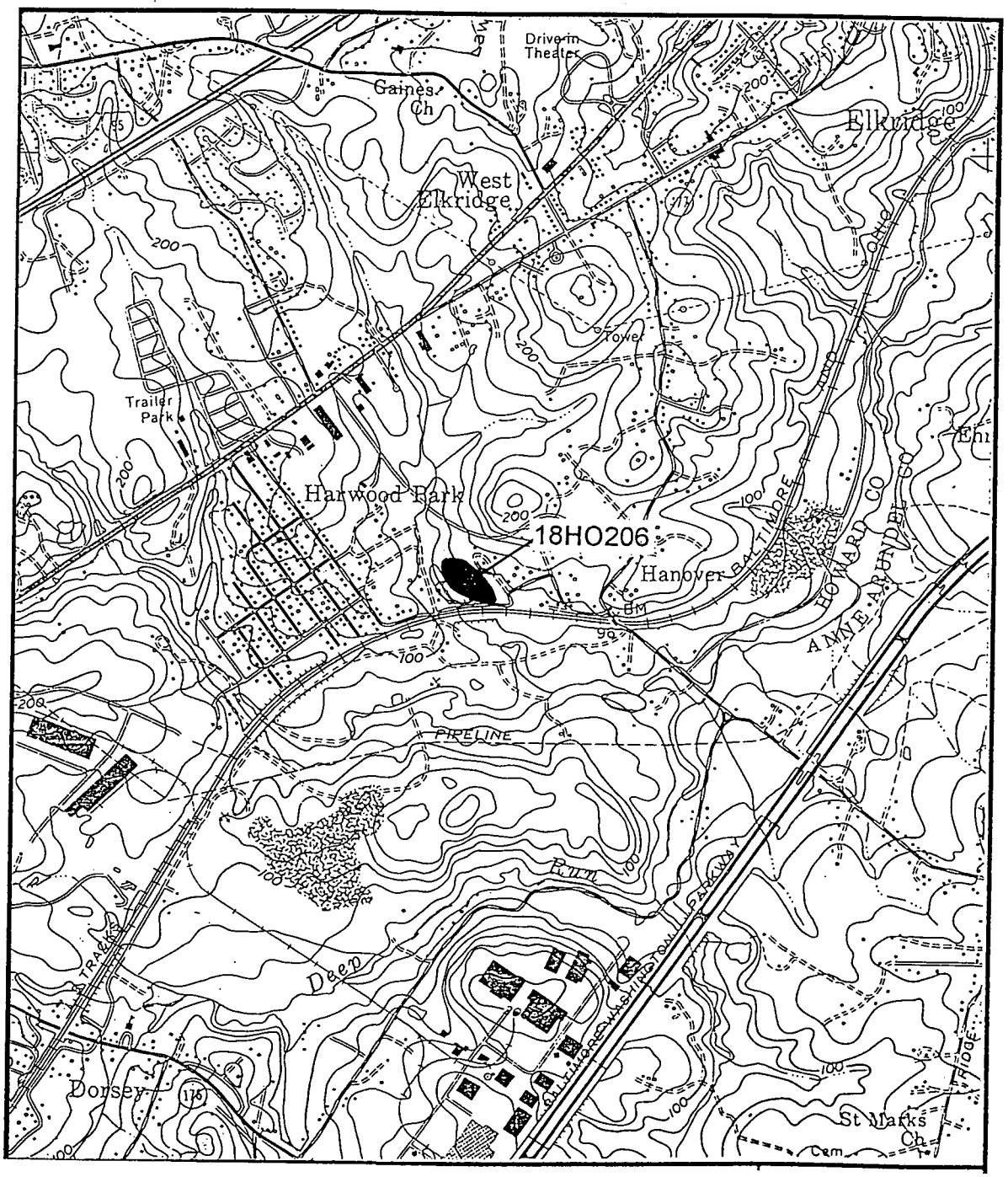
29. Site width: 91 meters (or 300 feet)

30. Is site confined to plowzone?
___ Yes
X No
___ Unknown

31. Does site have subsurface integrity?
X Yes
___ No
___ Unknown

BASIC DATA FORM

Photocopy section of quadrangle map(s) and mark site location with heavy dot or circle and arrow.



E. Support Data (Use additional sheets if needed)

32. Accompanying Data Form(s):

x Prehistoric
____ Historic
____ Submerged
____ Shipwreck

33. Ownership:

____ Private
x Public
____ Unknown

34. Owner: State of Maryland
Address: Department of Transportation
Phone: Date: June 1993

35. Tenant:
Address:
Phone: Date:

36. Known Investigations: Barse (1992) Phase IB Survey for MD100 Wetland Mitigation
Goodwin & Associates, Inc. (1993)
Goodwin & Associates, Inc. (1994)

37. Reports (Author & year): Barse (1992)
Polglase et al (1994)
Maymon et. al., 1995

38. Other Records?

x Yes
____ No
____ Unknown

39. If YES, type and location: Field records, Photographs, Maps to be permanetly curated with the Maryland Historical Trust

40. Collections?

x Yes
____ No
____ Unknown

41. If YES, give owner and location: To be permanently curated by Maryland Historical Trust

42. Artifact Conservation?

____ Yes
____ Partial
____ No
x Unknown

43. Maryland Register Status:

_____ Listed on register
_____ Nomination pending
_____ Determined eligible (formal)
_____ Considered eligible (consensus)
_____ Not eligible
_____ Insufficient data

44. National Register Status:

_____ Listed on register
_____ Nomination pending
_____ Determined eligible (formal)
_____ Considered eligible (consensus)
_____ Not eligible
_____ Insufficient data

45. Informant: _____
Address: _____
Phone: _____ Date: _____

46. Site visited by: Mr. Jeffrey H. Maymon; R. Christopher Goodwin & Associates, Inc.
Address: 337 East Third Street, Frederick, Maryland 21701
Phone: 301-694-0428 Date: November 5, 19

47. Form filled out by: Kathryn J. Saul; R. Christopher Goodwin & Associates, Inc.
Address: 337 East Third Street, Frederick, Maryland 21701
Phone: 301-694-0428 Date: October, 1995

48. Additional Comments:

F. For Division of Archeology Use Only

49. Form transcribed by: _____ 50. Date: _____
51. Form checked by: _____
52. Entered on computer by: _____ 53. Date: _____
54. Form updated by: _____ 55. Date: _____

MARYLAND ARCHEOLOGICAL SITE SURVEY: PREHISTORIC DATA FORM

Site Number 18 HO206

(Shaded areas are for Division of Archeology use only)

1. Site type (check all applicable):

____	village	____	earthen mound
____	hamlet	____	shell midden
____	base camp	____	fish weir
X	short-term resource procurement	____	submerged prehistoric
X	lithic quarry/extraction	____	lithic scatter
____	rockshelter/cave	____	unknown
____	cairn	____	other:

2. Categories of aboriginal material or remains present at site (check all applicable):

X	flaked stone	____	human skeletal remains
X	ground stone	____	faunal implements/ornaments
____	stone bowls	____	faunal material
X	fire-cracked rock	____	oyster shell
X	other lithics	____	floral material
____	ceramics (vessels)	____	unknown
____	other fired clay	____	other:

3. Lithic materials (check all applicable):

X	jasper	____	steatite
____	chert	X	sandstone
X	rhyolite	____	silicified sandstone
X	quartz	____	ferruginous quartzite
X	quartzite	____	European flint
____	chalcedony	____	basalt
____	ironstone	____	unknown
____	argillite	____	other:

4. Diagnostics (choose from manual and give number recovered or observed):

(1) Quartz Savannah River
(3) Piscataway
(3) Bare Island

5. Features present:

X yes
____ no
____ unknown

6. Types of features identified (check all applicable):

____	midden		
____	postmolds	X	refuse/storage pits
____	house patterns	____	burials
____	palisade	____	ossuaries
____	hearths	____	unknown
X	chipping clusters	____	other:

7. Method of sampling (check all applicable):

____ non-systematic surface search
____ systematic surface collection
____ non-systematic shovel test pits
____ systematic shovel test pits
X excavation units
X mechanical excavation
____ other: ____

extent/nature of excavation: Excavated 38 1m x 1m units. Surface collectionof 20 x 40m area at base of plowzone, and the excavation of 48m^2 block areas. Plowzone deposits removed as a unit and screened. Sub plowzone deposits excavated in 10cm or 5cm levels within natural strata. Units excavated to a minimum of 60cm or 30cm into sterile soil. Cultural strat below 150cm were examined *see below

8. Flotation samples collected:

X yes
____ no
____ unknown

analyzed:

X yes, by R. Christopher Goodwin & Associates, Inc.
____ no
____ unknown

9. Samples for radiocarbon dating collected:

X yes
____ no
____ unknown

Dates and Lab Reference Nos. Beta 63684

10. Soil samples collected:

X yes
____ no
____ unknown

analyzed:

X yes, by R. Christopher Goodwin & Associates, Inc.
____ no
____ unknown

11. Other analyses (specify): Blood residue analysis by Dr. Margaret Newman
Pollen and Phytolith analysis by Dr. Linda Scott Cummings.

12. Additional comments:

through the excavation of 50cm shovel tests in the bottoms of units.

13. Form filled out by: Kathryn J. Saul
Address/Affiliation: R. Christopher Goodwin & Associates, Inc.
Date: October 5, 1995

For Division of Archeology Use Only

14. Form transcribed by: ____ 15. Date: ____
16. Form checked by: ____
17. Entered on computer by: ____ 18. Date: ____
19. Form updated by: ____ 20. Date: ____

APPENDIX II

POLLEN AND PHYTOLITH ANALYSIS

POLLEN AND PHYTOLITH ANALYSIS, PHASE III ARCHEOLOGICAL DATA RECOVERY AT THE BEEHIVE SITE (18HO206), HOWARD COUNTY, MARYLAND

By

Linda Scott Cummings
Paleo Research Laboratories
Denver, Colorado

Paleo Research Labs Technical Report 95-25

Prepared For

R. Christopher Goodwin & Assoc., Inc.
Frederick, Maryland

March 1995

INTRODUCTION

Three soil samples from the A and B horizons at the Beehive Site (18HO206) were examined for pollen and phytoliths. The site lies on the inner coastal plain at the base of a heavily eroded escarpment marking the edge of the Piedmont (Jeffrey Maymon, personal communication, March 2, 1995). Soil samples were examined to assess pollen and phytolith preservation and the potential for more in depth investigation in the future.

METHODS

A chemical extraction technique based on flotation is the standard preparation technique used in this laboratory for the removal of the pollen from the large volume of sand, silt, and clay with which they are mixed. This particular process was developed for extraction of pollen from soils where preservation has been less than ideal and pollen density is low.

Hydrochloric acid (10%) was used to remove calcium carbonates present in the soil, after which the samples were screened through 150 micron mesh. The samples were rinsed until neutral by adding water, letting the samples stand for 3 hours, then pouring off the supernatant. A small quantity of sodium hexametaphosphate was added to each sample once it reached neutrality, then the beaker was again filled with water and allowed to stand for 3 hours. The samples were again rinsed until neutral, filling the beakers only with water. This step was added to remove clay prior to heavy liquid separation. Zinc bromide (density 2.1) was used for the flotation process. The samples were mixed with zinc bromide while still moist, immediately after centrifugation to remove the dilute hydrochloric acid and water. All samples received a short (10 minute) treatment in hot hydrofluoric acid to remove any remaining inorganic particles. The samples were then acetolated for 3 minutes to remove any extraneous organic matter.

A light microscope was used to count the pollen to a total of 100 pollen grains at a magnification of 500x. Pollen preservation in these samples varied from good to poor. Comparative reference material collected at the Intermountain Herbarium at Utah State University and the University of Colorado Herbarium was used to identify the pollen to the family, genus, and species level, where possible.

Pollen aggregates were recorded during identification of the pollen. Aggregates are clumps of a single type of pollen and may be interpreted to represent pollen dispersal over short distances, or the actual introduction of portions of the plant represented into an archaeological setting. Aggregates were included in the pollen counts as single grains, as is customary. The presence of aggregates is noted by an "A" next to the pollen frequency on the pollen diagram. In samples where an insufficient quantity of pollen was observed for analysis, pollen noted is represented on the pollen diagram by pluses (+).

Indeterminate pollen includes pollen grains that are folded, mutilated, and otherwise distorted beyond recognition. These grains are included in the total pollen count, as they are part of the pollen record.

DISCUSSION

The Beehive Site (18HO206) is situated at the edge of the Piedmont at the base of a heavily eroded escarpment. A small unnamed tributary of Shallow Run flows at the west edge of the site and is responsible for the alluvial deposition at the site. Pollen and phytolith samples were examined from an Ab horizon that was originally thought to be approximately late Archaic in age. Additional excavation produced evidence that this Ab horizon was historic, since it was associated with a large hearth that appears to represent the nineteenth century charcoaling industry. In addition, pollen and phytolith samples were examined from a Bwb horizon beneath the Ab horizon. The Ab horizon was overlain by a deposit of 60-90cm of sediments, which effectively sealed it from major twentieth century disturbances such as plowing (Jeffrey Maymon, personal communication, March 2, 1995).

Pollen and phytolith sample 1 was removed from Layer IV, a brown sandy clay mottled layer designated the Ab horizon. The pollen record indicates the presence of a mixed conifer and hardwood forest. Quercus (oak) was the dominant pollen type. Other trees represented include Acer (maple), Alnus (alder), Castanea (chestnut), Corylus (hazel), Ilex (holly), Pinus (pine), and Tsuga (hemlock). The presence of Castanea pollen is appropriate for a nineteenth century deposit, since the chestnut blight that destroyed most of the nation's chestnut trees occurred early in the twentieth century.

The shrubby and herbaceous portions of the local vegetation communities are represented by a variety of pollen types. Artemisia and Tubuliflorae-type Asteraceae pollen represent members of the sunflower family. Tubuliflorae pollen may be either High-spine or Low-spine Asteraceae, but are too deteriorated to make the distinction. Cheno-am pollen probably represents the local growth of weedy annuals. Cyperaceae (sedges) are often associated with relatively moist habitats and may represent growth of members of this family along the unnamed tributary. Ericaceae pollen represents a family that includes numerous shrubby plants, often with evergreen leaves. Onagraceae pollen represents the primrose family, which often grows in disturbed areas. Thalictrum-type pollen represents a plant common to meadows and wet areas. Typha latifolia-type pollen represents cattails probably associated with the local drainage. Recovery of starch granules with hila represents the deterioration of grass seeds, which are represented in the pollen record by Poaceae pollen. Spores are relatively abundant when compared to the quantity of pollen recovered. Both monolete and trilete spores were recovered, but are not identified to a specific genus or species of fern. The pollen record from the Ab horizon is consistent with the presence of a grassland or meadow at the site and a mixed conifer and hardwood forest in the area.

Phytolith frequencies were calculated by totaling phytoliths that are produced by grasses and using this total as the sum against which to compare other phytolith and non-phytolith forms. For instance, the quantity of elongate ridged forms presumed to represent conifers are compared against the total quantity of grass phytoliths, rather than being included in the total sum. Likewise, the total quantity of diatoms is calculated against the total quantity of grass phytoliths.

The phytolith record from this same sample shows a dominance of panicoid phytoliths, representing tall grasses that prefer humid conditions. Much smaller quantities of festucoid and chloridoid forms were noted and appear to represent the presence of grasses that grow during cool portions of the year and grasses that are adapted to dry conditions. The buliform and pillow phytoliths recovered are usually interpreted to represent the presence of adequate or ample moisture, since they represent forms in the plant that usually silicify only under conditions of adequate to abundant moisture. Trichomes represent silicified hairs on the exterior of grasses and possibly other plants. Elongate smooth and elongate spiny forms are produced primarily by grasses. A moderately large quantity of ridged elongates typical of those produced by conifers was noted in this sample, suggesting either that conifers grew in this area or that sediment was transported from the mixed conifer and hardwood forest by the unnamed tributary and deposited in this area. A few dicot triangles probably represent the silicified remains of a dicotyledenous plant. The form is unidentified at this time. Recovery of tracheids suggests the presence of woody shrubs or trees. Long diatom fragments recovered from this sample are consistent with the presence of soil moisture, as are sponge spicules. Sponge spicules also may be present through alluvial transport of these sediments by the tributary.

Pollen and phytolith samples 2 and 3 represent Layer Va, a dark yellowish brown clayey sand that was identified as part of the Bwb horizon. Pollen samples examined from the Bwb horizon did not yield sufficient pollen for analysis. They did, however, yield evidence of the presence of at least some of the pollen types observed in the Ab horizon. Hollow starch granules, which are presumed to be produced by grass seeds, were noted in sample 2 from the upper portion of the Bwb horizon, but not from the Ab horizon or the lower portion of the Bwb horizon.

The phytolith record from the Bwb horizon is different from that of the Ab horizon. Panicoid phytoliths were more abundant in this horizon than in the Ab horizon, and both buliform and pillow-shaped phytoliths were less abundant. The reduced abundance of buliform and pillow-shaped phytoliths suggests a decrease in soil moisture during the Bwb horizon compared with the Ab horizon. The quantity of elongate ridged phytoliths typical of those produced by conifers may reflect an expansion of the meadow or grassy area and a retreat of the mixed conifer hardwood forest. Alternatively, it may be the result of a change in deposition of alluvial sediments by the unnamed tributary. Diatoms were less abundant in the Bwb horizon than in the Ab horizon. It should be noted, however, that the diatoms recovered always were fragmentary. It is possible that sediment movement destroyed diatoms present in the Bwb horizon. A slightly larger quantity of sponge spicules was noted in the Bwb horizon compared with total phytoliths produced by grasses. Sponge spicules represent minute organisms that live in water. They are transported both with alluvium and aeolian deposits.

SUMMARY AND CONCLUSIONS

Pollen was recovered from the Ab horizon, which appears to represent a nineteenth century deposition. Pollen preservation was adequate in this sample to identify a large variety of pollen taxa. Deterioration of the pollen was noted, indicating that the pollen recovered do not represent modern pollen

contamination. Pollen recovered from older sediments exhibited a greater degree of degradation and was present in very small quantities. It is likely that any further pollen analysis in this area would not yield pollen from the Bwb horizon. The yellow color of sediments examined is consistent with oxidation, which is known to destroy pollen. This examination of the pollen record indicates that it is unlikely that pollen from the Archaic period is preserved in these deposits.

The phytolith recovery was excellent from all three samples. There was little degradation of individual phytoliths within the record, although phytoliths were slightly less abundant in samples 3 than they were in samples 2 or 1. The phytolith record appears to have preserved well in these sediments, and may contribute to an understanding of local vegetation and paleoenvironmental conditions. The mixed conifer and hardwood forest represented in the pollen record is represented to a degree by the presence of elongated ridged phytoliths commonly produced by conifers.

TABLE 1
PROVENIENCE DATA FOR SAMPLES FROM SITE 18HO206

Sample No.	Block	Depth (cmbs)	Provenience	Analysis	Pollen Counted
1	B	84-86	Ab horizon	Pollen Phyto	100 210
2	B	98-100	Bwb horizon	Pollen Phyto	Insuff. 224
3	B	120-122	Near bottom of Bwb horizon	Pollen Phyto	Insuff. 209

TABLE 2
POLLEN TYPES OBSERVED IN SAMPLES FROM SITE 18HO206

Scientific Name	Common Name
ARBOREAL POLLEN:	
Acer	Maple
Alnus	Alder
Castanea	Chestnut
Corylus	Hazel
Ilex	Holly
Pinus	Pine
Quercus	Oak
Tsuga	Hemlock
NON-ARBOREAL POLLEN:	
Asteraceae:	Sunflower family
Artemisia	Wormwood
Tubuliflorae	Includes eroded Low- and High-spine
Cheno-ams	Includes amaranth and pigweed family
Cyperaceae	Sedge family
Ericaceae	Heath family
Onagraceae	Evening primrose family
Poaceae	Grass family
Thalictrum-type	Meadow rue
Typha latifolia	Cattail
STARCHES:	
Hollow Starches	
Starches with Hilum	
SPORES:	
Monolete	
Trilete smooth	
Trilete spiny	

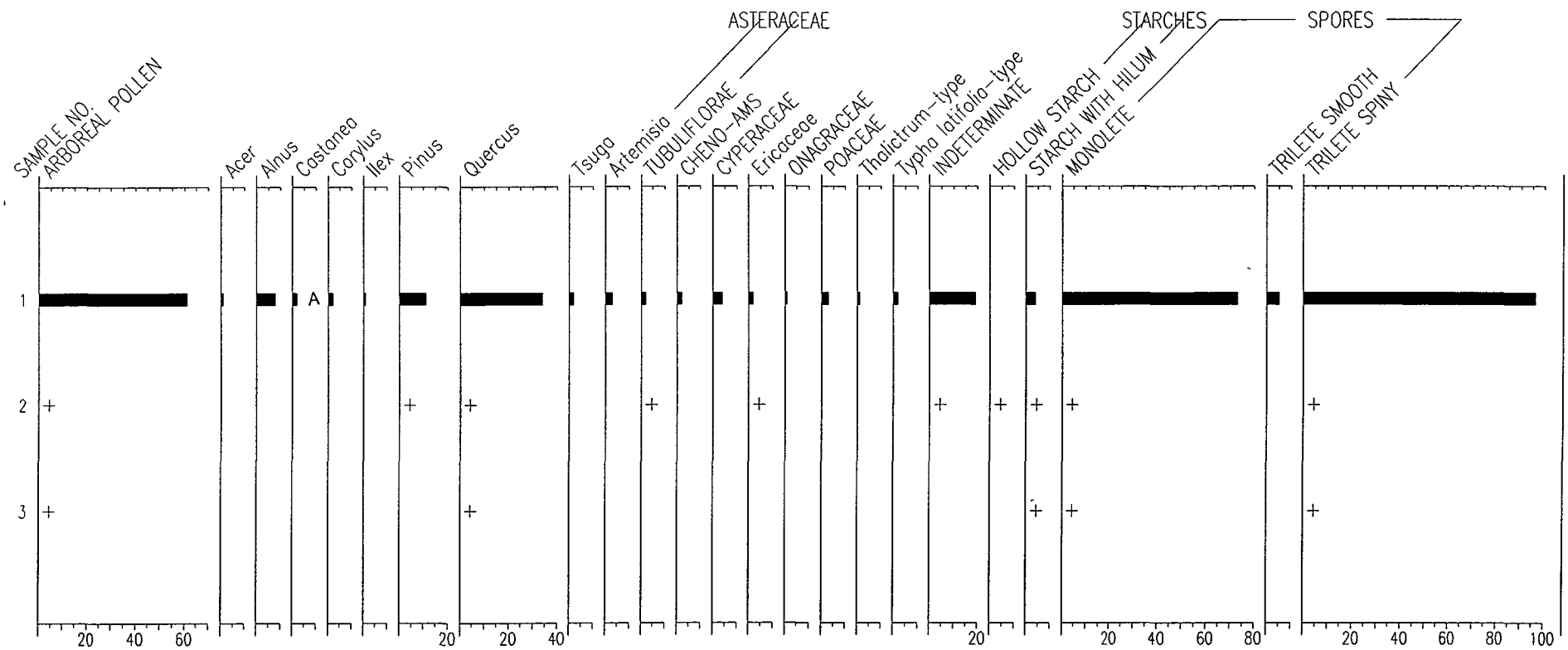


FIGURE 1. POLLEN DIAGRAM FOR SAMPLES FROM SITE 18HO06.

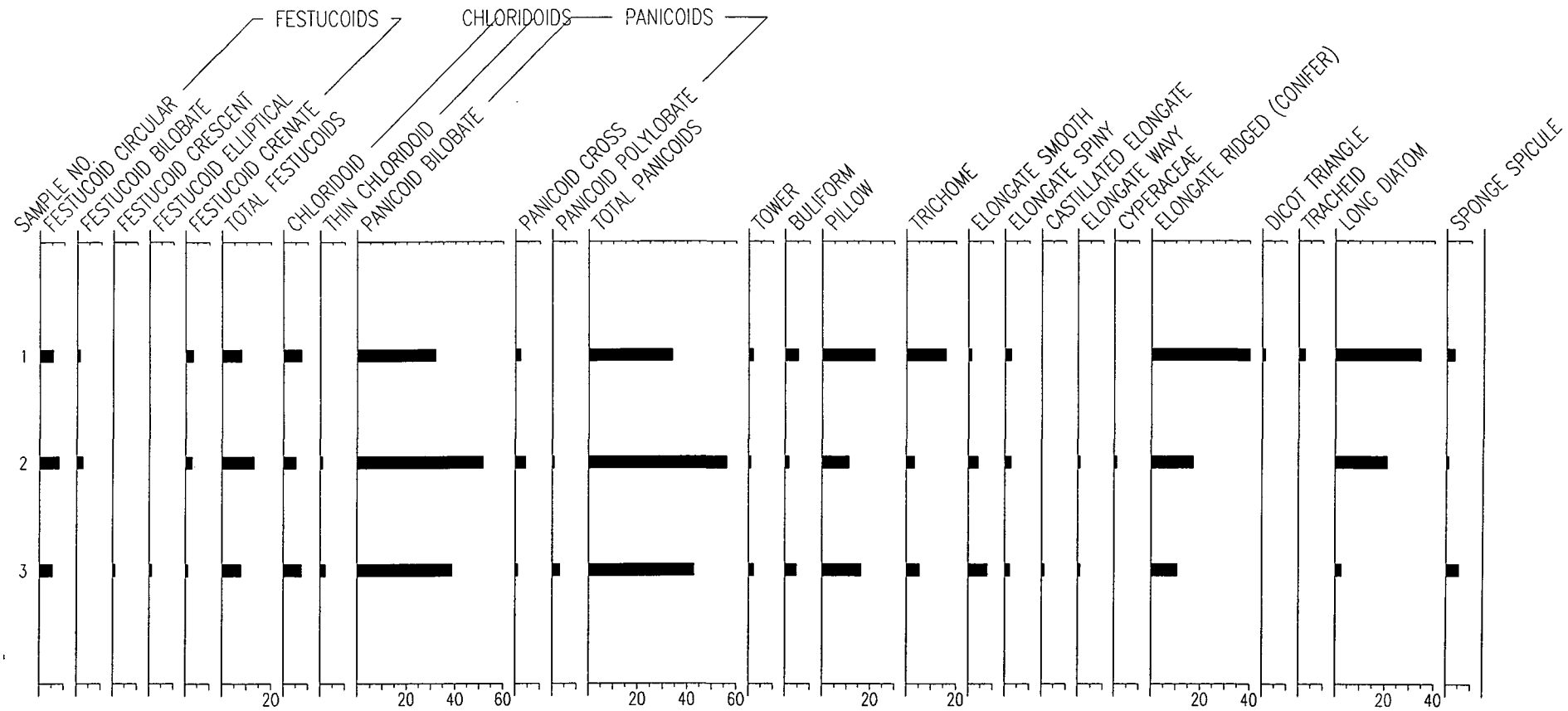


FIGURE 2. PHYTOLITH DIAGRAM FOR SAMPLES FROM SITE 18HO206.

APPENDIX III

RESIDUE ANALYSIS

RESIDUE ANALYSIS

In recent years there has been an increased use of molecular, biomolecular and biochemical techniques in the analysis of archaeological materials. Immunological methods have been used to identify plant and animal residues on flaked and groundstone lithic artifacts (Downs 1985; Hyland *et al.* 1990; Kooyman *et al.* 1992; Newman 1990; Newman and Julig 1989; Yohe *et al.* 1991). Plant and animal residues on ceramic artifacts have been identified by their amino acid sequences (Broderick 1979) and by analysis of lipid and fatty acids (Fredericksen 1988; Heron *et al.* 1991; Hill *et al.* 1985) while serological methods have been used to determine blood groups in skeletal and soft tissue remains (Heglar 1972; Lee *et al.* 1989) and in the detection of hemoglobin from 4500-year-old bones (Ascenzi *et al.* 1985). Human leukocyte antigen (HLA) and deoxyribonucleic acid (DNA) determinations made on human and animal skeletal and soft tissue remains have demonstrated genetic relationships and molecular evolutionary distances (Hansen and Gurtler 1983; Lowenstein 1986; Pääbo 1985, 1986, 1989; Pääbo *et al.* 1989). It has become evident that data obtained from these analyses can contribute valuable information to archaeologists - information that cannot be obtained by other means.

Several immunological methods have been utilized in the analysis of archaeological materials including Ouchterlony (Downs 1985), cross-over immunoelectrophoresis (CIEP) (Barr 1989; Newman 1990), radioimmunoassay (Lowenstein 1985, 1986) and enzyme immunoassay (Hyland and Anderson 1990, Hyland *et al.* 1990). These methods differ only in degrees of sensitivity with Ouchterlony being the least and RIA as the most sensitive. However the use of RIA is limited to a facility and person(s) licensed for nuclear medicine. Immunological techniques were first used in medico-legal work in the early 1900s and despite some dissenters at that time (Gaensslen 1983:223) have continued to play an integral role in forensic medicine. Although the application of these techniques to archaeological materials has been questioned, literature reviews of forensic studies (Arquembourg 1975; Haber 1964; Gaensslen 1983; Lee and DeForest 1976; Macey 1979; Sensabaugh *et al.* 1971, among others), demonstrate that a positive precipitin test can be obtained from old and denatured bloodstains (Gaensslen 1983:225). While these studies generally deal

with relatively recent stains, at least in comparison to the age of most archaeological materials, it has been shown that various efforts to remove bloodstains from clothing or other materials, using solutions such as bleach, harsh detergents or boiling, are generally unsuccessful (Gaensslen 1983:225; Lee and DeForest 1976). Species identification has also been made on tissues recovered from a sewer (Milgrom and Campbell 1970) and on body tissues (Bjorklund 1952; Milgrom *et al.* 1964). Chemicals present in soils such as tannic acid, aluminum chromate or organic solvents may result in non-specific precipitation of antiserum (i.e., false positive). However, routine testing of site soils will indicate the presence of substances that may interfere with, or give false positive results, in the analysis of artifacts. One of the pioneers in the field of forensic medicine was George Nuttall. During the course of his studies he carried out the most extensive testing of antisera in order to determine the relatedness of animals (Nuttall 1901a, 1901b, 1904). In this work more than 16,000 precipitin tests were carried out on over 500 animal species, which included mammals, birds, reptiles, and fish. When one considers that these experiments were carried out nearly 90 years ago it is a truly remarkable piece of work and, moreover, has been substantiated to a great extent by recent work in molecular evolution. It is interesting to note that many of the problems and sources of error experienced by Nuttall and other researchers are still applicable today. Such problems as the strength and reliability of antisera, the pH of the medium, bacterial contamination, the difficulty of re-solubilizing dried blood, and the fact that blood heated over 100^{0}C will not give a positive reaction often occur today as they did in the past (Nuttall 1904). However, he also noted : "The fact that dried bloods give reactions after the lapse of a considerable time, months, or even years has been fully established by Uhlenhuth and confirmed by others" (Nuttall 1904:120).

Materials and Methods

The method of analysis used in this laboratory is cross-over electrophoresis (CIEP). Minor adaptations to the original method were made following procedures used by the Royal Canadian Mounted Police Serology Laboratory, Ottawa (1983) and the Centre of Forensic Sciences (Toronto). Although this test is not as sensitive as RIA, it has a long history of use in forensic laboratories, does not require expensive equipment, is reasonably rapid and lends itself to the processing of multiple samples (Culliford 1964). In

this test the antigen and antibody are driven together by an electrophoretic force instead of simple diffusion as in the Ouchterlony test. The test is performed in agarose gels with a pH of 8.5, by this the antigen is positively charged and the antibody is negatively charged. Paired wells, roughly 1.5 mm. in diameter are punched in the agarose gel approximately 5 mm. apart. The antigen (unknown extract) is placed in the cathodic well of the pair and the antiserum in the anodic one. The gel is placed in an electrophoresis tank containing a barbital buffer, pH 8.6, and triple thicknesses of filter paper are used as wicks to connect the ends of the slides with the buffer. The application of an electrical current, set at a constant 100v, moves the two reactants towards each other. If the unknown sample contains protein corresponding to the species antiserum against which it is being tested, an extended lattice forms as a result of cross-linking, and a precipitate forms where they reach equivalence concentrations. Weak positive reactions, common in archaeological samples, are more readily observed if the gel is dried and stained with a protein stain, such as Coomassie Blue. Appropriate positive and negative controls, prepared in 5% ammonia solution, are run with each gel. These are: positive - blood of species being tested for e.g., deer blood for deer antiserum and negative - blood of species in which antiserum is raised e.g., rabbit if raised in that animal. Duplicate testing is carried out on all positive results.

The specific substances tested for in CIEP are immunoglobulins, or antibodies, a group of glycoproteins present in the serum and tissue fluids of all mammals (Roitt *et al.* 1985). There are five known immunoglobulin groups in normal human serum, IgG (70-75%), IgM (10%), IgA (15-20%), IgD (<1%) and IgE (in trace amounts). IgA is the predominant immunoglobulin in serosecretions such as saliva, tracheobronchial secretions, colostrum, milk, and genito-urinary secretions (Roitt *et al.* 1985). These are present in varying amounts in all vertebrates, but are absent in invertebrates (Roitt *et al.* 1985).

Fifteen lithic artifacts recovered from the Beehive Site (18HO206), Maryland, were submitted for potential identification of animal and plant residues by immunological analysis. One soil sample was also sent as a control for analysis.

Possible residues were removed from the artifacts using a 5% ammonium hydroxide solution. This has been shown to be the most effective extractant for old and denatured bloodstains and does not interfere with subsequent testing (Dorrill and Whitehead 1979; Kind and Cleevely 1969). Artifacts were placed in

shallow plastic dishes and 0.5mL of the 5% ammonia solution applied directly to each. Initial disaggregation was carried out by floating the dish and contents in an ultrasonic cleaning bath for two to three minutes. Extraction was continued by placing the boat and contents on a rotating mixer for thirty minutes. The resulting ammonia solutions were removed with a pipette, placed in individual numbered plastic vials and refrigerated prior to further testing. One milliliter (1mL) of Tris buffer (pH 8.0) was added to 1g of the control soil sample, mixed well and allowed to extract for 24 hours on a shaking mixer at $4^{0}C$. The resulting supernatant fluid was removed and tested together with samples obtained from lithics. Initial testing of all samples was carried out against pre-immune serum (i.e., serum from a non-immunized animal). A positive result against pre-immune serum could arise from non-specific protein interaction not based on the immunological specificity of the antibody (i.e., nonspecific precipitation). No positive results were obtained and testing of artifact samples was continued against the antisera shown in Table 1.

Antisera obtained from commercial sources are developed specifically for use in forensic medicine and, when necessary, these sera are solid phase absorbed to eliminate species cross-reactivity. However, these antisera recognize epitopes shared by closely related species and will often identify other species within the individual family. The relationship of animal antisera used to potential prey species identified is shown in Table 2. The elk antiserum, raised against serum from modern elk (*Cervus canadensis*), is species-specific. The plant antisera were raised against extracts from modern species and provide family level identity only.

Results

The results of CIEP analysis are shown in Table 3 and discussed below. One artifact, a quartz flake tool (FS# 2237), tested positive to deer antiserum. As shown in Table 2, any member of the Cervidae family may be represented by this result. However, as negative reaction to elk antiserum was obtained this species can be eliminated as a possibility. Cross-reactions with other families do not occur with this antiserum.

A positive reaction to rabbit antiserum was obtained on one artifact, a quartz flake tool (FS# 2137). As shown in Table 2 other members of the Order Lagomorpha could be represented by these results, but cross-reactions with other families do not occur with this antiserum.

TABLE 1: ANTISERA USED IN ANALYSIS

ANTISERA	SOURCE
anti-bear	Organon Teknika
anti-bovine	"
anti-cat	"
anti-chicken	"
anti-deer	"
anti-dog	"
anti-guinea-pig	"
anti-mouse	"
anti-rabbit	"
anti-sheep	"
anti-acorn	University of Calgary
anti-beans	"
anti-corn	"
anti-fern	"
anti-squash	"

TABLE 2: RELATIONSHIP OF ANIMALS TO ANTISERA USED IN ANALYSIS

ANTISERA	MOST PROBABLE SPECIES
Bear	Grizzly, brown, black.
Bovine	Bison, cow.
Cat	Bobcat, lynx, mountain lion, cat.
Chicken	Chicken, turkey, quail, grouse, pheasant.
Deer	Deer (all species), elk, moose, caribou, pronghorn.
Dog	Coyote, wolf, fox, dog.
Mouse	Mouse (all species), rat (all species)
Rabbit	Rabbit, hare, pika.
Sheep	Sheep, goat.

TABLE 3: RESULTS OF CIEP ANALYSIS

Artifact #	Artifact type	Result
FS# 788	Biface fragment	Negative
FS# 789	Biface fragment	Negative
FS# 1243	Biface	Negative
FS# 792	Flake tool	Negative
FS# 1139	Flake tool	Negative
FS# 2280	Projectile point	Negative
FS# 1510a	Flake tool	Negative
FS# 2237	Flake tool	Deer
FS# 2137	Flake tool	Rabbit
FS# 1135	Flake tool	Negative
FS# 1494	Flake tool	Negative
FS# 315	Flake tool	Negative
FS# 323	Groundstone tool	Negative
FS# 1553	Biface fragment	Negative
FS# 1559	Biface	Negative

No other positive results were obtained in this analysis. The absence of identifiable proteins on artifacts may be due to poor preservation of protein or that they were used on species other than those encompassed by the antisera. It is also possible that the artifacts were not utilized.

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APPENDIX IV

GEOMORPHOLOGICAL INVESTIGATIONS

FINAL DRAFT

1.0 INTRODUCTION

1.1 General

This study involved a geological/geomorphological examination of prehistoric archaeological site 18HO206, eastern Howard County, Maryland. Geoarchaeological investigations at the site were conducted in concert with the recently completed Phase III investigations conducted R. Christopher Goodwin and Associates, Inc., for the Maryland State Highway Administration.

1.2 Location and Description of Project Area

Site 18HO206 is ca. 4.5 acres in extent and lies along the terraced valley bottom of an unnamed first-order tributary of Shallow Run. The site is bound to the south by the active channel of this internal link, to the north and east by the sloping valley side walls and small alluvial fans and to the south by the raised berm of Loudon Avenue. From the site area, the unnamed tributary flows some 480 m (1575 ft) southeast to its confluence with Shallow Run (Figure 1).

The site proper is situated in the Embayed Section (Western Shore subdivision) of the Atlantic Coastal Plain physiographic province and lies immediately to the east of the Fall Line. Elevations in the project area range from ca. 27 m (90 ft) along the low bottom of the unnamed tributary to over 60 m (200 ft) on a high knoll situated just east of the site.

The principal landforms that occur within the general region include: knolls/high hills, gentle to more steeply sloping valley-side- walls, small, gently sloping alluvial fans, stream terraces and low flood plain zones.

Sediment supply to the valley bottom along the principal drainage lines in the region are primarily from small, internal drainage links or rills, unconfined surface runoff and colluvium (slopewash and creep processes) supplied from the adjacent valley slopes.

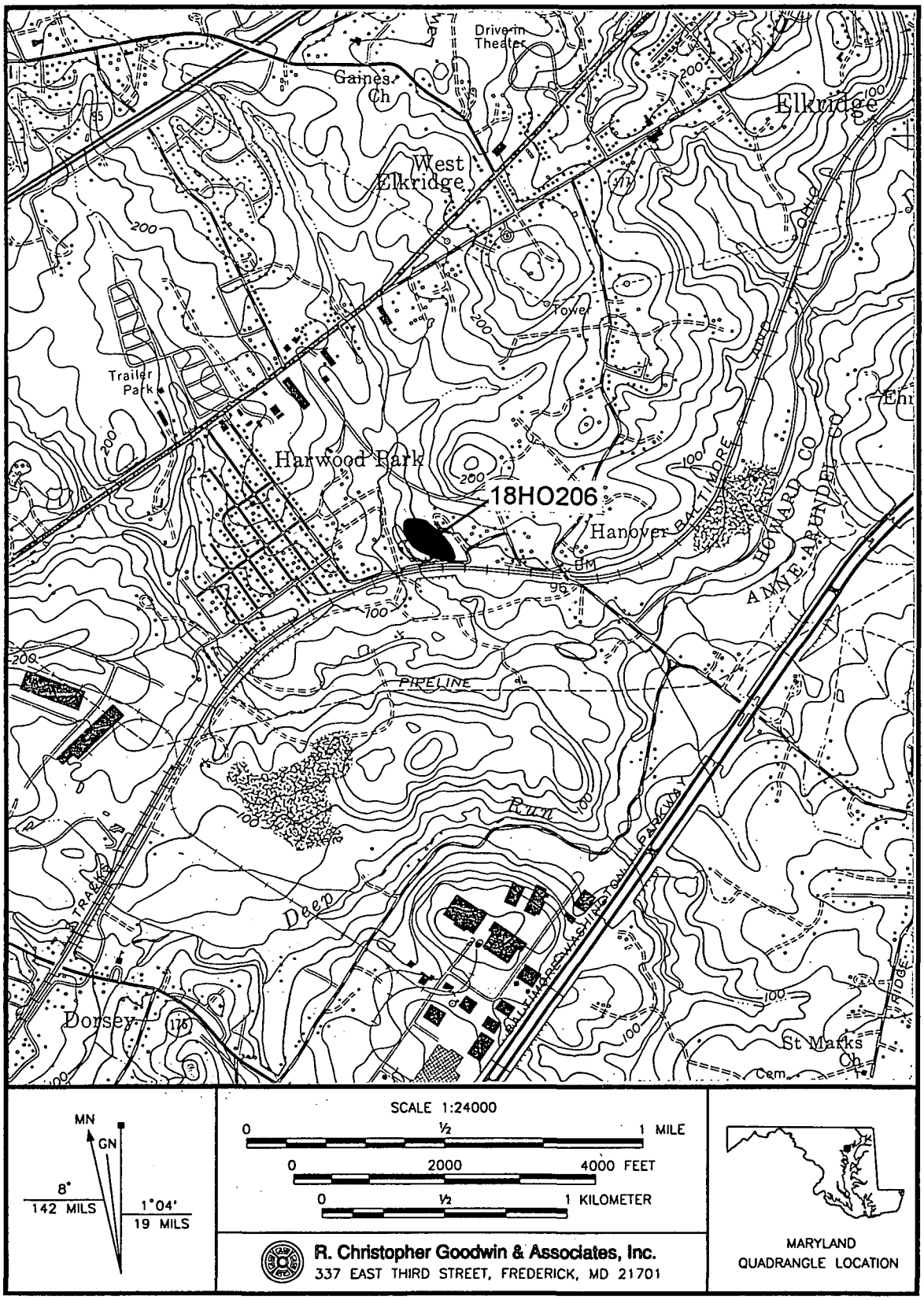


Figure 1. Topographic map showing location of site.

1.3 Purpose of Investigation

The objectives of the geomorphology study was to: 1) identify the various landforms and associated soils present at the site, 2) discuss sediment supply and modes of sediment transport that have and are operating within the study area, 3) determine the ages the soil packages present on the various terraces at the site and the depths to which testing should extend to ensure the recovery of any and all potentially significant cultural resources, 4) assess the effects of paleoclimatic and base level changes on the regime of the local drainage lines and 5) discuss the sources/provenance and procurement of lithic raw materials utilized for the manufacture of stone tools.

1.4 Scope of Investigation

This investigation was performed by Dr. Frank J. Vento, Professor, Department of Geography and Geology, Clarion University of Pennsylvania. The study included a review of both general and specific references of the bedrock geology and quaternary history of the project area. In addition, topographic maps, geologic reports, hydrologic information and areal photographs were reviewed.

Field investigations were initiated on during the spring of 1994 and included a pedestrian surface reconnaissance of the proposed wetland replacement site (Figure 2). In addition to the pedestrian walk-over, a number of deep excavation units were examined as well as several long (20 m) trench cuts which were emplaced perpendicular to the existing stream channel. Finally, several deep auger borings were emplaced on the higher T2 terrace. Aside from the stripped area on the eastern margin of the site, all of the Phase III units were hand excavated to culturally sterile lateral accretionary deposits.

2.0 PERTINENT ENVIRONMENTAL BACKGROUND INFORMATION

2.1 Physiography and Geomorphology

The Phase III study area is situated in the Embayed Section (Western Shore) of the Atlantic Coastal Plain physiographic province. The Embayed Section extends from north of the Neuse River in North Carolina to a somewhat debatable boundary near Cape Cod, Massachusetts (Thornbury 1965), and is defined by the occurrences of submerged river valleys. From Long Island, south to the James River in

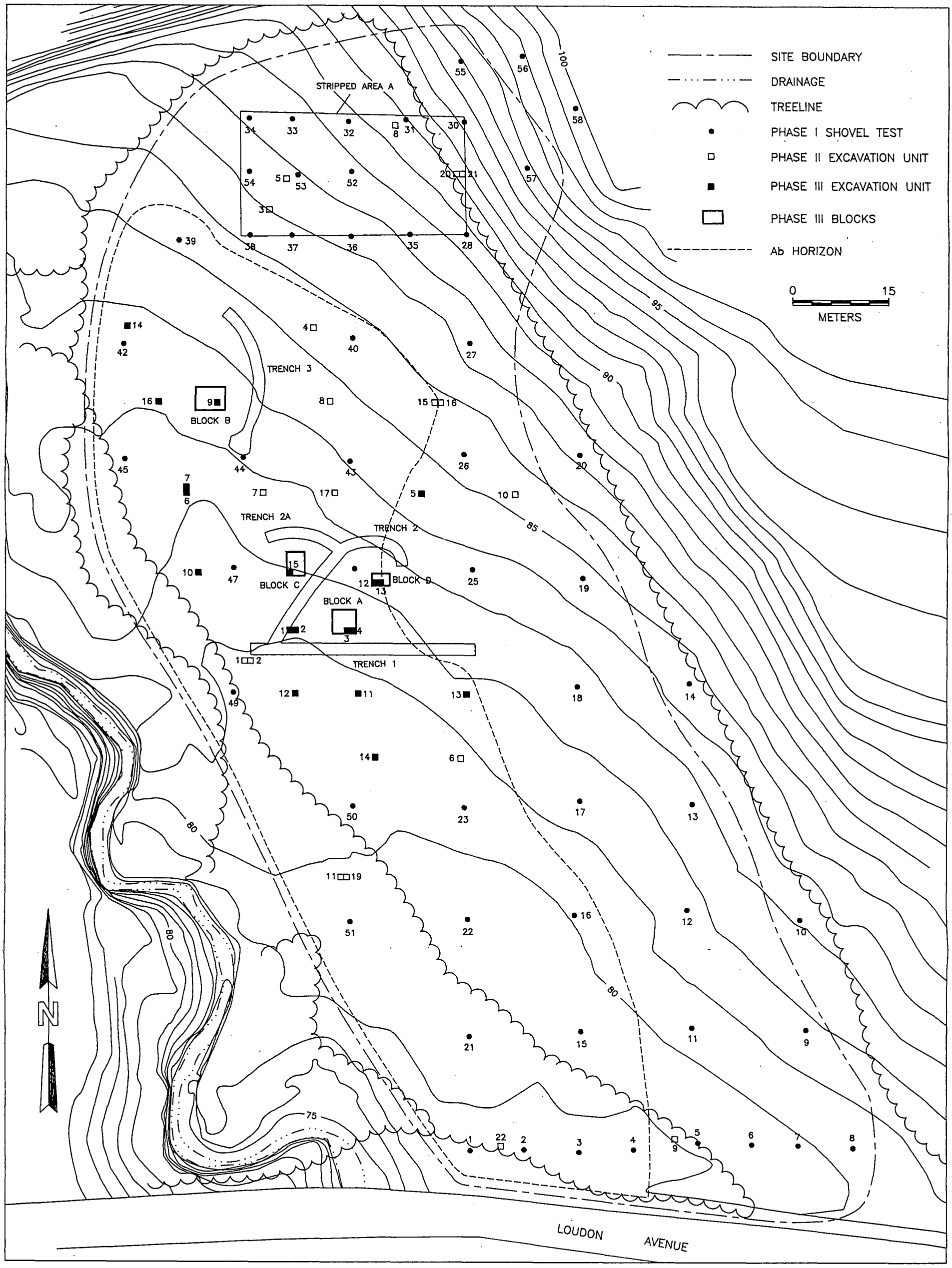


Figure 2. Planview of site area showing T0 flood plain zone, T1 terrace and mapped occurrence of buried Ab horizon (Stratum IV).

Virginia, this embayment reaches inland to the Fall Line, which mark the contact of Coastal Plain sediments with older lithologies of the New England and Piedmont physiographic provinces. Locally, the Fall Line occurs several kilometers to the west of the sites.

Post-glacial submergence along this reach of the Atlantic Coastal Plain resulted from isostatic adjustments of the crust level due to ice-loading, concomitant with a rise in base level due to ablation of the late Wisconsin ice sheet. The degree of submergence diminishes from north to south as evidenced by a northward decrease in the width of the Coastal Plain and the altitude of its inner edge. North of Cape Cod the Coastal Plain is completely submerged and has become a portion of the continental shelf (Thornbury 1965:36).

Topographic expression on the Western Shore of Maryland is surprisingly varied in contrast to the low-lying undissected flats typical of the Eastern Shore of the Chesapeake Bay. In southern Maryland elevations range from sea level to a maximum of 82.6 m (270 ft) above this point. The maximum elevations are associated with erosional remnants of a Pliocene (?) upland surface in southern Prince Georges County (Glaser 1971). The upland surface, with accordant elevations between 61.2 m (200 ft) and 67.3 m (220 ft) above mean sea level (Glaser 1971), is the dominant feature in southern Maryland, with the largest intact area straddling U.S. 301 between Mattawoman and White Plains in northern Charles County. The gently rolling to nearly flat topography of southern Maryland is dissected by numerous Quaternary-age rivers, creeks, runs and rills.

2.2 Drainage and Hydrology

The drainage pattern of the Western Shore is clearly dendritic with numerous rills and small tributaries supplying the major drainage lines--the Patapsco, Patuxent, Potomac Rivers and Chesapeake Bay. The few streams of the region are scarcely incised and are fringed with patches of swampy ground (Glaser 1971:5). In addition, there is a marked asymmetry in stream length within the region, with the east-flowing drainage lines exhibiting a distinctively longer course than those which flow in a westerly direction. This occurrence is due to the fact that the east-flowing streams follow the east/southeast dip of the bedrock units

in the region. Homoclinal shifting of drainage divides on the Western Shore also occurs along the downdip direction.

From just southeast of the study area, Shallow Run the principal drainage line, flows northeast to its confluence with the Patapsco River. The stream gradient along this reach of Shallow Run is ca. 5 m (16.5 ft) per km. The Patapsco River then flows in an easterly direction to its confluence with Chesapeake Bay. The Holocene marine transgression, beginning approximately 10,000 years ago and ending by about 3,000 years ago, was responsible for the drowning of the Patapsco and Susquehanna river mouths.

All of the first order drainage lines in the region (e.g., Deep Run, Shallow Run, Kitten Branch) display moderate gradients (ca. 17.2 m per mile), relatively narrow, often swampy, flood plain conditions, moderately straight channel courses which lack well-developed meanders and V-shaped valley profiles. All of these conditions would support the assignment of a late initial stage of development.

Runoff and subsequent flooding in the study area is dependent upon variations in precipitation. The highest discharges along Shallow Run and its tributaries occur during the late winter and early spring when there is a water surplus and lowered rates of evapotranspiration, while lowest flow volumes occur during the late summer and fall in association with decreased effective precipitation. Historic deforestation of the study area has allowed for increased surface runoff, higher sediment yields and more frequent overbank discharges along all drainage lines. These conditions allowed for the emplacement of a variably thick package of very late Holocene-age, vertical-accretionary and colluvial deposits along the valley bottom and lower valley slopes of Shallow Run and its tributaries.

Sources of potable water for the aboriginal inhabitants which utilized the study area could have been from: 1) both perennial and intermittent surface drainage lines, 2) shallow dug wells (<2 m) excavated along the valley bottom, and 3) from springs and seeps developed along the valley slopes.

2.3 General Geology

The Coastal Plain on the Maryland Western Shore, and eastern Howard County specifically, is composed wholly of generally unconsolidated sedimentary deposits ranging in age from Early Cretaceous to Holocene. The strike of the deposits is generally northeast-southwest with dips of typically less than 1

degree to the southeast (Glaser 1971). The mapped outcrop pattern is thus a succession of roughly arcuate bands which become younger to the southeast (the downdip direction). The Cretaceous and early to middle Tertiary deposits are overlain by nearly flat-lying Plio-Pleistocene-through-Holocene age alluvial deposits. Within the study area these alluvial and colluvial deposits rest uncomfortably on lower Cretaceous deposits of the Potomac Group. The Potomac Group includes the Raritan, Patapsco, Arundel and Patuxent Formations.

Within the general study area, the Potomac Group (lower Cretaceous) consists of two distinct facies-sand-gravel facies and a silt-clay facies. The following description of the silt-clay and sand-gravel facies of the Potomac Group (probable Patapsco Formation) is summarized from descriptions presented by Glaser (1976) on a geologic map of Anne Arundel County.

2.3.1 Sand-Gravel Facies:

This clastic facies consists of interbedded quartz sand, pebbly sand and gravel with occasional silt-clay. The sand is quartose with a mature heavy mineral suite (Glaser 1969). Texture varies from fine to coarse-grained, poorly to well-sorted, clean to very muddy. Color white, buff, red-brown to vari-colored. The pebbles present are primarily vein quartz and quartzite with some sandstone and chert. Fining upward cycles are common as are ferruginous concretions and limonite cemented pods or ledges.

2.3.2 Silt-Clay Facies:

The silt-clay facies ranges in color from red, tan gray, buff or mottled. Silt-clay facies appear generally massive and thick bedded. Texture varies from compact, stiff silty-clay, sandy clay, laminated silty-clay to nearly pure, plastic, kaolinitic clay. Sand lenses are typically muddy and poorly sorted. Anastomizing ironstone layers and sideritic concretions are also common within the silt-clay facies.

Fossil remains in the Potomac Group are limited to plant remains and extremely rare dinosaur bones. In all likelihood, the Potomac Group sediments were laid down in a complex floodplain environment. Previous investigators (Cleaves, et al., 1968) had mapped a thin band of probable Pliocene-age (termed Upland Deposits) sands and gravels capping the Potomac Group within the central portion of the study area.

These deposits, like those of the Potomac Group, share a fluvial origin. This study was unable to define any distinct facies change between the sand-gravel facies as mapped by Glaser (1976) and these probable Pliocene-age upland deposits. Glaser's (1971) discussion of the geology and mineral resources of southern Maryland presents an interesting historical summary on the semantic evolution of the terms Upland and Lowland Deposits. For the purposes of this discussion, Lowland deposits include any fluvial sediments emplaced during the Pleistocene and Holocene. Unlike the Upland deposits, lowland sediments are generally much less weathered as well as cleaner, with subordinate gravel, loosely compacted and paler in hue. The reds and strong browns of oxidation are seldom noted (Glaser 1971). This occurrence is especially true within the general project area, where strong-red, oxidized sands and gravels in the uplands give way to cleaner, less compact and more light brown, often mottled well sorted sands. The Upland deposits in this report, shall include both the lower Cretaceous Potomac Group and probable Pliocene age coarse clastics. Based upon the results of the recent field investigations conducted by Greiner Inc. (1994) at the Baltimore-Washington International Airport, the boundary or break between the Upland and Lowland deposits in eastern Howard County occurs at a nominal surface elevation of 33.6 m (110 ft) above mean sea level. This elevation closely follows the results of other investigators (e.g., Hack 1955; Glaser 1971; Vento 1993; Vento 1994) who have attempted to define the base of the Upland deposits. The importance of this contact between the Upland and Lowland deposits relates to the thickness of the Holocene deposits and the need to conduct deep testing (greater than 1 m) .

2.4 Soils

Presently, two distinct soil series occur within the mapped 4.5 acre site area. The Hatboro silt loam series occurs on the low bottom or T0 flood plain zone which is situated ca. 1 m (3.3 ft) to 1.5 m (4.5 ft) above the active stream channel. Hatboro soils are generally poorly drained, strongly acidic and occur on flood plains. A typical pedon consists of a 0 - 25 cm thick dark grayish brown (10YR 4/2) silt loam A/Ap horizon above a 20 cm thick dark grayish brown (10YR 4/2) B1 horizon. These strata are then underlain by a 20 cm thick gray (5Y 6/1) silt loam B2 horizon and a 40 cm thick light gray (5Y 6/1) silt loam B22 horizon. The basal C horizon is a gravelly clay loam.

The higher and older T1 terrace is covered with soils belonging to the Woodstown sandy loam series. Woodstown soils are moderately well drained soils found on slopes of 1-5 percent. At typical profile consists of a 0-25 cm thick dark grayish brown to grayish brown (10YR 4/2 - 2.5Y 5/2) A/Ap horizon. This horizon is then underlain by a 40 cm - 60 cm thick yellowish brown (10YR 5/6) sandy clay loam B horizon and a light gray (5Y 7/1) C horizon.

It is interesting to note that there is a clear correlation between soil type and site occurrence within eastern Howard County and western Ann Arundel County. Of the 40 previously recorded prehistoric sites which lie within 5 km (3 mi) of 18HO206, some 60 percent (24 sites) occur on terrace/flood plain soils (e.g., Rumsford, Woodstown, Hatboro). These association reflects the fact that these Fluvaquentic Dystrochept soils occur on flat, well-drained stream terraces/flood plains near perennial water sources (e.g., Stony Run, Deep Run, Shallow Run, Sawmill Creek, etc.).

Aside from some of the more steeply sloping valley sides, almost all of eastern Howard County have been farmed. Evidence of plowing can be found regionally as a sharp contact between the Ap (plow zone) and underlying C/Cg/Bw horizons. It does not appear that the buried A horizon at 18HO206 has ever been plowed but rather has been buried by recent (last 200 years) flood deposits emplaced in response to historic deforestation of adjoining land tracts. Additionally, the intensity of farming over the last 300 years (1650 - 1950) has caused extensive soil erosion, mass-wasting/colluviation and increased sediment yields to streams. Regionally, many of the soil profiles appear truncated or thinned to due mass-wasting processes acting on a landscape from which the natural forest stands have been removed. Today, this situation continues in many areas as a result of construction activities. Current flows or discharges along streams such as Deep Run, Shallow Run, Stony Run, Sawmill Creek and Cabin Branch are probably higher than during prehistoric times. These higher flows are due to reduced forest cover (which retards transpiration), more impervious cover (asphalt runways, roads, etc.) allowing for rapid surface runoff, and the fact that many streams are now serviced by sewers and drainage culverts, which drastically shortens the lag-time between precipitation and flooding. These events have impacted the degree of flood scouring and hence the potential for recovering intact prehistoric materials along the low bottoms of streams within the region.

Based upon previous archaeological studies and data gathered during this study, it can be concluded that alluvial soils developed on flood plains/terraces at elevations below 110 ft have the potential to contain, buried (greater than 50 cm) prehistoric resources and/or stacked solas. Burial of archaeological materials on landforms (i.e, terraces and flood plains) which contain these mapped soils is primarily from active-overbank deposition from flooding (e.g., vertical accretion).

2.5 Historic Land Use

Shortly after 1649 with the arrival of Puritan families from Virginia, the lands comprising the general project area were utilized by wealthy merchants as tobacco plantations with a lesser emphasis on corn. By the late 18th century numerous woolen and grist mills were built along streams in the county. Also during this time, crop farming became the dominant practice. The principal crops included: wheat, corn, beans, peas, strawberries, tomatoes, sweet potatoes and cantaloupes. The ability to get these crops to market were greatly enhanced by the advent of improved roads, steamships, and railroad lines during the first and second quarters of the nineteenth century (Flanagan et al. 1988; Frye 1986). This change to more diverse crops was due in part to the realization that tobacco farming practices were depleting the soil and that forced black labor force present prior to the Civil War was now gone.

It is interesting to note that by 1907, thousands of farms could be found operating in Howard and Ann Arundel Counties. Also during this time industries such as canning, box making, chrome and steel factories, seafood and truck farming became important to the economic growth of the area (Riley 1905; McWilliams 1977; Neumann 1990). Mineral extraction of iron ore, sand and gravel, paint ore and minor clay mines were also and important industry in the region (Kuff 1976; Frye 1986).

The effect of these changing land uses can be seen in the changing topography (e.g., modification of drainage lines, grading, etc.) and even within the profiles of recently excavated sites (e.g., 18HO203 and 18HO206). Thin soil profiles along valley side walls, mass wasting and active colluviation, combined with more frequent overbank discharges along streams, all attest to the effects of historic deforestation.

2.7 Paleoenvironmental Reconstruction

The following discussion details changes in climate, base level and vegetation patterns for the Middle Atlantic Coastal Plain. The information presented herein, has been largely taken from Ebright's (1993) analysis of the Higgins Site as well as more recent investigations at the BWI Airport by Greiner, Inc. (1994).

2.7.1 Late Pleistocene

The major expansion of the Laurentide ice sheet took place beginning in the Late Wisconsin stage at about 23,000 years B.P. In Pennsylvania the ice sheet was in full retreat by approximately 15,000 years B.P. Over the next four thousand years, there were several short-lived, small advances or pulses. While Anne Arundel County was never glaciated, full-glacial and then late-periglacial climatic conditions to the north and west would have had a profound impact on eustatic sea-level changes, rates of weathering and mass-wasting, vegetation patterns and stream regime.

Bloom (1983) has proposed that during the late glacial maximum (18,000 B.P.) sea level was lowered by 120 m +/- 60 m, exposing large portions of the continental shelves. In response to a lowered base level, streams like the Patapsco River and its major tributaries would have cut, through gradient adjustment, to keep pace with this change. The paired Late Wisconsin age terraces (T2 and T1) and sharp terrace risers which occur along Stony Run and Sawmill Creek would indicate several episodes of rapid downcutting with minor lateral channel migration during this time. The sandy parent material, greater effective precipitation and heightened stream competence/capacity would have allowed for rapid rates of incision. This is best evidenced at the Higgins Site where Stony Run has downcut over 14 m in the last 22,000 years. Given the absence of any ice within Anne Arundel County, it is unlikely that isostatic adjustments relating to ablation of the Laurentide ice sheet would have affected late Wisconsin or early Holocene rates of incision.

At the peak of glaciation, changes in radiation and insolation caused the jet stream to split into two portions, with strong easterly winds occurring at the southern margin of the ice sheet (COHMAP 1988; Ebright 1992). As noted by Ebright et al. (1988) these late glacial weather patterns would have resulted in a decrease in sea water temperatures, increase in sea-ice areas, and a decrease in seasonality in eastern

North America. Brush (1986) places the average land temperatures at 3 to 8 degrees Centigrade lower than present near the end of the glaciation in the Chesapeake Bay area. Other authors have argued (Webb and Bartlein 1988; Knox 1983; Vento et al. 1992) that it was not until 9,000 - 8,000 yrs. B.P. that the continental ice mass no longer affected continental atmospheric circulation (occurrence of meridional flow) and vegetation patterns.

Late glacial forest-vegetation communities consisted of boreal species dominated by jack pine and spruce, with lesser amounts of birch, fir, hemlock and alder (Brush 1986; Delcourt and Delcourt 1981, Davis 1983; Sirkin et al. 1977). Pleistocene-age peats from eastern Pennsylvania and the Delmarva Peninsula exhibit a diverse spectrum of forest taxa including pine, spruce, birch, alder, willow, oaks, heaths, grasses, sedges and forbes (Sirkin et al. 1977; Crowl and Sevon 1980). Like the flora, Pleistocene fauna was equally diverse including such fauna as mastodon, mammoth, bison, horses and camel (Guilday et al. 1966; Semken 1983; Eschelman and Grady 1986). The cause for the Late Pleistocene extinctions generally follows one of three models: 1.) overkill; 2.) environmental change; and 3.) combined effects of overkill-environmental change. Specific details regarding Pleistocene extinctions are reviewed by Lundelius and others (1983). It might be argued that the late glacial fauna (11,000 - 10,000 yrs. B.P.) of Anne Arundel County was a mosaic of both megafauna and more modern Carolinian species.

2.7.2 Early Holocene (10,000 - 8,000 B.P.)

By the start of the Holocene (circa. 10,000 yrs. B.P.) the Laurentide ice sheet had ablated to a position just south of present day Hudson Bay. The stagnant ice sheet effectively restricted the mixing of warm-moist air masses from the Gulf with cold Canadian air. In effect, the flow during the early Holocene was clearly zonal or westerly. Prior to 7,000 yrs. B.P. flood intensity would have been greatly reduced. Also during this time, rapid, eustatic sea-level adjustments along the Atlantic coast caused drowning of numerous river valleys. Kutzbach's (1983) notes that the radiation curves for tilt and precession reinforced each other at 10,000 - 9,000 yrs. B.P. resulting in the global average solar radiation for July being 7% greater than today and that precipitation was 7% greater and temperatures .7 degrees Celsius warmer.

As relates to the drainage lines within the study area, the early Holocene would have been a time of rapid alluviation-aggradation. Aggradation would have been caused by a base-level adjustment due to eustatic sea level rise. During this time, gradients were much reduced from the earlier late Wisconsinan as were sediment load and overall discharge. The probable braided reaches of these drainage lines changed their channel habit to one of a meandering form. Infrequent large floods during the early Holocene would have been promoted by strong zonal/westerly flow and greater rates of potential evapotranspiration. Within the central and upper Susquehanna basin, rivers experienced several episodes of rapid, vertical accretion followed by several hundred-year periods of relative flood-plain stability. The multiple, dated occurrence of a cumulic, buried A-horizons from the period 9,000 - 8,000 yrs. B.P., indicates a relatively lengthy period of flood plain stability.

During the early Holocene, the spruce and pine forest of the late glacial stage was rather quickly replaced by mixed conifers and northern hardwoods (Delcourt and Delcourt 1981; Davis 1983; Brush 1986). Both Brush (1986) and Davis (1983) note oak as occurring within the general study area by 10,000 yrs. B.P. Pollen cores from the southern Chesapeake Bay region document the rapid expansion of mixed deciduous-conifer forests at 10,000 B.P. (Harrison et al. 1965; Whitehead 1972).

2.7.3 Middle Holocene (7,000 - 5,000 B.P.)

The Middle Holocene along the Middle Atlantic coast is a period during which sea level rise rapidly decreases (Kraft 1985). The head of the Chesapeake Bay at this time was in the vicinity of Annapolis (Brush 1986). Continued ablation and retreat of the ice sheet by 7,000 - 6,000 yrs. B.P. allowed for the penetration and mixing of warm-moist, maritime-tropical air masses with cold Canadian/arctic air (Knox 1983). This mixing created the potential for large cyclonic storms and, in turn, large floods. At this time there is a rapid shift from zonal to more meridional circulation. In the upper and central Susquehanna basin, most medium to small-sized streams clearly lack any intact mid- to early- Holocene alluvium. The occurrence may be due to the effects of large floods spawned from cyclonic storms removing these earlier vertical accretionary deposits. Also during this time there is a marked shift from the warm-dry conditions of the late Early Holocene (circa. 9,000 B.P.) period to one of alternating cool-wet and warm-moist conditions. These

conditions favored incision and minor active lateral channel migration. The T1 terrace along Shallow Run, Deep Run, Stony Run and Sawmill Creek may be a result of this episode of Middle Holocene (Atlantic climatic phase) incision. If this is the case, then the vertical accretion package (overbank) at 18HO206 is less than 4500 years old.

According to Kraft (1985), between 8,000 - 4,000 yrs. B.P. sea level rose at a rate of ca. .4 cm per century in the Mid-Atlantic. Joyce (1988) proposes that the warm-dry Hypsithermal Interval prevailed between 9,000 - 5,000 B.P. in the Mid-Atlantic. This period fits well with vegetation shifts observed in the Midwestern Prairie Peninsula and Great Plains. These dates are considerably earlier than estimates based upon pollen core data from Hack Pond which restrict the period of warmth and dryness to the Subboreal (ca. 5100 - 2800 B.P., cf. Carbone 1976; Custer 1984; Custer and Curry 1982). These dates also conform well with dated soils located on low terraces (Port Huron) within the upper and central Susquehanna (Vento et al. 1992). Vento et al. (1992) would place the period of warmth and dryness between 4500 - 3000 yrs. B.P.). These dates are based upon dated, buried A-horizons which consistently bracket a cambic B-horizon which contains Transitional Archaic artifacts (e.g., broad-spear projectile points, steatite). As relates to vegetation, the mixed conifers and northern hardwood forests of the early Holocene were quickly replaced by an oak-hickory-southern pine association that was firmly in place by 5,000 yrs. B.P. in Maryland (Ebright et al. 1992).

2.7.4 Late Holocene (4500 - Present)

The opening of the late Holocene is marked by an episode of extreme warmth and dryness known as the Subboreal climatic phase. The warm-dry conditions are in marked contrast to the generally wet-moist conditions of the preceding Atlantic climatic phase. During this period (4500 - 3000 yrs. B.P.) a persistent mean-westerly atmospheric circulation expanded a midcontinental climatic regime of warmth and aridity (Bryson et al. 1970; Delcourt and Delcourt 1985; Knox 1983; Vento et al. 1992). In the upper and central Susquehanna River drainage basin, the stratigraphic evidence indicates that in response to these warm-dry conditions, streams entered a phase of active lateral channel migration and along specific reaches, active vertical accretion. These events may relate to a decreased vegetation cover associated with higher sediment

yields. The general absence of any buried A-horizons at this time on dated terraces would appear to indicate that flood plains were receiving enough sediment from flooding to preclude their development.

Recent fossil pollen data from Dan's Bog, Prince George's County, Maryland, indicates an increase in herbaceous taxa in the oak-dominated forests between 5,000 and 1770 B.P. (Leedecker and Koldehoff 1991). Davis (1983) and Winkler (1985) note that annual average temperatures may have been as much as 2 degrees Celsius warmer than at present.

Following the end of the Subboreal climatic phase, streams within Howard and Anne Arundel Counties would have experienced a rather pronounced episode of warm and moist climatic conditions (3,000 - 1750 B.P.) of the SubAtlantic climatic phase. These warm-moist conditions were have allowed for relative flood plain stability and in places, the development of a thick, surficial A-horizon. This A-horizon if present, would be found buried on the T1 terrace along such streams as Stony Run, Deep Run, Shallow Run and Sawmill Creek in Howard and Anne Arundel Counties. The SubAtlantic phase was then followed by a period of cool-moist conditions of the Scandic climatic phase (circa. 1750 - 1150 B.P.). Locally, streams would have entered into a phase of active lateral channel migration and incision with more active rates of vertical accretion which would have precluded A-horizon development. The Scandic phase was then followed by another warm-moist interval termed the NeoAtlantic climatic phase (1100 - 700 B.P.). Warm-moist conditions would have again favored relative flood plain stability. Once again, it might be expected that terraces (e.g., T1 terrace along the above streams) should, along select reaches, contain buried A-horizons from this period. If present, this buried A-horizon, should be overlain by a variably thick sola which has been emplaced during the cool-wet, Pacific climatic phase (700 B.P. - 300 B.P.) and as a result of increased surface runoff/sediment yields to streams from historic deforestation.

According to Brush (1986), sea level continued to rise but at a much slower rate. Chesapeake Bay had essentially attained its present form at ca. 3000 yrs. B.P. The mouth of the Patapsco River was also drowned during this period. Kraft (1985) estimates sea level rise of the last 2000 years at 15 cm per century.

The oak-hickory/southern pine forests typical of early Holocene times remained stable until, as noted above, Euro-American settlement. Brush (1986) notes an especially wet period between 4700 - 3400 yrs. B.P. and an extremely dry period between 1000 -1200 A.D. This latter dry period is based upon the

presence of holly, chestnut and ericaceous shrubs. These dates and the associated climatic conditions are exactly the reverse of those proposed for the central and upper Susquehanna River valley (Vento et al. 1992). The high quantities of metallic elements found in cores at this time has led Brush (1986) to postulate that this proposed dry period was characterized by intermittent fires. An alternative hypothesis for the occurrence of abundant free carbon and higher levels of metallic elements might be from aboriginal clearing of land for horticultural/agricultural use.

2.8 Previous Geomorphological Investigations

The earliest documented geoarchaeological studies undertaken in the general region were conducted by Foss and Segovia (1979). This study was initiated at the request of Dr. Fred Kinsey who was conducting a Phase I archaeological inventory investigation of three sites in Anne Arundel County for the Maryland Highway Administration. Foss and Segovia (1979) identified a 15.2 cm thick, loamy sand Ap horizon. This horizon was immediately underlain by a 152.4 cm thick, poorly developed, loamy sand to sandy loam B-horizon (B21 and IIB22 or C1 of this study). This Bw/B21-B22 horizon was then underlain by a gravelly, loamy sand (IIIC or C2 of this study).

Drs. Foss and Segovia tentatively concluded that many of the cultural materials were buried by 20 in to 24 in of aeolian sands. They also concluded that some overwash may have contributed sands to the accretion of the profile. Kinsey (1979) then concluded that wind-deposited sand with perhaps some deposition caused by surface water runoff was responsible for burying the cultural deposits at 18AN29A. Kinsey (1979) further postulates that the deposition of the aeolian sands was coincident with the warm-dry conditions of the SubBoreal climatic phase. While deflation would have been more active during this time, the coarseness of the sands (1 phi to 4 phi) at the Harman Site, argues for primary sediment deposition from active, lateral channel migration (C2) and then active, vertical accretion (C1 and Ap). Given the fact that both the Higgins Site (Ebright et al. 1992) and Harman Site occur on the same landform, it is probable that the same fluvial, depositional processes are responsible for the bulk of the included Holocene-age sediment package.

To date, the geoarchaeological investigations at the Higgins Site represents the most comprehensive site assessment in the B.W.I. Airport area. Ebright et al. (1992) notes that the terrace on which the Higgins site is situated consists primarily of a thick Holocene-age soil/sediment package emplaced primarily through overbanking and active channel migration by Kitten Branch as well as active mass-wasting processes (e.g., slopewash and creep). As noted by Ebright et al. (1992) reassessment of data from all the sites examined by Curry (1980) indicates that aeolian, colluvial and alluvial processes probably all contributed to soil deposition over prehistoric remains on uplands in the Coastal Plain and that a site-by-site study of the dominant depositional processes needs to be conducted on specific sites (Curry and Ebright 1989).

The most recent geomorphological investigations completed to date, involved the geomorphological assessment of the landforms and soils present within the BWI project area. The results of this study indicates that the ridgetops and hills are underlain by Cretaceous deposits of the Potomac Group and that the soils developed on the rolling upland tracts are residual in nature. In fact, all of the landforms which lie above an interpolated elevation of 110 ft above mean sea level lack any clear Holocene age deposits which exceed 50 cm in thickness. Aside from minor mass-wasting events (creep, slopewash), plowing and aeolian deflation, there is no available transport process capable of effectively redepositing medium to coarse sands and hence burying prehistoric archaeological remains.

A further conclusion of this study was that the only areas which have the potential to contain buried, in situ prehistoric artifactual material is along the Pleistocene and Holocene age terraces and flood plain zones which border the principal drainage lines (Stony Run, Sawmill Creek and their major first-order tributaries). The highest of these terraces (designated T2) occurs along both Stony Run and Sawmill Creek at an interpolated elevation of 95 feet above mean sea level or some 30 ft - 35 ft above the active stream channels. The Harman Site (18An29A) is situated on the T2 terrace. The contact between Holocene age soils and older late Pleistocene age sediments is defined by a layer of coarse-grained lateral accretionary deposits. These capping Holocene age overbank deposits also exhibit a more subtle brown colors (5YR 6/2, 7.5YR 7/2, 10YR 6/3), with less oxidation, than the strong reddish brown (10YR 4/8, 10R 3/6), red and white sands (5YR 8/1) of the Pleistocene and Cretaceous sediments. The intermediate terrace, designated T1, lies ca. 3 m - 4 m (10 ft - 12 ft) above the active channel of Stony Run. The alluvial soil stratigraphy

encountered on this terrace, consists of reaches which contain several stacked, Holocene age solas. Phase I testing on the T1 terrace (nominal surface elevation of 80 ft - 85 ft above mean seal level) should extend to basal lateral accretionary deposits. The lowermost T0 floodplain zone, occurs ca. 1 m (3 ft) above the active stream channels and contains a thin (less than 3ft) package of strongly mottled, often gleyed, overbank deposits of late Holocene age. Due to high water table conditions, and frequent flood scouring, there is little potential for the recovery of in situ prehistoric materials.

RESULTS OF INVESTIGATION

Site Stratigraphy

During the course of the Phase III investigations at Site 18HO206, ten distinct strata were identified. The following details a discussion/description of the soil stratigraphy encountered at the site (Figures 3 and 4).

Stratum I: (Ap)

Extent: Stratum I represents the top or surficial horizon at the site and can best be classed as an A/Ap horizon. The Ap horizon consists of a dark yellowish brown to dark brown silt loam to sandy loam. Stratum I is continuous across the site and is present on both the T0 flood plain and T1 terrace. Vertically, Stratum I occurs from the ground surface to a maximum depth of 25 cm below ground surface.

Texture: Stratum I is a loamy sand with a mean grain size of 2.58 phi. The standard deviation or sorting value is 4.0 indicate moderately poor sorting. The skewness and kurtosis values for Stratum I are -8.42 and 4.11, respectively. These values indicate an excess of particles in the coarser grain sizes and a mesokurtic character for the stratum. The primary modal peaks occur in the 2 phi (.250 mm) and <4 phi (<.063 mm) size classes (Appendix A).

Color: Dark yellowish brown loam sand (10YR 3/2).

Organics: Abundant, extensive small and large roots.

Bioturbation: Extensive bioturbation from rot and rodent activity.

Geologic Cross Section
Site 18ho206 Howard Co., Maryland

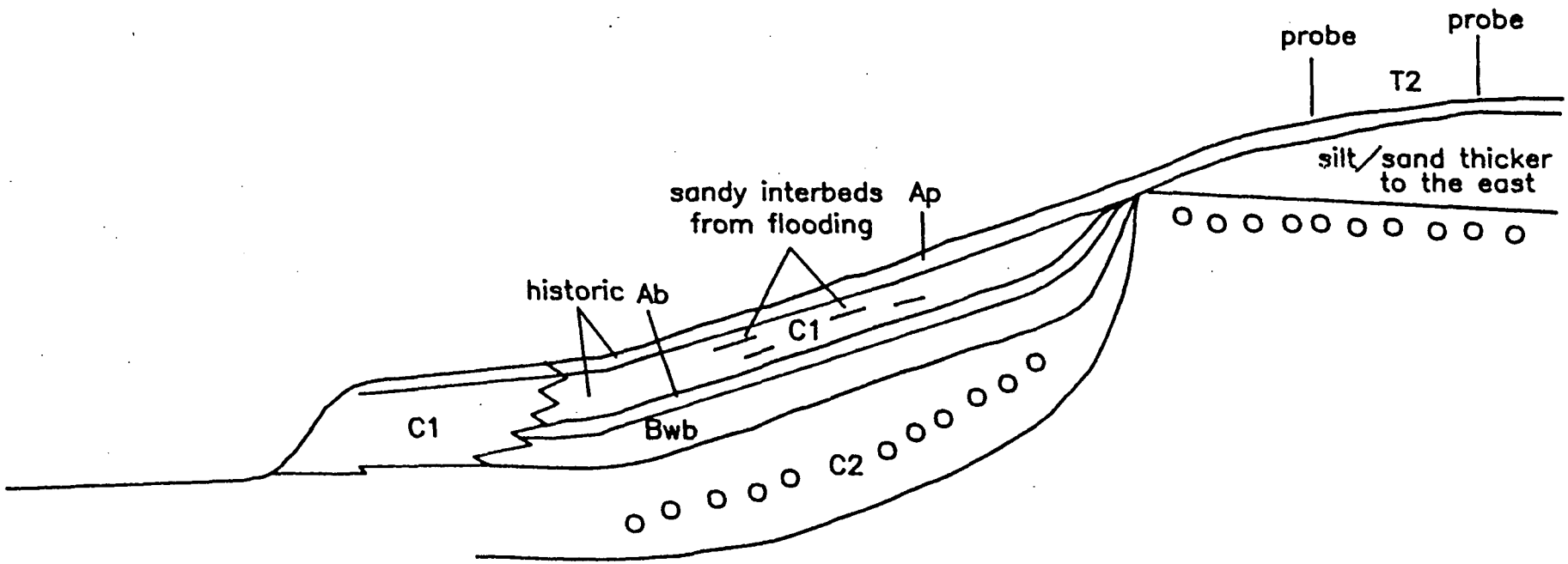


Figure 3. Geologic/Stratigraphic cross section of site showing stratigraphic horizons and their association on T0 flood plain and T1 terrace.

Source: Dr. Frank Vento

RCG

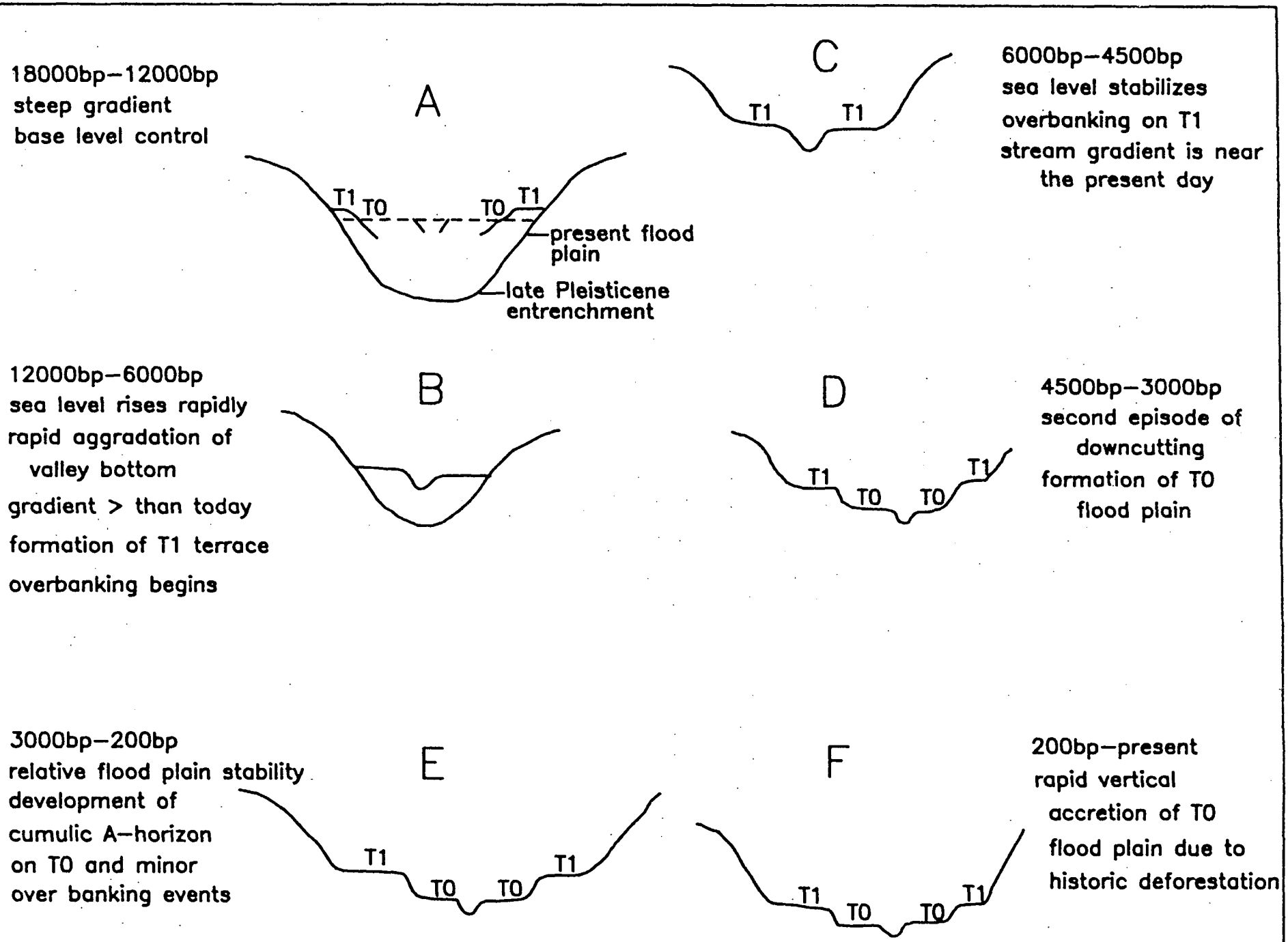


Figure 4. Evolution of Valley 18,000 BP to present.

Source: Dr. Frank Vanda

Cultural Associations: Historic

Depositional History: Stratum I has been emplaced via overbank deposition during late Holocene times on the T0 flood plain zone and during mid to late Holocene times on the T1 terrace. Stratum I has been variously impacted by historic plowing, cutting and charcoaling activities. Some colluvial sediment input has been supplied to this horizon from the adjacent valley slopes on the T1 terrace. The moderately coarse mean grain size for Stratum I documents the effects of historic deforestation as relates to increased surface runoff and stream competence.

Stratum II: (C1)

Extent: Stratum II is restricted in its occurrence to the T0 flood plain zone at 18H0206. Stratigraphically, Stratum II is situated disconformably below the Ap horizon and disconformably above Stratum III/IV (Ab). Stratum II ranges from 50 cm to 70 cm in thickness with the thickest and coarsest deposits occurring closest to the active stream channel.

Texture: Stratum II ranges from a gravelly loam sand to loam sand with a mean grain size of 1.1 phi. The mean standard deviation is 3.8 indicate moderate sorting. The primary modal classes typically occur at -2 phi (4 mm) and 2 phi (.250 mm). The mean standard deviation value for Stratum II is 3.8 indicating moderate sorting. The skewness and kurtosis values are highly variable given the occurrence of numerous autogenic, stacked flood events which comprise Stratum II. Skewness values range from positive to negative, while kurtosis values indicate both a leptokurtic to mesokurtic character for levels within the stratum. These varying values reflect varying competence levels of the stream during a given overbanking event.

Color: variable, highly oxidized and bedded sands and sandy gravels, ranging from orange brown, brown, gray brown.

pH: moderately acidic

Organics: moderate with decreasing organics from the top to bottom of stratum.

Bioturbation: moderate to minimal in lower part, primarily large roots.

Cultural Associations: Historic

Depositional History: Stratum II has been emplaced over the last 200 years from various flood events along the unnamed tributary of Shallow Run. Stratum II exhibits a package of laterally discontinuous and variably thick, cross bedded sands and sands and gravels which were emplaced under high flow velocities. It appears that these autogenic deposits were emplaced in response to historic deforestation which favored an increased sediment supply and runoff to the local drainage lines.

Stratum III: C1g

Extent: Stratum III is contained wholly on the low bottom or T0 flood plain zone. Stratum III is laterally continuous on the low bottom (T0) and occurs conformably above the Ab horizon (Stratum IV) and at a disconformable contact between overlying Stratum III. Stratum III ranges from less than 4 cm to over 10 cm in thickness. The best or thickest expression of Stratum III occurs in natural low areas or swales on the flood plain.

Texture: Stratum III can be classed as a fine sandy loam (Appendix A). The mean grain size for Stratum III is 4.04 phi with a primary mode occurring in the <4 phi (<.063 mm) size class (Appendix A). The standard deviation value of 3.0 indicates moderately good sorting. The skewness and kurtosis values are -6.9 and 9, respectively. These values indicate a tail tending toward the coarser grain sizes and a weak leptokurtic character for the horizon.

Color: grayish brown silty clay loam (10YR 5/2).

pH: strongly acid

Organics: minimal

Bioturbation: minimal

Cultural Associations: Historic

Depositional History: Stratum III is a grayish brown silty clay loam horizon which was emplaced during late Holocene times by slow-moving flood waters. The strong gleying and hydric character of this horizon is due to water moving through the permeable and porous sands of Stratum II becoming perched on the stiffer, more blocky ped structure of Stratum III/IV. The gray color of Stratum III is clearly diagenetic (post-depositional) and has formed in response to long-term perched water table conditions.

Stratum IV: (Ab)

Extent: Stratum IV is horizontally continuous across the low bottom or T0 flood plain of the site and is absent on the higher T1 terrace. Where the T0 flood plain intersects the riser of the T1 terrace the Ab horizon rises to the surface and becomes part of the surficial Ap horizon on the T1 terrace. The nominal thickness of the Ab horizon is 10 cm. Stratum IV (Ab) is conformably underlain by Stratum V and overlain by Stratum III.

Texture: Stratum IV can be classed as a loam sand with a mean grain size of 2.8 phi. The standard deviation is 3.04 which indicates moderately good sorting. The skewness and kurtosis values are 8 and 8.08, respectively. These values indicate an excess of particles in the finer grain sizes and a weak leptokurtic character for the horizon (Appendix A).

Color: brown sandy clay loam (10YR 4/3) mottled with yellowish red sandy loam (5YR 5/8).

pH: strongly acid

Organics: minimal roots and rootlets, however, contained abundant finely disseminated soil humin.

Bioturbation: moderate

Cultural Associations: Historic/Prehistoric

Depositional History: Stratum IV is a contact period surface which has been capped by a coarse grained and variably thick package of recent (<200 years) overbank deposits. The cumulic character and thickness of Stratum IV argues a long period of relative flood plain stability during its formation. An assigned age of 3000 B.P. to 200 B.P. is proposed for this stratum. This age is based upon the pedogenic development of the soil suite, the proposed temporal affiliation of the prehistoric artifacts recovered from Stratum V, and the occurrence of charcoaling activities on the surface of Stratum IV. While minor overbanking events did occur during this interval, no event was large enough to terminate development. Final burial of the Ab horizon came in response to historic deforestation of the watershed. Finally it should be noted that there is no clear evidence that Stratum IV had been impacted by plowing. If plowing did occur, it was never deep enough to mix the basal portion of the horizon.

Stratum Va/Vb: (Bwb)

Extent: Stratum V is horizontally continuous across the low bottom zone or T0 flood plain portion of the site. Vertically, it occurs immediately and conformably below Stratum IV and immediately above Stratum VI (C2, lateral accretion). The nominal thickness of Stratum V is 70 cm.

Texture: Stratum V can best be classed as a fine loamy sand with a mean grain size value of 2.8 phi. The primary modal peak occurs at 2 phi (.250 mm) with a secondary mode occurring at <4 phi (<.063 mm). The mean standard deviation value is 4.08 indicating moderately poor sorting. The mean skewness and kurtosis values for Stratum V are -3.44 and 8.14 respectively (Appendix A). These values indicate an excess of particles in the coarser grain sizes and a mesokurtic character for the horizon.

Color: Dark yellowish brown clayey sand (10YR 4/6) in upper part to a brownish yellow (10YR 6/8) clayey sand with pale brown clayey sand (10YR 6\3) mottles in lower part.

pH: strongly acid

Organics: minimal

Bioturbation: minimal

Cultural Associations: Transitional Archaic-Late Archaic

Depositional History: Stratum V is the subsoil horizon (Bwb) on the T0 flood plain zone at the site. This horizon coarsens downward with strong mottles developed in its lower part. In all likelihood Stratum V was emplaced at the beginning of the SubBoreal climatic phase (4200 B.P.) in response to warm-dry climatic conditions which favored active lateral channel migration and frequent overbanking events. The absence of any buried A horizons indicates a prolonged episode of frequent overbanking events during this time. It should also be noted that by 6000 yrs. B.P. sea level had reached its present level which would have favored vertical accretion or aggradation of the flood plain.

Stratum VI: (C2)-Channel Lag

Extent: Stratum VI is horizontally continuous across the T0 flood plain portion of the site. As one moves east and north from the active channel, Stratum VI rises and intersects older lateral accretion deposits of

the T1 terrace. Stratigraphically Stratum VI occurs conformably below Stratum V. The water table seasonally occurs within 20 cm of this contact.

Texture: Stratum IV ranges from a gravelly loam sand to a cobbly loam sand. The grain size values for Stratum VI range from -2.48 phi to -4.4 phi. The stratum is generally well sorted, positively skewed and mesokurtic (Appendix A).

Color: strong brown (7.5YR 5/6) slightly clayey sand, gravel and cobbles

pH: strongly acid

Organics: transported assemblage, small roots and rootlets

Bioturbation: minimal

Cultural Associations: Short transport of artifacts, not in situ. Artifacts may have been exhumed from occupation loci on higher T1 terrace and from lateral channel migration into T0 flood plain zone.

Depositional History: Stratum VI represents the old traction carpet or channel of the unnamed tributary of Shallow Run as it laterally migrated across the flood plain. As the channel migrated east to west, overbank deposits (Stratum V) were emplaced on top of these lag deposits. An inferred late Middle Holocene age is herein proposed for this stratum. It appears that this stratum/horizon was emplaced during the period 4500 - 6000 yrs. B.P. in response to the appearance of large cyclonic storms in the region (now allowed by the continued ablation of the Laurentian ice sheet) during the warm-moist Atlantic climatic phase and concomitant with the final stabilization of sea level following deglaciation. Continued active lateral channel migration may have continued well into the following warm and dry SubBoreal climatic phase.

Stratum VII: (weak Bt/Bw)

Extent: Stratum VII is laterally continuous across the T1 terrace. Vertically, Stratum VII lies disconformably below the Ap horizon and conformably above the C3 horizon (T1 terrace channel lag). The nominal thickness of Stratum VII is 70 cm. Along the distal margin of the T1 terrace, a small amount of fine colluvium has been contributed from the valley slopes to the terrace.

Texture: Stratum VII can best be classed as a silt to fine sandy loam with a mean grain size of <4.5 phi (<.063 mm). The horizon is moderately well sorted, strongly negatively skewed and mesokurtic.

Color: yellowish brown silt loam (10YR 6/8)

pH: strongly acid

Organics: moderate

Bioturbation: moderate

Cultural Associations: Archaic

Depositional History: Stratum VII (weak Bt) consists of a relatively textural homogeneous package of fine grained overbank deposits emplaced over the last 10,000 - 12,000 yrs. The initial emplacement of these overbank deposits began during early Holocene times in response to base level adjustments (rising sea level), a meandering channel habit and a change to more mesic climatic conditions. All of these factors would have favored aggradation of the flood plain of the unnamed tributary. Since early late Holocene downcutting of the stream and subsequent development of the low bottom (T0) few late Holocene or recent floods have reached the surface of the T1 terrace. Archaeological materials should be confined to the sola (A and B horizons) on the T1 terrace.

Lithic Raw Material Sources

The principal raw materials utilized for the manufacture of flaked stone tools at Site 18HO206 include vein quartz, quartzite and metarhyolite. The vein quartz and quartzite occur as cobbles in the bedload of local streams throughout the region. These materials have been shed via mass-wasting and fluvial erosion from the hilltops and ridges which are capped by the Potomac Group.

While chert pebbles can be found in the Potomac Group and as bedload material in the local drainage lines, there is no archaeological evidence that this material was utilized at 18HO206. This occurrence is not unexpected given the preponderance and high frequency of quartzite, vein quartz and metarhyolite found at other Transitional Archaic sites in the Mid-Atlantic region. The two primary in situ sources of metarhyolite are the Libertytown quarry which lies ca. 45 km to the east of the site and the South Mountain complex situated ca. 75 km to the northwest in southeastern Pennsylvania. Procurement strategies for metarhyolite like steatite could have been through trade and exchange or by the direct acquisition of these materials as groups moved seasonally.

The steatite found at the site could have come from three primary sources, the Boyce Farm complex in northern Maryland, the Albermarle complex in northern Virginia or the Georgetown-Christiana complex in southeastern Pennsylvania. A previous study in Pennsylvania utilizing the REE (Rare Earth Element) spectra analysis was able to determine what complexes were being utilized by the aboriginal inhabitants at select sites (Vento and Shulik 1992). Future studies in eastern Maryland may also be able to determine which steatite quarry complexes were being utilized and when.

General Conclusions

During the geomorphological investigations conducted at Site 18HO206, a single earlier Holocene/late Wisconsin age terrace (designated T1) and a lower probable Middle to Late Holocene age flood plain zone (designated T0) were identified. The lower and younger flood plain zone (T0) is situated ca. 1 m (3.3 ft) above the active stream channel, while the tread of the higher T1 terrace occurs some 1.2 m - 1.5 m (4 ft - 5 ft) above the stream. The mapped soil stratigraphy identified on the T0 flood plain and T1 terrace is graphically shown in Figure 3. Of primary interest is the fact that the artifact-bearing, buried A-horizon which occurs along the bank edge zone of the flood plain thins and rises towards the ground surface as one proceeds towards the valley slopes and T1 terrace. On the T1 terrace the Ab horizon has been entirely integrated into the surface Ap horizon as a result of plowing. Artifacts on the T1 terrace are restricted to the Ap and upper Bw horizons. The more mature sola identified on the T1 terrace is clearly due to the fact that it less frequently receives overbank alluvium.

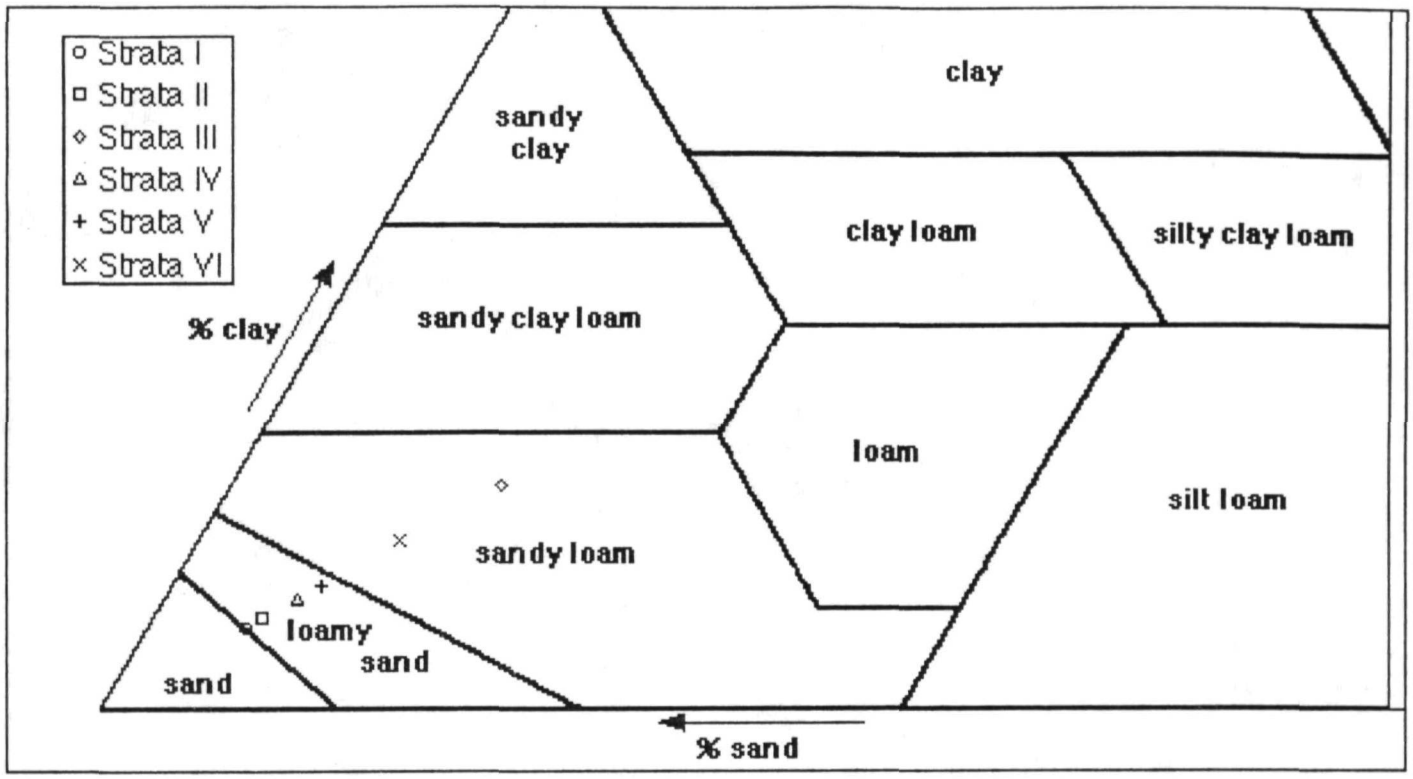
The occurrence of the buried A-horizon on the T0 flood plain is resultant from a episode (> 200 years) of relative flood plain stability which favored A-horizon development. While not presently dated, this buried A-horizon may be associated with a long period of stability beginning during the warm-moist SubAtlantic climatic phase (3000 B.C. to 150 A.D.) and extending through the similarly warm-moist Neo-Atlantic climatic phase (900 A.D. - 1250 A.D.). Interruption in the development of the Ab horizon probably took place over the last 700 years in response to climate change (during the cold-wet Pacific climatic event, 1300 - 1700 A.D.) and historic land usage (e.g., deforestation for lumbering and farming). Both of these conditions would have favored increased surface runoff, higher sediment yields to streams and more

frequent overbanking events. The Ap and C1 horizons on the TO flood plain are associated with these very late Holocene events.

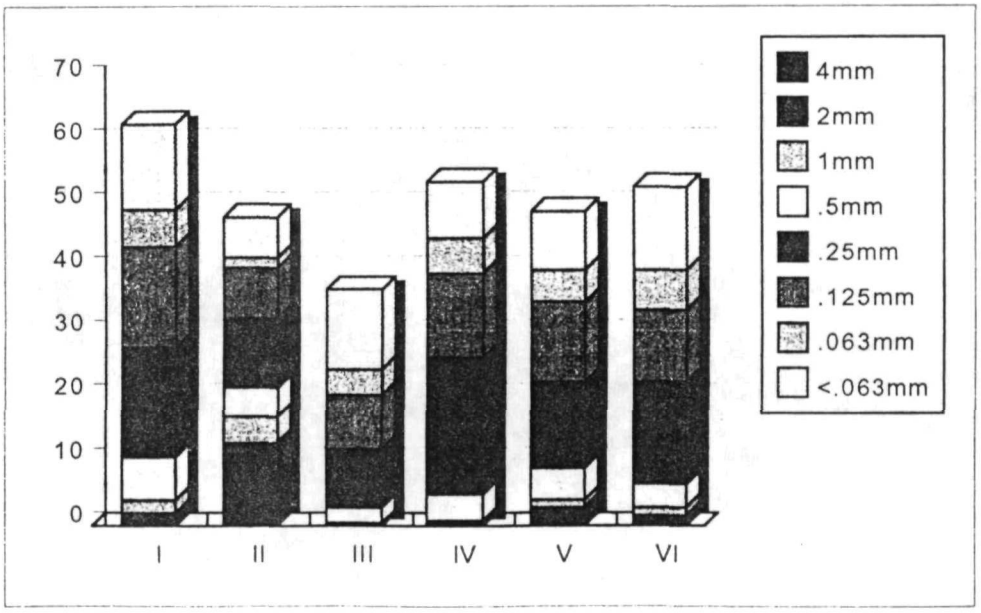
The occurrence of flaked stone artifacts in the and basal lateral accretionary deposits on the T0 flood plain zone can be explained in the two following scenarios: 1) Prehistoric occupants at the site were reducing quartzite cobbles on bars in the active stream channel. These lateral or medial channel bars were then rapidly buried by overbank alluvium as the stream laterally migrated. 2) Prehistoric occupants at the site procured cobbles from the active lag deposits in the stream channel. These cobbles were then reduced along the bank edge of the stream. The stream laterally migrated toward the bank edge at which time these artifacts became part of the bedload of the unnamed tributary of Shallow Run.

APPENDIX A

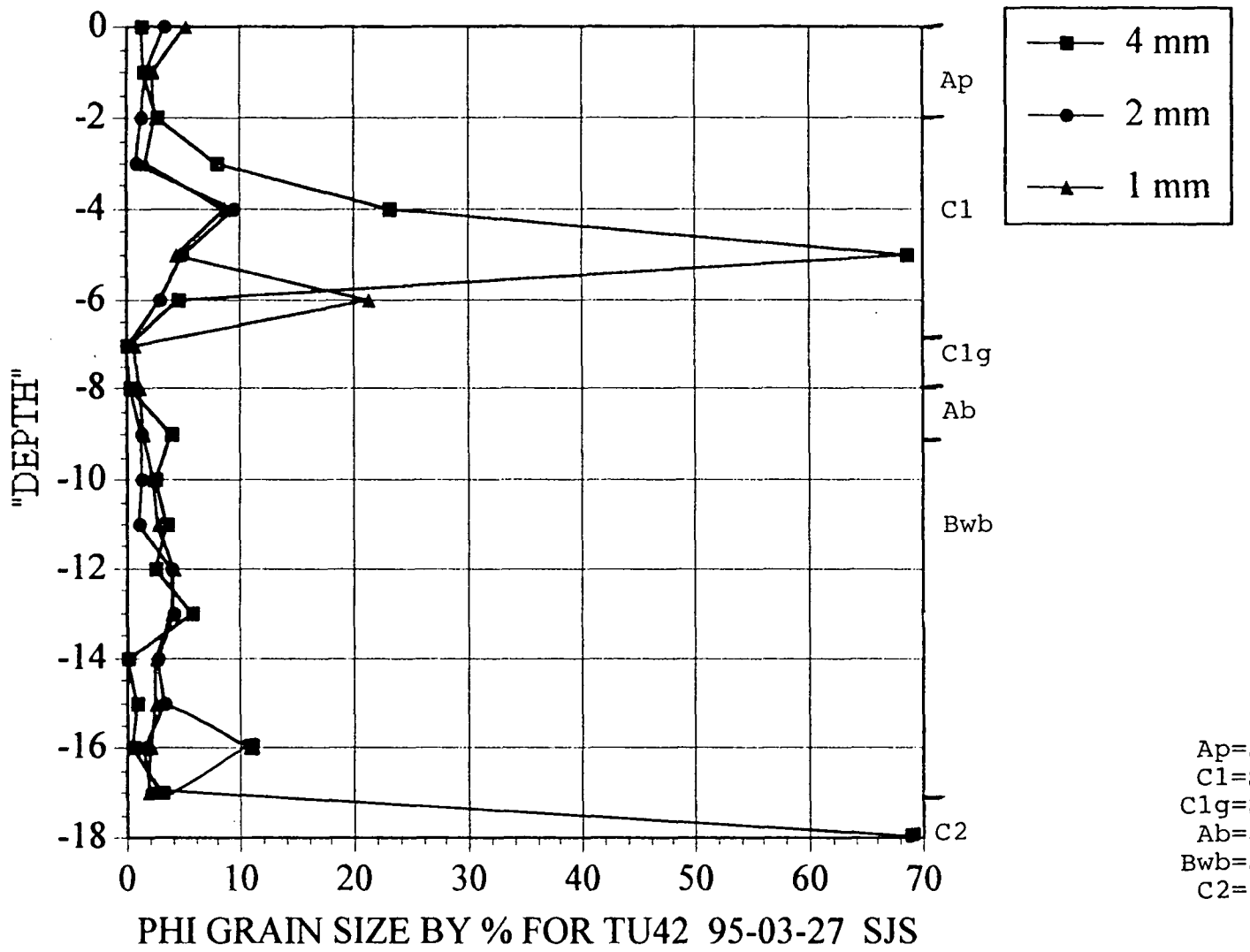
18 HO206



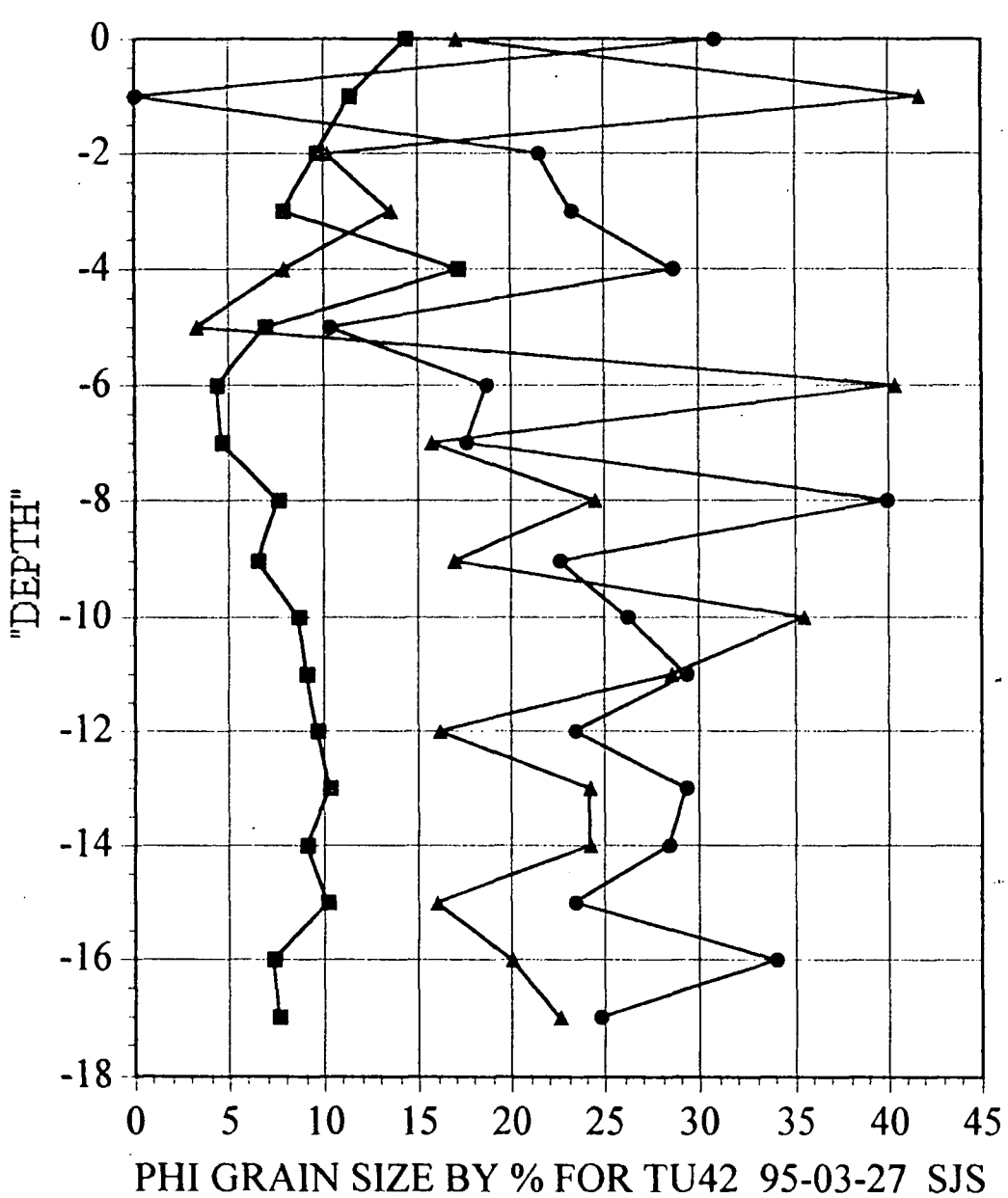
Grain Size	Weight %					
	I	II	III	IV	V	VI
4mm	0.65	11.09	0	0.08	1.42	0.925
2mm	1.345	1.99	0.03	0.16	1.31	0.935
1mm	2.025	4.05	0.34	0.57	1.46	1.035
.5mm	6.995	4.73	2.44	4.08	4.78	3.98
.25mm	16.77	10.6	9.22	21.55	13.71	15.54
.125mm	16.01	7.94	8.2	13.21	12.16	11.255
.063mm	5.915	1.62	4.52	5.51	5.27	6.225
<.063mm	2.475	6.50	12.36	8.78	8.9	13.035



MSK



Ap=Stratum I
C1=Stratum II
C1g=Stratum III
Ab=Stratum IV
Bwb=Stratum Va/Vb
C2=Stratum VI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.125 mm
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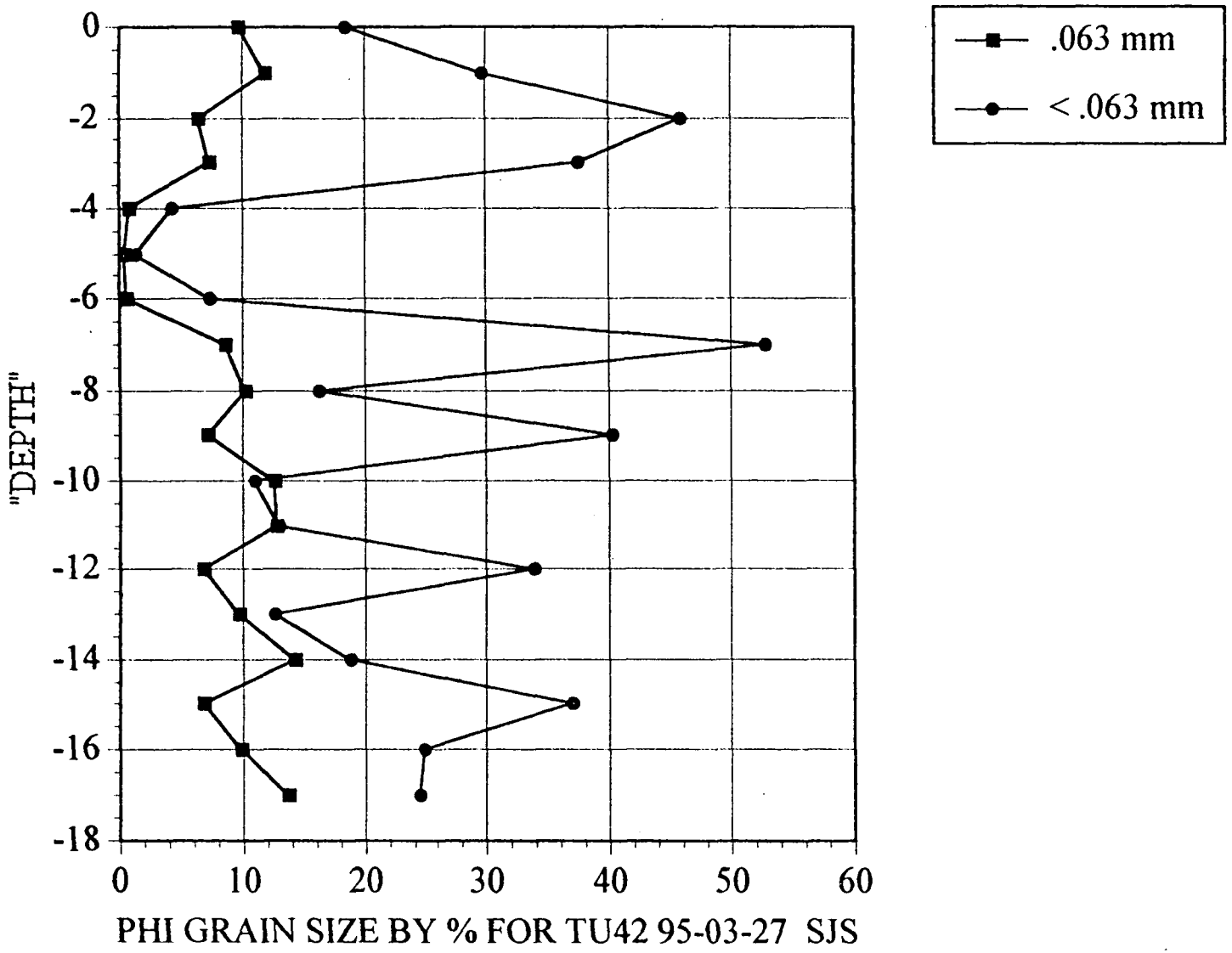
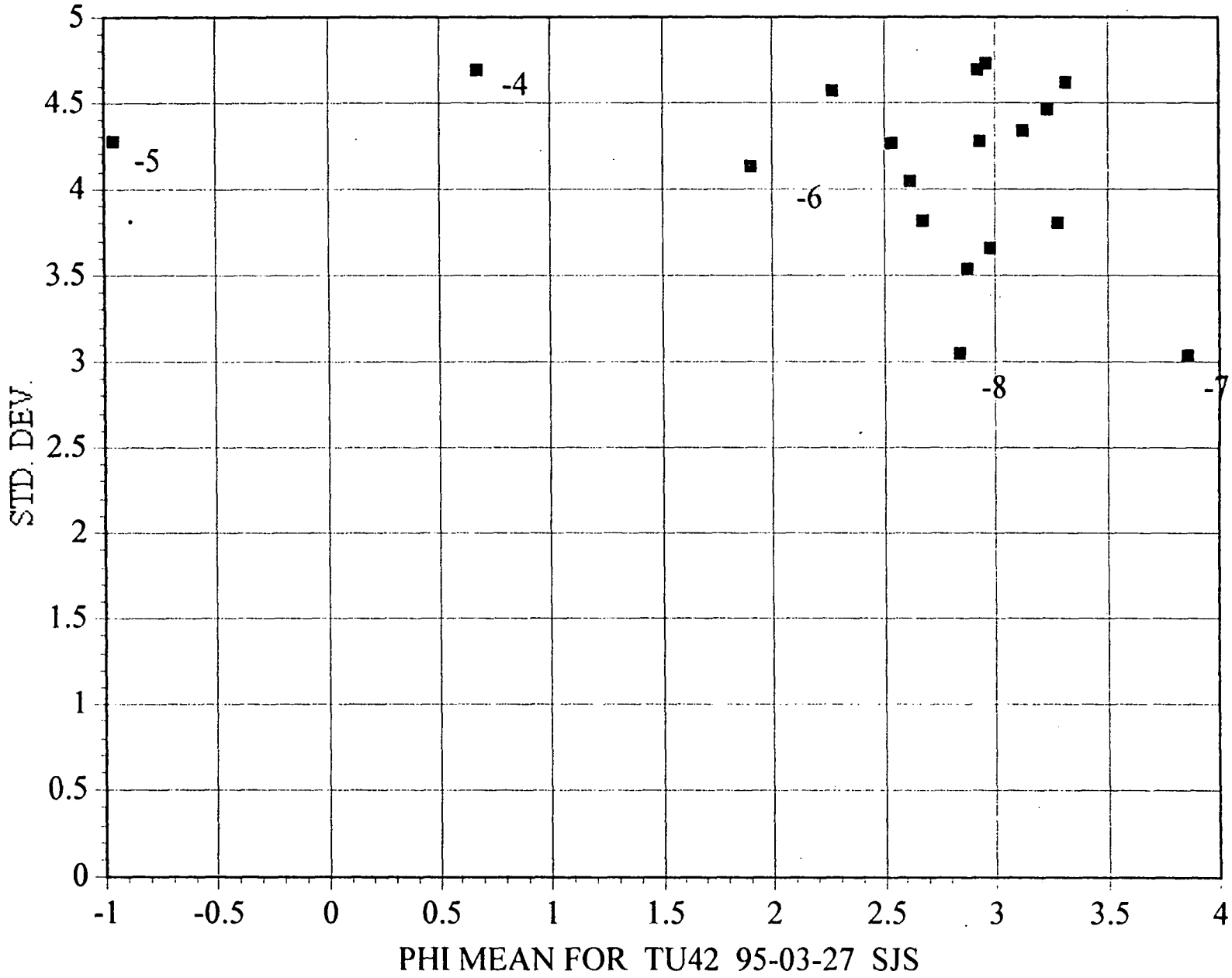
-4
-6
-8
-10
-12
-14
-16
-18
0
5
10
15
20
25
30
35
40
45
PHI GRAIN SIZE BY % FOR TU42 95-03-27 SJS


0
-2
-4
-6
-8
-10
-12
-14
-16
-18
"DEPTH"
0
10
20
30
40
50
60
PHI GRAIN SIZE BY % FOR TU42 95-03-27 SJS
.063 mm
< .063 mm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0
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1
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2.5
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-5
-6
-8
-7

APPENDIX V

MITIGATION PLAN

MITIGATION PLAN FOR PHASE III INVESTIGATIONS AT THE BEEHIVE SITE (18HO206), HOWARD COUNTY, MARYLAND

The Beehive Site (18HO206) will be impacted by the proposed Maryland Department of Transportation/State Highway Administration's Maryland Route 100 Wetland Mitigation Project. Based upon Phase II evaluative testing, Site 18HO206 is considered to be eligible for listing on the National Register of Historic Places under Criterion d by consensus determination between the Maryland Historical Trust and the Federal Highway Administration. Its significance lies wholly in its archeological value to yield information important in prehistory (36CFR60). The data embodied in the artifacts, spatial relationships among the artifacts, and from their environmental context, comprise the information that lends the property its significance. Extracting the data and making it available for study is the most desirable treatment option to preserve the property's value in the public interest.

The site is deeply buried, but not particularly complex. The artifact assemblage recovered during Phase II testing indicates that neither the overall density of artifacts nor their diversity is so great that extraordinary excavation or analytical techniques must be employed to preserve their value. Stratigraphic relationships of the cultural deposits are discernable, and geomorphological reconstruction of this setting is practicable. The Beehive site is considerably more amenable to meaningful pattern recognition, and less structurally complex than other tested and excavated Coastal Plain archeological sites (c.f., Site 18HO203, the Higgins Site [18AN489]).

Site 18HO206 cannot be practically preserved in place. To accomplish the intended result of wetland creation in response to regulatory obligations, the engineering design cannot be altered to lessen or avoid impacts to the site. An extensive search of potential mitigation sites that meet agency regulatory criteria was undertaken by the State Highway Administration and resulted in the acceptance of a limited number of sites that provide the minimum acreage required to mitigate loss from the ongoing construction of Maryland Route 100. The Beehive property is already state-owned. If other alternatives were available, the cost and time to complete additional environmental and cultural resources studies, and engineering, design and real estate expenditures, would outweigh any benefit preservation of 18HO206 would accrue in the public interest. It is therefore recommended that the site be excavated to mitigate the adverse effect of the proposed construction.

The proposed data recovery plan has been developed in accordance with State and Federal standards and guidelines including: the National Historic Preservation Act of 1966 (as amended), Executive Order 11593, the Archaeological and Historical Preservation Act of 1974, The Archaeological Resources Protection Act of 1979 (as amended), and Title 36 of the Code of Federal Regulations, Parts 60-66 and 800, as appropriate. All proposed mitigative efforts will adhere to *Guidelines for Archeological Investigations in Maryland* (McNamara 1981), to the draft *Standards and Guidelines for Archeological Investigations in Maryland* (Shaffer and Cole 1993), to *Archeology and Historic Preservation: The Secretary of the Interior's Standards and Guidelines*, and to standards promulgated by the Maryland Department of Transportation/State Highway Administration. This mitigation plan was developed in accordance with the Advisory Council on Historic Preservation's *Treatment of Archeological Properties: A Handbook*.

Description of Project and Site 18HO206

Site 18HO206, located in eastern Howard County, is a deeply buried, stratified prehistoric site located along the floodplain and associated terraces of a tributary of Shallow Run (Figure 1). Construction of the proposed 0.95 ha (2.4 acre) off-channel wetland mitigation area will result in impacts from subsurface grading, construction of access roads, and soil wasting (Figure 2). Although the locations of access roads

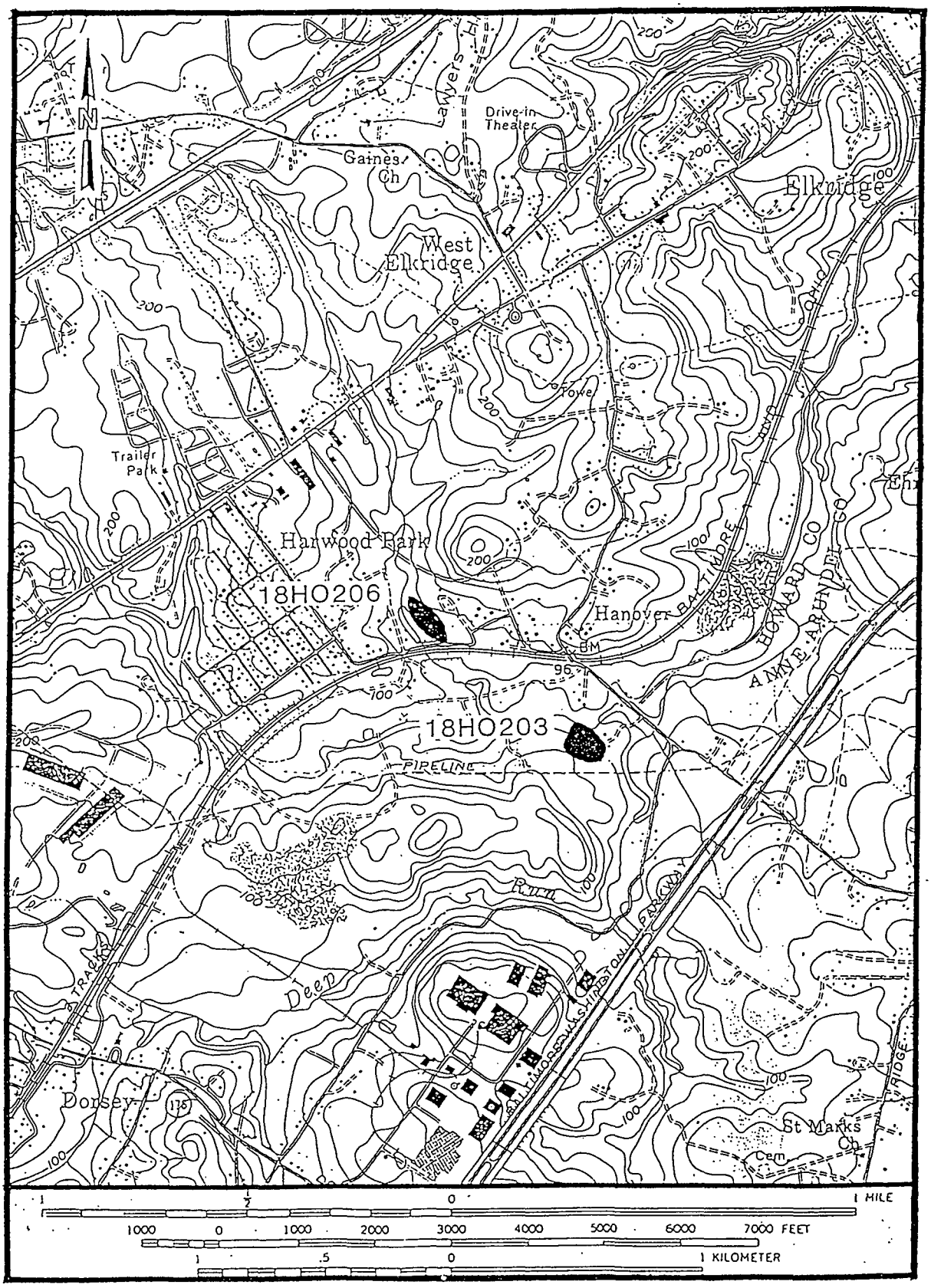

Figure 1. Excerpt from the USGS Relay, Maryland Quadrangle, Showing the Locations of Sites 18HO203 and 18HO206

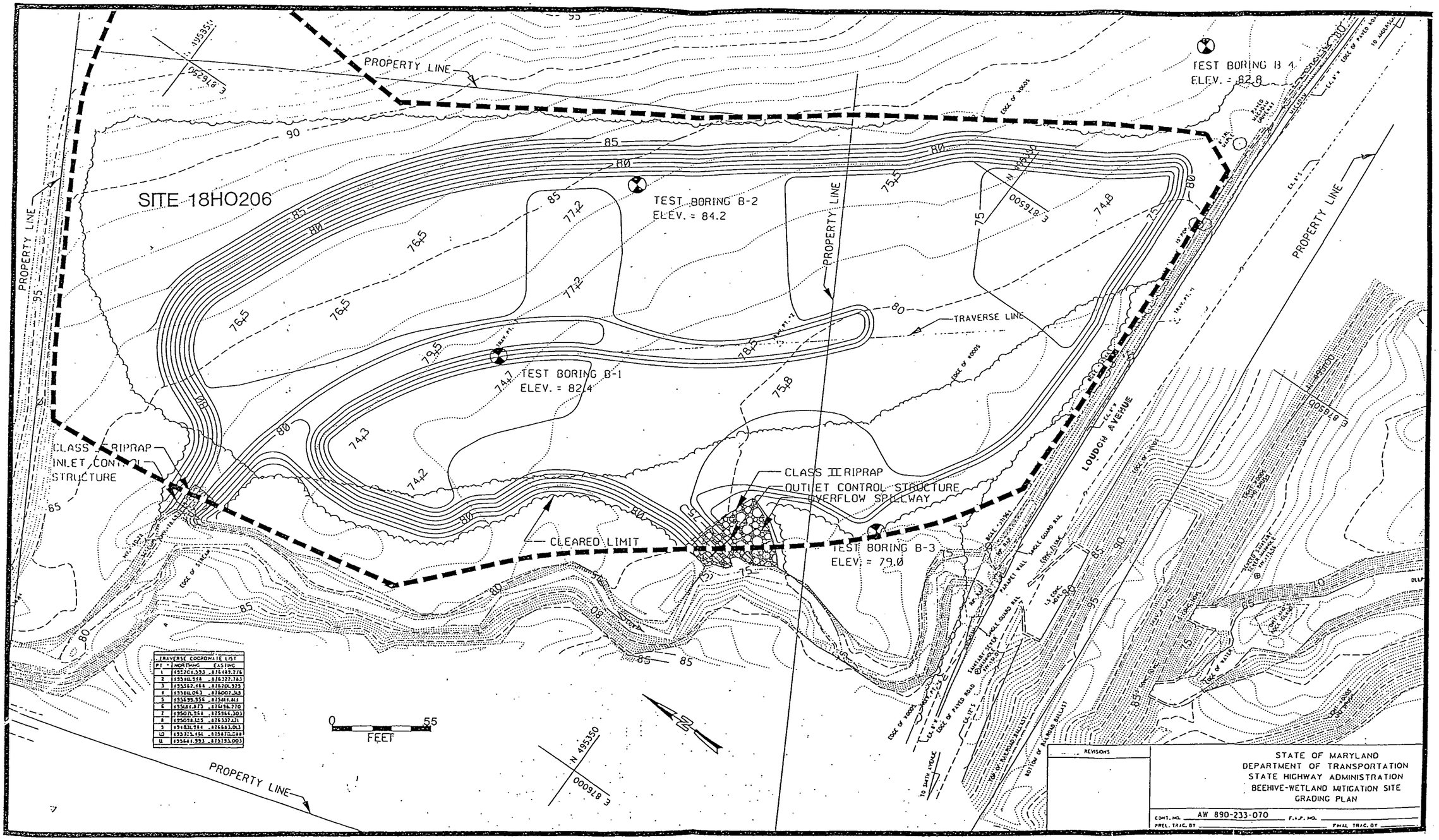

Figure 2. Proposed Construction Plans for the Beehive Site Wetland Mitigation Area, Showing Site Boundaries

and soil wasting areas have not been specified, all work will be confined to the area of potential effect that was subjected to previous archeological studies.

The site is characterized as a multi-component short-term resource procurement site and possible campsite. The principal site activity focused on the procurement and early stage processing of lithic material, specifically riverine deposits of quartz and quartzite cobbles. The topography of Site 18HO206 during the periods of prehistoric occupation consisted of a low floodplain that sloped gently up towards a low terrace in the eastern portion of the site. During the earliest period of prehistoric occupation at the site, its western margin may have been defined by a network of gravel and point bars that resulted from late Pleistocene/early Holocene outwash. The stream channel was better defined during subsequent occupations of the developing floodplain east of the stream. Prehistoric materials were recovered from both undisturbed contexts that were buried beneath deep alluvial deposits, and from a disturbed plowzone in the vicinity of the low terrace.

In addition to the plowzone deposit, the prehistoric components included:

(1) Buried A horizon - at a depth of 75-110 cmbs, this deposit contained discrete concentrations of lithic debris. The deposit extended across much of the site's floodplain and was truncated by historic plowing in the area of the low terrace;

(2) Buried B horizon - at a depth of 110+ cmbs, this deposit was identified in a few test units in the center of the floodplain. One feature, a shallow rock-filled hearth or pit, as well as a discrete concentration of lithic debris, is associated with this component; and,

(3) Gravel Bar Deposit - at a depth of 90-130 cmbs, this deposit consisted of gravels and sands that contained a dense concentration of primary and secondary lithic debris, as well as a number of flakes of non-local rhyolite. This deposit extended below the current water table. These artifacts showed little evidence of transport or redeposition.

Phase IB Survey

A Phase IB archeological survey was conducted by MDOT/SHA archeologists during 1992 (Barse 1993). During the Phase IB investigations, a total of 58 shovel tests was excavated at 10 and 20 m intervals within Site 18HO206. On the floodplain, an intact buried A horizon (Ab) was encountered in 19 of the 21 shovel tests; prehistoric artifacts were recovered from eight of these shovel tests. The horizon underlying this Ab horizon yielded lithic debitage in three shovel tests. Several of these tests revealed dense gravel deposits below the Ab horizon; in one of these shovel tests a concentration of lithic debitage was recovered to a depth of at least 130 cmbs.

A lithic scatter was obtained from the plowzone on a terrace that marked the northeastern limits of the site; two moderate density concentrations were identified in this setting. In addition, lithic debris and historic materials were scattered in the plowzone across the floodplain. One quartz stemmed projectile point (probably Savannah River or Bare Island) was recovered from the terrace area.

The Phase IB investigations characterized Site 18HO206 as a possible Late Archaic period lithic procurement/quarrying site. The topographic variation across the site and the apparent presence of prehistoric cultural material in sub-plowzone contexts implied that the site might contain important information relative to the prehistoric occupation of the Western Shore of Maryland. The Phase IB report recommended intensive Phase II evaluatory testing of Site 18HO206, especially those portions of the site that contained undisturbed prehistoric materials (Barse 1993:38).

Phase II Evaluatory Testing

During 1993, Phase II evaluatory testing was conducted by R. Christopher Goodwin & Associates, Inc. (Polglase et al. 1993). These investigations characterized Site 18HO206 as a multi-component prehistoric site with at least two well defined short-term occupations focused on lithic resource procurement. Deposits of quartz and quartzite cobbles exposed along the stream margins adjacent to the site apparently were exploited. The topography of Site 18HO206 during much of the period of prehistoric occupation consisted of a low floodplain, gradually rising toward the northeast to form a low terrace. Stratigraphic profiles within the portion of the floodplain nearest the present stream channel (the active floodplain) consistently have gravel deposits at their base. Test units placed farther back from the present stream channel (the mid-range floodplain) do not exhibit these gravel deposits. The active floodplain, mid-range floodplain, and the low terrace were examined separately during analyses of the site. Although the Ab horizon extended across the entire floodplain, the occupational horizons below this Ab could not be linked stratigraphically. Finally, prehistoric materials recovered from the terrace were disturbed by plowing.

The earliest prehistoric activity at the site centered on a gravel bar adjacent to the stream channel. A poorly developed floodplain may have extended toward the low terrace to the east. Although this component has not yet been dated, the artifact assemblage and its focus on procurement of large riverine cobbles in a gravel bar setting are similar to the deepest component defined at Site 18HO203 (Schultz Farm #1), which has been ascribed to the early Holocene.

Subsequently, a newly formed, yet stable, floodplain developed over the gravel bars. This latter occupation may date from the middle to late Holocene Transition (Late Archaic Period). The topography of the site at this time consisted of a well developed floodplain gradually rising to the east, where it abutted the Low Terrace. The convergence of the Ab horizon onto the terrace is documented in the stratigraphic sequence of Phase II Test Units 15/16, in which the Ab horizon slopes upward until it is truncated by the plowzone. This suggests that the prehistoric material from the site's terrace plowzone includes the same component as found in the floodplain Ab horizon. Concentrations of lithic materials in the plowzone indicate that the western terrace edge was a primary prehistoric activity locus.

Successive flooding since that putative Late Archaic occupation has resulted in the deposition of significant alluvial deposits over the prehistoric surface; those deposits have preserved that former surface as an Ab horizon on the floodplain. The presence of an intact feature (F1301) and discrete lithic concentrations support the integrity of the buried prehistoric surfaces in the mid-range floodplain.

The erosion of terrace soils relocated some lithic material onto the floodplain, where it became trapped within the alluvial sediments (1C horizon). Additional prehistoric and historic material not associated with cultural activities at 18HO206 also may have been washed in from off-site. Historic conversion of the land to agricultural usage further disturbed the remaining lithic materials on the terrace, scattering them within the plowzone.

Demonstrable morphological differentiation in the types of flakes recovered from the site's geomorphic zones is indicative of different types of reduction activities. For example, Test Units 1/2 reflected a primary resource procurement area wherein stream cobbles were tested to identify suitable material types. Potentially usable material and partially reduced cobbles appear to have been retained and transported to the drier mid-range floodplain and terrace base for secondary evaluation and further reduction. Final reduction of lithic material into transportable cores, blanks, and preforms probably occurred on the terrace.

The overwhelming majority of artifacts from the site are quartzite and quartz; most of this material originated from the stream bed as large cobbles. The small volume of rhyolite flakes and the lone jasper flake result from the reduction of blanks and sharpening of tools brought onto the site. The single projectile point/knife from the Phase IB survey indicates activities (e.g., food or tool processing or maintenance) not

associated directly with the site's primary lithic reduction activities; rather, complementary short-term campsite activities can be posited from these data.

Project Description

The proposed Wetlands Mitigation Project will impact Site 18HO206 directly through grading for the basin, by construction of access roads, and by creation of soil wasting piles. The Maryland State Highway Administration will create approximately 2.4 acres of densely vegetated emergent wetlands at the Beehive property to mitigate loss of wetland acreage from construction of Maryland Route 100 from Interstate 95 to Interstate 97 (Maryland Route 3)(Figure 2). The wetland shall function as an off-channel detention system for monthly storm events. Inlet and outlet structures will connect directly to an unnamed tributary of Shallow Run. The invert of the inlet structure to the created wetland shall be placed at least one foot below the monthly storm elevation. The bottom contour of the created wetland shall not exceed a one foot grade along the water treatment flow path and shall be designed to retain no more than two feet of standing water. The created wetland shall be graded down from the present land surface 3 - 10 ft, to an elevation that will be inundated or saturated to the surface by groundwater or surface water for a period of at least 20 consecutive days during the growing season. The graded slopes between the created wetland and surrounding uplands shall not exceed 35 per cent. One-hundred per cent of Site 18HO206 will be impacted by proposed construction.

Significance Statement and Research Questions

Site 18HO206 is a deeply stratified, multi-component prehistoric lithic procurement and possible camp site. The principal focus of these short-term occupations was the procurement and early-stage processing of local quartz and quartzite cobbles that apparently were obtained from the nearby stream bed. Limited evidence of cutting and scraping activities indicates that the prehistoric utilization of the site was not solely dedicated to lithic extraction. At least two, possibly three, well-defined stratified components were identified within the floodplain portions of the site during the Phase II evaluation. Data recovered from the site indicate that these components retain a very high degree of integrity; occupational horizons are contained within distinct stratigraphic units, these horizons are buried well beneath modern disturbances to the site (up to 70 cmbs), and the sub-assemblages recovered from different portions of the site exhibit functional variation.

The site's upper components, associated with a buried A (Ab) and Bw horizons, may date from the Late Archaic Period; a Savannah River/Bare Island point was recovered from possibly associated contexts on the terrace. The lower components, associated with the 2C1 and 2C2 horizons are presumed to be early to middle Holocene in age. Thus, the archeological components at Site 18HO206 fall, at a minimum, into the following Maryland Historic Contexts: Middle Archaic (6,000 - 4,000 B.C.); and Late Archaic (4,000 - 2,000 B.C.) (Weissman 1986:253). Data recovered indicate that Site 18HO206 can address a variety of research questions related to local and regional lithic procurement strategies, lithic technology, subsistence and environment, and settlement patterns.

Although numerous sites have been identified within the Deep Run drainage system, few lithic extraction sites are known and only one (18AN579) previously has been studied to the Phase II level (Wheaton and Reed 1989). Sites in similar settings (gravel bar/low floodplain) are not well-studied. Previous archeological investigations of Site 18PR94 (LeeDecker and Holt 1991) documented the use of gravel bar deposits by Archaic Period occupants of the site, though lithic procurement was not the primary activity at the site. In contrast, the identified prehistoric components at Site 18HO206 are dominated by procurement activities. The vertical and horizontal separation between these components provides an opportunity to study prehistoric lithic technology from both synchronic and diachronic perspectives.

A series of specific research questions that may be addressed at the Beehive site (18HO206) are posed and discussed below. The relevance of each question and evidence that they might be answered by data recovery at the site are reviewed briefly. The appropriate prehistoric period themes from Maryland's State Plan (Weissman 1986:255-256) are noted in brackets, following each research question.

#1 - What diagnostic artifacts are found in association with one another? In addition to projectile points, can other temporally sensitive artifacts and/or reduction strategies be defined? [Technology]

The stratigraphic and spatial integrity of Site 18HO206 affords an excellent opportunity to address issues related to the development of local and regional prehistoric chronology. Deeply stratified Archaic Period sites are relatively rare in the Piedmont/Fall Line region and in the Mid-Atlantic in general. Contextual study of known diagnostic material will help to refine regional chronologies. Detailed study of well controlled assemblages (e.g., the site's large cobble reduction episodes) also will provide information to assist in the definition of additional temporal markers in the region. For example, recent research in the region has led to a series of debates on the seriation and dating of Late Archaic projectile point forms (compare Polglase et al. 1990 and Ebright 1992 on the dates of Otter Creek points; see Polglase et al. 1990 and 1991 for discussions of bipolar pebble/cobble technology in the Little Patuxent drainage). Since the chronological relationship between recognizable diagnostic artifacts remains in flux, controlled stratigraphic excavations of Archaic period contexts remain a critical research concern in the region.

#2 - What lithic procurement and reduction strategies were employed at the site? Do these strategies differ over time? What kinds of groups were involved in the extraction and reduction of quartz cobbles at the site? [Technology; Demography]

Quarry sites are an important, yet often neglected, resource for studying lithic extraction and reduction strategies. These sites are often the only location in which the earliest stages of reduction can be examined. Core technologies and reduction strategies evident at such sites may be temporally or culturally distinctive (Johnson and Morrow 1987). However, the ascription of specific timeframes to lithic reduction strategies requires tight temporal control, combined with careful descriptions of the diagnostic features within the relevant assemblage (Polglase et al. 1990; Neumann and Polglase 1992; Polglase 1989).

Data recovered during Phase II testing at Site 18HO206 indicate that the site will provide information regarding these issues. Cursory analysis of the lithic debitage and cores indicated that a variety of reduction techniques and strategies were employed at the site; some of these reduction strategies are distinctive from previously defined reduction sequences documented in the archeological literature of Maryland's Western Shore (c.f., Neumann and Polglase 1992; Polglase et al. 1992; Maymon et al. 1993). Much of the prehistoric activity at Site 18HO206 was focused on core preparation and the production of large flakes from large cobbles; however, a small number of biface fragments also was recovered. Preliminary examination of a selection of cores from the site identified bipolar, irregular, and bifacial cores. Spatial variation in the amount of cortical flakes and lithic tool assemblages suggests that various reduction activities, and/or processing/maintenance activities occurred in distinct portions of the site. The suite of activities tentatively identified at the site suggest varied use consistent with short-term campsites. At the Russett 21 Site (18AN685), such short-term camps were hypothesized to reflect seasonal mast procurement episodes that were incorporated into an ad hoc round of lithic procurement (Polglase et al. 1990).

The procurement/reduction strategies employed within each of the two clearly identified occupations of the site will be reconstructed; particular emphasis will be given to changes in reduction techniques, to intra-site patterning of activities, and to the diversity of activities represented in the assemblages from each component. These functional reconstructions will be placed within the appropriate temporal and regional frameworks.

 # 3 - How do the site's spatially discrete activity areas relate to site organization and structuring? Are these intra-site patterns consistent through time? How does the internal structure of Site 18HO206 compare or contrast with other cobble quarries (such as 18AN579) or sites in which cobbles within gravel bar deposits were exploited (i.e., 18PR94)? [Technology; Settlement]

The level of integrity retained within the site's deeply stratified components will afford an opportunity to conduct detailed spatial analyses. Such analyses provide important information regarding the organization of space within a quarry-related site; information which will assist in understanding the spatial dimensions of lithic reduction strategies (c.f., Site 18BA433 [Maymon et al. 1993] and Site 18AN685 [Polglase et al. 1990]). Phase II testing encountered evidence indicating that the site retains distinct loci of prehistoric activity; these loci reflect functional variations in the lithic reductive and other activities across the floodplain. For instance, the initial stages of lithic reduction appear to have occurred nearest the stream, with more diverse activities occurring on those portions of the floodplain nearer the terrace (and probably on the terrace). Although debitage, cores, and hammerstones are prominent in sub-assemblages across the entire site, the smaller average flake size, the lower percentage of cortical flakes, biface fragment, and feature differentiate the mid-range floodplain from the active floodplain portion of the Ab horizon component. Similarly, the component associated with the 2C horizons may be functionally distinct; a high percentage of utilized/retouched flake tools was recovered from the near-stream portions.

The organization of procurement and reduction of lithic materials may vary across geographical, cultural and temporal boundaries. Comparison of the internal structure of Site 18HO206 with similar sites will help assess the degree to which the activities at the sites are unique or shared by other sites in the region. Preliminary examination of settlement data during Phase II research indicated that quartz cobble reduction was common in the Deep Run drainage. Research at the Lyonsfield III Site (18BA433) suggests that at least some of these quarry-related sites were not solely lithic extraction sites; evidence of short-term habitation also is present in that locus (Maymon et al. 1993). The high degree of integrity retained by the prehistoric quarry-related components at Site 18HO206 indicates that such comparisons between individual components at the site and with similar sites in the region will be possible.

#4 - What variables may be common to quarry-focused sites in the Piedmont/Coastal Plain transition zone? Is there a correlation between the locations of different lithic reduction activity areas and site-specific environmental variables? Was soil drainage an important variable in the selection of locations for short-term camps during the Late Archaic period, and does it appear to be an important factor in the siting of short-term camps in the Fall Line zone in general? [Settlement; Environmental Adaptation]

Although few quarry sites have been subject to detailed study in the Mid-Atlantic region, such sites often are presumed to have played an important role in defining prehistoric settlement patterns (i.e., Custer 1984, 1989; Gardner 1979, 1983; Stewart 1980). The procurement of suitable stone for stone tool manufacture was a serious and constant challenge to prehistoric peoples. This problem was solved in disparate ways by various cultures. Quartz minerals appear to have been a preferred raw material during the Late Archaic and Late Woodland periods in the Middle Atlantic region (Steponaitis 1987; Custer 1992) and beyond (Dincauze 1976). Those procurement strategies and settlement systems probably differed markedly from those cultural periods in which people relied more on exotic materials, such as chert and rhyolite (e.g., the early Holocene, late Middle Woodland). Quartz and quartzite are common throughout the region and occur in cobble form in stream beds and as outcrops in eroded upland areas. High quality quartz may have been distributed unevenly across the landscape, necessitating specific procurement efforts. Thus, Late Archaic lithic procurement and settlement systems may have been different from the Middle Woodland, when rhyolite use was at its peak (Polglase and Neumann 1991a).

The place of quartz and quartzite quarry sites within these settlement systems is poorly understood. Additional study of Site 18HO206 will provide a better understanding of the nature of these localized quarry activities and thereby provide crucial information regarding a little studied site type in the Mid-Atlantic region. Such research also will begin to place localized lithic reduction strategies within larger-scale regional procurement systems.

This research topic also must take into consideration the distribution of other resources on the prehistoric landscape that might have conditioned the lithic procurement system (c.f., Polglase 1991). For example, the availability of soils to support productive oak/chestnut stands may have been crucial to permit sufficient population growth in an area to warrant extensive reuse of quarry sites (Polglase et al. 1990). In addition, the character of the Deep Run/Shallow Run drainage system may have provided a limited number of settings where stream bed quarries could be located near temporary camps. In other words, are the floodplain temporary camps recognized at 18HO206 and 18AN579 unusual to the near-Fall Line area? Do local factors of floodplain development during the middle to late Holocene transition create new opportunities for the exploitation of the outwash deposits at the base of the Fall Line? Such issues can be addressed through further geomorphological examination of the Beehive Site's floodplain, relative to formation processes that encompassed the Deep Run/Shallow Run drainage system.

#5 - At what time of the year was the site occupied? What might the vegetative community in the vicinity of the site be composed of? What kind of plant and animal resources were exploited by the occupants of the site? [Environmental Adaptation; Settlement]

Prehistoric subsistence patterns are poorly known in the Mid-Atlantic region. Botanical and faunal material often are preserved poorly in the acidic soils of the region and the recovery of carbonized materials from features only recently has become widespread with the proliferation of floatation techniques. Analysis of fossil pollen and phytoliths, although rarely applied to site specific research in the Mid-Atlantic region, can provide data regarding local environmental conditions during the occupation of the site.

The presence of a feature and wood charcoal within stratified components at the site provide an opportunity for the reconstruction of prehistoric subsistence and the environment. The wood charcoal, carbonized nuts and seeds present at the site are valuable in the reconstruction of local paleo-environment and subsistence patterns. Identification of tree and plant species allow interpretation of seasonality, local vegetative communities, and subsistence practices. The determination of the season(s) of occupation of a site can be crucial for developing holistic models of the adaptive strategies that were developed by prehistoric Native Americans relative to environmental constraints; such models then can be tied into local and regional settlement systems. Phase III excavation and analytical efforts will be directed towards the recovery of archeo-botanical remains, and possibly fossil pollen and/or phytoliths to permit such paleoenvironmental and cultural reconstruction. Blood residue analysis will allow for the identification of animal species hunted or butchered by the occupants of the site.

The presence of a visible buried A horizon and entombed wetland vegetation within the silty clay immediately above the prehistoric occupation surface (Ab horizon) indicate the possibility that micro-botanical remains were preserved. Such micro-botanical remains were found preserved at the Higgins site (Ebright 1992). The analysis of features and sediments at that site (Seward 1992) provide a baseline with which to interpret the results of the proposed analyses at Site 18HO206.

#6 - Do vegetational/environmental changes in the vicinity of Site 18HO206 reflect broadscale regional patterns as reconstructed by Carbone (1976), Custer (1989), and others? How do the timing and character of local vegetative changes compare with regional patterns? [Environmental Adaptation]

The middle to late Holocene has been characterized as a time of extreme climatic oscillations, including maximum Holocene warm/dry conditions (the xerothermic). These environmental changes have been viewed as the major cause of rapid and widespread changes in settlement/subsistence patterns, social organization, and technologies in the Middle Atlantic region (Carbone 1976; Custer 1989; Steponaitis 1987). The mid-postglacial xerothermic has been related to the rate of river channel incision or floodplain development, aeolian deposition, and other depositional discontinuities on archeological sites. However, recent paleoenvironmental research indicates that the timing and character of such changes may be locally variable (Joyce 1988; Nicholas 1988). Coastal, riverine, and lacustrine areas developed micro-environments that may have been at variance with broadscale reconstructions. Recognition of this variability has had a impact on current reconstructions of settlement/subsistence patterns during the early Holocene in the Northeast (Nicholas 1983; Nicholas and Handsman 1984; Nicholas 1988; Joyce 1988). Examination of macro (seed and charcoal) and micro-botanical (fossil pollen or phytoliths) material from Site 18HO206 can help to clarify the environmental conditions that pertained to Maryland's Western Shore during the site's period of prehistoric occupation. If such data are available, they can be compared to generalized reconstructions for the region.

Data Requirements

Mitigation of project impacts will require sampling of the site's significant prehistoric components (the Ab and 2C horizon related components in the floodplain) combined with a suite of lithic analyses designed to describe fully the range of activities, and the spatial organization of the prehistoric occupations. The environmental background for the occupations also will be addressed through examination of macro-botanical materials, and fossil pollen and/or phytoliths, if available and appropriate. The field techniques will need to address the following requirements: (1) provide more extensive sampling of the site's floodplain to identify the most significant activity areas; (2) collect representative sets of lithic material from primary and secondary lithic reduction stations and possible campsite loci, such as that found in the vicinity of Feature 1301; (3) examine the low terrace area for sub-plowzone features that might support the dating of that component; (4) define more accurately the geomorphological relationship between the Ab and 2C horizons on different portions of the floodplain and the component lying on the terrace; (5) collect representative botanical data from the prehistoric components; (6) excavate sizable horizontal exposures within the floodplain that might expose features and activity areas in each component.

Laboratory analyses of materials recovered during the mitigative excavations will need to address the following research needs: (1) describe intensively the range of lithic reduction stages encompassed within the sampled activity areas; (2) provide a definitive morphological description of any distinctive classes of flaked tools or cores recovered from securely dated prehistoric contexts; (3) provide a detailed explication of the spatial relationships between the site's activity areas and within individual behavioral loci; (4) describe the conditions and geomorphological factors that led to the formation of this site; (5) place the lithic reduction strategy and the site's occupational loci within a relevant, chronologically-sensitive, reconstruction of subsistence and settlement systems for the Western Shore's near-Fall Line zone; and (6) reconstruct the local environment at the time of occupation and compare it with regional reconstructions.

Research Design

The prehistoric deposits at Site 18HO206 represent a Late Archaic occupation. Additional periods of occupation, including a possible early to middle Holocene deposit, may be present in the gravel bar

component. Phase II investigations revealed the remains of primary and secondary lithic processing, evidence of other activities that required retouched unifaces and flake tools, and the presence of an intact activity surface with associated features.

As the above-cited significance statement indicates, Site 18HO206 retains important information for the reconstruction of prehistoric lifeways in the near-Fall Line zone of Maryland's Western Shore. Such data are unique among the documented archeological database for the area. Although such data have been characterized at the Phase II level of analysis for 18HO206, 18HO203, and 18AN579, no prehistoric sites of this type have been documented fully in accordance with archeological data recovery standards. Such mitigative-level analyses are needed critically to provide an accurate understanding of the role of localized lithic procurement strategies in the subsistence/settlement systems of the Western Shore's Native American populations and for fleshing-out the culture history of the region. In addition, such information can serve as a much needed baseline for comparison with and assessment of other quarry-related sites in the region.

The mitigation efforts will concentrate on the intact buried components of the site (Figure 3). Only limited additional testing is warranted in the terrace area; this will take the form of stripping with a backhoe equipped with a clean-up blade of an approximate 20 x 40 m area to determine if prehistoric features are present. Historic alluvial and colluvial deposits also may be stripped mechanically from above the buried cultural horizons, allowing the hand excavation of sampling blocks. Such stripping will be limited to the immediate area of the planned units or blocks and will be monitored by the site field supervisor. Additional geomorphological sampling will be undertaken to assist in defining the temporal relationship between the site's components and to provide data relevant to the formation of the site's geomorphological features. Samples of macro-botanical material will be recovered to permit an environmental reconstruction for the periods of occupation. Soil samples for micro-botanical analyses also will be collected.

To date, a 22 m^2 portion of the site has been excavated. Phase III data recovery will expose another 64 m^2 of the site. Phase II testing found that the Ab horizon on the terrace was located at a depth of 75 - 110 cmbs; the gravel bar deposits are at a depth of 90 -130 cmbs.

Methods and Techniques

Field Design and Methods

Field methods will consist of four parts: (1) emplacement of a datum, "bush-hogging" of brush, and preparation of a topographic map with at least 1.00 m contour intervals; (2) excavation of 16 1 x 1 m test units on the floodplain; (3) excavation of two 10 m-long backhoe trenches to provide geomorphological control; and (4) excavation of three 4 x 4 m excavation blocks based on the results of the initial sampling program.

The 16 1 x 1 m test units are designed to provide more extensive sampling of the site's floodplain components; they will be excavated individually or as part of 1 x 2 m units. For most of these units, historic alluvium and colluvium will be removed mechanically to 10 - 15 cm above the intact cultural strata, at which point the cultural strata will be removed by hand. The use of these smaller testing units is designed to sample the significant strata rapidly and efficiently, so that the larger block excavations can be directed at the most important activity areas. A minimum of four of the units will be used to sample the areas that will be examined with the backhoe trenches. The general areas planned for the unit excavations are illustrated in Figure 3. Four of these units will be held in reserve until after the backhoe trenching, to allow for further study of geomorphic and cultural features revealed in that testing. It should be noted that the Principal Investigator will retain sufficient discretion to modify field methods, as circumstances warrant; such modifications will be approved by MDOT/SHA staff in advance.

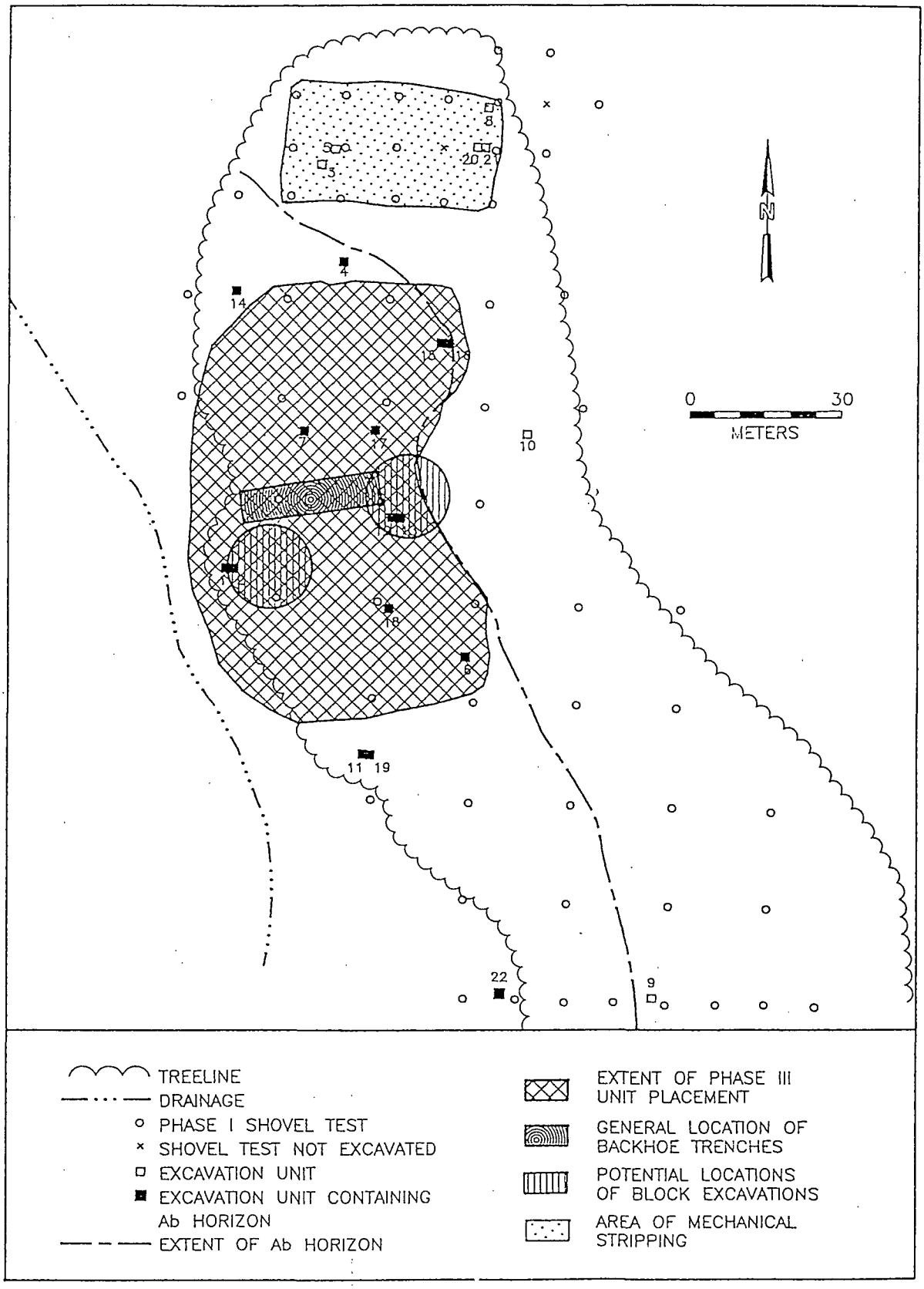

Figure 3. Proposed Mitigation at Site 18HO206

The four phases of field testing will be undertaken in an expeditious manner. Excavation of the test units will be initiated immediately upon completion of the "bush-hogging" and the contour map preparation. The units to be placed in the footprint of the planned backhoe trenches will be undertaken first; the excavation of the trenches will proceed as soon as these units are completed. Excavation of additional test units, the geomorphological documentation of the backhoe trenches, and the stripping of the 20 x 40 m area on the Low Terrace will move forward at the same time. The results of the unit testing and the trench documentation will provide data for the final determination on the placement of the three excavation blocks. The placement of the block excavations will be decided in consultation with MDOT/SHA staff and the Maryland Historical Trust.

The two backhoe trenches will be excavated on an east-west axis and will be placed to provide a general geomorphological cross-section of the site across the floodplain (Figure 3). The two trenches will provide a profile across the floodplain; however, they may be offset up to 5 m to avoid areas of disturbance or previously examined areas. The trenches are designed to clarify the geomorphological relationship between the site's components and to expose datable natural deposits. The profiles of these trenches will be prepared by a professional geomorphologist and/or pedologist familiar with the types of formation found at the site. Pedological samples will be taken of representative deposits in order to permit a detailed description of site formation processes.

The block excavation areas are designed to sample intensively three activity loci in different portions of the site. Block excavation will allow detailed intra-site spatial analysis and provide significant horizontal exposures within which features might be exposed. The placement of these blocks will be contingent on the findings of the Phase III test units, in combination with the Phase II excavation results. It is anticipated that two blocks will be excavated into the components on the mid-range portion of the floodplain and that a third will be placed onto the near-stream (active) portion of the floodplain, where the deep 2C horizon component lies on top of a gravel bar deposit. Two potential locations for these block excavations, based on the Phase II investigations, are illustrated in Figure 3. As noted above, all excavation block placements will be determined in consultation with MDOT/SHA and the Maryland Historical Trust.

Following the mechanical removal of sterile or disturbed overburden, the units will be hand excavated. Excavation generally will be completed by troweling; shallow shovel skimming may be employed when fine-grained soils and low artifact densities (<10 artifacts per 5 cm level) are encountered. Soils will be removed in 5 - 10 cm arbitrary levels within naturally occurring stratigraphic horizons. Within the finer-grained Ab and 1Cg horizons, soils will be removed in 5 cm levels within the natural strata. Within the coarse-grained sediments (e.g., gravel bar deposits) at the base of the floodplain, soils will be removed in 10 cm arbitrary levels within natural strata. Ten centimeter levels are appropriate in such deposits because it is felt that fine scale excavation will loose sight of the fact that the artifacts are likely to have moved vertically up to 5 - 15 cm in such coarse sands and gravels; in addition, hand excavation of 5 cm "spits" would be a costly exercise in such coarse materials. All excavated soil will be dry screened through 0.635 cm mesh. Units will be placed on the site map and labeled with their grid location. Standard soil nomenclature will be used to describe the site matrix; minimal pedological attributes recorded will be color and texture.

Horizontal provenience control will require a combination of lot collection and point proveniencing. As noted above, 5 - 10 cm levels within 1.00 m^2 will be the maximum collection unit for provenience lots. The use of 1.00 m^2 collection lots has been shown to be an effective sample unit at lithic processing/reduction camps in Anne Arundel County (Polglase et al. 1990, 1991, 1992); such a lot sample permits fine-grained horizontal pattern analyses, without excessive field excavation and laboratory processing costs. Classes of material that may be lot collected include flakeage (debitage and utilized flakes), non-feature fire-cracked rock, and any other non-diagnostic stone. All other classes of artifacts will be point provenienced within an x-y-z grid. In addition, distinct clusters of flakeage and cores will be classified as features; in such instances, all non-debitage will be point provenienced following the mapping and photographing of the feature.

Prehistoric features anticipated at Site 18HO206 include intact or "kicked out" hearths (Polglase et al. 1992), pits (Polglase et al. 1991), earth ovens (Neumann et al. 1991), and clusters of lithic debris (Polglase 1988). When encountered, features will be exposed completely, photographed, mapped, and then excavated completely. Features will be drawn in profile. A minimum of two liters of feature fill will be retained for flotation; the remainder of all feature fill will be screened through 0.635 cm (1/4 in) or finer mesh. All soil retained for flotation from features will be floated using froth flotation procedures. Volumetric samples (1 - 2 liter) will be taken from all buried cultural strata; such samples will be used to provide macro-botanical material and micro-debitage.

Representative samples will be floated and the remainder will be water-screened through 0.0625 in mesh. The samples from buried strata will be collected by hand from the southwest corner of the excavation level; these collection methods have been developed in consultation with the project ethnobotanist. Up to five samples from each significant stratum will be floated to determine whether sufficient macro-botanical or artifactual material is present to warrant further analyses; all floated samples will be examined by the project ethnobotanist. If a level of redundancy is reached during analyses of a particular stratum, the remaining float samples will be waterscreened for cultural material, or will be retained for future study. Any unprocessed soil samples will be turned over to the Maryland Historical Trust with the artifact collection.

Samples of sediment for pollen and phytolith analysis will be taken from all features and from selected stratigraphic columns at the site. Additional samples will be collected from areas off the site, as a control for cultural activities. Samples will be collected following procedures described by Bryant and Holloway (1983) and Dimbleby (1985). A small portion of these samples will be submitted for an assessment of the quantity and quality of fossil pollen and phytoliths within the matrix. If these samples indicate the presence of micro-botanical data that can address important research questions, additional samples may be submitted for analysis. The results of any micro-botanical analyses will be discussed fully in an appendix to the final report and will be incorporated into a synthetic analysis of the site's environmental setting that includes a review of macro-botanical data as well.

Excavation of Burials

The discovery of Native American remains or grave related materials is unlikely. However, if human remains are encountered during the excavation, the contractor will contact MDOT/SHA immediately. Excavation of the human remains will proceed only with written permission from MDOT/SHA's representatives and in accordance with the consultation requirements of the Native American Grave Protection and Repatriation Act of 1990 (NAGPRA).

Laboratory Analysis

Theoretical Framework for Analyses

The theoretical paradigm that underlies these analyses is based on assumptions that lithic reduction episodes can be characterized relative to stages of production (Stahle and Dunn 1982), and that these stages of production (e.g., primary vs. secondary reduction) are relevant organization tools for describing prehistoric behavior. Such an organizational framework has been applied throughout the Mid-Atlantic region for the past 10-20 years to describe lithic reduction behavior. Replication experiments of lithic assemblages generally have proven the veracity of these organizational constructs on an experimental level (Stahle and Dunn 1982; Ammerman and Andrefsky 1982; Polglase n.d.). Analyses designed to address the requirements of this methodological framework generally focus upon careful morphological characterization of lithic material from distinct behavioral subsets (Polglase 1988).

In addition, this paradigm incorporates recent prehistoric research in the eastern United States that indicates that the distribution of various classes of lithic material can be used to delineate intra-site patterning of prehistoric behavior. This type of activity area analysis has proven successful in defining the organization of multi-component/multi-functional sites in the eastern United States in general (Yerkes 1987; Goodwin et al. 1990; Custer and Bachman 1986) and on Maryland's Western Shore in particular (Polglase et al. 1990; Polglase and Neumann 1991b). Such analyses require the identification of all utilized flakes among the flaked stone assemblage (Neumann and Polglase 1992), the definition of subsets of utilized flakes through metrical analysis and statistical applications (generally parametric), and the determination of relationships between classes of flakeage and other artifact classes. The last step of these analyses generally is completed by running correlations (Chi-square or Pearson *r*) between each class of artifact (e.g., debitage vs. utilized flakes; debitage vs. bifaces) within stratigraphically meaningful subsets; distinct associations of artifact classes are plotted on site maps and are discussed relative to their potential to describe the prehistoric behavior. These loci of lithic activity will be correlated with ancillary data (i.e., feature location, macro-botanical remains, blood residue results) to provide a holistic reconstruction of the past activities.

Specific Analytical Treatments

All materials will be cleaned and rinsed, as necessary. Projectile points and other tools will be rinsed briefly, but not scrubbed; this cursory cleansing will permit initial temporal or functional ascriptions prior to subsequent blood residue analysis. Pursuant to the current requirements of the Maryland Historical Trust (August 1991), representative diagnostics will be labeled. The artifacts will be sealed in clean plastic bags, with provenience data recorded on the outside of each bag. Cultural materials will be separated into historic and prehistoric, should the former be present. Each item will be identified and classified by material, type, and distinguishing attributes. Specific analytical procedures are given below. General accessioning of the materials will use a dBase III+ laboratory program.

Debitage. All flaked stone items will be examined initially with a hand lens. Those flakes showing no evidence of subsequent modification will be classified as debitage; a 10 per cent random sample of these flakes will be examined at 10-20x using a dissecting microscope to determine if less demonstrable usewear is present. All flakes will be sorted by raw material type, weighed, then classified as primary cortex (>50 per cent dorsal face cortex), secondary cortex (<50 per cent dorsal cortex), or non-cortex. Each flake will be weighed and a maximum dimension measurement will be recorded. Distinctive data related to stages of reduction (i.e., evidence of core rejuvenation, platform preparation, etc.) will be noted where appropriate.

Cores. The maximum dimensions will be measured along each of the core's x-y-z axes. The weight will be taken and descriptive characteristics, such as heat-treatment, will be recorded. The raw material will be recorded while the amount of cortex covering the surface will be estimated. Each core will be placed into a generic descriptive category (e.g., tested cobble, bipolar, multi-dimensional, etc.).

During the Phase II evaluation of Site 18HO206 (as well as Site 18HO203), a distinctive class of "disk-shaped" cores was noted; such cores were found in association with the sites' gravel bar deposits and may represent a chronologically diagnostic form of this class of artifact. The delineation of such a diagnostic form may assist with the dating of other quarry-related sites that lack traditional diagnostic artifacts (i.e., projectile points). Cores defined as unifacial or "disk-shaped" will be described in the following manner: (1) percentage of cortex on unused face; (2) number of flake scars; (3) maximum length and width of flake scars; (4) "height" of the central portion of the core above the peripheral platform. Each example of core forms will be photographed and/or drawn to scale. If distinctive classes of cores are identified that may be chronologically diagnostic, the metrical range will be provided for class-defining attributes and a number of examples will be illustrated.

Metrical control on classes of cores is critical in determining their uses; for example, small pebble cores found at sites in Anne Arundel County could only be used to produce microliths for compound tools

(Neumann and Polglase 1992). In contrast, the height and number of flake scars found on large unifacial cores can reveal the number of successful removals of large flakes from each core; such large flakes could have been used for expedient or curated tools, or could have been reduced further into bifaces. Thus, the identification of the classes of cores at the site reveals the "target" lithics (microlith, as opposed to flake core or biface) that directed the lithic procurement patterns. In addition, the presence of broken cores may indicate episodes of reduction failure, which may have necessitated the procurement and early stage processing of other cores.

Groundstone/Pecked Stone. The maximum dimensions of each groundstone/pecked stone will be measured along the object's x-y-z axes. The weight will be taken and descriptive characteristics will be recorded. A generic use will be assigned. Samples of groundstone from distinct activity loci may be submitted for blood residue analysis.

Utilized/Retouched Flakes. The maximum dimensions of each utilized or retouched flake will be recorded along the object's x-y-z axes, and the weight will be taken. Raw material and the presence or absence of heat-treating also will be recorded. The edge angle of the working edge(s) will be measured, and the edge forms (i.e., class of retouch) will be described. A random sample of the edges of 25 - 40 per cent of the utilized flakes will be examined at 100-180x with a stereoscopic microscope to permit a more accurate characterization of past use. Each example of retouched tool forms will be photographed and/or drawn to scale. If distinctive classes of utilized or retouched flakes are identified, the metrical range will be provided for class-defining attributes and a number of examples will be illustrated.

Bifacial Tools. Bifacial tools include general bifaces, blanks, projectile point fragments, projectile points, and drills. For all bifaces, the length will be measured along the longest (y) axis parallel with the general edge orientation; width and thickness will be measured as the maximum dimensions in the resulting x-z plane. Weight, raw material, and presence/absence of possible heat-treating will be noted. The edge angles will be determined, and the edges will be examined at 100-180x with a stereoscopic microscope to characterize any usewear.

Examination of blanks, points, point fragments, and drills will include the above steps. In addition, any breaks on the object will be noted and the break angle in the x-y plane will be measured (with the y axis equalling 90°). The break edge will be examined for evidence of use. Determination of point type will begin with those described by Ritchie (1971) and Justice (1987), then refined based upon available regional literature (e.g., Fogelman 1988; Hranicky 1991).

Fire-Cracked Rock. Fire-cracked rock will be separated from other artifact classes. Those showing no other modification will be grouped together by provenience and weighed.

Archeobotanical Remains. All processing and analyses of macro-botanical samples will be undertaken by the project ethnobotanist (Ms. S. Justine Woodard, B.S.), who has demonstrated local expertise with floral remains from archeological contexts; Ms. Woodard has directed R. Christopher Goodwin & Associates, Inc.'s ethnobotanical research in the Mid-Atlantic and the southeast for nearly two years, including Phase II evaluation of prehistoric and historic sites and Phase III data recovery.

Two liter volumetric samples will be taken from all excavated features and floated. Each sample will be sorted into light and heavy fractions. Some fragments of charred wood and other plant materials usually are present in the heavy fraction; these will be transferred to the respective light fractions. Carbonized plant remains will be size-sorted using a 2 mm geological sieve. Uncarbonized, modern plant debris will be removed after sieving. Carbonized plant material will be sorted, counted, and weighed by material class. Materials that passed through the sieve (the residual fraction) will be scanned for seeds and other plant parts lacking in the large sized fraction.

Detailed taxonomic analyses will be done for subsamples of wood charcoal, for all nut shell and shell fragments, and for all carbonized seeds and seed fragments. Subsamples of wood charcoal will consist of 20 randomly selected fragments, unless fewer than 20 specimens occurred in the sample; the examination of 20 specimen samples of charcoal is considered the most cost-effective method to characterize a large charcoal assemblage (Pearsall 1989). Taxonomic identifications will be made for all charcoal fragments in samples with less than 20 specimens. Uncarbonized seeds also will be sorted from each sample and tabulated on a presence/absence basis. Identifications will be based on comparative collections as well as on various keys and manuals (e.g., Harlow 1959; Hillman and Henry 1935; Martin and Barkley 1961; Montgomery 1977; Panshin and De Zeeuw 1980; Schopmeyer 1974).

Micro-botanical Analyses. Reconstruction of prehistoric environments can be assisted through the analysis of pollen residues from subsurface contexts (Dimbleby 1985; Bryant and Holloway 1983) or through the examination of phytoliths (Seward 1992). Establishment of the paleoenvironmental setting of Site 18HO206 will be based on relevant research and regional models, analysis of plant macrofossils secured from the site, and archeological palynology and phytoliths, if appropriate.

Sampling for pollen or phytoliths will require small (>0.25 liter) hand samples from the site's soil column, and from cultural strata encountered during the archeological investigations; all necessary field samples will be collected. Up to six samples from the site will be screened initially to determine whether sufficient fossil pollen or phytoliths are present to address Research Questions 5 and 6 (see above); such analyses will be undertaken by a professional research facility that specializes in these investigations. If adequate data are identified during the screening process, a comprehensive pollen spectra for the site may be constructed from the remaining field samples, and a successional vegetative series and climatological history may be established within a temporal and cultural framework; the completion of additional pollen/phytolith analyses beyond the above-cited screening of six samples will be determined by MDOT/SHA in consultation with the Maryland Historical Trust. Any unused soil samples will be turned over to the Maryland Historical Trust with the site's artifact assemblage and the technical documentation.

Radiocarbon Dating. Up to four radiocarbon samples will be assayed by Beta Analytic, Inc. Samples will selected that are representative of the Ab horizon, the gravel bar component, and any earlier organic deposits that may be present.

Geomorphological Analyses

Two 10 m backhoe trenches will be excavated between the drainage and the terrace. A professional geomorphologist will prepare detailed profiles of one long wall in each of these trenches. He also will direct the collecting of appropriate samples for analysis and dating from these trenches. Appropriate tests (i.e., grain size) will be undertaken from each sample. A technical letter report will be prepared that presents the results of the geomorphological investigations. This letter report will be included as a technical appendix in the Phase III technical report. In addition to presenting a summary of the geomorphological history of the property, the geomorphologist will synthesize the results of the paleobotanical analyses into an environmental reconstruction of Site 18HO206 during its periods of occupation. This letter report will also present a review of the relationship of this site to other areas within the Deep Run drainage system.

Draft Report Preparation

A high quality technical report and interpretive overview that integrates the new field data with those obtained earlier will be prepared. The report will present information including, but not limited to:

(1) Important information needs that have been addressed through performance of this contract, and integration of the work results into a state or regional synthesis.

(2) How data recovered during this contract contribute to the understanding of cultural resources in the Patapsco River drainage and Maryland's Western Shore.

(3) How data recovered during this contract contribute to our understanding of the economic and technological prehistory of the region.

A balanced, interdisciplinary perspective will be presented in the report. Professional level investigations and reporting will define past human behavior in relation to chronological, geomorphological, pedological, ecological, and geographical features. Five copies of the draft report will be prepared.

Final Report Preparation

A final technical report will be prepared that addresses all of the comments of MDOT/SHA and the Maryland Historical Trust. The Final Report will be a single-spaced, high quality product. Fifty copies of the final report will be prepared; ten copies will be furnished by the contractor. As part of MDOT/SHA's public dissemination requirements, copies of the final report will deposited at the following local repositories: the Maryland Historical Trust, the National Park Service (National Capital Region), the Baltimore Center for Urban Archaeology, the St. Mary's City Commission, the Anne Arundel County Office of Planning and Zoning (Dr. Alvin Luckenbach), The American University, the Catholic University, and the University of Maryland.

Disposition of Records and Materials

All materials produced as a part of the Phase III data recovery will be prepared for curation in accord with the interim minimum guidelines set forth by the Maryland Historical Trust and with 36 CFR 79. These materials will be turned over to the Maryland Historical Trust for permanent curation.

Public Involvement and Interpretation

Public participation in Phase III mitigation is governed by Federal regulations (36 CFR Part 800). "Public participation," as presented in 36 CFR 800 is an opportunity to take public interest into account during the planning phases. Thus, presentation to the interested public of what is going on during Phase III data recovery is appropriate. This can be achieved by a public lecture and presentation of the research effort; it could also be achieved through constructive use of the print and visual media.

The public interpretation program for the mitigative efforts at Site 18HO206 will include: (1) the release of briefing materials to the local press; (2) the presentation of a scholarly article in a professional journal; (3) the preparation of a brief public brochure that describes the results of the archeological investigations in layperson's terms; and (4) the presentation of a research paper at a regional or national professional meeting.

The public brochure will emphasize stone tool technology and the important role of quarry sites in prehistoric procurement and lithic reduction strategies. However, the importance of this information will be presented in a non-technical format designed to brief the lay public on the range of prehistoric sites and stone artifacts that are found in the region; in other words, the brochure will provide an understanding of the importance of "non-village/non-Woodland" prehistory in the region. The results of field and laboratory investigations at site 18HO206 will be presented in the form of graphic models of procurement and reduction strategies and placed in a regional context.

The brochure will be illustrated (black & white) with photographs and drawings and will be up to 12 pages, including front and back cover. A draft copy of the brochure will be submitted to the Maryland

Historical Trust for comment. Up to 250 copies of the final, approved brochure will be prepared. The brochure's final distribution list will be determined by MDOT/SHA in consultation with the Maryland Historical Trust.

Coordination and Requirements

The Contractor will adhere to the professional staffing requirements set forth in Title 36 of the Code of Federal Regulations, which are compatible with the standards recommended by the Maryland Historical Trust. The Contractor will adhere to the standards for archaeology published in the Federal Register by the National Park Service (48:190:44716-44742). A *curriculum vitae* for the proposed Principal Investigator is enclosed. The Principal Investigator will be responsible for the technical quality of the work.

The contractor will provide the Maryland Historical Trust with adequate notice of the dates of the archeological fieldwork so that a field visit can be scheduled. If, in conjunction with construction activities, previously unidentified archeological properties are found which appear to meet the National Register criteria, a plan for archeological data recovery, or other appropriate treatment will be developed and implemented in consultation with the Maryland State Historic Preservation Officer, pursuant to 36 CFR 800.11. Should such unanticipated discoveries take place, a modification to the Phase III budget may be required.

At the request of MDOT/SHA, a Management Summary may be prepared following completion of the field investigations. This Summary may be submitted to the Maryland Historical Trust to notify that office that the relevant requirements of this Mitigation Plan have been completed.

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