PHASE I ARCHAEOLOGICAL SURVEY AND PHASE II EVALUATION OF SITES 21HE494, 495, 496, AND 497 FOR THE I-35W BRIDGE REPLACEMENT OVER THE MINNESOTA RIVER IN HENNEPIN AND DAKOTA COUNTIES, MN

State Project Number: 1981-124

Mn/DOT Contract Number: 06698 and Amendments 1 and 2

MN OSA License Numbers: 14-038, 14-074, 14-076, 16-035, and 16-065

Authorized and Sponsored by:
Minnesota Department of Transportation
and the Federal Highway Administration

Prepared by:

Frank Florin, Principal Investigator
James Lindbeck, Staff Archaeologist
Kent Bakken, Ph.D, Staff Archaeologist

Florin Cultural Resource Services, LLC
N12902 273rd Street
Boyceville, WI 54725
Reports of Investigation # 120

April 2017

PHASE I ARCHAEOLOGICAL SURVEY AND PHASE II EVALUATION OF SITES 21HE494, 495, 496, AND 497 FOR THE I-35W BRIDGE REPLACEMENT OVER THE MINNESOTA RIVER IN HENNEPIN AND DAKOTA COUNTIES, MN

State Project Number: 1981-124

Mn/DOT Contract Number: 06698 and Amendments 1 and 2

MN OSA License Numbers: 14-038, 14-074, 14-076, 16-035, and 16-065

Authorized and Sponsored by:
Minnesota Department of Transportation
and the Federal Highway Administration

Prepared by:

Frank Florin, Principal Investigator
James Lindbeck, Staff Archaeologist
Kent Bakken, Ph.D, Staff Archaeologist

Florin Cultural Resource Services, LLC
N12902 273rd Street
Boyceville, WI 54725
Reports of Investigation # 120

April 2017

MANAGEMENT SUMMARY

The Minnesota Department of Transportation (MnDOT) plans to replace the I-35W bridge over the Minnesota River, add a northbound lane, and raise the roadway (State Project S.P. 1981-124). The project extends approximately 1.7 miles (2,720 meters) along I-35W from the bluff on the north side of the river to the Cliff Road interchange south of the river. Florin Cultural Resources Services, LLC (FCRS) was retained by MnDOT to conduct a Phase I archaeological survey for the project and Phase II evaluation of sites identified during the survey. The Federal Highway Administration is the lead agency, and the MnDOT Cultural Resources Unit is the delegated review agent.

The project area is located in Archaeological Region 4s – Central Lakes Deciduous South in T27N, R24W, Sections 21, 22, 27, 28, 33, and 34 in Hennepin and Dakota counties. The archaeological survey corridor along I-35W was variable in width but was mostly within the current right-of-way. The archaeological survey area included approximately 110 acres. The project area is located on bluff, terrace, foot slope, and valley floor landscapes of the Minnesota River valley.

Fieldwork was conducted from October 27 to December 9, 2014 and April 20 to November 15, 2016. Frank Florin was the principal investigator. The Phase I and II archaeological field methods included pedestrian survey, shovel tests, deep auger tests, and excavation units. Close-interval tests in five-meter intervals were dug at all archaeological sites. The Phase I archaeological survey and Phase II evaluations for the project are complete.

Four new precontact sites were identified (21HE494, 21HE495, 21HE496 and 21HE497). Sites 21HE494, 21HE495, and 21HE496 are recommended not eligible for listing on the National Register of Historic Places (NRHP). Site 21HE497 is recommended eligible but will be avoided by the project. It is the opinion of FCRS that no historic properties eligible for or listed on the NRHP will be affected by this project. The sites are summarized below.

Site 21HE494 is a Late Woodland habitation with a very sparse artifact scatter that is located on the floodplain. The site contained a small amount of Late Woodland ceramics and charcoal from a fire hearth dated to 1000 +/- 30 RCYBP. Phase II evaluation included three (1-x-1 meter) excavation units and close-interval shovel tests. Artifacts included a very small amount of lithic debris, ceramics, and fauna. The site is extensively disturbed from previous construction activities. The site lacks the potential to provide important information on the Late Woodland or precontact period under Criterion D because of a lack of integrity and the sparse and limited artifact assemblage. The site is recommended not eligible for listing on the NRHP.

Site 21HE495 is a Late Archaic habitation with a sparse artifact scatter that is located on the bluff. No diagnostic artifacts were recovered, but a faunal sample dated to 4690 +/- 30 RCYBP. Other components may also be present. Phase II evaluation included ten (1-x-1 meter) excavation units and close-interval shovel tests. Artifact density was very low, except in a couple locations where slightly higher densities were present. Artifacts consist nearly exclusively of lithic debris, with a moderate amount of stone tools and very small amounts of cores, fauna, and FCR. Portions of the site are extensively disturbed from previous construction activities. The site lacks the potential to provide important information on the Late Archaic or precontact period under Criterion D because of a lack of integrity and a sparse and limited artifact assemblage. The site is recommended not eligible for listing on the NRHP.

Site 21HE496 is a deeply-buried Early Woodland habitation with a sparse artifact scatter that is located at the foot slope of the bluff. No diagnostic artifacts were recovered, but a calcined faunal sample dated to 1960 +/- 30 RCYBP. Artifacts were recovered from 80 to 340 cm below surface. At least three components are present based on the vertical distribution of artifacts. A geomorphological investigation was conducted by Strata Morph Geoexploration, Inc. Of the 22 artifacts recovered from the site, 11 are probably redeposited in colluvium and not in primary context. The other 11 artifacts may be in primary context, although they are also contained in colluvium and may have been redeposited. Phase II evaluation included close-interval deep auger tests. Artifact density was very low, considering that half of the artifacts are not in primary context and the remaining 11 artifacts are from at least three components. Artifacts that may be in a primary context include nine pieces of lithic debris, one FCR, and one calcined bone. The site lacks the potential to provide important information on the Early Woodland or precontact period under Criterion D because half of the artifacts lack integrity and the other artifacts consist of a very sparse and limited artifact assemblage from multiple components. The site is recommended not eligible for listing on the NRHP.

Site 21HE497 is a small multicomponent Woodland period habitation with a moderately dense artifact scatter on a high terrace of the Minnesota River. Early Woodland, Transitional Woodland, and Late Woodland components are present based on radiometric dates and diagnostic artifacts that include Late Woodland Madison ware, St. Croix Stamped ware, two small Late Woodland side-notched points, and two Early Woodland Waubesa points. Six radiocarbon dates were obtained from wood charcoal and animal bone at the site yielding dates of 1690 +/- 30, 1280 +/- 30, 1270 +/- 30, 1150 +/- 30, 1080 +/- 30, and 870 +/- 30 RCYBP. Four features, interpreted as cooking and/or heating pits, were identified. Phase II evaluation included 13 (1-x-1 meter) excavation units and close-interval shovel tests. Artifact density was moderate and included ceramics, FCR, lithic debris, stone tools, cores, and faunal material. The site is recommended eligible for listing on the NRHP under Criterion D because it has integrity and is likely to yield important information on the Early Woodland, Transitional Woodland, and Late Woodland periods. The current project design will avoid the site, and there will be no effect to the site. The construction limits near the site will be fenced prior to construction. However, if the project design changes or if other projects adversely affect the site, then a Phase III data recovery is recommended to mitigate the project's effects.

On the bluff top 9.4 meters north of the construction limits and survey area, there is an oval-shaped, earthen mound that measures 14 by 19 meters in diameter and about one meter high. There are two mature oak trees growing out of the mound, which may be a precontact period burial mound. A fence will be erected along an east-west line about 30 feet south of the mound to ensure it is not impacted during construction.

TABLE OF CONTENTS

APPENDICES

Appendix A: Geomorphological Investigation by Strata Morph Geoexploration, Inc.
Appendix B: Office of State Archaeologist Licenses
Appendix C: Artifact Catalogs
Appendix D: Radiocarbon Dating Reports from Beta Analytic Inc.

LIST OF FIGURES

LIST OF TABLES

1. Project Description

1.1 Overview

The Minnesota Department of Transportation (MnDOT) plans to replace the I-35W bridge over the Minnesota River, add a northbound lane, and raise the roadway (State Project S.P. 1981-124). Florin Cultural Resources Services, LLC (FCRS) was retained by MnDOT to conduct a Phase I archaeological survey for the project and Phase II evaluation of sites identified during the survey. The Federal Highway Administration is the lead agency, and the MnDOT Cultural Resources Unit is the delegated review agent. Fieldwork was conducted from October 27 to December 9, 2014 and intermittently between April 20 and November 15, 2016. A geomorphological investigation of site 21HE496 was conducted by Strata Morph Geoexploration, Inc. and that report is in Appendix A.

1.2 Project Setting

The project is located along the I-35W right-of-way (ROW) at the Minnesota River crossing, which is the boundary between Bloomington and Burnsville, Minnesota. The project area includes bluff, valley wall, terrace, toe slope, and floodplain landscapes in the Minnesota River valley. The survey area is a mixture of woods, wetland, and grassy areas. A large holding pond to contain water run-off is located under the bridge on the north side of the river.

1.3 Project Area and Area of Potential Effect

The project area is located in T27N, R24W, Sections 21, 22, 27, 28, 33, and 34 in Hennepin and Dakota counties (Figure 1). The archaeological survey corridor along I-35W was approximately 1.7 miles (2,720 meters) long, with a variable width. The project extends 1,000 meters (0.6 mile) north of the Minnesota River and 1,650 meters (1.0 mile) south of the river. The survey area is mostly within the existing ROW, which has been extensively developed for the I-35W highway construction by excavating the bluff top to decrease the road grade and adding fill to the floodplain and Black Dog Lake to raise the roadway above flood levels.

The archaeological survey included 110 acres, encompassing the final construction limits. The Area of Potential Effect (APE) for the project is the final construction limits and extends one meter below surface on the uplands and three meters below the surface in the Minnesota River valley bottom. The construction excavation may extend deeper than one meter in some upland areas, but there is no archaeological potential below one meter in the glacial-age upland soils. The UTM coordinates along I-35W for the survey area are the following: E476960 N4961800 for the north end and E477160 N4959080 for the south end (1983 Datum, UTM Zone 15). The survey area is bordered on the north by Valley High Drive (west side of I-35W) and on the south by the Cliff Road interchange. Land ownership included state owned right-of-way and lands owned by the city of Bloomington.

1.4 Curation

Copies of project documentation are on file at the FCRS office in Boyceville, Wisconsin. Project documentation and artifacts will be curated at the Minnesota Historical Society (MHS).

1.5 Permit and License

The Phase I archaeological survey was conducted under Minnesota Office of State Archaeologist (OSA) permits 14-038 16-035. Phase II evaluations were conducted under permit #'s 14-074 at 21HE494, 14-076 at 21HE495, and 16-065 at sites 21HE496 and 21HE497. A copy of the permits is in Appendix B.

1.6 Dating Format

Dates in this report are presented in two formats: 1) by their conventional radiocarbon age (uncalibrated) and 2) as calibrated to actual calendar years. The conventional radiocarbon age (measured radiocarbon age corrected for isotopic fractionation) is presented in the format of "RCYBP" (radiocarbon years before present; with "present" by convention being AD 1950). The use of "RCYBP" dates allows for the consistent comparison of dates from sites in previous reports, as this format has been the standard. Radiocarbon dates from older reports may not have been corrected for isotopic fractionation, but this correction is typically small. Dates calibrated to actual calendar years use the convention "cal BP" (for example cal. 8000 BP) to distinguish them from uncalibrated dates (RCYBP).

For various technical reasons, radiocarbon years are not equal to calendar years, and therefore calibration is necessary to assess the actual age of a sample. Radiocarbon years are converted to calendar years by a process called calibration. This process is based on dating samples with a precisely known age, such as wood that can be dated to a calendar year by tree-ring counts. These dates reveal systematic variations between radiocarbon years and calendar years, and allow the statistical estimation of actual calendar age for any given radiocarbon date. Generally speaking, conventional age back to about 3000 RCYBP will be close to the actual calendar (calibrated) age, but beyond that the calendar age becomes progressively older than the radiocarbon age. A date of 2000 RCYBP, for example, indicates an age of close to 2,000 calendar years ago, while a date of 10,000 RCYBP indicates a calendar age (calibrated date) of closer to 11,500 years ago. Calibrated dates in this report are 2 sigma calibrations (95% probability).

1.7 Personnel for Lab and Report Tasks

Frank Florin authored all sections of this report, except where noted otherwise. He was also the lab supervisor and conducted the artifact analysis. Beth Wergin was the lab manager, and she cataloged artifacts, prepared data tables, and drafted the wall profile illustrations for the report. James Lindbeck conducted background research, edited the report, and authored the Culture History and Literature Search sections and portions of the Environmental Background section. Kent Bakken wrote most of the Lithic Raw Material Resource Base section and conducted the lithic raw material identifications. Mandi Peterson prepared data tables for the report. Zooarchaeologist Steven Kuehn was retained to conduct the faunal analysis. Connie Arzigian and staff at the Mississippi Valley Archaeology Center (MVAC) were retained to conduct the botanical analysis.

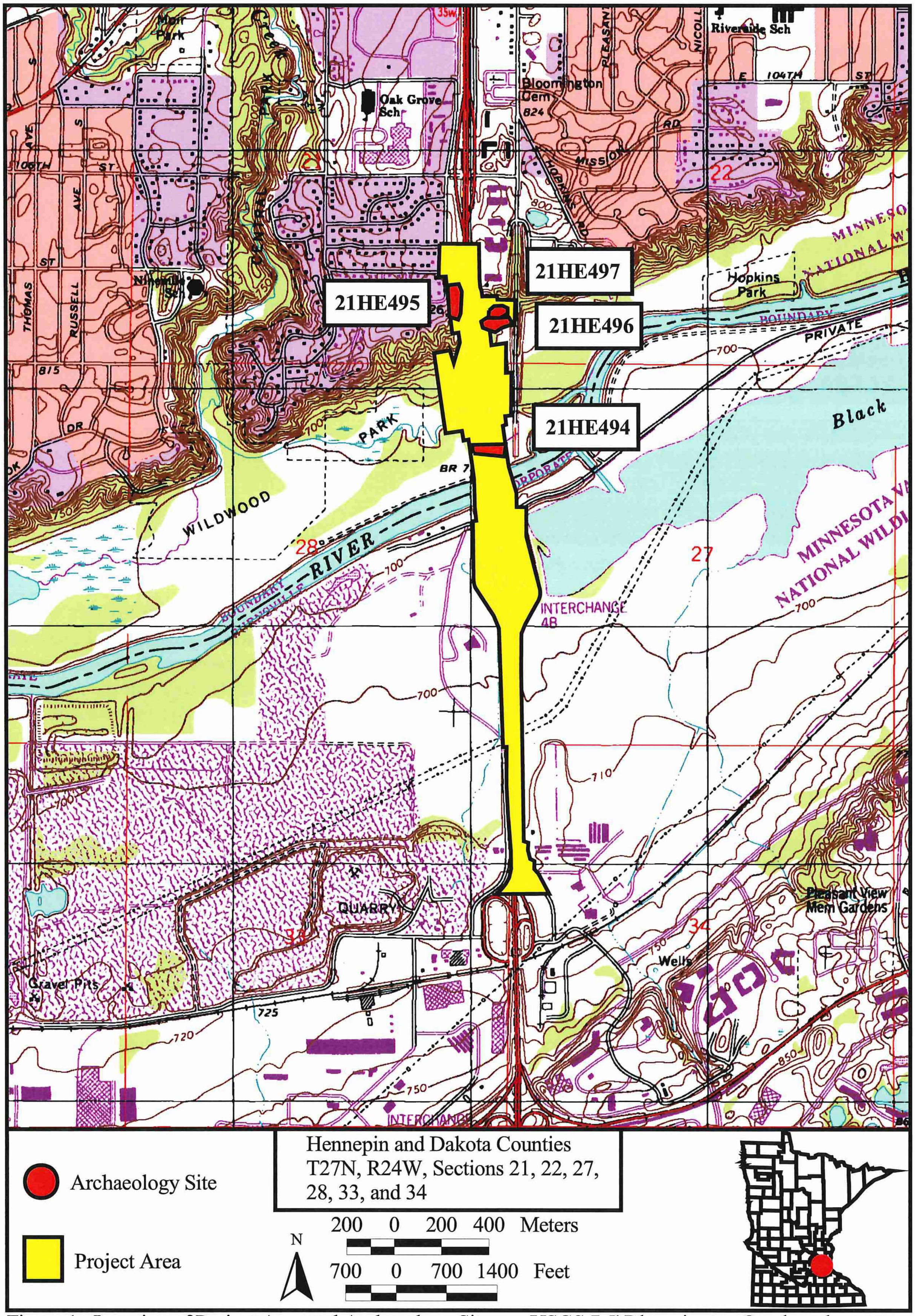


Figure 1. Location of Project Area and Archaeology Sites on USGS 7.5' Bloomington Quadrangle.

2. Research Design

2.1 Objectives

There are several objectives of the Phase I archaeological survey and Phase II site evaluations: 1) to aid project sponsors in complying with Section 106 of the National Historic Preservation Act and 36 CFR 800: Protection of Historic Properties; 2) to identify archaeological sites and assess their eligibility for listing on the National Register of Historic Places (NRHP); 3) to aid in project planning; and 4) to produce a report documenting the archaeological investigations.

2.2 Aspects of the Research Design

The research design was developed to meet project objectives, and it adhered to the research and field method guidelines established by the Minnesota State Historic Preservation Office (MnHPO), OSA, and MnDOT. These methods, which included a literature search, fieldwork, analysis of data, and production of a technical report, are summarized below and discussed in greater detail in the following sections.

The literature search provided information on previous investigations, previously recorded sites, potential cultural resources depicted on historic maps, and the environmental setting.

Archaeological fieldwork included pedestrian survey, shovel tests, deep auger tests, and excavation units (XUs). Pedestrian survey was used to identify artifacts or archaeological remains that were present on the ground surface. Shovel tests and deep auger tests were used to identify artifacts that were present below the ground surface, characterize soils at the survey areas and archaeological sites, and provide information on the horizontal and vertical provenience of artifacts. XUs were used to recover artifacts, provide detailed information on artifact provenience and cultural stratigraphy, identify cultural features, assess site integrity, and provide exposures of soil profiles at the sites. Specific details of the field methods are presented in Section 3.

The analysis of artifacts was conducted using current methods appropriate to each artifact class. The analysis was oriented towards identifying specific attributes that would provide useful information for interpreting the function and historic context of the site. Specific analytical methods for each artifact class are discussed in detail in Section 4.

The report documents the results of research, fieldwork, and artifact analysis and provides interpretations of the data and recommendations for the sites and project.

2.3 Eligibility Criteria and Historic Contexts

Recommendations for the NRHP eligibility of sites identified for this project are based on the National Register Criteria in 36 CFR Part 60.1 guidelines established by the National Park Service (1991) and Minnesota contexts for the Archaic period, Woodland period, and lithic scatters (Anfinson 1994; Arzigian 2008; Dobbs 1988; Gibbon and Anfinson 2008). Archaeological sites that retain integrity may be eligible for the National Register under the following criterion:

A. if they are associated with events that have made a significant contribution to the broad patterns of our history; or

B. if they are associated with the lives of persons significant in our past; or

C. if they embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic value, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

D. if they have yielded, or may be likely to yield, information important in prehistory or history.

Integrity is comprised of seven aspects that include: location, design, setting, materials, workmanship, feeling, and association. Several of these aspects must be possessed for a property to retain sufficient integrity for listing on the NRHP. The three aspects of integrity that are specifically relevant to archaeological sites are location, materials, and association. NRHP Criteria A, B, and C do not apply to the precontact sites identified for this project. The precontact components and sites were evaluated for their NRHP eligibility under Criterion D.

Specific historic contexts for the precontact period in Minnesota have been developed to summarize the extent of knowledge for each context and provide a framework to aid in determining whether a site has the potential to yield information that is considered important to local and regional prehistory. These contexts propose specific research questions and themes that are specifically relevant to each context. In order for the sites to be eligible for the NRHP under Criterion D, they must retain integrity and contain the potential to provide information on relevant research questions and themes that are applicable to the specific historic contexts present at the sites. These historic contexts are discussed in detail below.

2.3.1 Archaic Contexts (12,500 to 2500 BP)

Site 21HE495 yielded a radiocarbon date of ca. 4400 RCYBP, placing the site in the Late Archaic period. Historic contexts and basic research questions for the Late Archaic periods have been developed and are presented together here because of the overlapping and similar research themes (Anfinson 1997; Dobbs 1988; Gibbon and Anfinson 2008). The very sparse and limited knowledge of this period requires addressing basic research questions about this culturally and environmentally dynamic period. Based on a review of Archaic contexts, several basic research questions are proposed for the sites.

<u>Basic Research Themes and Questions</u>

- What are the ages of the components at the site, and how do they fit within the established chronology of the region?
- What specific complexes are present at the site, and how do these complexes relate to previously defined complexes in the region?
- What are the functions of the various components at the site and what activities occurred at the site?
- What are the diagnostic artifact types (especially spear and dart points) from the components at the site, and are they similar to named types elsewhere or are there unique types in Minnesota or regional variants of named types in the state?
- What are the contents of the artifact assemblages from the components? Are specific kinds of artifacts, features, and site types associated with these assemblages?

- What were the lifeways, subsistence strategies, and settlement patterns during the Archaic period in the region? How did they change through time? To what extent were they similar or dissimilar to contemporary lifeways in adjacent areas?

- What internal developments, changes, and adaptations occurred during the Archaic period and how do these relate to environmental changes occurring at that time?

- What types of lithic technology were employed?

- What is the pattern of lithic material use and is there evidence for interaction and trade with other cultural groups from the Plains or Woodlands? How were exotic raw materials (e.g., stone) procured?

- What is the geomorphic context of the components, and what site-specific environmental changes have occurred with respect to alluviation, soil formation, and site formation processes?

2.3.2 Woodland Period Contexts (2500 to 350 BP)

Sites 21HE494, 21HE496, and 21HE497 have components from the Early, Transitional, and Late Woodland periods. Historic contexts for the Woodland period were initially developed by Dobbs (1988). Updated contexts have been prepared for the National Register of Historic Places Multiple Property Documentation Form (Arzigian 2008). Specific Woodland period research themes for sites 21HE494, 21HE496, and 21HE497 are presented in subsequent sections. Primary statewide Woodland Tradition research themes, which are relevant to all these sites, are presented below (Arzigian 2008:12-16).

Primary Statewide Woodland Research Themes

- *Chronology*
  "A fundamental need for understanding Minnesota's Woodland complexes is an adequate chronology, including absolute dates for the full span of each complex, but particularly for the beginning and end, as well as charting important changes within the complex."

- *Technology and Material Culture*
  "Besides identifying diagnostic artifacts, the full range of material culture for each complex needs to be described. In addition to artifacts typically considered diagnostic, such as rim sherds and projectile points, can other region- or complex-specific cultural items be identified, such as unique pottery designs, bone tools, or patterns of raw material use?"

- *Ceramics*
  "Ceramics provide the most sensitive chronological and regional marker for a complex, but many of the typologies are inadequate or outdated. There is a need for refining and updating existing ceramic typologies, developing a better understanding of spatial distribution and regional and temporal variations for ceramics, and conducting detailed attribute analysis. Changes through time and across regions need to be explored. Comparisons also are needed between ceramic types used in Minnesota and those used in nearby regions (for example, how are Late Woodland corded ceramics in the southern part of the state related to the corded-ware horizon found across the Midwest?). Variability within many types of ceramics seems to be great but is also poorly understood. Single-component sites or separable components within stratified sites are needed to identify the range of contemporary ceramic types and varieties and

how they change through time. Attribute analysis could generate a database of ceramic characteristics that could be analyzed statistically and modeled in GIS.

Ceramic manufacturing processes and vessel function are in general also poorly known. More detailed technological study of ceramics (e.g., paste, temper) could improve understanding, as could thin-section analysis, X-ray florescence, and diffraction, which can help to identify mineralogical and elemental composition and differentiate locally made vs. imported pottery."

- *Lithics*
  "Much more information is needed on the full range of Woodland lithic artifacts, both tools and manufacturing debris, and the raw materials used, both local and exotic. Lithic typologies need to be refined and their associations with cultural complexes verified. Trait comparison to Archaic, Middle Woodland, and Plains types is essential for distinguishing the points from those of other periods and regions, or for confirming that they are all part of a homogeneous complex. Any temporal changes or specific geographic distributions would be useful.

  Lithic tools and debris need to be studied in terms of function, lithic reduction sequences, tool manufacturing, raw material selection, and changes through time in all of these. Can raw material debris profiles be developed to characterize these sites, and possibly to date them even if ceramics are not present? Single-component sites or multicomponent sites with a horizontally or vertically separate component are needed for this research.

  More work is needed on the accurate identification of specific lithic sources, and on documentation of changes in the use of particular raw materials through time and space, and for different tool types. Existing collections might then need to be reexamined, and implications drawn for understanding trade and interaction with other regions. Additional data could help to answer questions related to lithic technology and raw-material acquisition and how those might have changed through time.

  Further analysis is needed to identify any differences in lithic assemblages (tools, raw materials, etc.) between sites associated with mound construction and other habitation sites, between complexes in different areas, and between sites with different activities represented. What was the effect of the bow and arrow on the rest of the technological tool kit and on hunting practices, settlement, etc.? Where and when was bipolar core technology used?"

- *Subsistence*
  "More detailed information on subsistence is needed for all Woodland complexes in Minnesota. Additional sites with larger samples of subsistence remains are needed from a variety of habitats. Systematic fine-scale recovery from Woodland sites is needed, including flotation to recover plant and animal remains, fine lithic debris, and other small artifacts. Also needed are specialized analyses of these remains, not just superficial analyses such as sorting fauna by class (e.g., fish vs. mammal).

  Interpreting the variety of faunal taxa in terms of habitat selection and seasonal availability will be essential to understanding the whole Woodland seasonal round. Extractive strategies must be examined at the site, local area, and regional scales, including changes through time. Patterns will need to be considered with regard to both variable exploitative strategy and taphonomic changes, such as changes in patterns of transport, processing, and/or disposal of animals, and the final deposition of their remains.

Floral analyses need to include wood charcoal as a reflection of both the environment and cultural practices, as well as recovery and identification of macroplant remains such as seeds and nuts, and phytolith and pollen studies. Ceramics can be analyzed for evidence of phytoliths and pollen. Infrared spectrometry and gas chromatography can investigate cooking residues and fatty acids from products cooked in vessels, to identify how the vessels were used and what foods were consumed. The role of wild rice in precontact cultures is a crucial question. When was wild rice first used, and when did it become a prominent part of the economy? How did the use of other resources change? Are there special precontact features used to process wild rice? If so, can they be clearly identified, and can they be distinguished from postcontact ricing features? What cultivated plants were used by Woodland tradition populations in Minnesota? How did the northern limits of corn agriculture change through time? When did corn first appear in various regions? How did people exploit different resources as part of the broader annual round?

In addition to wild rice, where, when, and how were important specialized resources exploited, such as bison or sturgeon? Were sturgeon fisheries occupied for large parts of the year, or only for short periods? What was the nature of bison hunting in various regions, how did it relate to overall way of life, and how did it change through time (including in relation to environmental changes)? Were groups making use of seasonal bison hunts? Which groups, and at what times? Did some groups travel from one region to another as part of a large-scale seasonal round? Was there exchange of bison meat and products, and if so, with whom and in return for what?"

- *Geographic Distribution*
  "The boundaries and geographic distribution of individual complexes are poorly known, and the bases on which they were defined are often not explicit."

- *Modeling (i.e., Mn/Model)*
  "Modeling could identify locations along rivers (such as trade routes) that share the characteristics of a complex, to target future field investigations. GIS can be used for site catchment analysis to suggest what resources might have been exploited at individual sites, and how this compares between sites across regions. Site function within the complex's settlement system can be suggested, and multiple alternative explanations for site location and site function proposed and evaluated. How were ecotones exploited? In particular, what were the effects of the prairie/forest ecotone (and possible changes in this ecotone) on subsistence and settlement systems and movement of peoples across the ecotone? Did some areas, such as ecotonal areas, serve as central points, or trading or culture hubs? Were there regions that were transitional between a number of distinct complexes, and that would have made exposure to or intermarriage with other cultural groups more likely? Evidence of distribution of ceramics or raw materials between different groups might document such patterns of interaction.

  What effects did human subsistence and settlement systems have on the environment, including the prairie/forest ecotone? Were people using fires to maintain ecotonal and prairie habitats? Is there evidence of extensive areas of burning (such as in cores obtained from lakes or rivers)? Or evidence of natural resources that are dependent on fire, such as varieties of wood, plants, or animals?"

- *Regional Interaction*
  "Research is needed into the full range of interregional interactions within and between peoples of contemporary cultures or complexes, as well as the relationships that helped to shape changes in cultures through time."

- *Defining the Complexes*
  "Finally, after evaluation of the research themes, the definition of each complex needs to be refined. Additional dating and understanding of the regional distribution and changes through time, as well as the relationships to other complexes and other regional populations, will facilitate development of meaningful archaeological phases."

2.3.3 The Southeast Minnesota Early Woodland Complex, 2500 to 2200 BP (500–200 B.C.)

Site 21HE497 contained a Waubesa projectile point recovered from a feature that dated to 1690 +/- 30 RCYBP. Site 21HE496 contained calcined bone that dated to 1960 +/- 30 RCYBP and may also belong to this context. The date of the Waubesa point from 21HE497 suggests that the end date for this period may be later than the date of 2200 BP suggested by Arzigian (2008) and Gibbon (2012) and may be closer to the date of 2100 BP to 1900 BP proposed for southwestern Wisconsin (Stevenson et al. 1997:150). In addition to the statewide research themes identified above, the following are some important directions for future research on the Southeast Minnesota Early Woodland complex (Arzigian 2008:34):

- *Dating*
  "There are no La Moille Thick dates from Minnesota, but tight association of dates with La Moille ceramics is essential to understanding chronology and how La Moille relates to other possible early ceramics such as Brainerd and to Fox Lake Incised ceramics."

- *Material culture*
  "Virtually every aspect of this complex remains poorly known. Any single-component or separable occupation that could be identified for this complex would facilitate at least a basic understanding of the material culture and other aspects of the complex. Complete analysis of the artifacts and subsistence remains from La Moille Rockshelter would permit some basic separation of the Early Woodland component from the Archaic occupations, and would provide information on subsistence and lithic technology. Since all but three sherds from the rockshelter were from the La Moille vessel (Wilford 1954c:22), the distribution of sherds could be used to separate out this component for more detailed analysis."

- *Nature of the "Early Woodland" Transition*
  "Gibbon (1986:89) argued that how archaeologists define the concept of Early Woodland will affect our understanding of this complex. Is Early Woodland "the incidental addition of ceramics and a few new lithic types to an essentially stable Archaic lifeway"? Is it an Archaic florescence? A new technological stage marked by ceramic manufacture? Or an indicator of the emergence of "a new Woodland lifeway based on marked shifts in settlement-subsistence practices and burial ceremonialism"? Substantial separable components at stratified Archaic and Woodland sites would be important in documenting how cultures changed with the introduction of pottery."

2.3.4 The Central Minnesota Transitional Woodland Complex: Middle to Late Woodland in Central Minnesota, 1700 to 1000 BP (A.D. 300–1000)

Site 21HE497 yielded St. Croix Stamped ceramics and a radiocarbon date of 1270 +/- 30 RCYBP. In addition to the statewide Woodland research themes presented above, the following are some important directions for future research on the Central Minnesota Transitional Woodland complex (Arzigian 2008:92):

- *Subsistence*
  "Better subsistence information, both floral and faunal, is needed to understand the basic subsistence pattern and how it might have changed, before interpretations about changing demography and social structure can be made. In particular, the roles of both wild rice and large mammals need to be clarified with fine-scale recovery and analysis from single-component sites or separable components."

- *Cultural Transitions*
  "What was the nature of the transition from Middle Woodland and Hopewell-related cultures to the Late Woodland complexes such as Blackduck-Kathio? Comparison of material culture, settlement systems, and mortuary practices might provide indications. In some scenarios this complex ended with the entry of Mississippian influences. Did Mississippianization play a role in the cultural transformations seen in central Minnesota? What was the nature of any connection to Arvilla mounds? If this complex represented a transition to the bow and arrow, how is this change visible in the archaeological record?"

- *Regional Connections*
  "Cultural relationships, both contemporaneous and through time, are poorly known. Specific lithic raw materials, ceramics, or other cultural traits might be found across the region during this period; tracing these would allow identification of regions of interaction. Examining the distribution of similar ceramic traits such as dentate stamping might be one route of investigation. Such a study would also document any differences in ceramic style found in this ubiquitous and widespread complex. Documenting ceramics from other complexes including Plains Village that are found in Central Minnesota Transitional Woodland sites would be useful for tracing patterns of interaction."

2.3.5 Southeast Minnesota Late Woodland Contexts: A.D. 500 to 1150

Site 21HE494 contained Late Woodland ceramics and a radiocarbon date of 1000 +/- 30 RCYBP was obtained from a feature. Site 21HE497 contained Madison ware ceramics, small side-notched points, and bone and charcoal that dated to 870 +/- 30, 1080 +/- 30, and 1150 +/- 30 BP RCYBP. In addition to the statewide Woodland research themes presented above, the following are some important directions for future research on the Southeastern Minnesota Late Woodland complex (from Arzigian 2008:104-105):

- *Technology and Material Culture*
  "Besides identifying diagnostic artifacts, the full range of material culture for each complex needs to be described. In addition to artifacts typically considered diagnostic, such as rim sherds and projectile points, can other region- or complex-specific cultural items be identified, such as unique pottery designs, bone tools, or patterns of raw material use?"

- *Lithics*
  "Much more information is needed on the full range of Woodland lithic artifacts, both tools and manufacturing debris, and the raw materials used, both local and exotic."

- *Geographic Distribution*
  "The boundaries and geographic distribution of individual complexes are poorly known, and the bases on which they were defined are often not explicit."

- *Regional Interaction*
  "Research is needed into the full range of interregional interactions within and between peoples of contemporary cultures or complexes, as well as the relationships that helped to shape changes in cultures through time."

- *Defining the Complex*
  "Major research questions center on defining the context as something coherent, rather than as the time between two other cultures (Havana and Oneota). The relationship between effigy mounds and cord-impressed ceramics also needs to be clarified. Understanding this period and context is critical for understanding the transition to agricultural systems in the region. But what do these cultures look like in Minnesota? Is there a tight association between Madison ware ceramics and effigy mounds? How widely are these ceramics distributed, and are they part of components associated with other artifacts and ecofacts, or are they added as minor elements of components that can be assigned to other complexes?"

- *Chronology*
  "Dates on materials in tight association with both diagnostic ceramics and individual mounds are necessary to evaluate the development of the culture and the period of mound construction, particularly effigy mounds."

- *Regional Distribution of Ceramics*
  "Ceramics with single cords used as decoration over a cord-roughened surface are found across central and southern Minnesota, but the ceramics are not coded as such in the SHPO database and cannot be readily separated except by examination of the ceramics themselves.

  Detailed ceramic studies are needed for Late Woodland sites in Minnesota.
  The full range of ceramic types in southern Minnesota Late Woodland sites should be evaluated, along with a consideration of how they compare to series defined elsewhere in the Midwest. Because of the presence of a geographic reference in the complex name, archaeologists are likely to have identified this complex for the SHPO/OSA database only for sites in southeastern Minnesota, although the ceramics and other aspects of the complex might be found farther west and north.

  Dobbs and Anfinson (1990:164) argue that, based on typical assemblages in Wisconsin and Iowa, "There are a number of ceramic 'types' that should be present in Minnesota. These include the Lane Farm, Madison, and Minott Cord Impressed series (see Baerreis 1953; Hurley 1975; Logan 1976; Benn 1978, 1979, 1980)." Are these types present? How do they fit within the total ceramic assemblage? Can these types be distinguished from other defined types? This is especially true in the case of Nininger Cordwrapped Stick Impressed and Madison Plain types.

Besides refining the definitions of existing types, older collections need to be reexamined to update typological information and interpretations. What kinds of regional interaction are evident beyond the broad similarities in ceramics?"

- *Settlement and Subsistence models*
  The draft Late Woodland context (Dobbs and Anfinson 1990:166–167) notes:

  > *So little is known about Late Woodland in Minnesota that even the most basic information is crucial at this time. However, since there are models in place for Late Woodland in Wisconsin and Iowa, one fruitful approach will be to take these models and test them in Minnesota. Thus, rather than simply looking for Late Woodland sites, it might be useful to take Theler's (1987) model of subsistence and settlement, and structure surveys to test this model. Similarly, it would be helpful to conduct detailed quantitative analyses of existing collections of Late Woodland ceramics to see how these fit within the broader sequences developed by workers in other states.*

  Theler and Boszhardt's (2006) more recent interpretations of Late Woodland subsistence and settlement, population increase, and resource and population collapse in southwestern Wisconsin offer particularly useful insights for evaluating the Late Woodland in nearby regions.

2.3.6 Lithic Scatter Thematic Context

In addition to the contexts defined for each site, the sites were also evaluated under the Lithic Scatter Thematic Context. In order for a lithic scatter site to be eligible for the NRHP, it must retain integrity and exhibit one or more of the following characteristics (Anfinson 1994):

- The site must have a demonstrated historic context association.
- The site must contain unusual raw materials.
- The site must be in an unusual regional location.
- The site must suggest an exceptional special use.
- The site must be of an exceptional size (greater than 100,000 square meters).
- The site must have an exceptional density of material (one artifact per square meter or more on the surface; 100 artifacts or more per square meter in formal units).

3. Archaeological Field Methods

3.1 Archaeological Field Methods

The Phase I and II archaeological survey and testing methods adhered to the MnHPO and OSA guidelines for archaeological fieldwork. Specific field methods were discussed with MnDOT prior to conducting fieldwork. The survey design included an archaeological survey for the entire project APE.

3.1.1 Pedestrian Survey

The goal of the pedestrian survey was to identify and record archaeological sites that could be observed on the ground surface. Pedestrian survey was conducted within the entire survey area by walking transects parallel to the roadway in intervals not exceeding five meters. The pedestrian survey was a practical method for identifying certain types of potential archaeological resources that could be observed on the surface such as artifacts scatters, pits, earthworks, or historical foundations. No artifacts or features were identified during the pedestrian survey, except for a possible mound outside the survey area.

3.1.2 Shovel Tests and Deep Auger Tests

Shovel and auger testing was used to identify artifacts and features not visible on the ground surface, characterize soils at survey areas and sites, and provide information on the horizontal and vertical provenience of artifacts at the sites.

Because the survey area has high archaeological site potential, Phase I shovel testing was conducted at 10 and 15-meter intervals in all areas without excessive ground slope or deep fill. Shovel test transects were typically placed parallel to the roadway. At the archaeological sites, close-interval shovel testing was mostly conducted at five-meter intervals in cardinal directions adjacent to positive shovel tests in order to assess site integrity, limits, and artifact density. Shovel test data was used to guide the placement of excavation units within portions of the site that have the highest potential to yield data for answering important research questions and evaluating the site.

Shovel tests were 35 to 40 cm in diameter and generally dug to 85 cmbs. Soils were typically dug and screened in 20 to 30 cm increments to provide vertical control of artifact provenience. Because of the potential for deeply buried sites on the Minnesota River floodplain and toe slope, a Seymour auger with a 20.3-cm (8-inch) diameter bucket was used for deep auger testing below 85 cmbs in each shovel test hole. Following the MnDOT protocol for deep-site testing, two deep auger tests were dug at each test location to recover a volume of soil equivalent to a standard shovel test. However, only a single auger was dug in areas with deep fill, historic deposits, peat, or a lack of buried surfaces or cumulic soils. In such cases, the auger test basically provided a soil profile for assessing the potential of the soil for containing archaeological sites. For each specific landform with deep site potential, representative auger tests were dug to 300 cmbs, with a maximum depth of 340 cmbs. Subsequent augers were sometimes dug to shallower depths, based on the potential for deeply buried sites. All soil, except fill, was screened through 1/4-inch hardware mesh. The field crew returned all excavated soil to each test upon completion. All shovel test locations were recorded with a GPS unit.

3.1.3 Excavation Units (XUs)

XUs were 1-x-1 meter in size. XUs were dug and recorded in 10-cm levels either below ground surface or below a datum, whose relative elevation was established in relation to the adjacent ground surface. For practical reasons, excavation was typically conducted below ground surface for those XUs dug during winter conditions. Excavation depths were measured in cm below the ground surface (cmbs) for XUs that were dug below ground surface without a datum, and depths were measured in cm below datum (cmbd) for XUs dug below a datum. For XUs dug with a datum, the datum line is illustrated on the XU wall profiles. Excavation extended below the primary artifact bearing deposits to culturally sterile soil or to a depth where artifact counts were negligible and likely translocated by natural processes (such as bioturbation and free-thaw). The extent and types of soil disturbance were recorded for each level to aid in assessing site integrity. All soil was screened through ¼-inch hardware mesh. The units were backfilled after excavation was complete.

3.1.4 GPS Data Collection and Site Mapping in ArcView

GPS data was collected with a Trimble GeoExplorer 6000 for find spots, shovel tests, and XU corners. The data has a typical positional accuracy of 10 to 15 cm after post-processing. This data was then exported as northing and easting UTM coordinates to create maps on topographic and aerial imagery.

3.1.5 Field Documentation

A record of daily activities was recorded in a log that documented fieldwork and relevant information on the survey areas and sites. Project design maps provided by MnDOT were used as a base maps for recording project information. Photographs were taken of archaeological sites, survey areas, and wall profiles of the XUs. A record of the photographs was maintained in a project photo log.

Excavation level forms were maintained for each level of an XU and were filled out after the completion of each level. These forms contained information on excavation methods, soils, artifact counts, disturbances, and other relevant observations.

A soil profile was drawn for representative shovel tests and for each positive shovel test and XU. Soil colors, textures, horizons, and disturbances were recorded on the profile. Soil colors were described using the Munsell system, and the soils were moistened prior to determining color.

4. ARCHAEOLOGICAL LAB METHODS

4.1 Artifact Processing

Artifacts were analyzed and cataloged at the FCRS laboratory in Boyceville, Wisconsin. The precontact period assemblage consisted of precontact ceramics, lithic debris, stone tools, faunal remains, and fire-cracked rock (FCR). A few modern items or historic artifacts such as glass and nails were recovered, but these were from disturbed soil or secondary refuse deposits.

Artifact catalog numbers are comprised of a provenience bag number and a specimen number, following the MHS system. The provenience bag number is represented in the catalog database by the column titled "Prov.", and the specimen number is represented by the column titled "Specimen #". The artifact catalogs for the sites are contained in Appendix C.

Provenience bag numbers were established by FCRS in the lab and consisted of a unique number assigned to each specific provenience by find spot (FS), shovel test (ST), or excavation unit (XU) by depth ("cmbs" for cm below surface). For example, Prov # 1 would represent Shovel Test 1 (ST 1), 0-20 cmbs, and Prov # 2 would represent ST 1, 20-40 cmbs. The specimen portion of the artifact catalog number is a unique sequential number or number range assigned to artifacts within a specific provenience bag number. Individual artifacts were assigned a single number (e.g., 1.1), while artifacts with similar attributes and size grades were grouped together and assigned a sequential specimen number range based on their count (e.g., 1.2-10). Beginning and ending numbers in the range were recorded in one row of the database with attribute data for related artifacts.

Attribute data recorded in the catalog for each artifact, or group of artifacts, included: site number; provenience bag number; specimen number(s); provenience information; artifact class; artifact descriptions; weight (g); and size grade (in). Additional artifact information was entered in the "Notes" field of the catalog. The descriptive categories that apply to each artifact class are summarized in Table 1. Specific descriptive attributes recorded for each artifact class are discussed in detail in the following artifact sections. All data was entered in a Microsoft® Access 2010 database. Fields left blank in the database indicate that the attribute does not apply or that the attribute is absent.

Gilson standard-testing metal sieves were used for size grading. The following size grades (SG) were used to sort artifacts: ≥4.0 inch (SG00); <4.0 to ≥2 inch (SG0); <2 to ≥1.0 inch (SG1); <1.0 inch to ≥0.5 inch (SG2); <0.5 inch to ≥0.233 inch (SG3); and <0.233 inch (SG4). The light fraction of flotation samples from the features was recovered in a 0.0165-inch (#40) mesh screen. The heavy fraction was recovered in a 1/16" mesh screen. Weight was measured to the tenth of a gram with an electronic scale. Artifacts weighing less than 0.05g were given a weight of "0".

Table 1. Descriptive Categories for Artifact Classes in the Catalog.

Class	Description 1	Description 2	Description 3	Description 4	Description 5	Description 6	Description 7
Ceramic	Vessel portion	Temper	Surface treatment	Decoration type	Condition	Presence/ Absence of charred residue	N/A
Lithic	Debris	Flake type	N/A	N/A	Lithic material	Cortex amount	Heat treatment
Lithic	Tool	Tool category	Tool type	Tool flake type	Lithic material	Cortex amount	Heat treatment
Lithic	Core	Technology	Flake removals	Platform modification	Lithic material	Cortex amount	Heat treatment
Lithic	Fire-cracked rock	FCR type	N/A	N/A	Lithic material	N/A	N/A
Faunal	Class	Element/ Side	Portion	Thermal alteration	Modified	N/A	N/A
Botanical	Material	Type	Portion	N/A	N/A	N/A	N/A
Historic	Material	Type	Morphology	Condition	Decoration, Name, or Treatment	N/A	N/A

4.2 The Lithic Raw Material Resource Base

Bakken (2011) has defined several lithic raw material resource regions in Minnesota. The project area is located at the approximate border of the Hollandale Resource Region (to the southeast), Quartz subregion of the West Superior Resource Region (to the north), and the Shetek subregion of the South Agassiz Resource Region (to the west) (Figure 2; Bakken 2011).

While the regional resource map indicates which raw materials might be available as a local resource based on their occurrence in till, outwash, or bedrock (Table 2), it is possible to refine the picture by looking more closely at the local geology. The landscape of Hennepin County near the project area consists of deposits that originated from northeastern, northern, and western sources. Outwash terraces (undivided as to river association) occur within a one to three-mile-wide corridor of the current Minnesota and Mississippi rivers along the eastern and southeastern edges of the county, including the project area (Meyer and Hobbs 1989). These deposits would include sediments and rocks from the north via the Mississippi River and west via the Minnesota River. Most of the remainder of Hennepin County consists of Des Moines lobe till and outwash (northwestern source material), which overlies older till from the Superior Lobe (northeastern source material) (Meyer and Hobbs 1989; Wright 1972a). The older Superior Lobe till (and the rocks it contained) was incorporated into the overriding Des Moines lobe till creating a till of mixed lithology (Meyer and Hobbs 1989).

Because the project area is north of source areas for Galena, Grand Meadow, and Cedar Valley cherts, which comprise the primary materials from the Hollandale Resource Region, these materials are unlikely to be locally available in the project area. The presence of these materials at sites identified for the project is likely from travel or exchange.

Prairie du Chien Chert, a primary material of the Hollandale Resource Region, is likely to be available locally but probably not on-site. A short distance upriver near Shakopee, Minnesota, the Prairie du Chien Group geologic formation is within three meters of the surface on the lowest outwash terrace that borders the Minnesota River (Lusardi 1997). Also, there are many places where the Prairie du Chien

Group is exposed on the surface about 50 feet above the Minnesota River around the city of Shakopee, and outcroppings occur along the bluffs of the valley margin in Scott County (Roberts 1993:81-84). However, there has been no verification of Prairie du Chien Chert being available from bedrock or secondary deposits in the Shakopee area. Abundant sources of Prairie du Chien Chert are known to exist, mostly in residual deposits, near the Mankato area (Jason Reichel, personal communication 2014).

The abundance of Prairie du Chien Chert at nearby sites upstream (21CR155 near Shakopee) and downstream (21HE483 near Bloomington) along the Minnesota River, which includes initial stage reduction, indicates that this material was procured from local sources (Florin et al. 2015; Harrison and Bakken 2016). At site 21CR155, the Prairie du Chien Chert cortex is smooth and mechanically weathered, lacking any trace of host rock, which indicates it was not procured directly from bedrock sources, and the material is likely to be only present in very small amounts in the till. This suggests that the material was procured from local secondary deposits where the stone was concentrated, such as lag or fluvial deposits in or along the Minnesota River valley or tributaries where source stone was transported and possibly moved some distance from the original primary context. A large number of Prairie du Chien Chert cobbles were quarried from a fluvial ridge in the Minnesota River bottom near Bloomington, Minnesota at site 21HE483. In the Mankato area, Prairie du Chien Chert concentrations have been observed in lag deposits and residual deposits in river bottoms and washes, which presumably derived from nearby bedrock sources (Jason Reichel, personal communication 2014). It is likely that the Prairie du Chien Chert found at sites downstream, such as near Shakopee and Bloomington, was derived from fluvial deposits of the Minnesota River that originated in deposits near Mankato or similar deposits along the valley.

In summary, a wide range of lithic materials from the north, west, and south (limited to Prairie du Chien Chert) are likely to be present in the vicinity of the project area. Local sources for raw materials likely would have included areas where stones were exposed on erosional surfaces such as ravines, stream bottoms, lakeshores, and bluff or terrace scarps. Other local sources would include fluvial sediments such as river bars in the Minnesota River valley. Glacial River Warren, the predecessor to the Minnesota River, would have eroded a variety of tills, from the surficial Des Moines lobe to deeply-buried and poorly-known earlier tills, and deposited rock fragments (clasts) from these along the valley floor. These deposits could contain a potentially very diverse set of raw materials, but it is hard to speculate on the range of materials it might include. It seems that most of the raw materials available in the northern two-thirds of Minnesota could potentially be found in local sources and that only the materials with sources south of the project area or outside of the greater region would truly be nonlocal in origin, excluding Prairie du Chien Chert which as noted previously may have been redeposited from the Mankato area in fluvial deposits near the project area.

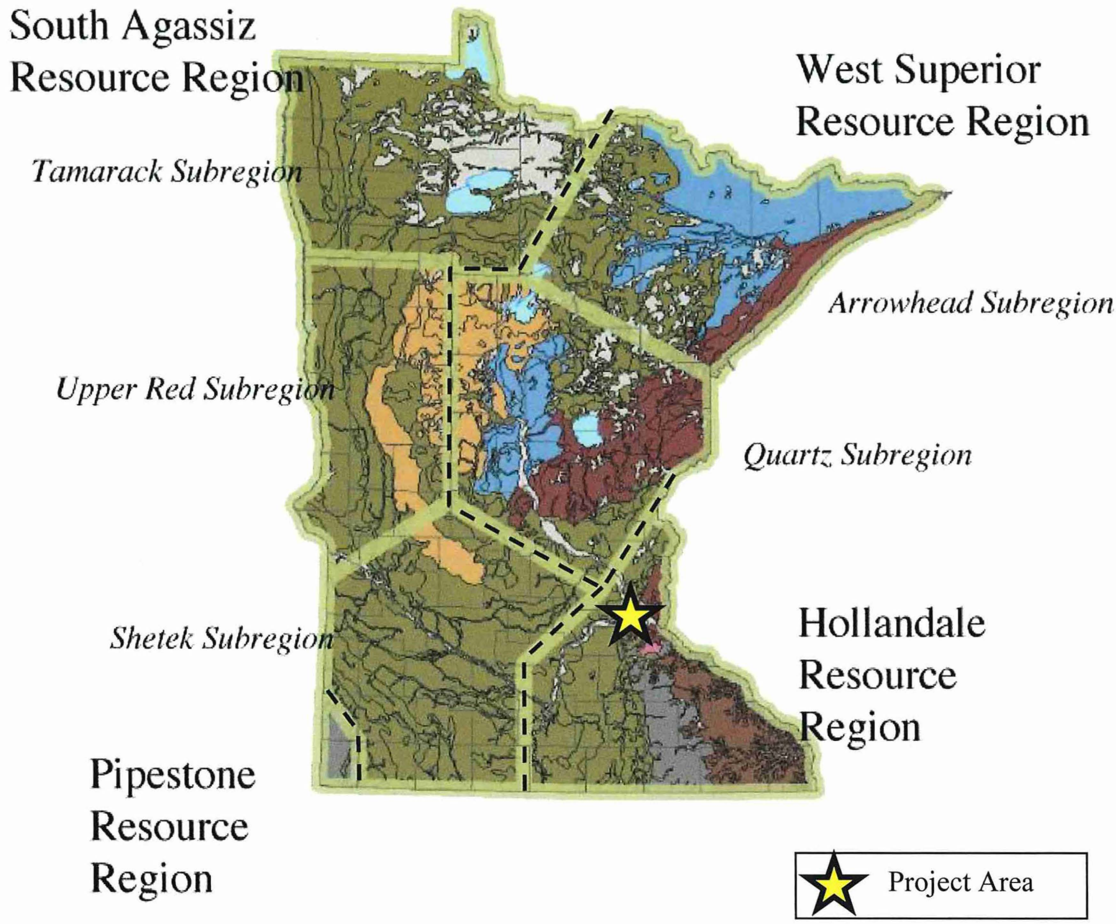


Figure 2. Lithic Resource Regions of Minnesota (adapted from Bakken 2011).

Table 2. Estimated Primary, Secondary, and Minor Lithic Raw Material Status by Region and Subregion (Bakken 2011).

Regions	Primary Raw Materials	Secondary Raw Materials	Minor Raw Materials	Main Exotic Raw Materials
South Agassiz Resource Region				
Tamarack Subregion	Swan River Chert Red River Chert	Border Lakes Greenstone Group	Quartz Tongue River Silica Western River Gravels Group ?	Knife River Flint
Upper Red Subregion	Swan River Chert	Red River Chert Tongue River Silica Quartz	Border Lakes Greenstone Group Western River Gravels Group Knife River Flint	Knife River Flint
Shetek Subregion	Swan River Chert	Tongue River Silica Red River Chert Quartz	Border Lakes Greenstone Group Western River Gravels Group Knife River Flint Fat Rock Quartz Other West Superior materials	Knife River Flint Burlington Chert
West Superior Resource Region				
Arrowhead Subregion	Gunflint Silica Knife Lake Siltstone	Quartz Hudson Bay Lowland Chert Jasper Taconite	Border Lakes Greenstone Group	Knife River Flint
Quartz Subregion	Knife Lake Siltstone Tongue River Silica Quartz *(Fat Rock and other)*	Swan River Chert	Lake of the Woods Rhyolite Biwabik Silica Gunflint Silica Jasper Taconite Kakabeka Chert Hudson Bay Lowland Chert Lake Superior Agate	Knife River Flint Hixton Group Burlington Chert
Pipestone Resource Region				
	Tongue River Silica Gulseth Silica ?	Sioux Quartzite Swan River Chert ? Red River Chert ?	Quartz	Knife River Flint
Hollandale Resource Region				
	Cedar Valley Chert Galena Chert Grand Meadow Chert Prairie du Chien Chert	Shell Rock Chert ?	Quartz Tongue River Silica Swan River Chert Red River Chert	Hixton Group

4.3 Lithic Analysis Methods

The analysis of lithics focused primarily on the identification of raw materials, lithic technologies, and specific types of flakes, tools, and cores. Information on site function, lithic economy, lithic technologies, settlement patterns, and regional interaction may be inferred from this data. Raw material, weight, size grade, and presence/absence of cortex were recorded for all lithics. Lithic debris was examined for macroscopic evidence of modification, such as use-wear or retouch. All lithics were examined using a 10x magnification hand lens, which was useful for identifying micro-flaking, lithic material, and other features not visible without the aid of magnification.

Frank Florin and Kent Bakken conducted the lithic raw material identifications. They have extensive experience in the raw materials of the region and utilized MHS sample collections as needed. Published guides to lithic resources of Wisconsin, Minnesota, and the Upper Midwest were also consulted (Bakken 1997, 2011; Gonsior 1992; Morrow 1984, 1994; Morrow and Behm 1986).

4.3.1 Thermal Alteration

Thermal alteration, commonly known as heat treatment, is the intentional alteration of a lithic material to improve its flakability. Heat treatment produces an increase in surface luster, intensifies ripple marks on flake scars, and creates reddish to orangish color in many cherts and other light-colored materials. In some materials, such as Tongue River Silica, Swan River Chert, and Prairie du Chien Chert, the effects of heat treatment are fairly well-documented and can be discerned with a good degree of accuracy. In the current analysis, materials were classified as heat treated if there was significant and noticeable reddish to orangish color and an increase in luster. If these color and texture traits were subdued, then the piece was coded as "probably heat treated". The effects of heat treatment on some materials are not well known.

In contrast to heat treatment, burning is defined by excessive heating that often compromises the stone's flakability. Traits of burning include potlid spalls, crazing, and cracks on the artifact's surface, and a notable darker color. Burning is interpreted to be unintentional, being caused either by accidental over-heating during the heat treatment process or by discard into a cooking facility.

4.3.2 Lithic Debris

Lithic debris includes flakes, flake fragments, and pieces of shatter that were produced from cobble testing, core reduction, stone tool manufacturing, and stone tool maintenance. The analytical methods used in this report are based on the results of previous lithic studies and experimental replications (Bradbury and Carr 1995; Callahan 1979; Cotterell and Kamminga 1987; Flenniken 1981; Hayden and Hutchings 1989; Inizan et al. 1999; Magne 1985, 1989; Odell 1989; Root 1992, 1997, 2004; Tomka 1989; Yerkes and Kardulias 1993). These studies indicate that lithic-reduction stages and technologies can be inferred from diagnostic flake attributes.

The most promising results are derived from studies that consider a combination of several flake attributes from a large sample of lithic debris. The work of Mathew Root (2004) provides the basis for much of the current analysis because of his extensive lithic replicative studies and their relevance to the current project with regards to cultural context, regional location, comparable raw materials, and lithic technologies. The basis of this analytical framework has been used for several large data recovery projects in North Dakota, including Lake Ilo 32DU955A (Ahler et al. 1994), 32RI785 (Root 2001), and Beacon Island 32MN234 (Mitchell and Johnston 2012). Root's methodology and results are supported by the lithic studies referenced above, which tend to focus on more specific aspects of technology and flake attributes. Similar technological approaches based on flake attributes from replicative studies have been developed in other lithic studies (Callahan 1979; Ozbun 1987; Fleniken 1981; Flenniken et al. 1990; Magne 1985). While Root's work is primarily oriented to bifacial technologies of Knife River Flint, other studies consulted for this analysis provided information on bipolar and nonbifacial technologies.

The lithic analysis assessed multiple flake attributes that were identified as technologically diagnostic in numerous studies. These attributes define the specific flake types used in this study, which are summarized and described in Table 3. The lithic analysis was accomplished by 1) identifying specific flake attributes; 2) comparing the attributes with those defined for specific flake types; and 3) making a determination as to flake type. The lithic analyst, Frank Florin, has moderate experience in lithic replication and has a comparative collection of flake types comparable to the ones used in this study.

Flake attributes examined in this analysis include the following morphological and technological characteristics: presence/absence of cortex; presence/absence of percussion bulb; presence/absence of bulbar scar; extent of platform modifications and preparations (grinding, battering, and faceting); platform size; platform angle; number of dorsal flake scars; flake morphology; flake thickness; and size grade. These attributes have been determined to be diagnostic of specific lithic-reduction technologies and stages.

Decortication flakes are indicative of cobble testing and early-stage core reduction, and in this study are linked to nonbifacial technology. Bifacial technology is indicated by bifacial thinning flakes and shaping flakes, alternate flakes, bifacial cores, and bifacial tools. Bipolar flakes and bipolar cores are indicative of bipolar reduction. Nonbifacial technology is indicated by nonbifacial flakes, decortication flakes, tools made on nonbifacial flakes, and nonbifacial cores.

Shatter is most strongly associated with cobble testing, core reduction, and the earlier stages of reduction. Types of lithic debris that are not indicative of specific technologies or reduction-stages include "other size-grade 4" (other SG4) flakes, broken flakes, and unidentified flakes. Some materials, like quartz, which do not have conchoidal fracture properties, are likely to result in greater amounts of nondiagnostic flake types than other materials.

Table 3. Definitions of Technological Flake Types (primarily adapted from Root 2004).

Technological Flake Type	Definition
Decortication Flakes	Decortication flakes have most (>50%) of their dorsal surface covered with cortex. They are associated with raw material testing and the early stages of core and tool reduction (Root 2004). These flakes have a large striking platform and a bulb and bulb scars that are nearly always quite pronounced as a result of direct percussion with a hard hammer (Inizan et al. 1999). Other traits of these flakes include: a large flake platform angle (60-90 degree range); whole flakes are typically are SG1 or SG2; typically two or less flake scars on the dorsal surface; and a relatively thick cross-section.
Blade Flakes	These are specialized flakes defined by the presence of 1) parallel or subparallel lateral margins; 2) dorsal flake ridges that are parallel or subparallel with the lateral margins; 3) at least two flake-removal scars evident on the dorsal surface; 4) an axis of applied force that is approximately parallel with flake's margins; 5) a length-to-width ratio of at least 2:1; and 6) plano-convex ,triangular, rectangular, or trapezoidal cross sections (Crabtree 1972:42-43; Root 2004; Whittaker 1994:33).
Bipolar Flakes	These exhibit the following attributes: 1) shattered or pointed platforms with little or no surface area; 2) wedging flake initiations; 3) evidence that force has been applied to both ends of the flake, such as crushing on opposite ends; 4) no bulbs of force (due to wedging initiations); 5) pronounced compression rings from compression-controlled flake propagation; and 6) a generally parallel-sided plan form (Root 2004; see also Flenniken 1981). Flakes classified as bipolar must exhibit most but not all of these attributes. Bipolar flakes do not exhibit positive bulbs of force on opposite ends of the same flake interior surface.

Table 3. Continued.

Technological Flake Type	Definition
Bifacial Thinning Flakes – (early to middle-stage)	These flakes are strongly associated with percussion bifacial thinning (Root 2004). Bifacial thinning flakes without platforms exhibit the following attributes: 1) thin curved long sections; 2) extremely acute lateral and distal edge angles; 3) at least three dorsal flake scars (usually more) that originate from different directions, especially other than the flake itself; 4) 20% or less cortex; and 5) an expanding shape in planview. Flakes with platforms exhibit attributes 1-5 along with 6) a bending initiation and 7) a narrow and faceted striking platform without cortex. Proximal flake fragments that consist mainly of a platform are classified as bifacial thinning flakes if they have the above attributes. Flakes with platforms often have a lip at the intersection of the striking platform and the flake ventral surface (caused by a bending flake initiation), and flakes with distal ends usually have feathered terminations. Soft-hammer percussion with a billet is typically used in the removal of these flakes. The flaking angle is acute, the bulb is diffuse, and there is often abrasion on the overhang (platform) (Inizan et al. 1999).
Bifacial Shaping Flakes by pressure or percussion – (late-stage)	These flakes are usually small, less than < 1/4 inch (SG4), but can be larger (Root 2004). Only flakes SG3 or smaller are classified as bifacial pressure flakes. These are relatively thin with multifaceted and ground platforms. Flakes must retain a platform to be placed in this class. Flakes produced early in the pressure flaking process have multiple scars on their dorsal surfaces and are curved in long section and slightly expanding, or petaloid, in planview. Flakes produced during final bifacial pressure flaking have parallel sides. These flakes are generally produced during bifacial pressure flaking. Occasionally, small flakes produced by late-stage percussion bifacial shaping possess the defining attributes of pressure flakes. Whether produced by pressure or percussion, these flakes are associated with final bifacial shaping (stage 5 as defined by Callahan [1979]) and bifacial tool maintenance.
Nonbifacial Flakes	Nonbifacial flakes are size-grade SG1 to SG3 and do not have the defining attributes of bifacial or decortication flakes. Diagnostic traits include 1) simple platforms with minimal platform modifications (often with no facets but up to one or two facets); 2) large platform angles (60-90 degree range); 3) generally less than three dorsal flakes scars that are likely to be unpatterned; and 4) may have bulbar scar on ventral side (Andrefsky 2005; Magne 1985, 1989; Odell 1989, 2003:126; Tomka 1989; Yohe 1998). Platform areas may be partially or wholly obliterated from hard hammer percussion. This flake type is comparable to Root's (2004) "simple flakes". In general, these flakes have relatively thick cross sections, steep lateral edge angles, and straight or slightly curving profiles. The amount of dorsal surface cortex typically ranges from 0 to 50%. This class contains conchoidal flakes that have a bulb of percussion and bending flakes. Included in this type are flakes classified as "interior flakes", which are removed from the interior of the core or cobble, with no cortex on their surface (Fleniken et al. 1990; and Yerkes and Kardulias 1993). While these flakes are produced in biface reduction, particularly the earliest stages, they are most strongly associated with cobble testing, unprepared nonbifacial cores for flake blank production, and the early stages of nonbifacial tool reduction.

Table 3. Continued.

Technological Flake Type	Definition
Shatter	Shatter includes angular, cubical, and irregularly shaped chunks that lack the following: bulbs of force, systematic alignment of fracture scars on faces, striking platforms, and points of flake initiation. Interior (ventral) and exterior (dorsal) surfaces and proximal and distal ends cannot be determined on these pieces (Root 2004). Shatter may be the result of poor-quality stone with fractures along bedding planes or other material flaws. Shatter is created by most production technologies but is most strongly associated with cobble testing, core reduction, and earlier stages of reduction.
Alternate Flakes	Alternate flakes are produced when beveled edges are created from: 1) squared-off or thick edges, such as those on tabular cobbles; 2) the thick margins of flake blanks (especially at the proximal end); 3) margins with stacked-step terminations; and 4) broken flakes or bifaces. The result is the creation of a bifacial (beveled) edge that prepares it for bifacial thinning or shaping by producing edge angles appropriate for use as platforms (Flenniken et al. 1990; Root 2004). They are thick in relation to their length and width, are triangular in cross section, have a squared edge (often cortical) adjacent to the platform (this is part of the squared edge of the object piece), have single-faceted platforms, and have a skewed orientation in relation to the axis of percussion.
Edge Preparation Flakes	A flake removed from the edge of a flake blank or core to change the angle of the edge to facilitate flaking in order to prepare the blank or core for further reduction (Flenniken et al. 1990). Bifacial edge preparation flakes usually have thick and wide platforms and are short in length.
Potlid Flakes	A flake expelled from the surface of a lithic artifact by heat-induced differential expansion when overheated in a fire, as opposed removal by the flintknapping process (Flenniken et al. 1990). The flake has a flat dorsal surface and a convex ventral surface and is shaped somewhat like the inverted lid of a pot.
Unidentified Flakes	These flakes do not fit any of the previously described types.
Other Size-Grade 4 (SG4) Flakes	Other size-grade 4 (SG4) flakes (< 1/4 inch in size) are either too small to be reliably identified using the diagnostic attributes of the other defined flake types or they simply lack diagnostic attributes (Root 2004). These are produced in all reduction technologies, including cobble testing. These flakes are likely to be underrepresented in lithic assemblages because their small size makes them less likely to be recovered.
Broken Flakes	Broken flakes are flake fragments that lack a bulb of percussion, platform, or other diagnostic features that would enable a determination of flake type. Such flakes are typically distal or medial flake fragments. Broken flakes occur in all technologies and are produced during all stages of lithic reduction.

Mass aggregate analysis based on size grades (see Ahler 1989) was deemed not useful for determining lithic technology and reduction stages because SG4 artifacts were typically not recovered, as the soils were screened through 1/4-inch mesh. The recovery of SG4 debris and large samples is imperative for conducting mass analysis within the established interpretive models. In addition, aggregate analysis draws its inferences from experimental replicative data sets that do not exist for the raw materials at the sites identified in the project area. There are other weaknesses of this method related to the accuracy of separating mixed reduction stages and mixed technologies (Andrefsky 2001:5).

4.3.3 Lithic Tools

Overview

Stone tools were vital to prehistoric lifeways, and they were used for a variety of tasks: perforating, cutting, sawing, scraping, boring or drilling, graving, whittling or slicing, chopping, pounding, and abrading.

Tool categories were defined by technological attributes (bifacial, unifacial, or pecked/groundstone) and by whether the tool was patterned or unpatterned. Patterned or formal tools include types in which the original shape of the flake blank or raw material has been substantially modified through a systematic sequence of reduction or retouch to produce a specific form that exceeds minimal functional requirements. In patterned tools, the shape of the tool reflects a distinctive style or cultural template. Projectile points, end scrapers, and bifaces are examples of patterned tools. Unpatterned or informal tools include types that were not substantially modified and still largely reflect the original shape of the flake blank or raw material. They lack the complex manufacturing methods of patterned tools and reflect an expedient technology. Flaking is typically restricted to the margin of the artifact. Utilized flakes and retouched flakes are examples of unpatterned tools.

Tool types and their inferred functions (e.g., projectile points, scrapers, cutting tools, etc.) were defined by technological attributes in conjunction with morphological attributes (form), general edge angle, size, and results from micro-wear studies that provide supporting evidence for general tool function (Root 2001; Kooyman 2000:164; Vaughan 1985; Yerkes 1987).

The use-life of a tool is an assessment of its estimated stage of manufacture and reason for discard. Use-life categories include the following: 1) unfinished tools that were not broken; 2) tools that are finished and in working condition; and 3) broken or worn out tools. This information was entered in the "notes" column of the catalog.

Numerous studies indicate that microwear analysis, which uses high-powered magnification to examine the edge of a tool in an attempt to identify the type of material that was worked by the tool and the type of motion with which the tool was used, is necessary to determine a tool's specific function (Keeley 1980; Odell 2003; Semenov 1976; Vaughan 1985; Yerkes 1987). Microwear studies clearly indicate that there can be a low correlation between tool form and specific function, as tools from different form classes were used for the same task, and a single tool form was often used for multiple functions (Yerkes 1987:128). These studies reveal that there is much more functional variation than is typically assumed from the traditional form-based tool classification.

Microwear studies also indicate that there is some viability to inferring general tool function from the form-based classification, especially for certain tool types. For example, scrapers defined morphologically by a steep working edge often correlate with micro-wear studies that show tools with steep working edges were used for scraping bone, wood, and hide (Kooyman 2000:164; Root 2001; Vaughan 1985; Yerkes 1987).

Of course, without microscopic examination of the edge wear, there is no way to tell what material was scraped. Also, microwear analysis often reveals greater functional variation than can be inferred from typological and technological classification alone (Odell 1996; Vaughan 1985). For example, some "scrapers" were also used for tasks such as cutting, engraving, wedging, shaving, chopping, and shredding. In some cases "scrapers" bear no evidence of use as scrapers. Many projectile points were also used for cutting, shaving, engraving, scraping, and drilling. Other bifacial tools were used to saw bone, antler, or wood as often as they were used for cutting meat (Yerkes 1987:186).

Thin, sharp-edged flake and blade tools (such as utilized and retouched flakes) generally correlate with microwear studies confirming their use as cutting implements (Kooyman 2000:164; Odell 1996; Root 2001; Yerkes 1987). Again, the specific material worked or specific use cannot be determined without microscopic examination of wear patterns. Some studies that tested the accuracy of identifying utilized flakes without magnification indicated a low success rate, as the multiple processes (besides use as a tool) that can produce edge wear are not discernible without microscopic analysis (Young and Bamfrorth 1990; Shen 1999). These processes include wear caused by flake production, artifact trampling, excavation damage, and artifact movement in the soil. The studies show two primary causes of incorrect identification. First, utilized flakes that exhibit no macroscopic wear go unrecognized as tools. Second, use-wear is incorrectly attributed to use as a tool when it is actually created by some other cause.

Despite the benefits of microwear analysis, there are several limitations that hinder its usefulness and practicality. The time and money needed for such analysis is often not available in contract work, few individuals have the necessary training and expertise, and microscopic equipment is not available in most labs. Further, experimental studies have not been conducted on many of the lithic materials that occur in the artifact assemblages in Minnesota. It has also been found that microwear analysis does not necessarily produce conclusive results. Blind tests revealed the accuracy of tool function to be 76 percent for high-power technique and 68 percent for the low-power technique (Yerkes 1987:115). The accuracy of identifying the material worked was 62 percent for high-power technique and 32 percent for low-power technique. Finally, micro-wear analysis may not clearly identify functions of a single tool edge that was used for different tasks, nor may it identify the function use of a tool used for a short time or on very soft materials that do not cause observable wear.

Stone Tool Techno-Morphological Categories and Descriptions

Tool types recovered from sites in the project area are discussed below.

Utilized and retouched flakes are unpatterned flake tools that have a sharp, narrow-angled working edge, which is not beveled. Utilized flakes have no intentional modification but do have a series of micro-flakes (use-wear) that were removed along the working edge during use. Retouched flakes are minimally modified by pressure flaking along the working edge, presumably to shape the edge for optimal use. The micro-flakes on utilized flakes are distinguished from retouch flakes by their smaller size. Use-wear and experimental studies indicate that these are typically light-duty cutting, slicing, scraping, and sawing tools that were used on soft materials (meat, hides, and plant material) or moderately resistant materials (wood and bone). These tools suggest that site activities may have included butchering, animal/plant processing, hide working, and bone and woodworking.

Scrapers are patterned flake tools that have been pressure flaked along a distal or lateral end to form a steeply beveled (wide-angled) edge that is optimum for scraping. End scrapers have a distal working edge that is generally shorter or the same length as the lateral side and may have been hafted. Side scrapers have the working edge along the longest side of a flake and were likely not hafted. Scrapers are typically associated with scraping tasks on a variety of soft materials (meat, hides, and plant material) or moderately resistant materials (wood and bone).

Projectile points are bifacial tools with a sharp-pointed distal end and proximal hafting elements. These tools were used for hunting, and larger points may have also been used as cutting tools. Published guides to projectile point types of Minnesota, Iowa, Wisconsin, the Upper Midwest, and the Northeastern Plains were consulted to aid in identifying the points (Alex 2000; Boszhardt 2003; Goldstein and Osborn 1988; Kehoe 1966, 1973, 1974; Morrow 1984; Justice 1987). Projectile points indicate that site activities were associated with the procurement of game animals.

Hammerstones are generally rounded stones that have pitting on one or more surface, which resulted from striking a hard material. They were used for flint knapping, processing foods such as acorns, or marrow extraction from animal bones.

Bifaces are classified into five stages after Callahan (1979), although Callahan's final stages are condensed in this scheme (cf. Odell 2003; Root 1999). The unfinished bifaces could have been used as tools in an unfinished state, although it is likely that their intended final form would have been projectile points. The bifaces from the current project include broken and whole specimens.

A Stage 1 Biface is a flake blank, a tabular piece of material, or a cobble that was obtained for reduction. Stage 1 bifaces were not identified in the assemblage, as flake blanks are generally classified as primary flakes, and there were no unworked cobbles.

A Stage 2 Biface has initial edging that is characterized by the following: bifacially flaked edges in which relatively widely-spaced scars produce a sinuous outline in lateral view; conchoidal flake scars with cones of force from hard-hammer percussion; minimal shaping; flakes often do not extend to the midline; irregular outline and cross section; and width to thickness ratio ranges from 2:1 to 3:1.

A Stage 3 Biface has primary thinning that is characterized by the following: major projections and irregularities removed edges straightened so they are less sinuous; ridges and humps removed by thinning; production of flakes with bending initiation from billet percussion; lack of cones of force; flakes that often extend to or past artifact midline; edge angles in the 40-60 degree range; and width to thickness ratios of 3:1 to 4:1.

A Stage 4 Biface has secondary thinning and shaping that is characterized by the following: a thin, flat to biconvex cross section; regular edge shape; edges with beveling and grinding; little to no cortex; production of flakes with bending initiation from billet percussion; lack of cones of force; flakes often extend to or past artifact midline; edge angles in the 25-40 degree range; and width to thickness ratios that range from 4:1 to 5:1.

A Stage 5 Biface has undergone final shaping and hafting preparation and is characterized by the following: pressure flaking or light percussion flaking to form a specific shape, especially along margins; edge beveling or grinding; removal of percussion platforms; pressure flaking of notches and stem shape; and basal grinding.

4.4 Faunal Analysis

The faunal analysis was conducted by zooarchaeologist Steven Kuehn. After separation by provenience, the following information was recorded for each specimen: element, side of the body (when applicable), section or portion of the element, weight in grams, and taxonomic classification. Relative age (e.g., adult or juvenile) was recorded when it could be reliably determined, based on epiphyseal fusion, tooth eruption, and occlusal wear. Refitting of bone fragments was restricted to specimens recovered from within the same feature or excavation unit (XU). Each specimen was examined for exposure to heat in the form of burned, charred, and calcined bone. Evidence of butchering and cultural modification was recorded when observed.

Due to specimen fragmentation, otherwise unidentifiable pieces of mammal bone are categorized as large-sized, medium-sized, or small-sized based on the relative size and thickness of each specimen. The approximate live weight of large-sized mammals is considered to be greater than 50 lbs (23 kg), 11 to 50 lbs (5 to 23 kg) for medium-sized mammals, and less than 10 lbs for small-sized mammals. When it was not possible to reliably categorize a specimen based on its size, it is listed simply as mammal of indeterminate size.

The quantitative measure of the number of identified specimens per taxon (NISP) is used throughout this report unless otherwise noted. Minimum number of individuals per taxon (MNI) determinations are based on comparison of repeating or multiple elements, relative age, and overall size, and calculated or the assemblage as a whole. In general, MNI estimates are made only for specimens minimally identifiable to the genus and species level (following Reitz and Wing 1999:198-199). An osteological comparative collection facilitated specimen identification.

4.5 FCR Analysis Methods

4.5.1 Definition of FCR

Stones used for cooking or heating, referred to here as fire-cracked rock(s) (FCR), are artifacts with distinctive characteristics caused by heating to high temperatures in a fire (House and Smith 1975; Jackson 1998; Latas 1992; Lovick 1983; McParland 1977; Taggart 1981; Thoms 2009). FCR includes both fractured and unfractured rocks that have been thermally-altered and lack other forms of cultural modification, such as flaking, pecking, polishing, or use wear.

Stones used for cooking or heating are generally cobbles of locally available materials that were chosen for their accessibility and predictable thermal qualities. These cobbles, which become FCR after heating, were generally larger than eight cm in diameter (Wentworth 1922). The types of cobbles chosen for heating or cooking were usually coarser than stones used for flintknapping (Lovick 1983) and commonly include quartzite, granite, basalt, sandstone, and limestone. Experimental studies show that igneous rocks are better able to withstand thermal stresses than metamorphic or sedimentary rocks, which explains the predominance of basaltic and granitic rocks in the archaeological record. Quartzite is also common as it one of the metamorphic rocks that can withstand a high degree of thermal stress.

FCR cortical surfaces are often discolored toward pink, red, gray, and/or black hues (Latas 1992; Schalk and Meatte 1988; Taggart 1981). Many pieces retain a high percentage of cortex because of the way FCR fractures. Heating in a fire causes FCR to become more friable (particularly non-basaltic rocks) than unheated stones (House and Smith 1975; McParland 1977). A variety of FCR shapes have been described from experimental studies and archaeological sites, although a correlation between shapes and function is unclear.

FCR is generally recovered either as part of a feature, which is the physical remains of a cooking or heating facility, or in a secondary refuse context where they are no longer in their location of original use. Context is important for the understanding and interpreting FCR and associated subsistence activities at a site.

4.5.2 FCR Background and Previous Studies

The use of heated rocks for cooking, extending back at least 10,000 years, is well-documented ethnographically and archaeologically in North America (Thoms 2009). Cooking stones (FCR) and their associated features have valuable research potential, as is made clear by recent studies that illustrate their significance for interpreting site function and settlement and subsistence patterns (Jackson 1998; Thoms 2007, 2008a, 2009). Ethnographic research has shown that specific cooking and heating facilities were related to specific types of food resources and the seasonality of those resources. Thus, the identification of cooking facilities may indicate the type of food being processed and the seasonality of the site.

Thoms (2008a) notes three important qualities in cooking stones that explain their widespread use. First, the relative non-combustibility and high density of rocks (i.e., heavy per unit volume) enable them to capture and hold heat for longer periods of time than hot coals, allowing extended cooking of foods (particularly roots) to render them readily digestible and nutritious. Second, cooking stones hold heat generated by fire, thus reducing the amount of fuel needed to cook, which is important in areas where wood and other fuels are sparse. Third, cooking stones can be used to boil water and produce greater amounts of steam for longer than would be possible with hot coals alone. Compared to other cooking methods, boiling probably yields a greater proportion of potentially available calories/nutrients from a given piece of food (Wandsnider 1997), especially when the liquid medium is consumed. The heating benefits from rocks are also apparent in their widespread use for sweatbaths and keeping campsites and habitation shelters warm. Crumbled pieces of FCR were also used for temper in pottery.

Cooking-stone facilities and their archaeological byproducts, FCR features, have considerable functional and morphological variation, as they were used to cook a wide array of animal and plant foods (Driver and Massey 1957; Ellis 1997; Thoms 1989, 2007, 2008a; Wandsnider 1997). However, four primary cooking methods are consistently noted (Thoms 2008a): 1) **baking** in an earth oven with stone heating elements in closed pits and mounds where cook stones may be heated in situ (i.e., in the pit) or on an adjacent surface fire and, once heated, placed in the pit; 2) **steaming** with stone heating elements in closed pits and mounds where water is added, using cook stones heated in or outside the pit; 3) **roasting** (stone griddles) on open-air hearths built on an unprepared surface or in shallow pits using stone heating elements; and 4) **boiling** in open pits and non-ceramic vessels with stones heated on nearby surface hearths/fires. In general, steam cooking takes place over several hours whereas baking often spans several days, but distinctions between hot-rock baking and steaming are often blurred. Hot-rock roasting refers to the use of cook-stone griddles in open-air hearths built on an unprepared surface or in shallow pits.

Jackson (1998:8-10; citing Driver and Massey 1957) provides additional details on the types of cooking facilities that were widespread across North America, which created much of the cooking-related FCR recovered from archaeological contexts:

> As this and other ethnographic records indicate, a typical **earth oven** was usually between 1-3 m in diameter and 30-40 cm deep. The hole was filled with fuel (usually wood) and rocks, and then set ablaze. Once the fire was largely burned down, hot rocks were maneuvered into a flat heating element and then vegetal materials, food packages, more vegetal packing materials, and finally an earth seal were successively added. After sufficient time had passed, usually between twelve and 48 hours, the oven was opened and food was removed; this left a concave basin filled with FCR. Both plant and animal foods were cooked in earth ovens, however, plants were cooked more often (Driver and Massey 1957:233).
>
> The second major type of cooking facility was the **rock griddle**. It was a type of hearth, used for short-duration cooking, that usually lasted no more than a few hours. It was akin to broiling over a fire or roasting on hot coals (cf. Driver and Massey 1957:233) because it used dry, open-air convection heat to cook food. As such, this cooking facility would have been used most often with animal foods and less often with plants (Driver and Massey 1957:233). In a generic rock griddle, rocks were placed directly in a fire to take on heat; they would release that heat after the fire died down. The fire was usually on a flat surface, enclosed with rocks, or in a shallow basin. A rock griddle was usually about 1 m in diameter. When the fire was mostly burned down, the hot-rocks were spread into a flat or slightly concave platform. Food was placed directly on the platform or placed on skewers directly over the rocks. Rocks

would cool in place after the food had been removed, and would not be disturbed as a result of food removal.

Stone **boiling**, the third cooking facility, occurred when hot stones were immersed in a container of liquid (Driver and Massey 1957:229). It was a common cooking technique across North America, although it was seldom used among groups that had access to pottery.

Ethnographic accounts indicate that a variety of plants, large and small game, fish, and shellfish were cooked using hot-rock facilities. Plant foods, however, predominate in hot-rock cookery, especially those requiring inulin or fructan hydrolysis (Thoms 1989; Wandsnider 1997), with earth ovens being used most commonly for prolonged cooking of root foods (Thoms 2008b). High-lipid and collagen-rich meats that require substantial hydrolysis, which entails prolonged, high-temperature baking, are also well represented in hot-rock cookery (Wandsnider, 1997).

The distinguishing characteristics of primary cooking facilities types on archaeological sites are summarized in Table 4 (Thoms 2008a).

Table 4. Cooking Facilities and Expected Characteristics of FCR Features and Scatters (from Thoms 2008a).

Hot-rock Cooking Facility	**Expected archaeological characteristics of resulting FCR feature**	**Expected archaeological characteristics of non-feature FCR**
Earth oven (baking), rocks heated therein	Basin-shaped pit, 1–3 m in dia. and 0.1–0.3 m deep, sometimes with rock lining and always with a lens of FCR (i.e., heating element) underlain by and intermixed with thermally-altered (oxidized, carbon-stained) sediments; FCR (small to large *), typically carbon stained and mostly fragments, varies considerably in size, whole rocks often found along edges of heating elements; burned bone (possibly from fuel residue), flakes and tools expected therein as discard from routine clean-up activities	Scattered FCR in the immediate vicinity of remains of earth ovens, representing discard and scavenging activities, and perhaps rocks used with oven-top fire; also other scattered camp debris, furniture rocks, and unused cook stones
Surface oven (roasting), rocks heated therein	Large to medium, presumably flattish, rock(s) on or just below the occupation surface, underlain and encompassed by thermally-altered sediment (oxidized, perhaps some carbon stained); burned bone (possibly from fuel residue), flakes and tools expected therein as discard from routine clean-up activities	Scattered FCR in the immediate vicinity of remains of surface ''ovens" (i.e., open-air griddles) representing discard and scavenging activities; also other scattered camp debris, furniture rock and unused cook stones
Steaming pits; rocks heated nearby	Basin-shaped pit (ca. 1 m dia. and 0.3 m deep) partially filled or lined with medium and large FCR (typically not carbon stained), or occasionally a large flat rock, underlain by thermally-unaltered sediment; nearby surface hearths (ca. 1 m dia.) where rocks were heated, represented by ash, charcoal, oxidized sediments, and a few pieces of FCR	Scattered FCR in the immediate vicinity of remains of steaming pits, representing discard and scavenging activities; also other scattered camp debris, furniture, and unused cook stones

Table 4. Continued.

Hot-rock Cooking Facility	Expected archaeological characteristics of resulting FCR feature	Expected archaeological characteristics of non-feature FCR
Stone boiling in a pit; rocks heated nearby	Bucket-like (i.e., near-vertical side walls) pits, 0.3–0.45 m in dia. and 0.15–0.45 m deep, partially filled with small, possibly medium-sized, FCR, not typically carbon stained, underlain by thermally-unmodified sediment; nearby surface hearths where rocks were heated, represented by ash, charcoal, oxidized sediments, and a few pieces of FCR, burned bone (possibly from fuel residue), burned flakes and tools discarded in the fire pit	Comparatively dense, scattered FCR in the immediate vicinity of remains of stone-boiling pits or concentrations representing discard and scavenging activities; also other scattered camp debris, furniture, and unused cook stones
Stone boiling in a container; rocks heated nearby	Surface hearths where rocks were heated, represented by ash, charcoal, oxidized sediments, and FCR (not typically carbon stained); concentrations of discarded small- and possibly medium-sized FCR, burned bone (possibly from fuel residue), burned flakes and tools, possibly discarded in fire pit	Comparatively dense, scattered FCR in the immediate stone boiling area, representing discard and scavenging activities; also other scattered camp debris, furniture rock, and unused cook stones
Open-pit drying ovens, rocks heated elsewhere	Basin-shaped pit (ca. 1 m dia. and 0.3 m deep) with FCR lens, mostly medium-size large rocks, underlain by thermally-unmodified sediment; nearby surface hearths (ca., 1 m dia.) where rocks were heated, represented by ash, oxidized sediments, and a few pieces of FCR, burned bone (possibly from fuel residue), flakes and tools expected therein as discard from routine clean-up activities	Scattered FCR in the immediate vicinity of remains of open pits, representing discard and scavenging activities; also other scattered camp debris, furniture rock, and unused cook stones

* Original rock sizes: large rocks, >25 cm in diameter; medium rocks, 10–25 cm in diameter; small rocks, <than 10 cm in diameter.

Thoms (2008a) notes that a better understanding of the relationship between cooking methods and cooking requirements allows for a better understanding of the nature of archaeological FCR features. By considering FCR feature characteristics, it should be possible to assess whether FCR represents stone-boiling or oven-baking, estimate the magnitude of activities, suggest what foods may have been cooked there, and fine-tune the search for confirming evidence.

Jackson (1998:45) summarizes the types of information that can be gleaned from collecting basic FCR data:

> FCR weights and counts give rough estimates of cooking methods (Taggart 1981:149). In general, large heating elements (i.e. earth ovens) required kilograms of rock to sustain high temperatures for days. While there is considerable overlap between large rock griddles and small earth ovens, rock griddles generally used fewer rocks because they did not need to remain hot for as long as earth ovens. Still fewer rocks were needed for stone boiling in generally small, pot-sized containers.
>
> Rock size is also related to feature function. Large rocks (larger than 10-cm diameter) were preferred in earth ovens and rock griddles (Schalk and Meatte 1988:8.9; Taggart 1981:148-149) because they stored heat for long periods of time. Small rocks (less than 10-cm diameter) were not preferred in earth ovens because they had a higher ratio of surface area to mass, which caused them to lose heat more rapidly than large rocks (Schalk and Meatte

1988:8.9). This is a bad quality where extended cooking is required. Large rocks should have been preferred for structure heating, be it a sweatlodge or habitation, because of the same heat retention quality. Small rocks were preferred for stone boiling because of better resistance to thermal shock and because they were easier to handle (Schalk and Meatte 1988:8.8; Taggart 1981:148-149).

Ethnographic accounts and archaeological excavations attest to the differential use (preference) of smaller rocks in stone-boiling features and larger rocks in earth ovens. Small rocks <10 cm diameter are good for stone boiling because they have a high surface-to-mass ratio which allows them to store and release heat energy quickly; they are also easy to handle.

Raw material is a critical factor. Certain rock types can be good for certain cooking methods and poor for others (McDowell-Loudan 1983:26; Zurel 1979:5). For example, sandstone reacts well in a rock griddle because it is generally coarse-grained and porous, which makes it elastic and able to deform in response to heating and cooling. It is not very good for stone boiling because it loses individual grains and adds grit to water (Brink et al. 1986:290-292; Jackson 1997); it also absorbs a lot of water because of its high porosity, which requires longer drying periods than fine-grained rock types (Brink et al. 1986:296). Fine-grained rocks were generally preferred for boiling, while coarse grained rocks were preferred for griddle roasting and earth-oven baking. However, some materials like quartzite were preferred whenever available. Homogeneity in mineralogy, grain size, and grain shape, as well as a strong bond make quartzite an all-purpose rock.

Size grade analysis can be used to address these questions. Every time a cooking/heating facility is used, some of the rocks will fracture and/or crack. As the number of times the facility is used increases, the resultant rock sizes become smaller as rocks continue to fracture; the number of fractured rocks increases at the same time. Therefore, size grade analysis can be used to discriminate this thermal weathering process. A relatively small number of large FCR pieces would indicate relatively less use of the rocks than a similar feature containing relatively more FCR that are smaller in size.

New lines of research are extending the range of information that can be recovered from FCR through more complex techniques such as analyzing fatty-acid residues to identify remnants of animal fat on FCR, paleo-magnetic testing to reveal whether stones were moved after heating, AMS dating of FCR samples, and examining starch grains, phytoliths, and calcium oxalate crystals on FCR and in features to provide information about plants that were cooked using FCR (Thoms 2008a and 2009).

4.5.3 FCR Analytical Methods

Several criteria were established to provide a consistent method of identifying FCR. The lack of naturally occurring cobble-size rocks within the project area aided the identification of FCR. Data collected for FCR included count, weight, and size grade. In order for a rock to be classified as FCR, it had to meet at least one of the following criteria:

1) The rock is associated with a cooking feature such as fire hearth or cooking pit. Such features may have carbon-stained (blackish) or oxidized (reddish) soil and may be other associated with other materials such as charcoal, ash, and thermally-altered fauna.

2) The rock has distinctive shapes that have been observed at archaeological sites and in ethnographic and experimental studies, such as angular blocky fragments, crenulated or jagged edges, spalls (potlids),

or a variety of intermediary shapes. FCR cobbles contain the negative impression where an angular or spall piece detached.

3) The rock's fracture surfaces are fresh, unweathered, and have fairly sharp edges. The rock also lacks the characteristics of cores and lithic debris from stone knapping, such as bulbs of force, ripple marks, hinge or step terminations, and crushing.

4) The rock is unfractured and whole but has other distinctive thermal stress features such as crazing (surface cracks) or a friable and crumbly surface, especially with granitic rocks and sandstone.

5) Rocks have a reddish, pinkish, or blackish discoloration, particularly the cortical surface.

6) The rock's grain size is generally too coarse for flaking. Common rock types include granite, basalt and quartzite that originally occur in the local area as rounded cobbles with their source in glacial or outwash deposits.

Some experimental studies appear to have demonstrated that the shape of individual pieces of FCR (spall or angular) results from specific rates and methods of heating and cooling (Homsey 2009: House and Smith 1975; McDowell-Loudan 1983; McParland 1977; Wendt 1988; Zurel 1979). Angular pieces were thought to result from FCR being quickly cooled by immersion in water for stone boiling, while spalls were thought to result from slower cooling around a fire hearth. However, the results of these studies have not produced consistent results. Jackson's (1998) experimental study suggests that FCR shapes are not related to specific rates and methods of cooling but to rock size and duration of heating. Similar rock shapes can be produced by various types of cooking facilities.

Jackson (1998) conducted microscopic analysis of rock thin-sections subjected to various cooking facilities to examine the mechanical aspects of thermal weathering of rock. The results show that thermal weathering was highest for all rock types in the earth oven and rock griddle plates, while it was lowest in the stone boil and sweatbath plates. The thermal weathering variation is attributed to the length of heat exposure, rather than the rate of cooling. His results indicate that there is valuable research potential for the microscopic study of FCR for understanding cooking facilities and subsistence. In conclusion, additional microscopic and experimental studies need to be conducted before more reliable interpretations can be made.

4.5.4 FCR Morphology

Observations of FCR from archaeological sites and experimental studies led to the delineation of three basic FCR shape types (Jackson 1997, 1998; McParland 1977; Schalk and Meatte 1988; Thoms 1986: Zurel 1979, 1982), which are defined as follows: 1) spall types are expansion-fractures that, according to Jackson (1998), "occur because of an internal thermal gradient, where the exterior of a rock becomes hotter and expands more quickly than the interior. When stress becomes too high, a rock releases it by sloughing off curvilinear spalls or convex potlid"; 2) angular types are blocky contraction-fractures that, according to Jackson (1998), "occur because of tension stress where the exterior of a rock cools rapidly and causes cracks to form perpendicular to the surface and at evenly spaced intervals"; and 3) spall/angular types include FCR that is intermediary between the spall and angular types (Jackson 1997; Thoms 1986; Zurel 1979), which represent opposite ends of the typology continuum (McParland 1976, 1977; Thoms 1986).

Despite evidence that cooking methods (rate/methods of heating and cooling) cannot be inferred directly from FCR shapes (Jackson 1998), these shapes are recorded for this analysis because they provide a fair description of the basic shapes and properties of the FCR, are currently in use in the archaeological community, and may someday prove to have more interpretive value. In addition, the FCR analysis for this project also includes other descriptive types that were established to encompass the variety of FCR shapes and conditions that were recovered at the sites. These FCR types are summarized in Table 5.

Table 5. FCR Type Descriptions.

FCR Type	Description
Spall	Expansion-fracture, has straight or curvilinear profile following the natural shape of cobble cortical surface (like a section of orange peel), relatively thin in cross-section in relation to the width and length, also includes interior non-cortical pieces that have thin cross-sections, fracture plains are relatively large, smooth, and lack complexity
Angular	Thick, blocky, and angular pieces with fractures that are generally perpendicular to the exterior surface, sometimes with distinctive serrated or crenulated edges at the exterior surface. The length, width, thickness ratio more approximately equal compared to the relative thinness of spalls.
Spall/Angular	Intermediary pieces between the Spall and Angular types.
Crumb	Crumbs are small pieces, typically less than 1/2" (SG2) that do not fit other categories
Cobble (Nonfriable)	These are whole cobbles that have cortical discoloration and/or cracks on the surface but do not have spall or angular fractures.
Cobble (Friable)	These are whole cobbles that have a crumbly surface or portion of the surface, which is most common on granitic or sandstone FCR. They do not have spalls or angular fractures.
Cobble with Spall	These are mostly whole cobbles that have one or more spall fractures.
Cobble with Angular	These are mostly whole cobbles that have one or more angular fractures.
Friable Rounded Piece	These are round-shaped FCR with a crumbly surface, which is most common on granitic FCR, classified as crumb if smaller than 1/2" (SG2)
Split Cobble	Cobble that has split
Indeterminate	FCR that do not fit any other categories

11.1 Ceramics

Data recorded for each ceramic sherd included vessel portion (morphology), temper, surface treatment, decoration, condition, and presence/absence of charred residue. The small size and fragmentary condition of most sherds made it difficult to determine "vessel portion". Unless the sherds could be confidently identified to a specific vessel portion (e.g., rim, neck, or base), they were classified as body sherds. None of the sherds were large enough to determine the vessel form, which is often a diagnostic trait of wares from different traditions. Thickness was measured for sherds that retained intact internal and external surfaces. Rim sherds were measured at the lip and one cm below the lip. The thickness was entered into the "Notes / Sherd Thickness" column of the catalog. These measurements were useful for establishing the relative age and affiliation of the sherds in the absence of decoration or other diagnostic attributes. For example, thin-walled (< 5.0mm), cordmarked sherds are likely to be Late Woodland Madison ware, while thicker-walled (>5.0mm), cordmarked sherds are likely to be Transitional Woodland (Middle to Late) St. Croix Stamped ware.

Surface treatments were placed in one of three categories: net-impressed, cordmarked, or smooth. The cord-marked category includes sherds that have twisted cord impressions (generally finely spaced) that resulted from a cord-wrapped paddle, woven cordage (fabric), or having been formed in a woven bag. Smooth sherds have no discernable impressions from cordage or other objects as a surface treatment. Net-impressed ceramics are generally easy to identify by the impressions of fine cordage that is coarsely woven into a net and secured with distinctive knots at the intersection of the cords (Caine and Goltz 1995). None of the ceramics from sites in this project had net impressions. The analysis of ceramics was conducted by Frank Florin. Primary guides used were *A Handbook of Minnesota Prehistoric Ceramics (Anfinson 1979)*, *An Analysis of Effigy Mound Complexes in Wisconsin* (1975 Hurley), and *Minnesota Statewide Multiple Property Documentation Form for the Woodland Tradition* (Arzigian 2008).

4.6 Historical Artifacts

The analysis of historic artifacts was conducted using specific manuals designed to aid in interpreting and dating historical materials (Peterson 1995; University of Utah et al. 1992). These manuals were used to establish date ranges for specific artifact types and aid in site interpretation. Historic artifacts recovered during the current project included items from architectural and household classes. The following attributes were recorded in the catalog for each artifact when applicable: functional class, material, type, portion, morphology, condition, and decoration or type of surface treatment.

5. Literature Search

5.1 Archival and Background Research for Previous Archaeology Sites

Archival and background research was conducted to determine whether any previously identified archaeological sites or potential historic sites are located within one mile of the project area. FCRS staff conducted an initial review of sites located near the project area prior to fieldwork. Additional research was conducted in February 2017 at the MnHPO and the Minnesota Historical Society Library in St. Paul. Site inventory files, USGS 7.5' quadrangle site location maps, and research reports were reviewed to provide information on previously recorded archaeological sites and previous investigations within one mile of the project area. Mr. Tom Cinadr, Survey and Information Management Coordinator at MnHPO, also conducted a search of the site file database and provided a list of sites within 1.5 miles of the project area.

There are nine previously recorded archaeological sites within a radius of approximately 1.5 miles around the project area (Figure 3). These sites, which are summarized in Table 6 below, include precontact period mounds (earthworks), precontact period lithic scatters, precontact and historic period artifact scatters, and a historical structure. A number of other sites, including earthworks, have also been recorded on the bluffs overlooking the Minnesota River outside of the one-mile radius.

Table 6. Previously Recorded Sites Within 1.5 Miles of the Project Area.

Site Number	Location	Site Type	Comments	Distance to Project Area (meters)	Reference
21HE12	T27N, R24W, S ½ of SW ¼ of SE ¼, Sec 24	Woodland period earthworks with historical component	"Findlay Mounds Group 1" includes (21HE1), identified by Winchell and later named "Davis Mound"	2700	Winchell (1911), Brown (1933), Chamberlain 1972
21HE13	T27N, R24W, N ½ of SW ¼ of SE ¼, Sec 14	Woodland period earthworks	"Findlay Mounds Group 2", location described as "possible"	3015	Winchell (1911), Chamberlain 1972
21HE14	T27N, R24W, NE ¼ of SE ¼, Sec 24	Woodland period earthworks	"Findlay Mounds Group 3", location described as "possible"	3300	Winchell (1911), Chamberlain 1972
21HE15	T27N, R24W, SE ¼ of NW ¼, Sec 29	Woodland period earthworks	"Palmer Mounds", location described as "possible"	2160	Winchell (1911)
21HE16	T27N, R24W, N ½ of NE ¼ of SW ¼, Sec 22	Woodland period earthworks	"Hopkins Mounds", location described as "possible"	525	Winchell (1911)
21HE95	Location unclear; T27N, R24W, Sec 28	"Nine-Mile Creek" Dakota village	"Exact location unknown", SHPO field verification in 1978 "unable to locate"	280	Roberts (1993)
21HE228	T27N, R24W, NE 1/4 of SW ¼ of NW ¼ of SE ¼, Sec 22	Precontact period lithics and faunal material, historical ceramics	Includes subsurface "fire ring" with lithics, faunal material, and charcoal	610	Murray (1993), Harrison (2007)
21HE244	T27N, R24W, NE 1/4 of SW ¼ of SE ¼ of NE ¼, Sec 22	Historical period structure, foundation remains, and artifacts along with sparse precontact scatter	NRHP listed "Gideon Pond House" dating to the mid-1850's and remains of other structures dating as early as an 1843 mission.	1440	Gibbon (1981), Birk (1993)
21DKx	T27N, R24W, Sec 28	"Penichon's" Dakota Village	Location unknown, reported at mouth of Nine Mile Creek		Roberts (1993)

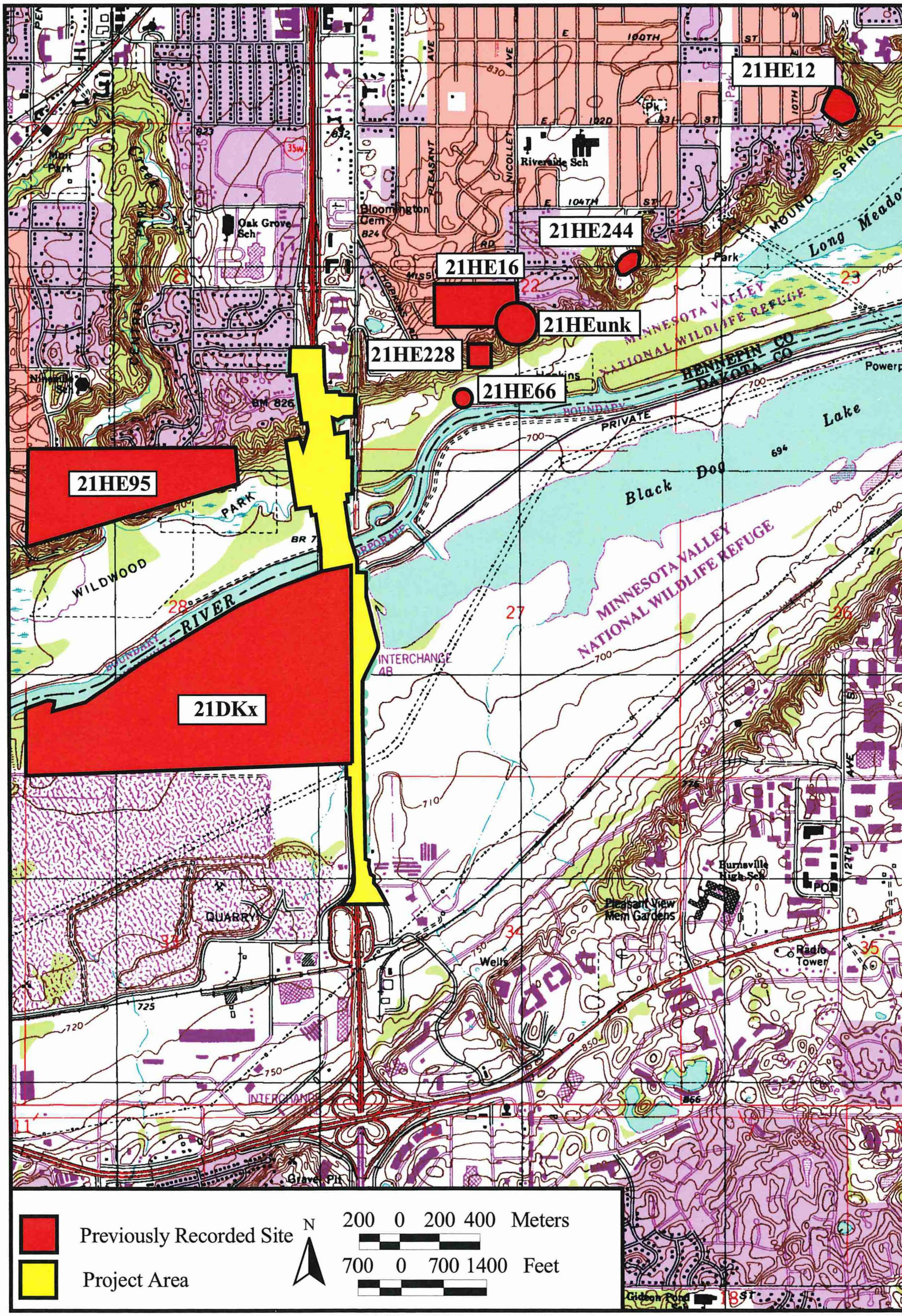


Figure 3. Location of Previously Recorded Sites Within 1.5 Miles of the Project Area on USGS 7.5' Quad.

The Minnesota River valley and the surrounding bluffs have been the subject of a number of formal archaeological investigations; beginning with T.H. Lewis and the Northwestern Archaeological Survey (NWAS), which focused on recording mound groups. N.H. Winchell later compiled and published the original survey notes and maps from the NWAS survey (Winchell 1911).

During his survey in 1882, Lewis recorded three mound groups (Findlay Mound Groups 1, 2, & 3) that became sites 21HE12, 21HE13, and 21HE14. Findlay Mound Group 1 (21HE12) also contains site 21HE1, a single mound known as the Davis Mound, which was excavated in 1933 (Brown 1933) resulting in the exposure of numerous human burials and the recovery of artifacts dating to the European-contact and historical periods such as trade beads and a brass bracelet. The Davis Mound and Findlay Groups were revisited in 1971 during an inspection of mound sites in Hennepin County by the Minnesota Archaeological Survey (Chamberlain 1972). During this survey, the researchers found that 15 of 36 originally-recorded earthworks at 21HE12 were still intact and were protected within the boundaries of Indian Mound Park in the City of Bloomington. None of the eight earthworks originally recorded at 21HE13 or the nine recorded at 21HE14 could be relocated. Lewis recorded two groups of earthworks at site 21HE15 (Palmer Mounds), comprising two mounds in group one and five mounds in group two. The 1971 Hennepin County Survey concluded that these earthworks had been destroyed by highway and airport development. Site 21HE16 (Hopkins Mounds) consists of two earthworks also recorded during the Lewis survey. The Hopkins Mounds were not relocated during the 1971 Hennepin County survey and the location of the site is described in the SHPO site files as "possible".

The locations of 21HE95 (Nine-Mile Creek Village) and "Penichon's" Village (21DKx) are also tentative in the state site files and historical reports and neither has been definitively relocated. The names "Nine-Mile Creek" and "Penichon's" Village are used synonymously in much of the literature, and it appears that there was either a single village that spanned the river or that the location changed over time. Roberts (1993) reports that Nine-Mile Creek Village was "swept away by a flood in 1826 and that it may have been moved across the river following that event. Taliaferro's Journal of 1826 indicates that the village is on the north side of the river. Roberts (1993) also cites historical accounts, including Eastman (1849) and Babcock (1930) suggesting that Nine-Mile Creek/Penichon's Village was one of the oldest along the river and was one from which many people moved from Wabasha's Village following their displacement from the early townsite of Winona.

Site 21HE228 was identified in 1993 during a survey for improvements to a recreational trail for the City of Bloomington (Murray 1993). The site comprised two areas approximately 40 meters apart, which were found to include an intact subsurface "fire-ring" with associated lithic debitage, animal bone, and nineteenth-century ceramic fragments in one area and additional lithics, historical ceramics, iron muskrat spears, and a gunflint in the second area. Both assemblages suggest an historic-period Dakota occupation, but there was not a sufficient amount of cultural material to argue that it is a village location. The researchers concluded nonetheless, that because there are few known sites containing historic Dakota and early Euro-American components, the site has significant research potential and it was avoided.

The site was revisited in 2006 (Harrison 2007) for a reroute of the recreational trail, at which time it was confirmed that the site area was still intact but that, despite accurate narrative reporting of the site location in Murray's 1993 report, there was a transcription error on the map included in that report and therefore when the City of Bloomington contacted the OSA regarding site locations of concern for their trail improvement plans, the correct location of 21HE228 was not provided. Harrison (2007) re-reported the correct location of 21HE228 and conducted additional shovel testing and inspection of eroded areas along the trail, which recovered lithic debitage, a grindstone and polisher, FCR, and a small amount of historical refuse. They concluded by agreeing with the 1993 report conclusion that the site contains significant research potential and recommended that the area be stabilized and protected from further impacts by trail-users.

The final site recorded within one mile of the project area is 21HE244, the Gideon Pond House. Investigations were conducted at the site by the University of Minnesota (Gibbon 1981) and the Institute for Minnesota Archaeology (Birk 1993). The site area covers approximately 40 acres and includes an 1856 brick house that is listed on the NRHP, along with the locations of many other structures and historical archaeological features dating to as early as 1842, along with precontract period archaeological sites at the periphery of the site area.

The significance of the site is enhanced by the historical status of the Pond brothers, Gideon and Samuel, who came to the Minnesota Territory in 1834 to serve as missionaries among the Dakota. The brothers built a temporary mission at Lake Calhoun, in what became the City of Minneapolis, before moving to separate locations and establishing permanent mission sites. Gideon was the designated Government Farmer, he served in the territorial legislature in 1849, he was an interpreter during the treaty negotiations of 1851 during which the Dakota ceded most of their lands in southern Minnesota, and he occupied his mission site until his death in 1878. His brother Samuel established his mission in present-day Shakopee and he became known for completing the first Dakota/English dictionary and for publishing the first newspaper that was directed at both native and Euro-American readers.

The 1981 investigation at 21HE244 was limited to excavations along the foundation of the brick house in preparation for construction activities adjacent to the foundation. Gibbon (1981) noted that few alterations to the house had been made since its construction and therefore the modern efforts to stabilize and maintain the structure could destroy valuable archaeological information. Three test trenches excavated into the original builder's trench recovered a small number of historical artifacts and no precontract period materials. Gibbon concluded that, while the materials recovered were not of special significance, there should be continued monitoring during construction given the potential for significant discoveries within other portions of the original builder's trench.

Birk's 1993 investigation encompassed the entire mission site and documented the locations of "over three dozen historic sites or features," including additional farm and residential structures along with an "almost continuous scatter" of historical debris. He found that the original mission house was located where the current brick house now stands. This original building was known as the "pre-emption" house, based on the Pre-emption Act of 1841 that allowed for the purchase of public land by settlers. Birk concluded that many structures were built and torn down on the farm in the years following Gideon's death up and that by 1985, only the brick house remained extant. He also notes that a gravel mine to the southeast of the house likely destroyed significant portions of the site. Possible sites associated with the early occupation of the Pond mission and farm are likely present downslope of the site but these areas were not part of the investigation.

The U.S. Fish and Wildlife service conducted a study of four reported river ferry crossing locations within the Minnesota Valley National Wildlife Refuge, including one for the Bloomington Ferry near the current project area (Hoisington 1994). This location is near the site of the old Lyndale Avenue Bridge, built in 1921 and demolished in the early 1960's. The authors note that following the construction of I-35W in 1957, a marina and mooring area were dredged out just east of the old Lyndale Bridge and that this activity likely destroyed all evidence of the landing. The author notes that the crossing is not indicated on any maps and did not likely include significant construction features, and he concludes that these ferry crossings "have only minor historical significance" (Hoisington 1994:5)

5.2 Mn/Model Study of the Big Woods Subsection

The Mn/Model is a statewide GIS-based predictive model for pre-1837 archaeological site locations. The project area is located within Mn/Model's Minnesota Big Woods subsection, which is characterized by a presettlement vegetation of mesic deciduous forest comprised of oak woodland and maple-basswood (Big Woods) and a loamy end moraine associated with the Des Moines Lobe of the Late Wisconsin Glaciation (Hudak et al. 2002). The Minnesota River flows southwest to northeast through the subsection. The Mn/Model depicts areas of high site potential along the Minnesota River, which flows through the center of the region (Hudak et al. 2002, Chapter 8.10; Figure 8.10.3 and 8.10.8). The site potential within the valley is variable and dependent on topography, alluvial history, and geomorphic processes.

5.3 Historic Map and Air Imagery Review

Several historic maps were examined to aid in identifying potential historic period archaeological resources within the project area. The earliest map examined was the General Land Office (GLO) survey maps of 1854 (Figure 4), which was available online (http://www.mngeo.state. mn.us/glo/). Copies of historic plat maps in Hennepin County for 1873, 1874, 1898, and 1916 (Andreas 1874a; Dahl 1898; Hixson and Company 1916; Wright 1873) and Dakota County for 1874, 1896, 1911, 1916 (Andreas 1874b, Pinkney 1896, Rand, McNally and Company 1911, Webb Publishing 1916) were reviewed. USGS topographic maps from 1901 (1:62,500 scale; reprinted 1928) and 1954 (1:24,000 scale) were also reviewed. The 1913 Hennepin County and 1916 Dakota County plat maps do not depict private dwellings but the other maps do.

Aerial photos from 1937, 1951, 1956, 1960, 1962, 1964, and 1967 were obtained online from the Borchert Map Library at the University of Minnesota (http://map.lib.umn.edu/mhapo/) and the Minnesota Department of Natural Resources online air photos (http://www.dnr.state.mn.us/maps/ landview/index.html). The photos reveal land use changes in the project area and also changing landscape conditions.

The 1873 map has an east-west road between Nine Mile Creek and the bluff on the north side of the Minnesota River (Figure 5). No evidence of this road was identified during survey. The first structure in the project area appears on the 1901 topographic map on the south bank of the Minnesota River near the current location of the interchange on the east side of I-35W (Figure 6). The structure is either outside of the survey area or was destroyed by highway construction if it was in the survey area. The 1937 air image and 1954 topographic map depicts a homestead or farmstead at the north and south ends of the project area (Figures 7 and 8). The structures at the north end were on the east side of I-35W but are no longer extant. The survey area at this location was confined to the ROW, which was consists of hill cut. The structures at the south end were likely destroyed by I-35W construction, as there is a large interchange at that location. These maps also depicts a structure on the east side of I-35W on the terrace below the below bluff top. A local informant indicated that this was a mink farm. However, no buildings are extant in this area.

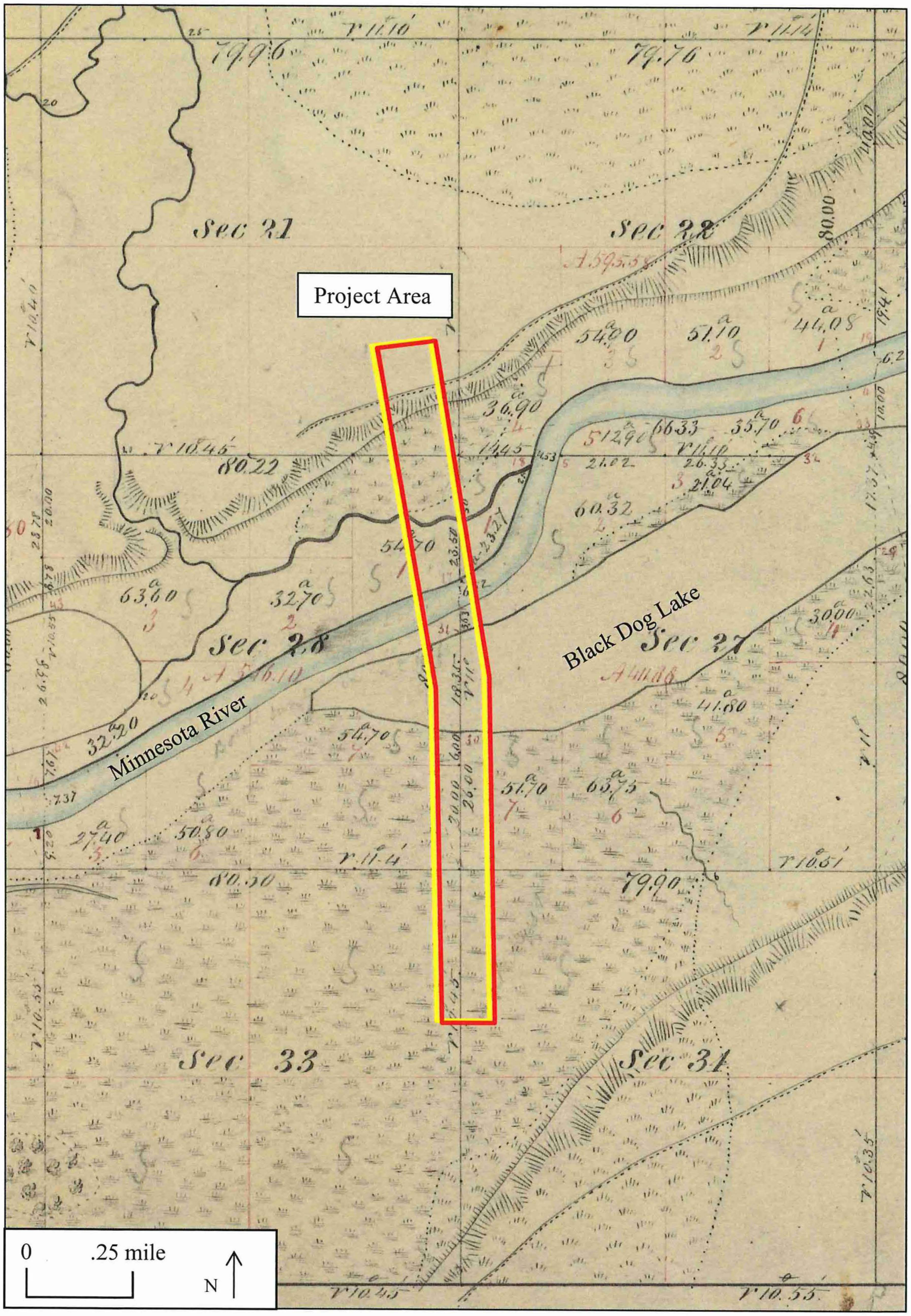


Figure 4. 1854 General Land Office Map of Project Area.

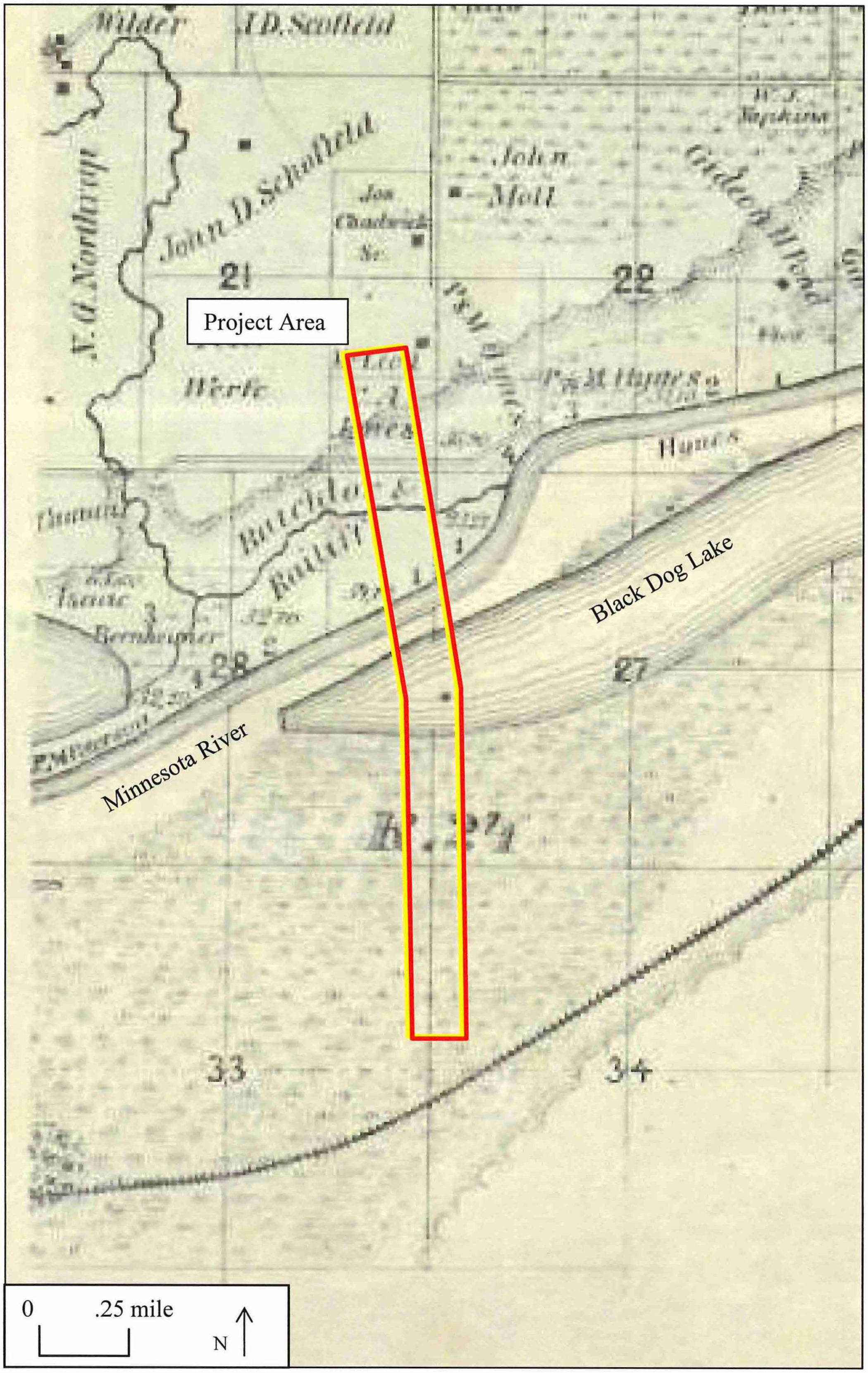


Figure 5. 1873 Hennepin and Dakota Counties Plat Map of Project Area (Wright 1873).

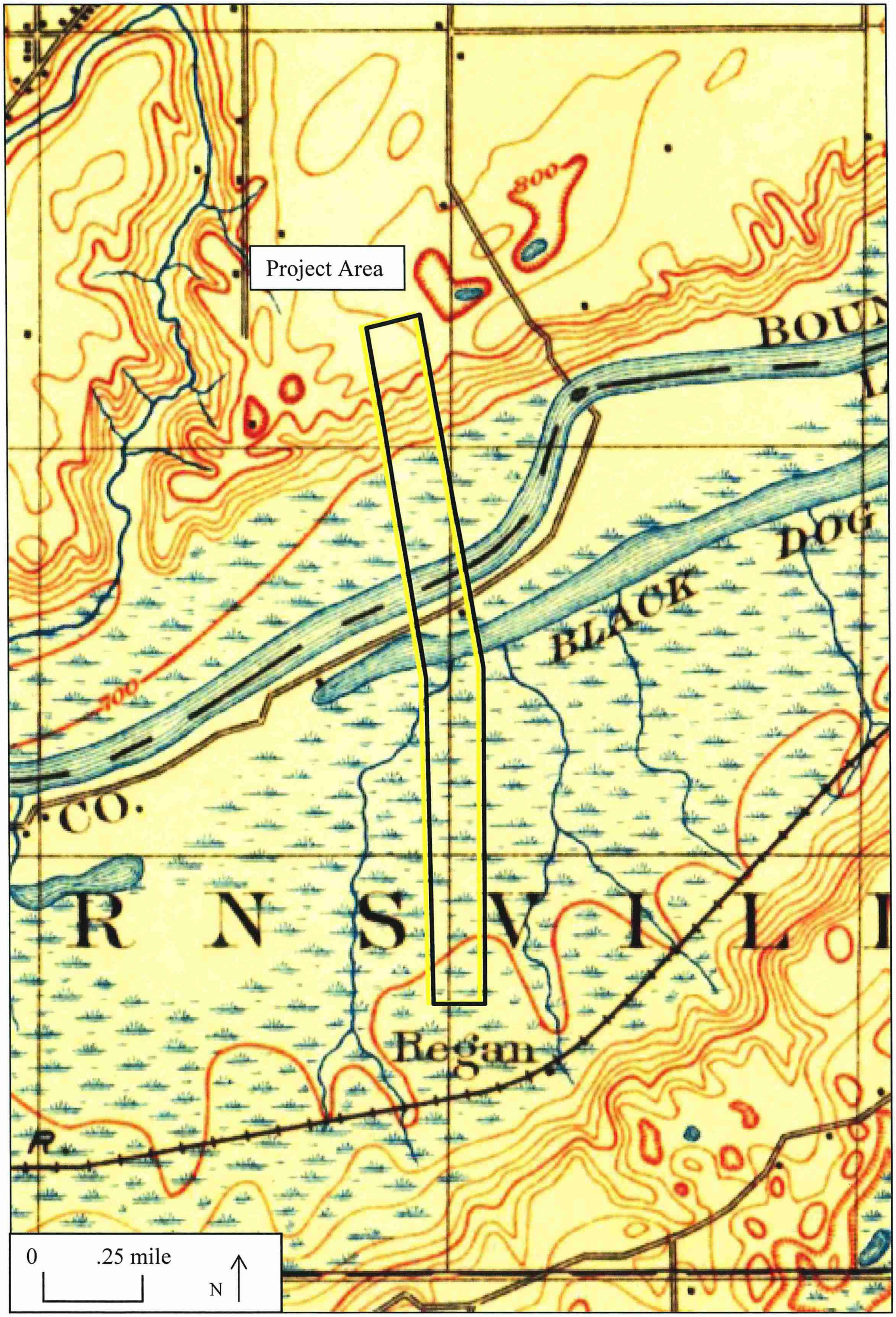


Figure 6. 1901 USGS Topographic Map (1:62,500 scale) of Project Area.

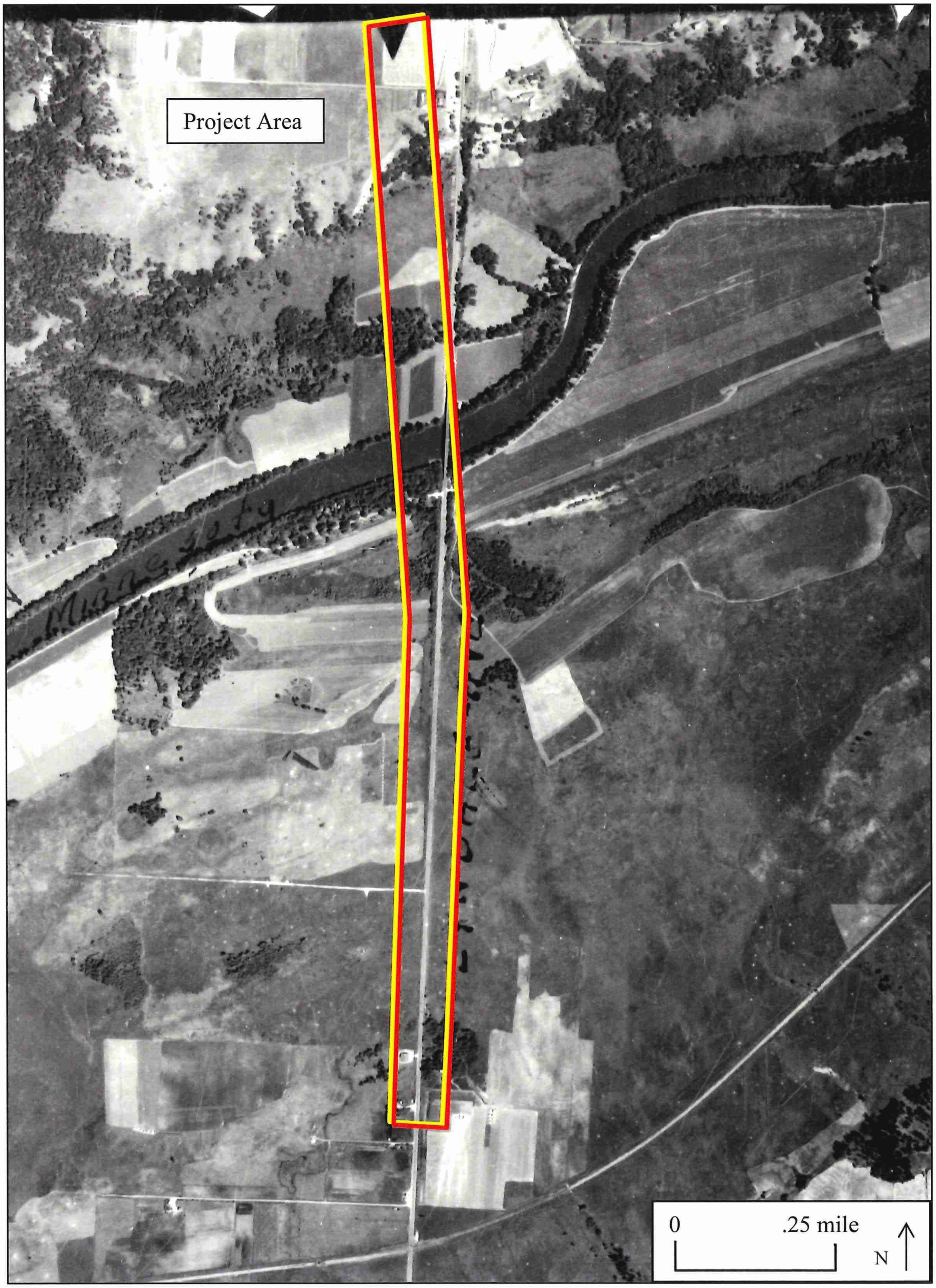


Figure 7. 1937 Air Photo of Project Area.

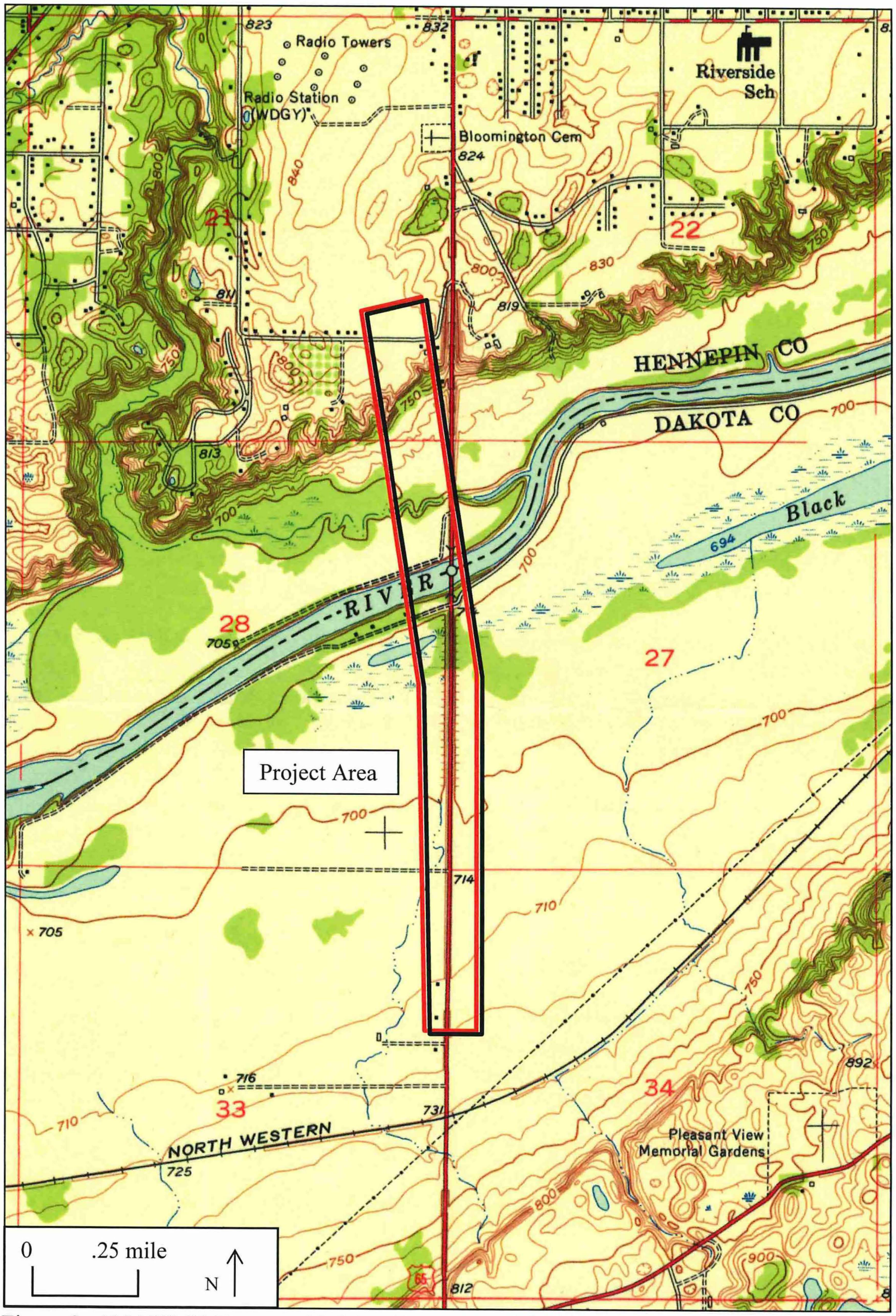


Figure 8. 1954 USGS Topographic Map (1:24,000 scale) of Project Area.

6. Culture History

by James Lindbeck

The following culture history of the precontact period in the project area is derived primarily from *Archaeology of Minnesota: Prehistory of the Upper Mississippi Region* (Gibbon 2012); *Minnesota Archaeology: The First 13,000 Years* (Gibbon and Anfinson 2008); the *Minnesota Statewide Multiple Property Documentation Form for the Woodland Tradition* (Arzigian 2008); and *Outline of Historic Contexts for the Prehistoric Period (ca. 12,000 B.P. - A.D. 1700)* (Dobbs 1988). The discussion follows the organization of cultural periods used by Gibbon (2012) and uses calibrated dates that are 10 to 20 percent older than conventional dates often used in archaeological literature.

The culture history of the project area is complex for three reasons: 1) there is a lack of detailed information about most of the precontact period in the state; 2) the project area is located near the boundary of three different ecological zones (prairie, big woods, and oak savanna vegetation), which shifted during the Holocene in response to climate changes; and 3) the project area is located near the boundary of distinct physiographic settings (Late Wisconsin glacial deposits and loess plains). These complexities are reflected in the multiple MnHPO Archaeological Regions that border the project area and in the archaeological record of the region.

The project area is located in south-central Minnesota at the south end of MnHPO Archaeological Region 4s – Central Lakes Deciduous South. Adjacent regions include Archaeological Regions 4e – Central Lakes Deciduous East, 2e – Prairie Lake East, and 3w – Southeast Riverine West.

The Central Lakes Deciduous South region (4s) occurs in central Minnesota and is characterized by 1) glacial moraines, till plains, and outwash plains, 2) hardwood and mixed deciduous-coniferous forests, and 3) numerous lakes, streams, and wetlands. The Prairie Lake region extend across southwestern and south-central Minnesota and is characterized by 1) prairie vegetation with a mixture of oak savannah in the eastern portion, and 2) numerous lakes, wetlands, and rivers resulting from the Late Wisconsin glaciation. The Southeast Riverine region is a loess-covered plain that covers the southeastern corner of Minnesota and borders the Mississippi River valley. The region is characterized by 1) vegetation communities with a mixture of oak savannah, Big Woods, and prairie, and 2) a landscape that consists of a loess plain overlying Kansan till. Lakes and wetlands are largely absent in this region, and the landscape consists of rolling terrain in the west and more extensively-dissected and steeply-incised river valleys in the east.

6.1 Paleoindian Period (13,200 to 9500 BP)

The Paleoindian period was a time of rapid environmental change as the glaciers retreated from Minnesota (Wright 1974). Substantial changes in vegetation, wildlife, waterways, and the landscape occurred as a result of the ameliorating climate, and Paleoindian lifeways reflect adaptations to these rapidly changing landscapes. The first Paleoindian peoples in the southern Minnesota encountered a subarctic environment with no direct parallel in the modern world. It is not known what animals lived in the area at this time, but it can be assumed that mammoths, giant bison, and other now-extinct megafauna were present. Fish would have been present in the newly-formed lakes and rivers soon after the establishment of open water (e.g. Pielou 1991), and plants became established on the ice-free landscape.

It is presumed that Paleoindians were highly mobile and traveled in small bands. However, the lack of Paleoindian sites in Minnesota makes it difficult to identify settlement patterns, subsistence, or site types. Only one burial of this period is known, the Browns Valley site (21TR5) in the west-central part of the state. The known sites appear oriented toward current bodies of water, but these locations are also areas that have had a greater amount of archaeological survey. The locations of known sites therefore do not necessarily represent the actual settlement patterns. It is not clear whether the paucity of sites demonstrates that there was a small Paleoindian population in Minnesota, or whether the population was more numerous but the sites have not been identified because they have been destroyed, are deeply-buried, or lack diagnostic artifacts. It is likely that some of the lithic scatter sites that are scattered throughout the state belong to this period, but without the recovery of diagnostic artifacts or datable material, it is not possible to determine the cultural affiliation of these sites. Research in other parts of the country, where Paleoindian sites are more common, suggests that the margins of lakes and swamps were preferred habitation locations, and these landscapes were prevalent in the late-glacial and early Holocene periods of central Minnesota.

The Paleoindian period is divided into Early (13,200 to 12,500 BP) and Late (12,500 to 9500 BP) periods, as defined by the use of fluted (Early Period) or plano (Late Period) projectile points (spear points) for hunting and also possibly butchering. During the Early Paleoindian period, artifact typologies in Minnesota suggest that the culture was mostly related to the eastern Midwest. During the Late Paleoindian period, the cultural affiliation is clearly more related to the Plains, except in the Mississippi Valley region of southeastern Minnesota.

6.1.1 Early Paleoindian (13,200 to 12,500 BP)

The glaciers were gone from the southern half of the state by approximately 14,000 BP, and the Late Glacial and Early Holocene environments that followed were very dynamic, with rapidly-evolving climate, vegetation, animals, surface hydrology, and landforms. Within the project area, the most dramatic of these evolving landscapes was the cutting of the Minnesota River valley by the Glacial River Warren. Glacial Lake Agassiz, which covered all of northwestern Minnesota, was the source of Glacial River Warren. The current Minnesota River valley was formed by the catastrophic discharge of glacial meltwater that drained from the lake until approximately 12,700 BP, when eastern outlets to Lake Agassiz opened and the lake retreated to the northern Red River valley. The southern outlet of the Glacial River Warren was abandoned for a period at this time, and the landscape of the valley began to stabilize and fill in (Matsch 1983). Vegetation in this post-glacial environment included boreal forest species, with a mix of deciduous tree such as larch and ash, reflecting a wetter and cooler climate than is seen today.

Fluted point types such as Clovis, Folsom, and Gainey of the Early Paleoindian period are rare in Minnesota, and little archaeological evidence of Early Paleoindian people has been documented thus far. Isolated finds, primarily recovered from the surface of agricultural fields, have been recorded at scattered locations across Minnesota (Anfinson 1997:28-30; Buhta et al. 2011; Higginbottom 1996). In Wisconsin most fluted points occur in the southern portion of the state south of the most recent glacial ice margins (Mason 1997:87). These isolated finds are in themselves important contributions to the archaeology of the Early Paleoindians, but it is unfortunate that no other site data are available.

Early Paleoindian people are traditionally thought to have been nomadic big-game hunters, an interpretation derived from the dramatic and defining finds of lanceolate points at megafauna kill sites in the American southwest. These now-famous discoveries at places such as Blackwater Draw and Folsom in New Mexico initially established the antiquity of the Paleoindian tradition and the association of Clovis and Folsom points with mammoths and other extinct megafauna. Mason (1981:97) points out, however, that, "as eastern fluted point sites were found and investigated, and dramatic kill sites eluded discovery… enthusiasm for this idea waned. Because most Paleo-Indian sites east of the Mississippi are unaccompanied by preserved bones, it is now a popular notion that big-game hunting was a western specialization not indulged in by the easterners. But just as it is difficult to argue one way in the absence of evidence, so is it difficult to argue the other way."

While paleontological finds of extinct megafauna have been made in Minnesota, only the Itasca Bison Kill site (Shay 1971), which contained the extinct bison type *Bison occidentalis*, also contained cultural materials. The closest known megafauna kill (or possibly scavenging) sites are in Wisconsin, including several on beach ridges of Glacial Lake Michigan. The Boaz Mammoth site in southwestern Wisconsin is the nearest site. The site, which was discovered in the late nineteenth century, contains the remains of a mammoth in apparent association with a Hixton orthoquartzite fluted point (e.g., Overstreet 1993, 1996; Mason 1981, 1997). Anfinson (1997) suggests that Early Paleoindians in the Prairie Lake Region relied on a much wider variety of resources in their boreal environment, such as smaller animals, fish, and vegetal foods, than did the Paleoindians of the southwestern United States.

6.1.2 Late Paleoindian (12,500 to 9500 BP)

The transition from the Early Paleoindian to the Late Paleoindian period is indicated by the appearance of some groundstone tools, such as the adze, and by a variety of large, finely-crafted stemmed and lanceolate projectile point types that lack the distinctive fluted points of the early period. Some of the Late Paleoindian points in Minnesota and the Midwest are smaller and less-finely crafted than those from the Plains, which is perhaps a result of raw material quality and cultural changes through time (Florin 1996). Many of the points from Minnesota are extensively resharpened and reworked so that their original condition is no longer apparent. Another unique feature on points from the Midwest is the presence of basal ears on some specimens, particularly the stemmed forms. Gibbon (2012:73) suggests the Late Paleoindian may have persisted in northern Minnesota until 8000 to 7000 BP and similar late dates have been suggested for northern Wisconsin (Mason 1997). Two projectile point bases that resemble Agate Basin and an Eden stemmed type were recovered at site 21CR156 in the Minnesota River valley bottom near the current project. A radiocarbon date from calcined bone associated with these points was ca. 7000 RCYBP (cal. 7900 BP), indicating that the Late Paleoindian period overlaps Archaic period, as Gibbon (2012) has suggested. Late Paleoindian points have recovered in association with Archaic points at several sites in Wisconsin and adjacent areas in the Great Lakes region, confirming they are contemporaneous (Mason 1997; Pleger and Stoltman 2009). Hixton quartzite was used as a raw material throughout the eastern Midwest at this time.

Faunal assemblages from five Late Paleoindian sites in Wisconsin contain a variety of terrestrial and aquatic animal resources, including deer, bear, beaver, muskrat, porcupine, birds, turtle, and fish, indicating a generalized foraging subsistence base (Kuehn 2010). This data contrasts with the out-dated concept of Paleoindians being primarily hunters of a few select species of large game animals such as bison, moose, and caribou. The prevalence of wetland and aquatic animals is particularly noteworthy. Faunal material recovered from the Late Paleoindian component at site 21CR156, near the current project area, conforms to this generalized foraging pattern and the reliance on wetland and aquatic resources.

Glacial River Warren began to flow briefly again around 11,000 BP, following a refilling of the southern end of Glacial Lake Agassiz. This was a time of rapid environmental change, and deciduous tree species moved rapidly into the area from the south. Presumably, Late Paleoindians consisted of small, highly mobile groups that foraged widely and occupied territories only briefly.

Late Paleoindian points are found more frequently than Early Paleoindian points, probably reflecting increasing population levels in the post-glacial era. Numerous points have been recorded from private collections and also identified during archaeological investigations across the state (Florin 1996). Twelve points were reported in Hennepin County but none in Dakota County during a statewide survey of Plano points. The point types from Minnesota resemble the stemmed and lanceolate types defined from type sites on the Plains. Point types most commonly found in the Prairie Lake Region include the lanceolate Agate Basin and Browns Valley types and the subsequent stemmed Scottsbluff and Eden types.

One of the best-documented Late Paleoindian sites in the Prairie Lake Region is the Browns Valley Site (21TR5) at the southwestern edge of Lake Traverse in western Minnesota. The site contained human remains, which date to approximately 10,000 BP, and several possibly associated lanceolate bifaces (Browns Valley type) that discovered from a gravel pit. Browns Valley points have also been recovered from site 21CP35 near Montevideo and from the Hildahl #3 site (21YM35) on a terrace of the Minnesota River valley near Granite Falls, which also contained Early Archaic, Middle Woodland, and Late Woodland components. Scottsbluff points were recovered from the Goodrich site (21FA36) in Faribault County; Eden points from 21DL8 and 21DL54 in Douglas County; and a Dalton point from Lac qui Parle County is in the Minnesota Historical Society collection. Late Paleoindian points are also reported from the Pedersen site (21LN2).

Another important Late Paleoindian site is Bradbury Brook (21ML42) located in Mille Lacs County about 100 miles north of the project area. The site is a siltstone lithic procurement and initial reduction site associated with the Alberta Complex (Malik and Bakken 1993, 1999). A Phase III data recover was conducted at the site. One feature was identified, which produced the base of an Alberta point and an associated radiocarbon date of approximately 10,500 BP. The site is the oldest radiometrically dated site in Minnesota, and provides a unique perspective on the Late Paleoindian period in central Minnesota.

The East Terrace site (21BN6) on the Mississippi River near St. Cloud, about 70 miles north of the project area, is described as a Plano site that represents an intermittently-occupied location (BRW, Inc. 1994). Diagnostic points recovered included Hell Gap, Alberta, and Scottsbluff, which were extensively reworked.

The Reservoir Lakes Complex of northeastern Minnesota is one of the best professionally documented sites. The complex consists of a cluster of surface collections along a chain of reservoir lakes near Duluth that contain a variety of stemmed and lanceolate points (Harrison et al. 1995; Steinbring 1974). Some of these points have basal ears, suggesting an eastern influence. A variety of stone tools also occur, including choppers, bifaces, crescentric blades, adzes, long heavy picks, retouched flakes, scrapers, drills, and asymmetrical knives. The sites are located along lake shores that have been eroded by fluctuating water levels. Because of the deflated nature of the sites, it is not possible to confidently characterize the site components, and some of the assemblages are mixed with later Archaic components.

The Cherokee Sewer site (13CK405) in northwestern Iowa provides some of the best information on the Late Paleodindian and Early to Middle Archaic period in the northeastern plains and adjacent prairie region. The site contained three distinct cultural horizons dating from 8400 to 6400 BP. The earliest component contained points resembling the Hell Gap type that were recovered with bison and other animal bone.

6.2 Archaic Period (12,500 to 2500 BP)

The Archaic period is generally characterized by the following: 1) a subsistence base that relied on a variety of game animals and wild plant food resources; 2) the absence of agriculture, ceramics, and burial mounds except at the end of the period; and 3) an increasing variety of notched and stemmed projectile points (e.g., Raddatz, Little Sioux, Durst) and stone tools that included pecked and groundstone implements (adzes, axes, and mauls), native copper artifacts, and some exotic materials such as marine shell. As with Paleoindian sites, most recorded Archaic sites are small, short-term camps and activity areas. Most of the information from this period comes from sites in the southeastern part of the state or in neighboring Wisconsin and Iowa. A few significant Archaic sites have been recorded in the Prairie Lake Region. Geological processes resulting from the climatic changes of the Altithermal may have buried or eroded many Archaic sites, and there has been no comprehensive study of the Archaic on a statewide scale. For these reasons, our knowledge of Archaic period lifeways is still very limited.

The Archaic period spanned the time when the post-glacial environment of Minnesota continued to moderate, and ecosystems similar to those of modern times evolved. During this time, the northern hemisphere experienced an episode of warm and dry weather that is variously referred to as the Altithermal, the Middle Holocene Climatic Optimum, and the Prairie period. The peak of this warming period was reached around 7800 BP, by which time most of southern Minnesota, except the southeast corner, was dominated by a prairie landscape. The hot and dry conditions persisted at their maximum for about 1000 years before gradually giving way to a cooler and wetter climate that led to the evolution of ecological communities similar to those of the modern era by about 5000 BP. The dramatic environmental changes of the Altithermal would have caused major shifts in the lifeways of the people, as post-glacial animal species of the forest such as moose, caribou, and deer were replaced by prairie species such as bison. Plant communities also would have changed with the spread of the prairie, and wild rice may have been gathered during this time. Surface water significantly decreased during the Altithermal, as shallow lakes and wetlands dried up or were greatly reduced in size.

It is likely that Archaic period populations engaged in seasonal rounds of resource gathering as the climate stabilized following the retreat of the glaciers. Small bands would have returned to seasonal campsites, and territories may have been relatively limited. With the onset of prairie conditions, however, resources would have become less predictable, and populations would have been pushed into shrinking areas surrounding the larger lakes and streams. The appearance of groundstone milling tools suggests that there was a greater use of seeds and other plant foods. Domesticated dogs, used for transport, suggest that longer-distance travel was required to keep up with migratory bison herds. Group sizes appear to have remained small throughout the Archaic, and known site locations indicate that a high value was placed on a proximity to game, water, and supplies of wood.

The Archaic has traditionally been divided into Early, Middle, and Late periods, and Gibbon (2012) argues that the Early Archaic period in Minnesota overlapped the Late Paleoindian period for perhaps thousands of years. He emphasizes that this was not necessarily a time of transition from Paleoindian into Archaic, but that the two cultures were contemporaneous and may have interacted in various ways. When this overlapping period is included, the Archaic Period in Minnesota may be understood to extend back as far as 12,500 BP and the Paleoindian Period to as late as 8000 BP. There are a few sites in Wisconsin that have yielded Late Paleoindian points in association with Archaic notched points (Pleger and Stoltman 2009). The transition from Paleoindian to Archaic appears to have been more abrupt and of shorter duration in the eastern and southwestern United States than it was in Minnesota. Gibbon (2012) adds the modifier "Eastern" to his discussion of the Early Archaic in Minnesota for complexes presumed to be derived from the East, which distinguishes it from the "Prairie" Archaic period that is centered on the northeastern plains, including southwestern Minnesota. Anfinson (1997:35) points out that the Prairie Archaic of the northeastern plains region began about 7500 years ago, and Archaic of the eastern Midwest may have begun as early as 10,000 years ago.

6.2.1 Early Eastern Archaic

Most of the information we have about the Early Eastern Archaic period in the upper Midwest (ca. 12,500 to 9500 BP) comes from sites in the mid-south and central Mississippi valley region. The chronology of the various Archaic periods is not firmly established, and dates from adjacent areas are later than those proposed by Gibbon (2012). The Early Archaic period in Iowa extends from 10,000 to 8500 BP (Benn and Thompson 2009) and from 10,500 to 7500 BP (Alex 2000). In Wisconsin the period extends from 11,500 to 7500 BP (Pleger and Stoltman 2009). There has been no comprehensive study of Early Eastern Archaic sites and site distributions in Minnesota, and therefore Gibbon and Anfinson (2008: Chapter 5) state that there is "… little useful to say about that tradition's sites and their distributions in the state." Most Early Eastern Archaic projectile points recovered in Minnesota have come from the southeastern part of the state, although a St. Charles point was found in Martin County in the west.

Classic Early Eastern Archaic point types that have been recognized in Minnesota include Thebes, St. Charles, Kirk Serrated, Graham Cave, and Hardin. Except for the stemmed Hardin type, the Early Eastern Archaic points are generally medium to large size, side- or corner-notched points that lack the parallel flaking characteristic of Late Paleoindian points. The Kirk type is generally smaller than the other types. Gibbon and Anfinson (2008) state that Hardin is considered a likely Late Paleoindian/Early Archaic transitional point form that may have developed in the mid-continent.

Early Eastern Archaic points are often associated with thin scatters of non-diagnostic artifacts such as scrapers, blades, and point blanks. Other materials likely used by Early Eastern Archaic people such as wooden tools, textiles, and bone implements have not survived in the archaeological record.

6.2.2 Middle Archaic

The Middle Archaic in Minnesota spans the period of roughly 9500 to 5000 BP, although dates from adjacent areas are later than those proposed by Gibbon (2012). The Middle Archaic period in Iowa extends from 8500 to 4500 BP (Benn and Thompson 2009) and from 7500 to 5000 BP (Alex 2000). In Wisconsin the period extends from 7000 to 3700 BP (Pleger and Stoltman 2009). This period includes the peak of the Altithermal episode, and the climatological and ecological changes of that time had profound impacts on subsistence and settlement patterns. Warming and drying during the period would have been dramatic, with prairie spreading across northwestern and southern Minnesota, except for the southeastern corner. Eventually, deciduous forests would have been restricted to river valleys and lake edges in most of the southern part of the state. As the post-glacial landscape continued to stabilize, water flows through the Minnesota River valley were reduced and water temperatures warmed. This allowed aquatic species to migrate up the river valley from the south, and waterfowl likely became abundant. Few Middle Archaic sites have been discovered in Minnesota compared to more southerly portions of the Midwest.

Gibbon (2012:73) summarizes a challenge in describing the Middle Archaic period in Minnesota:

> "Middle Archaic artifacts and sites are sparse or remain unrecognized at the moment, even though this time period … is well represented by sites and by growing populations farther south. In fact, there is some confusion in Minnesota archaeology about how non-Paleoindian artifact assemblages dating to this period should be classified. The problem in part is the presence of an early Archaic time gradient, with the earlier appearance of Early Eastern Archaic assemblages to the south correlated with the earlier appearance of deciduous forests in that area."

The Prairie landscape and accompanying bison herds begin to enter Minnesota around 10,500 BP at a time when Lake Agassiz still covered the northwestern corner of the state and the glacial River Warren was flowing through the Minnesota River valley. Late Paleoindian people living on the plains likely followed bison herds with the advance of the prairie into Minnesota. By approximately 7800 BP at the peak of the warming and drying, prairie covered most of western and southern Minnesota, and the Archaic-period bison hunters who used medium-sized, side-notched points spread across the prairie regions of the state.

Middle Archaic projectile points are small to medium-sized and generally smaller and less well-made than the points from the Paleoindian period, and there is an increased use of local cherts. These points were most likely attached to atlatl darts rather than spears and were thrown with an atlatl. Diagnostic Middle Archaic point types common to Minnesota are divided into two broad categories (Eastern Woodlands and Plains), based on their presumed region of origin outside of Minnesota, and by the dates (*Early Phase* and *Late Phase*) of their presence in those regions (Gibbon 2012). *Early Phase* points from the Eastern Woodlands include the Raddatz, Fox Valley, and Osceola types. *Late Phase* Eastern Woodland types include Matanzas, Benton, and Elk River. Point types of the *Early Phase* in the Plains include Simonsen, Little Sioux, and Oxbow. *Late Phase* point types from the plains include McKean and Table Rock. Many of the Middle Archaic point types continued into the Late Archaic. Other artifacts that were developed in the later portion of this period, and more fully in the Late Archaic, include ground stone tools, such as grooved axes and mauls, manos, metates, and apparatus for the atlatl, including bannerstones, gorgets, and boat stones.

The most significant Middle Archaic site recorded in the state is the Itasca Bison Kill site (21CE1) near Lake Itasca in Clearwater County (Shay 1971). At this site a number of now-extinct *Bison occidentalis* were killed in a boggy area, and a campsite associated with the processing of the bison was on a hill overlooking the bog. Projectile points from the site include small to medium-size, side-notched types, which have been referred to as Little Sioux or Simonsen points, and also occur at the Cherokee Sewer (13CK405) and Simonsen (13CK61) sites in northwest Iowa and the Soldow (13HB1), Ocheyeda (13OA401), and Arthur (13DK27) sites north-central Iowa (Alex 2000; Morrow 1984). The date for these points at the Cherokee Sewer site is 8200 to 7900 BP. Similar points have been found at the following sites in southwestern Minnesota: Granite Falls Bison Kill (21YM47), Goodrich (21FA36), Pederson (21LN2), and Hildahl #3 (21YM35) (Anfinson 1997; Christiansen 1990) and the Rustad Quarry site (32RI775) in southeastern North Dakota (Michlovic and Schmitz 1996). The Granite Falls Bison Kill site had four small, side-notched points (3.7 cm long by 2 cm wide, 4.5 cm long by 2 cm wide, and two bases that are similar in sizes to the others) and dates to between 8000 to 7000 BP from two radiocarbon dates (Lewis and Heikes 1990).

The Jackpot Junction site (21RW53) in the Minnesota River valley near Redwood Falls contained bison, turtle, small mammal, and fish bone from depths of 1.5 to three meters along with stone flakes. No projectile points were recovered, but radiocarbon dates of about 5600 BP place the site in the Middle Archaic period. Closer to the project area, site 21NL63 (Fritsche Creek II), located on an alluvial-colluvial fan along the northern margin of the Minnesota River in Nicollet County, contains an intact buried component that dates to the Middle Archaic (ca. 7000 BP), or even earlier, based on dating of bone collagen (Roetzel et al. 1994). The buried component may reflect a short-term occupation associated with a bison kill and processing. Site 21NL58, located near 21NL63 and in a similar landscape setting, also contains a buried component with bison bone and other materials dating to about 7000 BP (Terrell et al. 2005). The dates from 21NL58 and 21NL63 are similar to the dates obtained from sites 21CR155 and 21CR156 which are located in the Minnesota River valley bottom near the current project area.

Archaic site 21CR155, located in the Minnesota River valley near Shakopee, had cultural deposits that included bison and other terrestrial and aquatic remains buried as deep as four meters. The site contained multiple occupations, spanning most of the Holocene from ca. 7100 to 500 RCYBP (8000 to 500 cal BP. The Archaic points include an unnotched "Delong" type and a medium-sized notched type. The site was determined eligible for listing on the NRHP and a Phase III data recovery was conducted prior to highway construction.

The Archaic component at site 21CR156, also located in the Minnesota River valley near Shakopee, contained lithic debris in a buried soil that was dated to ca. 6700 RCYBP (cal. 7600 BP). Multiple buried soils and archaeological components are present across the site area. The site was recommended eligible for listing on the NRHP and the construction plans for the CSAH 61 project that necessitated the archaeological survey were changed to avoid the site area.

A Middle Archaic component, dating from about 8000 to 7500 BP, was identified from a buried component on top of an alluvial fan at site 21CR141, which is in the Minnesota River valley near Shakopee (Schoen 2006). Faunal material (n=203), lithic debitage, and charcoal that were interpreted to represent an intact midden deposit from a buried soil, ranging in depth from 316 to 358 cmbs. The site was recommended as eligible for listing on the NRHP based on the discrete deposit of datable materials from the Archaic period, along with the potential for intact features and diagnostic materials from other parts of the site.

Anfinson (1997) proposed that an "Itasca Phase" be designated to describe the Middle Archaic (Prairie Archaic) adaptation to the widespread prairie landscape in the Prairie Lake region. The social organization during the period is poorly understood, but it is likely that the need to adapt to changing environments and the hunting of bison may have led, at least seasonally, to small family bands merging into larger groups that could more efficiently track and hunt the migratory animals. Burials from the period found in northwestern Iowa reveal that people were interred individually in pits with red ochre and ritual items.

6.2.3 Late Archaic

The Late Archaic in Minnesota begins around 5000 BP, as a cooler and moister climate ushered in the beginnings of today's environmental conditions and biomes; a sequence that was completed by around 2500 BP. Late Archaic dates from adjacent regions are generally similar to those proposed by Gibbon (2012). In Iowa the period extends from 4500 to 2500 BP (Benn and Thompson 2009) and from 5000 to 2800 BP (Alex 2000). In Wisconsin the period extends from 3700 to 2400 BP (Pleger and Stoltman 2009). During this time, smaller lakes that had dried up during the Altithermal once again filled in. Forests in the northern and southeastern part of the state expanded as the prairie retreated west and south. These climatic and environmental changes led to the decrease of bison as the main game animal in reforested areas and the arrival of forest animals into their historical ranges. Bison continued to be a primary species across most of southern Minnesota, except in the southeast.

The Late Archaic is defined by diagnostic side-notched and stemmed projectile point types along with groundstone tools (such as manos, matates, mauls, and axes), the use of communal burial sites without mounds (until the period of transition between Late Archaic and Early Woodland), and the increased presence of exotic raw materials (such as native copper and marine shell). Diagnostic Late Archaic point types are divided into regional clusters (Gibbon 2012:79). The *Upper Mississippi River Valley Region* includes the Large Side-Notched Cluster, the Durst Cluster, and the Late Archaic Stemmed Cluster among others. The *Central Mississippi River Valley Region* includes the Table Rock Cluster, the Etley Cluster, the Nebo Hill Cluster, and the Wadlow Cluster. The *Northern Plains region* includes the McKean and Oxbow Clusters. The *Southeast Region* includes the Eva Cluster, the Benton Cluster, the Ledbetter Cluster, and the Dickson Contracting Stem Cluster. As Gibbon notes, however, some Late Archaic point types overlap with the earlier Middle Archaic and later Initial Woodland occupations, and therefore the dating of Late Archaic occupations based solely on point typology is problematic.

The lifeways of the people during this period in Minnesota were marked by adaptations to the changing environmental conditions and to increasing influences from people and cultures in surrounding regions. It was a time of increasing population numbers and more diverse artifact assemblages, which together with the advent of communal burials and expanded exchange of exotic materials, indicate increased social complexity and changes in subsistence patterns.

In southern and central Minnesota, the people likely adapted to two distinct biomes: the prairies of the west and south and the forests of the north and southeast. To the west, the hunting of migratory bison continued, and sites such as Canning (21NR9) may represent seasonal habitations of people who moved east to the woodlands during the cold months. In the north and east, the people of the period became more adept at exploiting stabilized resources such as fish, forest animals, and wild rice. Woodworking tools and fishhooks begin to appear in the archaeological record during the Late Archaic.

Gibbon and Anfinson (2008) use the term Proto-Horticulturalist to describe the addition of garden produce into the resource base of the Late Archaic period, suggesting that this indicates the beginning of a fundamental social transition, although not a heavy reliance on cultivated foods. Fragments of squash (Cucurbit pepo) recovered from a probable Late Archaic context at the King Coulee site near Winona on the Mississippi River is an example of this type of early horticulture from Minnesota (Perkl 1998).

The people during this period likely inhabited a series of relatively stable "base camps" that shifted during the year to access seasonal resources. A variety of smaller special activity areas, such as quarries, butchering, and extraction sites, radiated from these base camps. Communal burials that appear during the Late Archaic period may indicate increasing territoriality associated with greater settlement permanence. Highly ornamented grave goods have been interpreted as an indication of increasing religious complexity; and the appearance of burial mounds at the transition of the Archaic-Woodland periods is perhaps an indication that it had become more important to make these territorial indicators more visible to outside populations.

As with the preceding Early and Middle Archaic periods, the Late Archaic period has been studied much more thoroughly in the central Mississippi Valley and eastern woodlands than in Minnesota, and a great deal of information about the period in Minnesota is still lacking. Artifact assemblages from the period in Minnesota are not as diverse or abundant as those found in other regions, where plant-processing tools are commonly found and exotic materials such as conch shell were widely-traded. Fiber-tempered pottery was present during the Late Archaic in the southeastern states but no such materials have been found in Minnesota.

Sites in the Prairie Lake region with confirmed or possible Late Archaic components include Pedersen (21LN2), Fox Lake (21MR2), and Mountain Lake (21CO2). Anfinson (1997) has proposed a Mountain Lake phase dating from 5800 to 2200 BP, with 21CO2 as the type-site. Excavations at the site recovered small lanceolate points that more closely resemble forms to the east rather than to the west, and none of the distinctly northern-plains point types such as those of the McKean cluster were found at the site. In the prairies of southwestern Minnesota, the bison-centered lifeway continued until around AD 1000 with the advent of the Plains Village culture. The Pedersen site contained bison bone in all occupation levels, along with remains of other mammals, fish, and bird species. Bison bone is also the main component of the Archaic faunal assemblage at the Mountain Lake site.

There is little information about the Late Archaic period in the southeastern deciduous forest zone of Minnesota, but Gibbon (2012) suggests that it may be associated with the Durst phase in southwestern Wisconsin, suggesting that populations were moving into the state from the south and east during this time.

6.3 Woodland Period (2500 to 350 BP)

While the Woodland period has traditionally been defined by the first appearance of pottery, burial mounds, and agriculture, Gibbon (2012:93) proposes that:

> Information gathered within the last twenty years has clearly demonstrated [that these traits] had already made their first appearance in areas of the Eastern Woodlands in the earlier Late and even Middle Archaic.... The result of these discoveries has been a redefinition of the Woodland tradition, a redefinition that now depends more on new socioeconomic adaptations than on shared diagnostic material traits. Still, the first associations of these three traits in about 700 BC in some areas of the Midwest do seem to mark the inception of these new adaptations. Misleading reconstructions of the culture history of other areas of the Midwest have resulted, however, from the assumption that the presence of pottery, burial mounds, or cultigens, or some combination of the three, necessarily means that similar socioeconomic adaptations were present in those areas, too.

The Woodland period in the Midwest has been divided into Early, Middle, and Late periods based on cultural developments that have been documented primarily in the lower Mississippi Valley region. Gibbon points out that these cultural developments occurred in Minnesota and other parts of the northern Midwest and plains much later or not at all. Furthermore, he argues (2012:93) that "...unique adaptations and artifacts appear in the prairies, Northwoods, and boreal forest of Minnesota that have no specific counterparts in the traditional lower tier zone to the south." To accommodate this distinction, Gibbon divides the Woodland Period into *Initial* and *Terminal* periods rather than Early, Middle, and Late in all but the southeastern corner of the state. He concludes that ... "Although awkward at times, these concepts stress the unique accomplishments of Native Americans in our region rather than their marginality to events and processes that occurred in different environments to the south."

During the late Holocene, from the end of the Archaic period through the Initial Woodland period, the climate and landscape continued to evolve. These changes are well-documented through an extensive series of a series of pollen core studies from across the state and by correlation with other research on vegetation and climate change across the continent. Arzigian (2008:8) summarizes the climate and landscape developments of the Woodland period in Minnesota:

> Of greatest significance to the Woodland tradition is a period of cooler temperatures, the Sub-Boreal, that extended through the Early and Middle Woodland periods and was followed by the warmer Neo-Atlantic and Pacific periods, and then the cooler, moister Little Ice Age from about AD 1550 until 1915. During these broader climatic shifts and more local changes, the most noticeable changes would have been the local expansion or contraction of the prairie-forest ecotone and the prairie bison herds. Changes in local lake levels would have affected settlement patterns adjacent to the lakes, with some lakes drying up completely. Fires would have caused changes in the composition and distribution of forests as well as expansion of shrublands and savannas. Fire frequency would have been affected by local and regional climatic conditions, and possibly also by the human population. Starting about AD 1550, the Big Woods expanded at the expense of prairies as a result of changes in fire frequency in the cooler, moister Little Ice Age climate.

6.3.1 Initial Woodland in Southeastern Minnesota

The Initial Woodland Period in Minnesota dates from approximately 2500 to 1300 BP. This period begins around 2500 BP in the southeastern corner of the state. In the rest of southern Minnesota, the Initial Woodland begins around 2200 BP.

Gibbon (2012) differentiates the Initial Woodland period in the southeastern part of the state (Southeast Riverine region) from the rest of the state by separating the period into *Early Woodland* (2500 to 2200 BP), the *Havana-Related Middle Woodland* (2200 to 1800 BP), and the *Late Middle Woodland* (1800 to 1500 BP) sub-periods. These sub-periods reflect the Woodland period culture history of regions to the east and south in Wisconsin and Iowa, with which the people in southeast Minnesota appear to have been more closely associated than they were with cultures to the west. Outside of the Mississippi River Valley, the Initial Woodland period in southeastern Minnesota is not well known. Few sites have been excavated, and there has been little systemic research. Therefore, Gibbon cautions that the dates and content of the period remain tentative.

<u>Early Woodland</u>

The Early Woodland period (2500 to 2200 BP) is recognized by diagnostic La Moille Thick pottery, which resembles Marion Thick and other very early pottery types in the southern Midwest. La Moille Thick pottery is cordmarked and has distinct vertical to oblique exterior surface marking and horizontal to oblique cordmarking on the interior. A variety of straight-stemmed projectile points, most commonly the Kramer type, are associated with La Moille occupations. In southwestern Wisconsin, the later part of the Early Woodland, dating to 2100 BP to 1900 BP, is characterized by Black Sand–related Prairie ceramic wares and Waubesa points that have rounded, contracting stems (Arzigian 2008:32; Stevenson et al. 1997:150). Arzigian (2008:30) states that it is unclear whether mounds are associated with the Early Woodland, and that the lack of data on the period in southeastern Minnesota "might reflect the gradual nature of the transition between Archaic and Woodland in this region, and the probable persistence of Archaic lifeways with the addition of ceramics that reflect intermittent contacts with other regional cultures."

Only a few sites have been recorded in Minnesota with La Moille pottery and these include the type-site La Moille Rockshelter (21WI1) in Winona County. The site, located in the bluffs along the Mississippi River, was a deeply-stratified rockshelter excavated by Wilford in 1939. The site was described as a "fishing camp" and in addition to ceramics it contained fish, turtle, and mammal bones along with charcoal and clam shell but few other artifacts. Other Early Woodland sites include Schilling (21WA1), Kunz (21WW8), Enno Schaeffer (21FA104), and NSP II (21GD59). Arzigian (2008) concludes that there is not enough information to speculate on Early Woodland lifeways or settlement patterns in southeastern Minnesota, although it is likely that the people followed as seasonal resource-gathering pattern similar to that of the Archaic period.

<u>Havana-Related Middle Woodland</u>

Gibbon (2012) describes two Havana-Related Middle Woodland period phases in Minnesota, *Howard Lake* and *Sorg*, although Arzigian (2008) adds a *Malmo* phase to the period. *Howard Lake*, with sites concentrated in the Anoka Sand Plain, is considered to be the northernmost regional variant of the Havana Hopewell culture from the Central Illinois River Valley. Significant sites include the type-site 21AN1 (Howard lake), Anderson (21AN8), and Long Lake (21HE100). Sites from the *Sorg Phase* are found mainly in the northern portion of southeast Minnesota, with a concentration along the shores of Spring Lake near St. Paul. Significant sites include the type-site 21DK1 (Sorg), Lee Mill Cave (21DK2), and Hamm (21DK3). Malmo phase sites are the most common of the Havana-Related period and they are found across much of central and eastern Minnesota, with concentrations around the Mille Lacs area and from there to the west into Ottertail County and the plains. Arzigian (2008:37) suggests that there may be a significant underestimation of the distribution of Havana-Related occupations in Minnesota as the statewide database of archaeological sites lists many "Middle Woodland" sites that might be included following a careful examination of ceramic assemblages.

Havana-related ceramics are wide-mouthed jars with thick walls, straight rims, slightly constricted necks, and sub-conoidal bases. They are grit-tempered and are decorated with punctates, bosses, incised lines, slashes, cordwrapped-stick impressions, and dentate stamping. Lithics from the period include small notched and stemmed Manker and Snyders-like points. Most lithic raw materials are local but exotic raw materials such as obsidian, Hixton silicified sandstone, and Knife River Flint were also used. Burial Mounds are present at some *Howard Lake Phase* sites and some of these mounds are quite large and complex, with primary and secondary burials. The Indian Mounds Park site (21RA10) in St Paul contained burials with limestone crypts and exotic artifacts that included a perforated bear canine and hammered copper. Although subsistence and settlement patterns are little-understood, Arzigian (2008) suggests that the populations engaged in a pattern of seasonal mobility, with larger summer villages and dispersed winter camps. Havana-related cultures in Illinois were focused on riverine settings, while in Minnesota, sites are located in mixed habitats around wet prairies and oak openings, often bordered by mixed deciduous forest.

Late Middle Woodland

The Late Middle Woodland period in Minnesota is largely unknown and Arzigian (2008) does not cover it as a separate complex. Gibbon (2012) states that the period involved a gradual process of transition from the Havana-Related to the Late Woodland in southeastern Minnesota and the Upper Mississippi valley. He uses the closely-related Millville and Allamakee phases of northeastern Iowa and southwestern Wisconsin as surrogates for the period in Minnesota. The primary distinction of the Late Middle Woodland period is the appearance of thin-walled Linn ware ceramics in a series of seemingly more spatially-restricted occupations, as opposed the relatively widespread presence of Havana wares. Lithic assemblages are defined by the side-notched Steuben point and smaller Ansell points from later in the period. Scrapers, drills, knives, and groundstone tools are also present in assemblages. Some burials of the period continued to be in mounds, although they tend to be smaller and less complex than those of the Havana-Related period. Other burials have been found in pits. Gibbon (2012) suggests that the period represents a process of cultural differentiation or regionalization that occurred in a series of steps. Overall, it appears to have been a less materially-elaborate time than was the earlier Havana-Related period. The Transitional Woodland complex from central Minnesota is a comparatively similar complex for the adjacent area to the north, although there is geographical overlap in the complexes. This complex is discussed below.

6.3.2 The Central Minnesota Transitional Woodland Complex

Some ceramics from 21HE497 are similar to St. Croix stamped ware from the Central Minnesota Transitional Woodland complex, which spans the period of roughly A.D. 300 to A.D. 1000 (1700 to 1000 BP), a period of transition between Middle Woodland (Malmo) and Late Woodland (Blackduck-Kathio) complexes Arzigian (2008). The Transitional Woodland complex is presumably associated with significant shifts in technology, interregional interaction, mortuary practices, subsistence, and settlement, although there is a lack of data to fully document the complex and these probable changes.

Dating of the complex has been based on a relatively small amount of stratigraphic information, radiocarbon dating, and on similarities to other transitional Woodland sherds, such as Onamia-like ceramics from southwestern Wisconsin. Two phases were initially defined for this period in the Mille

Lacs area, distinguished by ceramic style; the Isle phase (A.D. 500–800 / 1500 to 1200 BP) with St. Croix pottery and the Vineland phase (A.D. 800–1000 / 1200 to 1000 BP) with Onamia pottery, although there has been some debate among recent researchers over the date ranges for the two ceramic styles and the relationships between them, including the possibility that both styles should be subsumed into subtypes of a single Onamia Series.

Geographically, the complex is defined in Central Minnesota (SHPO archaeological regions 4, 5, 6), though similar ceramics and lifeways are found in adjacent areas (Anfinson 2006; Arzigian 2008). Sites with St. Croix stamped ware extend as far south as the Minnesota River, with a few sites even farther south (Arzigian 2008:206). Two sites are located near the Hennepin and Craver county border near the Minnesota River. Concentrations of sites occur at Mille Lacs and along the Snake River drainage, but sites occur over a much larger area in the region. St. Croix and Onamia pottery are commonly found in the south-central Deciduous Lakes archaeological subregion (Johnson 1994:3.51–3.52) and occur across most of the Minnesota except in the northeast and extreme south. St. Croix Stamped ceramics occur in adjacent areas of northwestern Wisconsin, northeastern South Dakota, and eastern North Dakota.

In general, peoples of the Central Minnesota Transitional Woodland complex followed a hunting-gathering lifeway similar to that of the preceding period and settlement patterns are believed to reflect seasonal use of sites. There are connections between the complex and the later Blackduck-Kathio complex in central Minnesota and to contemporaneous cultures in southwestern Minnesota such as Lake Benton. Arvilla burials have been linked to this complex through the presence of St. Croix and Onamia pottery in burial mounds. Principal sites from the Central Minnesota Transitional Woodland complex in the Mille Lacs area include: 21ML2 (Aquipaguetin Island), 21ML3 (Crace), 21ML6 (Indian School), 21ML7 (Vineland Bay), 21ML9/16 (Cooper), 21ML11 (Petaga Point Site [NRHP]), 21ML12 (Lloyd A. Wilford Site [NRHP]), and 21ML20 (Old Shakopee Bridge). Property types expected for the complex include: habitation sites, resource procurement and processing sites, special-use sites, mound sites, and non-mound mortuary sites.

Leland Cooper first defined St. Croix as a distinct ceramic type based on his excavations at the Altern site in Wisconsin, at Mille Lacs Kathio State Park, and at the Vach, Stumne and Neubauer sites in Pine County (Caine 1966, 1969). This ceramic ware was noted by Elden Johnson as marking the transition from the Middle Prehistoric period to the Late Prehistoric Period in the Mille Lacs region. Elden Johnson included St. Croix as a ceramic series in his initial Mille Lacs typology in 1968 (Dickinson 1968, Bleed 1969), and Christy Caine defined St. Croix Stamped as a ceramic series in *A Handbook of Minnesota Prehistoric Ceramics* (Anfinson 1979). Additional information is presented in George (1979) and (Caine 1983). Matthew Thomas includes St. Croix Stamped as a type within Onamia Ware, based on their many shared similarities (Thomas 2000). In Thomas's typology, Onamia Type I is traditional Onamia ware, Type II is that which Gibbon lists as St. Croix Dentate Stamped Type, and Type III is the same as Gibbon's St. Croix Comb Stamped Type.

Arzigian (2008) describes St. Croix vessels as subconoidal to rounded, with slight neck constrictions, high vertical rims, and rounded shoulders. They range in size from small bowls with openings of eight centimeters to large vessels with openings of 40 centimeters. They are grit-tempered (often crushed granite) with a surface treatment as tightly-spaced cordwrapped paddle impressions. Rims are usually smoothed before decoration and two varieties of lips have been defined; dentate-stamped and comb-stamped. The dentate-stamped variety features simple geometric decorations formed of square or rectangular impressions that form rows of parallel horizontal, oblique, or vertical lines around the vessel. Occasional rectangular punctates border the lower edge of the decoration. The comb-stamped variety also has simple geometric decorations in rows of parallel horizontal, oblique, or vertical lines in various combinations but with V-shaped rather than rectangular impressions. Caine (1974:63) describes two dentate stamp tools recovered from the Snake River area: "One is made of bone, the other of white chert. When applied to moist clay, both form a dentate impression of the type found on St. Croix Stamped pottery from the region." An additional minor variety is characterized by cord-wrapped stick impressions. Interior treatment consists of horizontal striations. Wall thickness averages four to five millimeters, lip and neck thicknesses average 6.5 millimeters. The vessels are made of medium- to fine-textured paste, though both coarser and sandy-textured pastes were used.

One of the type vessels for St. Croix ware was recovered in the early 20th century from the Fort Poualak site (21CW7/14) on the Whitefish chain of lakes in Crow Wing County (Caine 1983). The context of the find was interpreted as a house depression, and two other fragmented St. Croix vessels were found at the same time. Charcoal residue from the exterior shoulder of the pot provided the first radiocarbon date from St. Croix pottery, ranging from approximately A.D. 600 to 760.

Onamia Series vessels are often very similar to St. Croix in form and decoration and they can be difficult to distinguish. Onamia vessels are also subconoidal to semi-subconoidal, with a constriction of the neck that creates a pronounced shoulder. The rims are straight and vertical, with a wide orifice. The surface of these pottery types is cord-marked, and the walls are notably thinner than Malmo Ware, averaging approximately six millimeters in thickness. Onamia Series ceramics are tempered with grit, composed primarily of crushed granite (Caine 1979, 1983; Ready and Anfinson 1979; Thomas 2000). Decoration of Onamia Series pottery consists of impressions made by a cord-wrapped stick or dentate stamps in oblique and horizontal bands. Cord-wrapped stick impressions are the more common of the decoration types, forming an oblique row around the exterior and sometimes also the interior of the rim. A horizontal band of impressions often appears below the oblique band and sometimes there is a horizontal band of impressions on the rim. When dentate stamps are used, they tend to be described as "heavy" when compared to St. Croix, with larger, more widely-spaced teeth.

Three varieties of the Onamia Series are defined by decorative motif, based on analyses by Caine (1983). Type I is the traditional Onamia Ware, with long oblique decorations, and decoration on the interior of the rim. Types II and III are varieties of the traditional St. Croix Ware. The first (Type II) is typified by oblique or vertical over horizontal decorations, with interior decorations. A subtype has cord-wrapped object impressions. Type III has horizontal decoration but no lip or interior decoration. A subtype has bosses (Thomas 2000). Previous definitions of these wares are provided by Caine (1979, 1983) and Ready and Anfinson (1979). St. Croix mortuary pots from the Arvilla Complex are generally miniature versions of the ware, and are presumed to not be functional artifacts (Johnson 1973).

Caine (1966:89) has suggested that St. Croix pottery was probably made with coils and shaped with a paddle and anvil, though she also acknowledges (1983:94) that there is no good evidence in support of any particular manufacturing technique. She notes (1983:192) that there are distinct size differences between the smaller mortuary vessels from Stumne and DeSpeigler and the much larger vessels from Cooper Mounds and Poualak/Hay Lake (21CW7/14).

Little is known about lithic use or technology in the Central Minnesota Transitional Woodland complex. The Q-Pattern, reflecting heavy reliance on quartz, continues to be prevalent throughout this period (Bakken 2000), suggesting continuity with the preceding Havanna-Malmo Period. Projectile points found with Onamia ceramics are predominantly side-notched, sometimes described as similar to Prairie Side-Notched. Side-notched Cross Lake points have been associated with St. Croix ceramics in the Snake River Valley (Caine 1969, 1974). Unnotched triangular points have also been recovered. Arzigian (2008) describes the lithics recovered from site 21AN108, a considerable distance south of the Mille Lacs area, and one of the few sites with a well-defined assemblage. Large amounts of fire-cracked basalt and granite were found along with three utilized flakes, two cores, two biface fragments, two retouched blades, two scrapers, and one point. Most of the assemblage was of local raw materials.

Burlington chert, Hixton silicified sandstone, Knife River flint, and obsidian were also present. Very little specific information regarding subsistence for the Central Minnesota Transitional Woodland complex has been recovered from excavations. The Isle Phase is inferred to represent a shift to focal resource use, with a particular emphasis on wild rice utilization (Gibbon and Caine 1980; Johnson 1984). Evidence for this is derived from phytolith analysis of food residues from the Fort Poualak bowl at site 21CW7/14 in nearby Crow Wing County. The charred material from inside the vessel produced a phytolith assemblage consistent with wild rice, but it is cautioned that the diagnostic phytoliths were too infrequent for statistical certainty (Thompson 2000). It seems likely that the Black Brook site plant macrofossil data from the Rum River Phase (*Chenopodium* and raspberry) apply to the Isle Phase as well.

Despite the limited data, Arzigian (2008) outlines a model of subsistence strategy changes proposed by researchers for the Central Minnesota Transitional Woodland complex. An increasing dependence on wild rice and large or abundant animals suggests an increasing availability of wild rice, perhaps as a consequence of ongoing climatic changes, that allowed for the sustenance of growing populations that could not be readily supported by traditional hunting and gathering food resources. She cites Caine (1983) in suggesting that the rapid stylistic changes that culminated in the development of St. Croix ceramics are related to this increased population density, and the shift from diffuse to focal subsistence patterns that this necessitated. The distinctive style of St. Croix ceramics found across a very wide area may also have played a role in maintaining social unity as increasingly large populations began to segment.

Linear earthworks are loosely associated with St. Croix ceramics through Johnson's (1973) definition of the Arvilla Complex. With the working assumption that they can be assigned to the Isle Phase, they are certainly the most visible indicator of sites dating to this time. Linear mounds are found from the Pine City area east of Mille Lacs to the western prairies and in the Red River Valley (Johnson 1973:3-5) with many around the Mille Lacs area. Conical mounds are also known from the Isle Phase, as seen at Cooper Mound 3, excavated by Jan Streiff in the late 1960s. Conical mounds are also listed as a trait of the Isle Phase by Johnson (1984).

Little is known of the temporal, spatial, and cultural relationships between the Central Minnesota Transitional Woodland complex and earlier, later, and contemporary cultures. Arzigian (2008) discusses possible relationships between St. Croix and early Blackduck bossed ceramics and between Onamia and Lake Benton ceramics to the west. In terms of settlement, the Isle Phase does truly seem "transitional" (Caine 1983; Johnson 1984). Some sites, such as Black Brook, show continuity from the preceding Rum River Phase. At others, such as Cooper and Griffin, the Isle Phase appears to be the beginning of an occupation that intensified in later phases. The landscape position of sites is a constant in Mille Lacs archaeology, as all sites are situated on high ground in proximity to water. It is believed that population densities were increasing during this period based on an intensified exploitation of wild rice and a few large animals, although there is not enough subsistence information from excavations to prove this belief. Johnson (1984) suggests a pattern of small winter habitation sites with scattered summer occupations and possibly small-group hunting camps. Most habitation sites with St. Croix Stamped series ceramics have been found along streams near lake outlets. Little information is available on structures or within-site patterning.

6.3.3 Late (Terminal) Woodland in Southeastern Minnesota

The Late Woodland period in southeastern Minnesota dates from ca. 1500 to 800 BP, the time of first European contact. The period is marked in the archaeological record by changes in the design and manufacture of ceramic vessels and projectile points. Throughout the period, population sizes continued to increase and dependence on domesticated plants was becoming more widespread. In southeastern Minnesota and nearby parts of Wisconsin, Iowa, and Illinois, the people of the Late Woodland also developed new forms of social organization, as evidenced by the disappearance of burials in large mounds that contained non-utilitarian items made of exotic materials. In southwestern Minnesota, the Late Woodland period evolved differently than in the southeast, as Gibbon (2012:137) explains:

> Many but not all of these cultural innovations and elaborations [of the southeast] reached southwestern Minnesota by at least A.D. 900. More dramatic changes occurred throughout the southern part of the state between A.D. 900 and 1100, when agricultural societies with large, often defended villages and new material equipment appeared. Later forms of these "Mississippian" cultures still occupied parts of southern Minnesota when European missionaries and adventurers first paddled the Mississippi and Minnesota rivers.

The period of change from Initial to Terminal (Late) Woodland in the southeastern part of the state remains poorly understood, but the main material features found in the archaeological record include the development of the bow and arrow, effigy mounds and elaborate mortuary rituals, increasing long-distance trade networks and the acquisition of exotic materials, an elaborate smoking-pipe complex, and possibly the development of socially-ranked societies (Gibbon 2012). Population sizes were increasing and appear to have begun to develop into more localized cultures with year-round settlements. Domesticated plant foods became an important part of the subsistence base and ceramic vessels developed thinner walls and a finer temper. Given the general lack of data from the period in Minnesota, Gibbon (2012) relies on information from sites in neighboring states and adopts the terminology used for the period in the driftless area, dividing the period into *Initial, Mature,* and *Final* Late Woodland sub-periods.

The Initial Late Woodland spans the period of 1500 to 1300 BP and includes the Mill phase and Lane Farm phases in Wisconsin and Iowa. The ceramic type, Lane Farm, is a cord-impressed ware with a somewhat rounded base and constricted neck. Decoration includes cord impressions on the rim and rocker stamping on the body. The walls are thin and use a fine grit temper. Small corner-notched projectile points (Steuben Stemmed and Manker Corner-Notched types), which may have been the first true "arrowheads" in the region, are associated with the early part of the phase. Other possible points from later in the phase include Scallorn, Klunk Side-Notched, and Koster Corner-Notched. The forms of these points vary greatly and can range for broad to slender, corner-notched to barbed, and straight to convex blade edges. Elongated linear mounds with a limited number of grave goods (including copper beads and clay pipe parts) were developed during the period.

The Mature Late Woodland, from 1300 to 1000 BP, is best known by the Effigy Mound Complex of Southern Wisconsin, with a smaller number of sites in Iowa, Minnesota, and Illinois. A primary ceramic component of the complex, Madison Cord-Impressed, extends throughout southeastern Minnesota to the vicinity of the Blue Earth River. Madison ware vessels are thin-walled and use a fine grit temper. The vessels are globular in shape with constricted necks and out-flaring rims. They have cord-impressed decorations on the exterior and most vessels found are similar in their design treatment, featuring geometrical patterns. Another ceramic type associated with the period is the Angelo Punctated, which is also thin-walled and cord-marked, but is decorated with punctates and fine trailing lines in complex patterns. Gibbon (2012) suggests that the Angelo ware shares traits with Great Oasis ceramics.

Arzigian (2008:105) discusses some considerations regarding the use of Madison Ware in evaluating the Mature Late Woodland period:

> Ceramics with single cords used as decoration over a cord-roughened surface are found across central and southern Minnesota, but the ceramics are not coded as such in the SHPO database and cannot be readily separated except by examination of the ceramics themselves. Detailed ceramic studies are needed for [Mature] Late Woodland sites in Minnesota. The full range of ceramic types in southern Minnesota [Mature] Late Woodland sites should be evaluated, along with a consideration of how they compare to series defined elsewhere in the Midwest. Because of the presence of a geographic reference in the complex name, archaeologists are likely to have identified this complex for the SHPO/OSA database only for sites in southeastern Minnesota, although the ceramics and other aspects of the complex might be found further west and north.

Other ceramic types that Arzigian suggests might be identified within the *Mature Late Woodland* period in Minnesota include Lane Farm, Madison, and Minott Cord-Impressed wares. Projectile points from the period are small, stemmed and side-notched or unnotched in form. Diagnostic types from early in the period include Scallorn, Klunk Side-Notched, and Koster Corner-Notched (the same as in the *Initial Late Woodland* period). The later part of the period (ca. 1200 BP) is marked by the widespread adoption of the simple unnotched triangular Madison Point throughout the eastern United States. Other lithic tools found in association with the Effigy Mound Complex include scrapers and utilized flakes along with a variety of groundstone tools (adzes, axes, celts, grinding stones, pounding stones). Bone awls, needles, punches, and harpoons have also been recovered, along with exotic or ritual goods such as cooper knives and points, clay pipe elbows, obsidian blades, cut mica, effigy pipes, ear spools, and worked shell. Gibbon (2012) points out that Havana-related artifacts are conspicuously absent from *Mature Late Woodland* assemblages.

Two significant *Mature Late Woodland* sites are Sorg (21DK1) at Spring Lake in Dakota County and the Prior Lake Mounds (21SC16) in Scott County, which is the only excavated effigy mound site in Minnesota. Middle and Late Woodland deposits were excavated at Sorg and a variety of Madison ware was recovered, including Cord-Impressed, Punctated, and Plain. The Prior Lake Mounds site is in an upland setting adjacent to the driftless area and is the only know Effigy Mound complex site in Minnesota not adjacent to the Mississippi River. It consisted of five bird effigies and four linear mounds when mapped in 1883. Madison Cord-Impressed and Madison Plain ceramics were recovered from 21NL140 (Falls habitation site), which is on a terrace overlooking the Minnesota River valley west of Mankato, and from 21BE24, just south of the Minnesota River. These are the westernmost sites in Minnesota known to have *Mature Late Woodland* components. Site 21CR156 near the current project appears to have Madison ware ceramics.

The *Final Late Woodland* spans the period of 1000 to 800 BP and is defined by significant changes in the archaeological record of southeastern Minnesota and the Upper Mississippi valley. Effigy mounds are no longer found, and stockaded sites with Mississippian traits become more common as it appears that large portions of the driftless area were abandoned. Corn horticulture and distinctive grit-tempered collared ceramics belonging to the Grant series are found throughout the area of western Wisconsin, southeastern Minnesota, northern Iowa, and northern Illinois. Grant series ceramics are cord-roughened globular vessels with prominent rims that feature collars castellations, and squared orifices. The rims are higher than those of Madison ware vessels and they flare out more. They have a broader shoulder, thicker cord-impressions, and less complex decoration. When present, exterior-surface decoration is generally a single-cord impression in a chevron or zigzag form. It has been suggested (Gibbon 2012:146) that the shape and size of Grant series vessels was designed for simmering large quantities of grain, which requires longer and more gradual heating than does the cooking of seeds and other foods from the time before corn horticulture. Projectile points common to the period include the Madison Triangular type along with Cahokia, Reed, Harrell, and Des Moines types of the Cahokia Side-Notched cluster. Bryan, King Coulee, and Mero I are significant sites from the *Final Late Woodland* in southeastern Minnesota and western Wisconsin.

Following the end of the *Final Late Woodland* period in the Upper Mississippi Valley, Oneota peoples seem to be the only cultural group that remained into the period of Euro-American contact in the seventeenth century. Gibbon and Anfinson (2008) discuss two hypotheses to explain the development of the Oneota culture. Under the first hypothesis (credited to Stoltman and Christiansen 2000), the Effigy Mound Culture of southern Wisconsin, which had established cultivation as a major form of subsistence while continuing a mobile lifestyle that involved regular gatherings at important ritual sites where social bonds were reinforced and territories were demarcated, was gradually influenced by the Middle Mississippian culture centered at Cahokia. As these influences continued to expand, the Effigy Mound peoples were drawn to central locations such as the Red Wing locality to facilitate contact with Cahokia. These newly-emerging Oneota peoples adopted an increasingly sedentary lifestyle focused on maize horticulture and along with it, new social and ceremonial behaviors associated with planting and harvesting.

A second hypothesis from Gibbon and Anfinson (2008) suggests that the cultural developments in the middle Mississippi Valley between 1200 and 1000 BP, which led to the emergence of Cahokia, also reached into the upper Mississippi and Missouri River Valleys and led to the development of maize-growing Oneota and of Plains Village cultures. Under this hypothesis, the widespread Oneota cultural influences found throughout the northern section of the Prairie Peninsula by 800 BP represent a transformation rather than a displacement of Late Woodland peoples through the integration of Middle Mississippian influences and the migration of Oneota peoples from southern Wisconsin, where the culture had already emerged.

6.3.4 Mississippian/Plains Village

The Woodland period in southern Minnesota ended by 800 BP, overlapping with the advent of cultures that began to live in larger settlements, which were often fortified. Distinctive ceramics of the period are identified by shell rather than grit temper, handles rather than collars, smoothed rather than cord-marked surfaces, and decoration on the shoulder rather than rim. These cultural complexes been grouped into a number of cultural subdivisions associated with the central Mississippi River Valley, based on material traits that are more similar to that region than to the earlier local Woodland cultures. The Mississippian cultural manifestation in the central Mississippi River Valley is known as the Middle Mississippian. The northern region has traditionally been known as the *Upper* Mississippian and in the prairie region as the *Plains Village* Mississippian, although Gibbon (2012:159) notes that this usage suggests that the peoples of the period inhabited either "fringe" societies or were migrants from the south. Instead, he argues that the processes of change between Terminal Woodland and Mississippian cultures in Minnesota were more complex and subtle than is suggested by a dependency on cultures to the south and east, and he proposes that the terms *Upper* and *Plains Village* be eliminated – although he acknowledges that it is necessary to continue their use in making comparisons to other areas.

Mississippian complexes in Minnesota include Silvernale, Great Oasis, Cambria, Big Stone, and Blue Earth phases. Archaeological sites from these phases are concentrated along the Minnesota River trench from Mankato to the Red River and at the confluence of the Cannon and Mississippi Rivers near Red Wing.

Silvernale Phase

The Silvernale Phase (950 to 800 BP) is the clearest example of the Middle Mississippian in Minnesota, Illinois, and southern Wisconsin, and it is strongly related to the cultural center at Cahokia, Illinois.

The complex is characterized by large fortified villages that were often surrounded by conical burial mounds. Corn horticulture and subterranean storage pits were used. Ceramic vessels are shell-tempered and have rolled rimes and Ramey-scroll designs. Ceremonial objects made of exotic materials such as copper and marine shell from the southeast are found, along with ceramic mask carvings that resemble objects from sites in the southeast. Other artifacts found at Silvernale sites, such as stone tools, and many of the lithic raw material types, appear to be more related to Upper Mississippian cultures. Large Silvernale village sites include Silvernale, Mero, and Adams.

Great Oasis Phase

Great Oasis (1050 to 900) is considered to be the earliest and most widespread Plains Village phase. Ceramics are grit-tempered, globular vessels with a smooth exterior or cordmarked-smoothed and trailed line decorations and motifs. Decoration consists of bands of incised horizontal and oblique parallel lines along the rims, which are outflared and outcurved. The lips are thickened and beveled. Lithic assemblages include small notched and triangular projectile points; a variety of ground stone tools, (celts, abraders, hammerstones, manos, and mutates). A variety of bone and shell items such as awls, chisels, and beads are also found at Great Oasis sites. Corn horticulture was a component of the complex and settlements were focused along shallow lakes in southwestern and western Minnesota, Iowa, Nebraska, and the Dakotas. The Great Oasis site (21MU2) is the primary Great Oasis phase site in Minnesota. No Great Oasis sites have been identified in the southeastern Minnesota region.

Cambria Phase

The Cambria Phase (900 to 800 BP) includes Woodland, Middle Mississippian, and Plains Village characteristics. The ceramics are grit-tempered, globular vessels with a smooth surface. Lithic assemblages contain small side-notched and triangular projectile points; ground stone tools such as celts, abraders, and hammerstones. Bone and shell items such as scapula hoes, punches, and awls have been recovered. Evidence suggests that this phase was linked to the trade network centered at Cahokia. Settlement patterns include village sites on terraces of the upper Minnesota River and smaller habitation areas by lakes or rivers. Subsistence was based on hunting, fishing, gathering wild plant and aquatic foods, and the cultivation of maize and sunflower. The type site is 21BE2 (the Cambria site), which is located along the Minnesota River in Blue Earth County near Mankato.

6.3.5 Oneota Tradition

Oneota sites occur south of the Minnesota River and in the St. Croix River Valley in prairie and forested areas, dating from 800 to 300 BP. Two main phases have been defined: the Blue Earth Phase and the Orr Phase, which is restricted to far southeastern Minnesota and the adjacent area in Iowa.

Blue Earth Phase

The Blue Earth Phase (800 to 500 BP) occurs across southern Minnesota, with notable sites at Red Wing (Bartron), near Stillwater (Sheffield), and also along the Blue Earth and Upper Minnesota rivers. This phase is characterized by smooth surfaced, shell-tempered ceramics and triangular unnotched arrow points. Agriculture is evident from bison scapula hoes and plant remains of maize, sunflower, squash, and beans. Sites consist of large village farming communities with smaller hunting and gathering camps .

6.4 Contact and Historic Period

Prior to direct contact with Europeans/Euro-Americans during their settlement of the region, Native American people were indirectly affected by the European presence in the eastern United States as trade goods, diseases, and displaced tribes (such as the Ojibwe) moved westward into the territory that became Minnesota. This period of first contact in the southeastern Minnesota region is not well understood and there is little documentation from that time period. It is known that Native groups in the area at the time of French contact included the Dakota, Oto, Ioway, and possibly the Illinois. The Ioway and Oto are believed to have descended from precontact Oneota groups in the region (Gibbon 1994).

In the mid-1600s, the Ioway occupied much of southern Minnesota and the eastern Dakota occupied much of central Minnesota (Dobbs ca. 1988). In the early 1700s, the Ioway were forced out of southern Minnesota as the Dakota began to occupy the area following years of warfare with the Ojibwe, a conflict that lasted to the mid-1800s.

The French began to explore the territory that became Minnesota in the mid-1600s and they engaged in trade with the Ojibwe and Dakota shortly after initial exploration. Although several forts were constructed along riverways in southern Minnesota during the French fur-trade era (ca. 1660 to 1763), including one built around 1700 near the confluence of the Blue Earth and Minnesota Rivers near the present-day city of Mankato (Blegen 1975), little is known of this time period in south-central Minnesota. In 1762, the French ceded land west of the Mississippi River to Spain, and in 1763 under the Treaty of Paris the French ceded land east of the Mississippi to the British. The fur trade continued as the British gained control of the region (1763 to 1815). The British, ignoring Spain's claim to lands west of the Mississippi River, entered the region and established posts along the Minnesota River to aid in their fur trade interests. British trade continued until shortly after the War of 1812, when the Americans deprived them of licenses to trade within the United States. American fur trade companies replaced the British until the fur trade declined in the mid-1800s. After the war of 1812, the United States gained full control of the area and following the establishment of Fort Snelling in 1820, trading posts began to spread along the major riverways.

Samuel Pond (1940) estimated that approximately 2000 Dakota people occupied a number of villages spanning the area between Fort Snelling and the Shakopee. Some of the most significant Dakota villages on the Minnesota River near the project area were Nine-Mile Creek Village (21HE95) and "Penichon's" Village (21DKx). Roberts (1993) suggests that Nine-Mile Creek Village was one of the oldest along the river and was likely the one to which people from Wabasha's Village moved following their displacement from the early townsite of Winona. The exact locations of these villages remain unknown, and it is possible that both names refer to a single village that was located in different locations on either side of the river at different times. Black Dog Village was also well-known at the time of settlement and its location is now occupied by a power plant.

6.5 Hennepin and Dakota County River History

Euro-Americans settlers began to claim land in the Minnesota River Valley in the early 1850's after the Dakota were removed under the Treaties of Traverse de Sioux and Mendota. Small steamboats that were capable of traveling the river even during periods of low water facilitated settlement by providing relatively stable lines of supply for trading posts and individual settlers. In 1849, Victor Chatelle claimed land near the mouth of Nine-Mile Creek, adjacent to the Pond property, and platted a townsite on the upper bluff and a steamboat landing near on the river in 1854. Steamboat service flourished for about 20 years until railroads became the dominant means of travel along the valley in 1871. The steamboats used large amounts of wood to fire their boilers, and early settlers reported that vast areas were cut-over for many miles on both sides of the river to supply these needs (Neetzel 1969).

The valley was also traversed by a number of trails including the Minnesota Valley Trail along the south side of the river, which was the principle trail to the Red River Valley in the 1840's. The trail became a stage route in 1853 with service between St. Paul and Shakopee and an inn was built in the location of Bloomington 1854 built as a stopping point on the stagecoach line. Despite the riverboats and stage service, the promoters of towns along the south side of the river struggled with isolation during periods of low water and during the winters. Early travel was even more challenging on the north side of the river where settlers either had to follow the southern trail and then cross the river by ferry or they had to cut their own roads out of the woods. A stage and mail road on the north side of the river connecting St. Paul to Hutchinson was finally developed in 1856.

Early settlements were established nearly simultaneously between 1850 - 1855 along almost the entire length of the Minnesota River and the census of non-Indian inhabitants in the valley grew from less than 5,000 in 1849 to over 170,000 in 1860 (Roberts 1993:75).

The townsite of Bloomington was staked by a group of settlers from Bloomington, Illinois in 1852. Land speculators first promoted the "Town of Bloomington" in 1857, but they were not successful in this first effort. A ferry service across the Minnesota River was developed in 1852 and continued until 1892, when the Bloomington Ferry Bridge was built. Bloomington became a township in 1858, the same year Minnesota became a state. Old Shakopee Road, which runs through modern-day Bloomington, was the heart of the early settlement. Initially a trail from Shakopee to Fort Snelling that eventually became a stagecoach route, the road crosses Nine Mile Creek (named for its distance from Fort Snelling) roughly halfway between Shakopee and Fort Snelling. The first general store was established near this juncture and the settlement soon came to include blacksmith shops, a flour mill, a saloon, and a post office.

On the south side of the river, across from Bloomington, was a farming community that became the Village of Burnsville 1858. The two communities share a fraught history stemming from an effort by Bloomington to annex the village, leading to a dispute that Burnsville won in the state Supreme Court and to Burnsville's decision to incorporate as a city in 1964. The basis of the legal struggle was control of the taxes paid by the Black Dog power plant, which is now within the legal boundaries of Burnsville. The historical society credits the legal victory with the preservation of the community that otherwise had no traditional main street or center of development and is essentially an extension of housing and businesses for the rest of the twin cities metro area.

Another blow to settlement along the river was the Panic of 1857, when financiers from the east were forced to call in loans during a financial crash. Minnesota was especially hard-hit during the panic because it was on the frontier of western expansion at the time and much of that settlement was financed by debt. Settlement along the Minnesota River resumed following the Panic of 1857 with a continued emphasis on agriculture and associated industries such as milling and food processing. The other major industry in the region was stone-quarrying and brick-making, which took advantage of abundant supplies of high quality clay in the river valley. The limestone that lines the river valley was used directly as a building material and was also burned in kilns to make lime for mortar and whitewashing.

Most farmers at the time practiced a form of subsistence agriculture until the late 1860's, when there developed a national demand for spring wheat from the region. Although agricultural prices collapsed following the First World War, the intensive development of roads during the 1920's and 1930's allowed for a significant recovery in the 1940's as it became easier and less expensive for farmers to provide their products to outside markets.

The process of clearing the land for agriculture eliminated vegetation, ponds, and marshes in the river valley and on the bluffs above. All of this land modification reduced the storage capacity of the land and dramatically increased the flow of the water into the Minnesota River, which increased the frequency and severity of flooding (Neetzel 1969). Widespread livestock grazing on the hills and bluffs also caused a significant amount of erosion. Although soils in the river valley are very fertile, the severe erosion buried many areas with deep deposits of overburden, and this combined with the fact that many of the fields in the valley are too small to be easily farmed by modern equipment meant that many small farms were abandoned and the buildings removed. The decline of family farms increased rapidly in the 1970's as agriculture was consolidated into large corporate holdings and much of the production in the river valley is now centered on nursery and landscaping operations.

Neetzel (1969) explains that logging in the Minnesota River Valley was not as significant economically as it was in the northern parts of the state and, as mentioned earlier, much of the early timber harvest was used to supply riverboats. River valley tree species such as cottonwood were not commercially valuable in the larger regional market, although many of the early buildings in the towns and farms in the valley used locally-produced cottonwood lumber. Logging in the valley intensified during World War II to meet increased demand for wood products of all types in the war effort and following the war, an increasing demand for pallets made of low-grade wood opened a new commercial market for lumber from the valley.

A very significant land-use development in the Minnesota River Valley was the establishment of the Minnesota Valley National Wildlife Refuge in 1976. The refuge occupies much of the valley in Hennepin and Dakota counties and has allowed recreational activities to flourish in the area. More recently, a great deal of development in the region has centered on residential development for commuters and businesses in the expanding twin cities metropolitan area.

7. ENVIRONMENTAL BACKGROUND

7.1 Modern Environment

The project area is located along I-35W on the north and south sides of the Minnesota River in an urban area between Bloomington and Burnsville, Minnesota. The north side of the river consists of a wooded wetland floodplain in the valley bottom, a wooded terrace on the valley wall, and grassy bluff top on the north side of the Minnesota River valley. There is a large retaining pond under the bridge on the north side of the river. The south side of the river is a grassy wetland floodplain and grassy low terrace in the valley bottom. There is a paved trail south of the river along the east side I-35W. The survey area is mostly within the existing ROW and is extensively developed for the I-35W highway construction.

7.2 Glacial History

The most recent glacial activity in the region occurred during the Late Wisconsin glaciation at the end of the Pleistocene when much of the Upper Midwest was buried beneath glaciers. The Des Moines lobe covered much of western and east-central Minnesota, receding and advancing several times between 15,000 and 11,700 years BP when it finally retreated (Clayton and Moran 1982; Gilbertson 1990). The project area is situated near the eastern extent of the Des Moines lobe. These glacial deposits shaped the surficial features of the landscape that characterize the region today. The final retreat of the Des Moines lobe left behind a vast glacial lake (Lake Agassiz) in northwestern Minnesota that was drained by Glacial River Warren, which carried a tremendous flow of water, forming the wide and deep valley that is now drained by the Minnesota River.

7.3 Physiography

The project area is located in the Owatonna Moraine Area physiographic region, which is characterized by a series of moraines that formed along the eastern margin of the Des Moines lobe (Hobbs and Goebel 1982; Wright 1972b).

The surficial geology of the project area has been mapped in Hennepin County by Meyer and Hobbs (1989) and Dakota County by Hobbs et al. (1990). The bluff top landscape is mapped as a middle terrace (t2), which was formed by Glacial River Warren as it drained Glacial Lake Agassiz at the end of the Pleistocene. This terrace is a sandy deposit that extends along the upland of the river valley to a distance over one mile north of the bluff edge. Site 21HE495 is located on this terrace. Although not mapped, the valley wall on the north side of the river contains a narrow but prominent terrace approximately half way up the wall, and this terrace likely correlates with the t1 terrace that formed from Glacial River Warren in the Early Holocene. The terrace is about 50 feet above the modern river level, and t1 terraces are between 5 and 70 feet above the river according to Hobbs et al. (1990). Site 21HE497 is located on this terrace. Colluvium and a small alluvial fan are mapped at the base of the bluff, where site 21HE496 is located. The fan was deposited by a ravine that cut into the bluff at this location. Floodplain alluvium is mapped in the valley bottom on both sides of the river. Organic deposits are mapped near the outlet of Nine Mile Creek on the floodplain on north side of the river and on the south side of Black Dog Lake on the south side of the river. A low terrace (t1) is mapped on the south side of the river on slightly higher ground south of the floodplain and organic deposits. The terrace is a sand and gravel deposit from the down cutting of the river valley by Glacial River Warren during the early Holocene.

7.4 Hydrology

The project is located within the Minnesota River valley, which is the primary drainage for a large portion of southern Minnesota, extending from its headwater near the North and South Dakota border to its outlet at the Mississippi River in St. Paul. The Minnesota River's broad drainage system provided a route for the transmission of people, goods, and ideas across distant areas, connecting the prairie and Plains region of western Minnesota and the Dakotas with the woodlands in the eastern part of the state. Further connections in all directions across the middle of the continent could be maintained via the Mississippi River, the Red River, and their tributaries.

The Minnesota River flows within a large, steep-walled valley. On the valley bottom adjacent to the project area is an extensive, abandoned river channel (Black Dog Lake) and adjacent wetlands. Black Dog Lake appears to be very shallow based on the fluctuations of its extent on historic maps. Nine Mile Creek, which drains the uplands on the north side of the river, flows into the Minnesota River on the west side of I-35W.

A review of historic maps and air imagery allows for a reconstruction of the hydrology in the area before its alternation for the I-35W highway. All the historic maps and air imagery from 1854 to 1964 (Figures 4 to 8) show an ancient, water-filled river channel (Black Dog Lake) on the south side of the Minnesota River, extending east-west across the area where I-35W is now located. The lake extends at least 1000 feet west of I-35W and more than two miles east. On the 1967 USGS 7.5' topographic map (Figure 1) Black Dog Lake does not extend west of I-35W and appears to have been filled in sometime after 1964 based on the air images, presumably for the I-35W interchange and other developments that occur at that location.

The 1901 topographic map shows wetlands on both sides of the Minnesota River that cover the valley bottom between the bluffs. Numerous springs flow from the base of the bluffs and drain to Black Dog Lake and the Minnesota River. Water levels apparently decreased by 1954, as portions of Black Dog Lake are indicated by wetlands and not open water, and the vast valley bottom areas that were wetlands on the 1901 topographic map are no longer mapped as wetlands. On the 1967 USGS 7.5' topographic map, Black Dog Lake is filled with water, but wetlands are not mapped in the river valley bottom.

On the north side of the Minnesota River, all the historic maps and imagery (except the 1901 map) depict Nine Mile Creek flowing west to east across the project area. After 1951, it was channelized and redirected to flow south into the Minnesota River on the west side of I-35W.

7.5 Ecology

The project lies within the Big Woods subsection of the Minnesota and Northeastern Iowa Morainal Section of the Eastern Broadleaf Forest Province (Minnesota DNR 1998). The primary characteristics are a loamy end moraine associated with the Des Moines Lobe of Late Wisconsin Glaciation and presettlement vegetation of mesic deciduous forest comprised of oak woodland and maple-basswood forest. In general the landscape consists of rolling terrain with scattered lakes and streams.

Vegetation in the Minnesota River valley bottom near the project area at the time of European settlement consisted of river bottom forest (silver maple, elm, ash, cottonwood, and willow) (Marschner 1974). The upland and terraces above the valley bottom consisted primarily of hardwood forest (oak, maple, basswood, and hickory), oak barrens, and smaller areas of prairie.

7.6 Post-Glacial Ecology

Regional vegetation changes during the Holocene are inferred from pollen samples preserved in lake-bottom sediments from several lakes in eastern Minnesota. The following discussion is derived from Gibbon (2012) and Gibbon and Anfinson (2008), citing the research of Wright (1992, 1976a, 1976b); Wright and Watts (1969); Amundson and Wright (1979); Webb et al. (1983); and Webb (1981).

These analyses show that following the retreat of the glaciers in southern Minnesota about 12,000 RCYBP (14,000 cal BP) all of the area was covered with an open boreal forest of grasses and stands of conifer trees mixed with deciduous species such as black ash; a composition that is not seen in modern landscapes. This "spruce parkland" landscape was more open on high ground and was likely swampy or contained open water in the low areas. The parkland evolved into a more uniform spruce forest by 11,000 RCYBP (13,000 cal BP). By approximately 10,500 RCYBP (12,500 cal BP), deciduous forest had developed across southern Minnesota. In the project area and to the south and west, the forest composition was oak and elm, while just east of the project area it comprised birch, alder, and pine. The oak-elm forest continued to advance and covered the entire south central and southeastern parts of the state by 9,000 RCYBP (10,000 cal BP).

Continued warming and drying of the climate provided the conditions for prairie and oak savannah to flourish in the western and southern parts of the state by 8000 RCYBP (8800 cal BP), and the broad vegetation zones of historic times had begun to develop, with prairie in the west, deciduous forest in the southeast, and coniferous forest in the north and northeast. Further warming and drying led to continued eastward expansion of the prairie, which reached its maximum extent and covered all but the northeastern quarter of the state by 7000 RCYBP (7800 cal BP). The climate cooled and grew wetter after 6000 RCYBP (6900 cal BP), causing the prairie to retreat westward and oak woodland to expand. Gibbon (2012) points out that this advancing oak woodland would not have been the same as the historic oak forest but rather would have been a mosaic of prairie and woodland, with the forest gradually becoming denser. The basic vegetation zones present at the time of settlement (1850's) were in place by 3000 RCYBP (3200 cal BP), with oak woodland near the project area. By approximately 400 years ago, the Big Woods (elm, basswood, ironwood, hickory, maple, ash, and butternut) became established in south-central Minnesota in the vicinity of the project area.

A more fine-scale review of the landscape evolution near the project area is provided in a recent research project for Le Sueur County (Schirmer et al. 2014), which is adjacent to and environmentally similar to the project area. Using historic records (e.g., Marschner 1974) and studies of pollen and charcoal specimens from regional lake-bottom sediment cores (e.g. Sugita 1994 and Umbanhowar 2004), the authors looked at major climatic regimes, vegetation changes, and the associated occurrences of large-scale fires. Schirmer et al. (2014) note that the pollen studies used to provide much of the vegetation reconstructions by other researchers are somewhat generalized, in that they rely on information from localized features such as lake and pond basins, which are then extrapolated onto the broader ecosystem. Complex landscapes that occur near the project area, such as the Minnesota River valley, uplands, wetlands, smaller streams, and many lakes and ponds, require a more nuanced review of the paleoenvironmental data. The Minnesota River valley includes many niche environments ranging from the bluffs tops and side slopes to the valley bottom, where numerous springs, lakes, and wetlands occur.

Schirmer et al. (2014:27) define five major climatic regimes that have dominated the landscape of south-central Minnesota and the project area since the retreat of the glaciers: a cool and humid period from 10,200 to 7700 RCYBP (12,000 to 8500 cal BP), a warm and arid period from 7700 to 4000 RCYBP (8500 to 4500 cal BP), a warm and humid period from 4000 to 2900 RCYBP (4500 to 3000 cal BP), a cool and humid period from 2900 to 1000 RCYBP (3000 to 1000 cal BP), and finally a cool and arid period from 1000 to 200 BP. Two comparatively wet episodes of approximately 500 years each, spanning 6500 to 6000 cal BP and 5000 to 4500 cal BP, have been identified during the warm and arid period. These climatic regimes are divided by vegetation trends and the occurrence of fires, as postulated by the abundance of charcoal in sediment samples recovered from lakes and ponds in the south-central Minnesota area (Table 7).

Table 7. Holocene Climatic Regimes and Ecological Trends near the Project Area (from Schirmer et al. 2014: 26-27).

ca. Date Range (cal BP)	ca. Date Range (RCYBP)	Climatic Regime	Vegetation Trends	Dominant Species	Fire Regime
12,000–11,500	10,200–10,050	Cool and Humid	Boreal Forest	Spruce, Pine	Low
11,500–11,000	10,050–9550		Deciduous Forest	Oak, Elm, Forbs	
11,000–10,500	9550–9300				
10,500–10,000	9300–8900				
10,000–9500	8900–8500		Woodland		
9500–9000	8500–8050				
9000–8500	8050–7700		Prairie	Grasses, Forbs	Moderate
8500–8000	7700–7200	Warm and Arid			
8000–7500	7200–6600				
7500–7000	6600–6150			Oak, Grasses	
7000–6500	6150–5750				
6500–6000	5750–5300	Wet Episode	Savanna	Oak, Elm, Grasses, Forbs	
6000–5500	5300–4800	Warm and Arid	Prairie	Grasses, Forbs	
5500–5000	4800–4450	Wet Episode	Savanna	Oak, Elm, Grasses, Forbs	
5000–4500	4450–4000	Warm and Arid	Prairie	Oak, Grasses, Forbs	
4500–4000	4000–3700	Warm and Humid	Woodland	Oak, Ironwood, Hickory, Basswood, Forbs	High
4000–3500	3700–3300			Oak, Grasses	
3500–3000	3300–2900				
3000–2500	2900–2500	Cool and Humid		Oak, Elm, Ironwood, Pine, Forbs	Moderate
2500–2000	2500–2050				
2000–1500	2050–1550				
1500–1000	1550–1100				
1000–500	1100–400	Cool and Arid	Forest	Oak, Ironwood, Elm, Basswood	
500–200	400–150			Maple, Basswood, Ironwood, Elm (Big Woods)	Low

A boreal forest of spruce and pine advanced into southern Minnesota between 10,200 to 10,050 RCYBP (12,000 to 11,500 cal BP). This was followed by oak-elm forest and woodland from 10,050 to 8050 RCYBP (11,500 to 9000 cal BP). Prairie dominated the landscape during the warm and dry climatic regime of the mid-Holocene, which persisted from 8050 to 4000 RCYBP (9000 to 4500 cal BP). Prairie is defined as a fire-maintained ecosystem with a mix of grasses and forbs and less than 10% tree cover, primarily oak. During the later portion of this period from 5750 to 4000 RCYBP (6500 to 4500 cal BP), two wetter episodes allowed the spread of savanna vegetation. *Savanna* is a grassland ecosystem containing oak, elm, and forbs, in which the trees are sufficiently widely-spaced so that the canopy remains open. Woodland vegetation (primarily oak, elm, hickory, basswood, grasses, and forbs with 10-70% total tree cover) with areas of grasslands and sparse brush was the dominant vegetation type from 4000 to 1100 RCYBP (4500 to 1000 cal BP). Forest (primarily maple, oak, elm, basswood, and ironwood with 70% or greater tree cover, closed or nearly closed canopy, and comparatively little shrub growth but significant forb and grass ground cover) occurred in the area from 1100 RCYBP (1000 cal BP) to the present day. Big Woods developed around 400 RCYBP (500 cal BP).

Schirmer et al. (2014) found the same type of relationship between landscape changes and fire prevalence as is discussed in Yansa (2007), noting that there is a counter-intuitive interaction between arid and warm periods and charcoal evidence of large-scale fires. The reason for this is that during the arid times there was less fuel to support large fires, and therefore fires were more common during wetter periods when primary fuels such as grasses and forbs would have been more plentiful.

Yansa (2007) focused on pollen and diatom samples from the Altithermal period of warming and drying from 7200 to 4000 RCYBP (8000 to 4500 cal BP), which corresponds to the Early and Middle Archaic periods. While these data are from the northern Great Plains, east and north of the project area, they can be extrapolated to provide insights into the landscapes of the project area as well, given that the shifting prairie/forest border meant that there were periods of time in which the general environment of the project area would have shared many similarities with the Great Plains study area as described. The shifts in climate, and subsequently in habitat and vegetation, were more variable in time and space than has been previously understood. The onset of widespread grasslands on the northern Plains does not represent a large-scale biome shift, but rather a series of localized changes in species composition along the edges of lakes and ponds (Yansa 2007:129). She proposes that fine-scale fluctuations during the periods of drought and moisture resulted in the creation of "oasis" landscapes, in which large areas became very dry but other areas closer to water sources (such as the river valley of the project area) would have stayed relatively wet, thereby supporting resources for animals and humans.

Yansa suggests that the proposed oasis landscape model of the Early Archaic means that populations would not have had to abandon the prairie region to the degree that has been assumed, but rather would have been able to thrive in localized upland areas and river valleys, such as the Minnesota River, that did retain moisture.

Another recent study (Williams et al. 2009) supports Yansa and Schirmer in suggesting that the shifting mid-Holocene boundaries of the prairie-forest ecotone in southeastern Minnesota were more asymmetrical than previously believed, with a relatively rapid early Holocene deforestation and more gradual reforestation later in the Holocene. Using fossil pollen records and modern surface analogs, the researchers mapped changes in "woody cover". They argue that the period of rapid deforestation was likely caused by fairly sudden climate changes and the subsequent onset of large fires, which caused a positive feedback loop in which a shift to grasslands increased the frequency of fires, which then accelerated the burning of more forest. The loss of forest cover was also likely exacerbated by climate change-caused outbreaks of pests and pathogens that weakened trees and made forests even more susceptible to fire.

The researchers conclude that the prairie-forest ecotone boundaries in the eastern Dakotas and southern Minnesota generally match earlier mapping efforts (e.g. Webb et al. 1983), with some differences in detail (Williams et al. 2009:201). The general patterns are similar; there is a dramatic regional advance of prairie between 8900 to 7200 RCYBP (10,000 to 8000 cal BP), a maximum advance to the east from 6100 to 5300 RCYBP (7000 to 6000 cal BP), followed by a retreat of the prairie to the west after 5300 RCYBP (6000 cal BP). While the maximum extent of the ecotone boundary in southeastern Minnesota is somewhat ambiguous (Williams et al. 2009:195), they find that the range of movement is smaller than in Webb et al. (1983), and that the boundary of the prairie-forest ecotone did not advance much farther to the east than the current project area. Their reconstructions indicate that the Holocene prairie-forest ecotone in southern Minnesota and Wisconsin was gentler than in northern Minnesota.

They conclude that the changes in both the northern and eastern prairie-forest ecotone boundaries were caused by the changing climate, while the causes for differences in the rates of change between the north and east are less certain.

7.7 Plant and Animal Resources

The paleoenvironmental data cited by Schirmer et al. (2014) indicate that, although the landscape and environment around the project area changed through time, from forest and woodland to prairie and savanna and then back to woodland and forest, all of these major vegetation types would have been present in south-central Minnesota during each of the climatic episodes at differing locales and in varying amounts. It appears that there was never a time of complete ecological uniformity in the prairie-forest ecotone. The variety of landscape settings, along with the presence of wetlands, lakes, and streams associated with the broad Minnesota River valley would have created niche environments around the project area in which a wide and changing variety of vegetation and associated plant and animal resources would have been available.

Aquatic habitats such as lakes, streams, and wetlands around the project area would have provided fish, clams, small mammals, turtles, waterfowl, edible tubers, and wild rice. Spector (1993:112) reports that the remains of bottom-dwelling fish, such as drumfish, along with turtles were the most abundant in the archaeological record at the Little Falls site, which is located upstream of the project area near the town of Jordan. Other aquatic resources recovered during excavation and potentially used by the Dakota people in the Minnesota River valley included catfish, walleye, gar, pike, muskellunge, sucker, teal, mallard, shoveler, wood duck, coot, merganser, grebe, grouse, goose, loon, muskrat, otter, beaver, fisher, mink, ermine, and shellfish (Spector 1993:144). While these types of aquatic resources would have been more limited during warm and dry periods (when water levels declined), they would have remained viable even during those periods in the Minnesota River valley and the lake basins associated with it, which would have continued to support more diversity of flora and fauna than was found in the upland areas farther from water sources.

The wide variety of plant resources available in the woodland and savanna habitats of the project area are also summarized in Spector (1993:145): legumes, crabapple, cress family, elderberry, grape, seed grasses, hazelnuts, acorns, joe-pye weed, mint, knotweed, pig weed, pin cherry, black cherry, plantain, purslane, raspberry, gooseberry, sorrel, sumac, strawberry, and vervain among others. Faunal remains recovered from the Little Falls site (Spector 1993:144) include deer, coyote, squirrel, rabbit, grouse, elk, raccoon, and pigeon.

Based on early historical accounts, a wide variety of mammalian game species were present in southern Minnesota, including bison, elk, deer, muskrat, rabbit, beaver, bear, and occasionally antelope (Anfinson 1997; Ernst and French 1977; Herrick 1892). Anfinson (1997) explains that plant foods were much less abundant in the prairie landscape, consisting primarily of the prairie turnip and a type of bean called ground plum. Most of the prairie vegetation comprised grasses and forbs that provided excellent forage for prey species, primarily bison, with smaller numbers of elk and both white tail and mule deer. Large prey species such as elk and deer were not as abundant in closed-canopy forests due to limited browse and therefore this type of environment provided a more limited animal resource base.

8. PHASE I FIELDWORK SUMMARY

8.1 Overview of Fieldwork and Results

Archaeological fieldwork was conducted from October 27 to December 9, 2014 and intermittently from April 20 to November 15, 2016. Frank Florin was the principal investigator and field supervisor. The FCRS field crew included Mike Bradford, Val Chapman, Gregg Felber, Frank Koep, Ryan Letterly, James Lindbeck, Amanda Peterson, Kevin Reider, Jeff Shapiro, Michael Straskowski, Bob Thompson, and Seth Thompson.

The location of the Phase I archaeological survey area and sites identified during the survey are presented on a USGS 7.5' quadrangle map in Figure 1. The locations of survey areas, sites, and shovel tests discussed in the subsequent section are depicted on aerial imagery in Figures 9 and 10.

A discussion of the field conditions, physical setting, survey methods, and results of the investigation is presented below and is organized from north to south. Because of very low surface visibility throughout the survey area, shovel testing was conducted in all areas without excessive slope, deep filling, or hill cuts. The field methods are described in Section 3.1. Four new sites (21HE494, 21HE495, 21HE496 and 21HE497) were identified during the Phase I survey. The sites are discussed in detail in Sections 9 to 12. Phase II evaluations were conducted at all of the sites.

8.2 Bluff Top on North Side of Minnesota River

<u>Bluff on East Side of I-35W</u>

The survey area on the bluff top on the east side of I-35W was mostly confined to the existing ROW, which consists of a massive road cut through the bluff, allowing for a gentler slope going up the bluff. No testing was conducted in that area because several meters of soil were removed from the road cut, and there is no potential for sites.

One small area on the bluff edge along a ravine was shovel tested in 5-meter intervals. This area is a mowed lawn. Six tests were dug, and they all contained fill, disturbed soil, and modern debris (plastic, styrofoam, wire nails, sheet metal, and drain tile) to a depth of 65 to 90 cmbs. Below the fill was a yellowish brown (10YR 5/4) sand. The owner of the commercial building to the north said that there was substantial landscaping, grading, and filling in this area along the ravine as part of burying debris from demolition of a former house located nearby.

On the bluff top 9.4 meters north of the construction limits and survey area, there is an oval-shaped, earthen mound that measures 14 by 19 meters in diameter and about one meter high (Figures 9, 11 and 12). The mound is 13 meters north of the shovel tests and near the head of a ravine. There are two mature oak trees growing out of the mound, which may be a precontact burial mound. A construction map from c. 1970 (Figure 13) was obtained from the owner of the commercial building to the north. The map depicts a former house adjacent to the mound, and it is possible that the mound is constructed from basement back-dirt, but this seems unlikely. A fence will be erected along an east-west line about 30 feet south of the mound to ensure it is not impacted during construction.

Figure 9. I-35W Bridge Replacement Survey Area, Sites, and Shovel Tests on North Side of Minnesota River (Air Imagery).

Figure 10. I-35W Bridge Replacement Survey Area, Sites, and Shovel Tests on South Side of Minnesota River (Air Imagery).


Figure 11. Photo of Earthen Mound on Bluff Top, Facing West.


Figure 12. Photo of Earthen Mound on Bluff Top, Facing South.

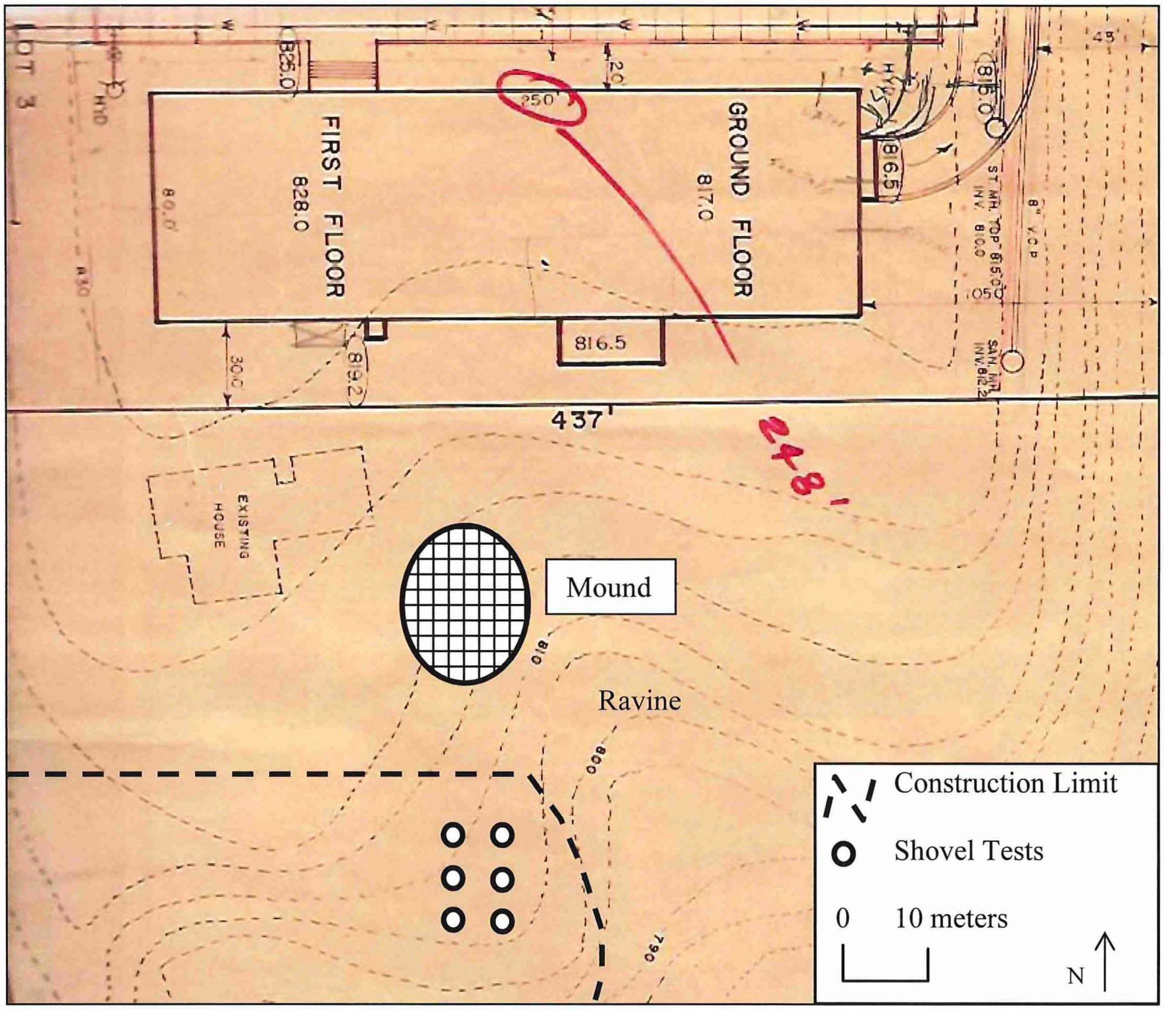


Figure 13. Construction Map c. 1971 on Bluff Top, Showing former House and Approximate Mound Location and Shovel Tests.

<u>Bluff on West Side of I-35W</u>

The survey area on the bluff top on the west side of I-35W was confined to the existing grassy ROW, which is mostly on the east side of River Terrace Drive but also includes a small grass lot on the west side of the road. The ROW included a relatively intact landscape adjacent to the massive road cut along I-35W. This area borders a residential neighborhood and has fairly level terrain. Shovel testing was conducted at 10-meter intervals. All tests in the grass lot on the west side of River Terrace Drive contained fill or disturbed to depths of 65 to 80 cmbs. Precontact site 21HE495 was identified from several positive shovel tests. The site is discussed in detail in Section 10.

8.3 Valley Wall and Upper Terrace on North Side of Minnesota River

The valley wall of the Minnesota River Valley is steep, descending 100 feet from the bluff top to the valley bottom. A narrow terrace is inset about half way up the valley wall. This terrace likely correlates with the t1 terrace that formed from Glacial River Warren in the Early Holocene (see Section 7.3 Physiography). The terrace is approximately 50 feet above the river. Except for the terrace, the valley wall is very steeply sloping and would not have been suitable for habitation or most activities. The soils would have been prone to erosion and slope wash, and a significant amount of colluvium is present at the base of the bluff, as observed in the soil profiles from site 21HE496. Therefore, shovel testing was not conducted on the very steeply sloping valley walls.

The terrace on the east side of I-35W consists of dense vegetation and trees. Shovel testing was conducted at 10-meter intervals. A former house and another structure are present on this terrace near the base of a ravine about 60 meters west of Lyndale Avenue South and 120 meters east of I-35W. The structures are depicted on several maps, including a c. 1970 construction map provided by the owner of the commercial building nearest the bluff top edge, and air photos from 1937 to 1967. The driveway and clearing are present on the 1945 and 1951 air images, but the vegetation is too dense to see the house. There is a large pile of asphalt and debris on the terrace near the former house. Some shovel tests hit impenetrable concrete at this location. Precontact site 21HE497 was identified from several positive shovel tests on the terrace west of the former house. The site is discussed in detail in Section 12. All of the tests on the terrace west of 21HE497 had extensive fill, disturbed soils, or concrete near the surface.

The terrace on the west side of I-35W has been eroded by a ravine and consists of only a narrow remnant with mature trees. Three shovel tests were dug at 10-meter intervals. No sites were identified.

8.4 Valley Wall Toe Slope and Alluvial Fan on North Side of Minnesota River

The intersection of the steep valley wall and the valley bottom is abrupt, and interrupted only by a narrow toe slope along the base of the wall. On the east side of I-35W, an alluvial fan is inset into the toe slope at the base of the ravine. A small stream flows along the base of the toe slope, and the area is wooded. Auger testing to a depth of more than three meters was conducted at 10-meter intervals. Precontact site 21HE496 was identified from positive shovel tests on the toe slope and alluvial fan. The site is discussed in detail in Section 11.

On the west side of I-35W, springs flow from the toe slope at the base of valley wall. Shovel Tests 24W and 26W had an upper stratum of muck and peat and a lower stratum of mineral sediment to a depth of 300 cmbs (Table 8). Shovel Test 25W had peat to 60 cmbs and mucky soils to 300 cmbs. Shovel Test 27W, located nearer the bridge, had fill to a depth of one meter. All these tests were single-augured because of the low potential for deeply buried sites. No sites were identified.

Table 8. Shovel Test 24W Profile.

Depth Below Surface (cm)	Description
0-20	Very dark gray (10YR 3/1) mucky silt
20-100	Very dark gray (2.5Y 3/1) peat
100-150	Dark gray (2.5Y 4/1) silty clay loam; massive
150-300	Gray (2.5Y 5/1) silty clay loam with gravels; massive

8.5 Valley Bottom Floodplain on North Side of Minnesota River

I-35W is raised about 50 feet above the floodplain so that it is above flood levels, and much of the ROW and survey area has more than three meters of fill. So, shovel tests were generally dug along the outer margins of the ROW where the fill was thin or nonexistent.

<u>Floodplain on East Side of I-35W</u>
On the east side of I-35W adjacent to the Minnesota River, the floodplain includes a 30-meter-wide strip of land between the retaining pond under the bridge and the parking lot. Shovel testing was conducted at 15-meter intervals in this area, and precontact site 21HE494 was identified from a few positive shovel tests. The site is discussed in detail in Section 9. Nearly all of the tests in this area had extensive disturbance and fill.

North of the pond and parking lot, the floodplain is a wooded wetland that is drained by a small stream the flows along the west side of Lyndale Avenue South. A small stream also flows along the base of the toe slope where it intersects with the floodplain. The former channel of Nine Mile Creek used to flow through this area just north of the parking lot, but it has been channelized to flow on the west side of I-35W. Shovel testing was conducted in 15 meter and larger intervals in this area, depending on the soils. Shovel Test 9E had fill to 250 cmbs. Shovel Tests 10E and 11E had very poorly developed and poorly drained mineral soils below fill (Table 9). Shovel Tests 12E and 13E were similar to Shovel Test 11E, except they had muck below the fill from about 70 to 100 cmbs. The soils are poorly developed, consisting of a thin topsoil overlying non-pedogenically altered sediments (C horizons). No buried soils were present. The soils are likely very young, based on the lack of pedogenesis (soil development) and the presence of modern debris found in the tests from 100 to 200 cmbs. Plastic was found at 200 cmbs in Test 10E and at 100 cmbs in Test 13E, and a piece of clear glass was found at 120 cmbs in Test 14E. Tests 10E and 11E were double augered to 300 cmbs, and because of the young age of the soil and the low potential for deeply buried sites, subsequent Tests 12E to 14E were single augured to 170 cmbs.

Table 9. Shovel Test 11E Profile.

Depth Below Surface (cm)	**Description**
0-70	Fill
70-100	Dark olive gray (5Y 3/2) clay; very fine subangular blocky structure
100-160	Dark gray (5Y 4/1) silty clay to clay; massive
160-300	Gray (5Y 5/1) silty clay; massive

Farther to the north, the soils from Shovel Tests 15E to 19E consisted of muck and peat to a depth of 300 cmbs. Fill was present in these tests to a depth of 100 cmbs (Test 15E), 200 cmbs (Test 16E), 235 cmbs (Test 17E), and 90 cmbs (Test 18E). These tests were single augured to 170 cmbs (Test 15E), 215 cmbs (Test 16E), 250 cmbs (Test 17E), 200 cmbs (Test 18E), and 300 cmbs (Test 19E).

<u>Floodplain on West Side of I-35W</u>
On the west side of I-35W adjacent to the Minnesota River, the floodplain includes a narrow (7-meter-wide) strip of land between the retaining pond under the bridge and Nine Mile Creek, which has been channelized to flow south along the west side of I-35 instead of flowing eastward.
The floodplain is wooded. Shovel testing was conducted at 15 and 20-meter intervals. A portion of precontact site 21HE494 was identified from shovel tests on the floodplain next to the pond. The site is discussed in detail in Section 9.

North of site 21HE494, Tests 13W to 16W were located along Nine Mile Creek, and these tests had mineral soils to 300 cmbs. The soils are poorly drained and poorly developed, consisting of a thin topsoil overlying non-pedogenically altered sediments (C horizons). No buried soils were present. The soils are likely very young based on the lack of pedogenesis (soil development) and data from tests on the east side of I-35W, which included modern debris from 100 to 200 cmbs. A typical profile from Tests 13W and 15W is presented in Table 10. Tests 13W and 15W were augered to 300 cmbs, and Tests 14W and 16W were augered to 100 and 250 cmbs. All these tests were single augured because of the young age of the soil and the low potential for deeply buried sites.

Table 10. Shovel Tests 13W and 15W Profile.

Depth Below Surface (cm)	Description
0-15	Very dark gray (10YR 3/1) silty clay loam
15-35	Very dark grayish brown (2.5Y 3/2) silty clay loam; very fine subangular block structure
35-60	Dark grayish brown (2.5Y 4/2) silty clay loam; weak, very fine subangular block structure
60-130	Olive brown (2.5Y 4/3) silty clay loam; massive
130-200	Dark grayish brown (2.5Y 4/2) silty clay loam; massive
200-300	Dark gray (2.5Y 4/1) silty clay loam; massive

Farther to the north, Tests 20W, 22W, and 23W had mucky topsoil underlain by peat to a depth of 300 cmbs. Test 21W had mucky topsoil overlying a massive gray (2.5Y 5/1) silty clay loam to 70 cmbs, underlain by a very dark gray (2.5Y 3/1) clayey muck to 100 cmbs. Tests 17W to 19W had fill and impenetrable large rocks at 90 cmbs. Tests 20W and 23W were augered to 300 cmbs, and Test 22W was augered to 145. All these tests were single augured because of the young age of the soil and the low potential for deeply buried sites.

8.6 Valley Bottom Floodplain on South Side of Minnesota River

I-35W is raised about 50 feet above the floodplain so that it is above flood levels, and much of the ROW and survey area has more than three meters of fill. So, shovel tests were generally dug along the outer margins of the ROW where the fill was thin or nonexistent. There is an interchange for West Black Dog Road on the south side of the Minnesota River.

Floodplain on East Side of I-35W

On the east side of I-35W, shovel testing was conducted on the wooded levee between the Minnesota River and West Black Dog Road. Three tests (20E, 21E, and 22E) were dug at 20-meter intervals. These tests consisted of impenetrable fill, which contained large rocks or concrete pieces at 145 cmbs.

On the east of I-35W, four shovel tests (23E to 26E) were dug at dug at 10-meter intervals in a wooded area between West Black Dog Road and Black Dog Lake. The soils consist of alternating layers of light-colored loamy sand and dark-colored sandy loam to 180 cmbs, and from 180 to 300 cmbs the soil was a dark grayish brown (10YR 4/2) silt loam (massive) to sandy loam (massive). Fill layers were noted at 250 to 260 cmbs in Test 23E and at 150 to 160 cmbs in Test 24E. The soil profile from Test 26E (Table 11) was different than the profile in the other tests, and it is uncertain if the soil in this profile was disturbed or filled. In summary, no buried soils were present in this area, and the area appears to be extensively disturbed and filled. All these tests were single augured because of the fill and the low potential for deeply buried sites.

Table 11. Shovel Test 26E Profile.

Depth Below Surface (cm)	Description
0-90	Fill
90-100	Dark grayish brown (2.5Y 4/2) silty clay loam; massive
100-170	Grayish brown (2.5Y 5/2) sandy loam; massive
170-200	Dark gray (5Y 4/1) sandy loam; massive
200-260	Dark gray (5Y 4/1) silty clay; massive
260-300	Dark gray (5Y 4/1) sandy loam; massive

Black Dog Lake, which formerly extended across the I-35W, ROW has been filled in on the east side of I-35W and drained on the west side. No tests were dug on the east side of I-35W in this area because of the fill.

South of Black Dog Lake on the east side of I-35W, tests were placed in a grassy wetland area along the edge of a bike trail that parallels I-35W. Initial tests were dug at 15 meter intervals, but the interval was increased because fill was encountered in the tests. Test 28E was dug to 260 cmbs and terminated because of impenetrable rock, which was likely fill. Tests 27E, 41E, 42E, and 43E were dug to 200 cmbs, and fill with mechanically fractured rocks (limestone and sandstone) was found to depths of 190 cmbs in these tests. Impenetrable rocky fill was encountered in Test 30E at 120 cmbs, Test 31E at 90 cmbs, and Test 32E at 160 cmbs.

Floodplain on West Side of I-35W

On the west side of I-35W, two shovel tests were dug at 20-meter intervals on the levee between the Minnesota River and West Black Dog Road. Test 28W had fill to 300 cmbs, with historic and modern debris (cement, glass, metal, and slag) to a depth of 280 cmbs. Test 29W had fill with impenetrable rocks or concrete at 115 cmbs. All these tests were single augured because of fill.

Black Dog Lake, which formerly extended to the west side of I-35W, has been drained and the surrounding area has built up for a landfill and roads. Three tests (36W to 38W) were placed on the west side of I-35W in the drained portion of the lake bottom. A soil profile for Test 36W is presented in Table 12. No buried soils are present, and the profile consists of non-pedogenically altered alluvial or lacustrine sediments (C horizons). Test 37W had fill and impenetrable rock at 70 cmbs, and Test 38W had impenetrable rock at 10 cmbs. All these tests were single augured because of the impenetrable fill and the low potential for deeply buried sites.

Table 12. Shovel Test 36W Profile.

Depth Below Surface (cm)	Description
0-120	Fill
120-160	Dark gray (2.5Y 4/1) silty clay; massive
160-285	Light olive brown (2.5Y 5/3) silty clay; massive

South of Black Dog Lake, Tests 31W to 35W were placed along the base of a large landfill. Shovel tests were dug at 75 meter and larger intervals in this area because deep and impenetrable rocky fill was encountered in each test to a maximum depth of 160 cmbs (Test 31W at 80 cmbs, Test 32W at 120 cmbs, Test 33W and 34W at 160 cmbs, and Test 35W at 150 cmbs).

8.7 Valley Bottom Low Terrace on South Side of Minnesota River

At the south end of the project area, the landscape rises slightly onto a landform mapped as a low terrace. The extensive modifications and development of the landscape make it difficult to discern the original landforms in the field or on the topo maps from various years. The low terrace is mapped on the south side of Sections 27 and 28 on the Dakota County surficial geology map (Hobbs et al. 1990). A bike trail and a landfill are along the east side of I-35W in this area.
The west side of I-35W has a road and parking lot that parallels the highway.

East Side I-35W
Tests 33E to 38E are the east side of I-35W along the edge of a large landfill. These tests were dug in 30 meter and larger intervals because of fill. Impenetrable rocks were encountered in fill from Test 33E at 150 cmbs. Tests 34E, 36E, and 38E had fill with impenetrable rocks at 90 cmbs. Test 35E had fill to 300 cmbs, and three pieces of slag at 260 cmbs. Test 37E had fill with impenetrable rocks at 210 cmbs. Tests were single augured because of fill.

Tests 39E to 40E were placed in the grassy areas of the Cliff Road interchange at the south end of the project area. Test 39E had fill with impenetrable rocks at 100 cmbs. Test 40E had impenetrable rocks at 25 cmbs.

West Side I-35W
South of the landfill, the survey area is located between Embassy Road and the road cut along I-35W. There is a quarry on the west side of Embassy Road. The survey area consists of road pavement and road cut, with an occasional narrow grass strip (one-meter wide) separating them. The area has been extensively developed and disturbed from road building and the quarry. Test 30W was dug in the narrow grassy strip between Embassy Road and the road cut along I-35W, and the test had fill to 100 cmbs. No additional tests were dug because the area is pavement, road cut, and fill. At the south end of the project is the Cliff Road interchange, which has been built up with two to three meters of fill.

9. Radiocarbon Dates

by Frank Florin

Ten samples from archaeological sites 21HE494, 21HE495, 21HE496, and 21HE497 were submitted to Beta Analytic, Inc (Beta) for AMS dating to aid in establishing the age of the components at the sites. The sample results are summarized in Table 13, along with their associated site contexts. The reports from Beta are included in Appendix C, and the samples are further discussed in the site sections.

Table 13. Radiocarbon Dates from the Sites.

Site and Provenience	Material	Beta Lab No.	$^{13}C/^{12}C$ Ratio (o/oo)	Conventional ^{14}C Age BP RCYBP	2 Sigma Calibrated Results (95% Probability)	Historic Context
21HE494 Feature 1 91-100 cmbd	Wood charcoal (charred material)	454888	-28.8 o/oo	1000 +/- 30 BP	Cal AD 990 - 1045 (cal BP 960 - 905) and cal AD 1095 - 1120 (cal BP 855 - 830) and cal AD 1140 - 1145 (cal BP 810 - 805)	Late Woodland
21HE495 ST62WS5 0-30 cmbs	Calcined (cremated) bone carbonate	454887	-18.6	4690 +/- 30 BP	Cal BC 3625 - 3590 (cal BP 5575 - 5540) and cal BC 3525 - 3485 (cal BP 5475 - 5435) and cal BC 3475 - 3370 (cal BP 5425 - 5320)	Late Archaic
21HE496 ST16 190-200 cmbs	Calcined (cremated) bone carbonate	443706	-26.4	1960 +/- 30 BP	Cal BC 40 - AD 85 (cal BP 1990 - 1865)	Early Woodland
21HE497 XU13 50-60 cmbd	potsherd residue	455235	-25.7	1280 +/- 30 BP	Cal AD 665 - 775 (cal BP 1285 - 1175)	Late Woodland
21HE497 Feature 6 E1/2 80-119 cmbd	Wood charcoal (charred material)	457227	-26.1	1270 +/- 30 BP	Cal AD 670 - 775 (cal BP 1280 - 1175)	Transitional Woodland
21HE497 Feature 6 W1/2 90-115 cmbd	Wood charcoal (charred material)	457226	-26.8	129.4 +/- 0.5 pMC (Modern)	NA – Modern	-
21HE497 Feature 5 E1/2 70-79 cmbd	Wood charcoal (charred material)	457225	-25.5	1080 +/- 30 BP	Cal AD 895 - 1020 (cal BP 1055 - 930)	Late Woodland
21HE497 ST30NE7 30-50 cmbs	Bone collagen	458050	-19.7	1150 +/- 30 BP	Cal AD 775 - 975 (cal BP 1175 - 975)	Late Woodland (probable)
21HE497 XU3 50-60 cmbd	Bone collagen	457515	-21.1	870 +/- 30 BP	Cal AD 1050 - 1085 (cal BP 900 - 865) and cal AD 1125 - 1140 (cal BP 825 - 810) and cal AD 1150 - 1225 (cal BP 800 - 725)	Late Woodland
21HE497 Feature 7 88-102 cmbd	Wood charcoal (charred material)	457514	-26.2	1690 +/- 30 BP	Cal AD 255 - 295 (cal BP 1695 - 1655) and cal AD 320 - 415 (cal BP 1630 - 1535)	Early Woodland

Database used INTCAL13; References Mathematics used for calibration scenario: A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322; **References to INTCAL13 database:** Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55(4):1869–1887. 2013.

The Beta reports provide a summary of the corrections and calibrations to the Measured Radiocarbon Age as follows:

> Dates are reported as RCYBP (radiocarbon years before present, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C activity of the National Institute of Standards and Technology (NIST) Oxalic Acid (SRM 4990C) and calculated using the Libby 14C half-life (5568 years). Quoted errors represent 1 relative standard deviation statistics (68% probability) counting errors based on the combined measurements of the sample, background, and modern reference standards. Measured 13C/12C ratios (delta 13C) were calculated relative to the PDB-1 standard. The Conventional Radiocarbon Age represents the Measured Radiocarbon Age corrected for isotopic fractionation, calculated using the delta 13C. The Conventional Radiocarbon Age is not calendar calibrated. When available, the Calendar Calibrated result is calculated from the Conventional Radiocarbon Age and is listed as the "Two Sigma Calibrated Result" for each sample.
>
> Calibrations of radiocarbon age determinations are applied to convert BP results to calendar years. The short-term difference between the two is caused by fluctuations in the heliomagnetic modulation of the galactic cosmic radiation and, recently, large scale burning of fossil fuels and nuclear devices testing. Geomagnetic variations are the probable cause of longer-term differences. The parameters used for the corrections have been obtained through precise analyses of hundreds of samples taken from known-age tree rings of oak, sequoia, and fir up to about 12,000 BP. Beyond that, back to about 42,000 BP, correlation is made using multiple lines of evidence. This older data is still subjective and should be interpreted conservatively.

10. SITE 21HE494

10.1 Overview

Site 21HE494 is a Late Woodland habitation with a very sparse artifact scatter that is located on the floodplain. The site contained Late Woodland ceramics, and charcoal from a fire hearth dated to 1000 +/- 30 RCYBP. The site is in T27N, R24W, S1/2, SE, NE, NE Section 28 (Figures 1 and 9) and is 120 by 10 meters in size, encompassing 0.3 acre. UTM coordinates are E477060 N4960950 (1983 NAD Zone 15). A map of the site on aerial imagery is presented in Figure 14. Photos of the site are in Figures 15 to17.

10.2 Physical Setting

The site is on the floodplain 75 meters north of the Minnesota River and is located between channelized Nine Mile Creek and a parking lot (Lyndale Lot – Minnesota River Bottoms Trails). The site extends 70 meters east and 50 meters west of the I-35W centerline. The eastern and western portions of the site are separated by the retaining pond under the I-35W bridge. XUs 1 and 2 are located between the pond and a park road, and XU 3 is on the east side of the park road in a depression west of the parking lot. The western portion of the site is on a narrow strip of land between channelized Nine Mile Creek and the pond. The soil excavated for the creek channel is bermed up about a meter high along the margins of the channel. The terrain is relatively flat, and surface visibility was very low (<10%).

10.3 Soils

Soils at the site are mapped as Minneiska fine sandy loam (Web Soil Survey 2017). The soils formed in alluvium on rises on the flood plain. A typical profile of the Minneiska consists of an Ap horizon from 0 to 25 cm of fine sandy loam and a C horizon from 25 to 152 cm of stratified sand to silt loam.

A soil profile from positive Shovel Test 5E, which is located in the eastern portion of the site, is presented in Table 14. The profile consists of a soil that formed in fine textured alluvium, overlying massive alluvial sediments. The soil is poorly drained and lacks a buried soil. The upper portion of the profile from 0 to 50 cmbs was fill compacted by the heavy equipment that was used to excavate the pond and build the road.

Fill and modern debris were recovered from nearby tests as follows: Test 1E had disturbed soil and bottle glass to 40 cmbs; Test 2E had glass at 135 cmbs; Test 5EAW5 had disturbed soil and glass to 80 cmbs; Test 5EAN5 had fill with a mop head at 100 cmbs; Test 6E had a pop can from 40 to 50 cmbs; and Test 7E had concrete at 100 cmbs. Additional soil profiles from the eastern portion of the site are provided with the XU 1, 2, and 3 discussions.

Table 14. Site 21HE494 Shovel Test 5E and Radials Profile.

Depth Below Surface (cm)	Description
0-50	Very dark grayish brown (2.5Y 3/2) silty clay; compacted; road gravels and wood; fill
50-80	Very dark grayish brown (2.5Y 3/2) silty clay; weak, very fine subangular blocky peds
80-130	Dark gray (2.5Y 4/1) silty clay; weak, very fine subangular blocky peds becoming massive with depth
130-280	Olive gray (5Y 4/2) silty clay; massive; with lenses of silt loam
280-300	Dark grayish brown (2.5Y 4/2) silt loam; massive

A soil profile from positive Shovel Test 7W, which is located in the western portion of the site, is presented in Table 15. The profile consists of a soil that formed in fine textured alluvium, overlying massive alluvial sediments. The soil is poorly drained and lacks a buried soil. The upper portion of the profile was very compacted and disturbed from the heavy equipment that was used to excavate the pond and channel for Nine Mile Creek.

Table 15. Site 21HE494 Shovel Test 7W Profile.

Depth Below Surface (cm)	Description
0-90	Very dark grayish brown (2.5Y 3/2) silty clay; 0-40 cm compacted; weak, very fine subangular blocky peds from 50-70 cmbs; massive from 70-90 cmbs
90-140	Dark gray (2.5Y 4/1) silty clay; massive
140-220	Dark gray (2.5Y 4/1) to gray (2.5Y 5/1) silty clay; massive
220-300	Gray (2.5Y 5/1) silty clay; massive

Modern debris was recovered from Test 7W and nearby tests as follows: Test 6W had plastic from 30 to 60 cmbs; Test 5W had plastic at 85 cmbs; Test 7W had plastic from 20 to 30 cmbs; Test 7WN8 had plastic from 20 to 40 cmbs; Test 7WN12 had fishing line and concrete from 20 to 60 cmbs and a plastic bag from 60 to 70 cmbs; and Test 7WN20 had plastic from 30 to 55 cmbs. The compacted soils and modern debris to a depth of 85 cmbs indicates that the area has been extensively disturbed from previous construction activities, and it is likely that the artifacts recovered from Tests 7W, 7WN5, and 7WW3 are not in situ.

10.4 Radiocarbon Dating

A charcoal sample from Feature 1 was submitted to Beta for radiometric dating, and the results are presented in Table 16 and Appendix x.

Table 16. Site 21HE494 Radiocarbon Date.

Material/ Provenience	Beta Lab No.	$^{13}C/^{12}C$ Ratio (o/oo)	Conventional ^{14}C Age B.P.	2 Sigma Calibrated Results (95% Probability)	Historic Context
Wood charcoal (charred material) Feature 1, 91-100 cmbd	454888	-28.8 o/oo	1000 +/- 30 BP	Cal AD 990 - 1045 (cal BP 960 - 905) and cal AD 1095 - 1120 (cal BP 855 - 830) and cal AD 1140 - 1145 (cal BP 810 - 805)	Late Woodland

10.5 Phase I Survey Methods and Results

The site was identified by shovel testing at 15-meter intervals. Tests along channelized Nine Mile Creek were placed at the base of the berm. Three tests were positive, and seven artifacts were recovered, including six ceramics and one faunal fragment (Table 17). Artifacts were recovered from 0 to 80 cmbs.

Table 17. Site 21HE494 Summary of Artifacts from Phase I Shovel Tests.

Shovel Test	Depth (cmbs)	Count	Artifact Type
5E	50-80	5	Ceramic, grit temper, cord marked and smoothed over cordmarking
5EA	40-60*	1	Ceramic, shell temper, smooth
7W	0-30	1	Medium/large Mammal longbone fragment
Total	-	**7**	-

*likely from fill or disturbed soil – see soil discussion above for adjacent Tests 5EAW5 and 5EAN5 and for XU 3 below

10.6 Phase II Survey Methods and Results

Phase II testing methods consisted of digging close-interval tests adjacent to the positive Phase I tests in order to refine site limits, make a preliminary assessment of site integrity, recover additional artifacts, and provide data on intra-site artifact patterning. The Phase II close-interval radial shovel tests were numbered based on the direction and distance from the Phase I test. For example, Shovel Test 5EN5 is located five meters grid north of Shovel Test 5E. Three XUs were placed in site areas that offered the greatest research potential based on the data from the shovel tests.

10.7 Phase II Shovel Testing

Phase II shovel tests were typically dug at five meter intervals in cardinal directions adjacent to the positive Phase I tests. However, smaller and larger intervals were also used to aid in assessing disturbances and avoiding disturbed areas. Four Phase II shovel tests were positive, and six artifacts were recovered, including four faunal fragments and two pieces of lithic debris (Table 18). The lithic from Test 5EAN5 was recovered from fill. Artifacts were recovered from 0 to 125 cmbs.

Table 18. Site 21HE494 Summary of Artifacts from Phase II Shovel Tests.

Shovel Test	Depth (cmbs)	Count	Artifact Type
5EAN5	0-10*	1	Bifacial thinning flake; Cedar Valley Chert
5EN5	115-125	1	Broken flake; unidentified chert
7WN5	0-20	1	Medium/large Mammal unidentified fragment, calcined
	35-55	1	Medium/large Mammal unidentified fragment, calcined & charred
7WW3	50-65	2	Faunal, unidentified fragment, charred
Total	-	**6**	-

*artifact in fill

10.8 XUs 1 and 2

XUs 1 and 2 were contiguous units centered on Phase I Shovel Test 5E, which yielded five small ceramic sherds. The units were on the west side of the park road. The landscape sloped down to the west towards the pond. Fill was removed from 0 to 65 cmbd. Excavation was terminated at a depth of 95 cmbd in XU 1 and 105 cmbd in XU 2 because of the lack of artifacts. A shovel test was placed in the base of the unit and dug to 125 cmbs to examine the soils and ensure that no deeply buried archaeological deposits were present.

Only one piece of lithic debris was recovered from the XUs (Table 19). Feature 1, a fire heath, was identified at 91 cmbd and is discussed below. Modern debris was observed as follows: a plastic bag in the wall at 50 to 55 cmbd; plastic, concrete, and road gravels from 65 to 75 cmbd; a plastic bead and wire from 75 to 85 cmbd; and a pen tip and small piece of concrete from 85 to 95 cmbd. A small amount of road gravels were present to the bottom of excavation.

Table 19. Site 21HE494 Summary of Artifacts from XUs 1 and 2, Excluding Feature 1.

Depth (cmbd)	Lithic Debris	Total	%
0-65*	-	-	0
65-75	1	1	100
75-105	-	-	0
Total	**1**	**1**	**-**
%	**100**	**-**	**100**

*removed fill from 0 to 65 cmbd

Wall profiles and photographs from XUs 1 and 2 that depict the soil horizons are presented in Figures 18 to 20. The soil profile consists of fill to a maximum depth of 65 cmbd, overlying intact soils. The contact between the fill and intact soil indicates mechanical disturbance, probably from heavy equipment during construction of the road or pond. A small amount of road gravels and modern items occur throughout the soil profile to a depth of 105 cmbd. It is likely these items were displaced downward through the soil by natural processes, such as freeze-thaw and bioturbation. The soils below the fill appear to be relatively undisturbed, as indicated by the intact fire hearth that was present. The cultural deposits appear to retain integrity, as only a minimal amount of rodent burrows and other disturbances were observed below the fill.

However, soil profiles from adjacent shovel tests indicate more substantial disturbance. Test 5ES5, which is five-meters south of XUs 1 and 2, had fill to 45 cmbs, a dark gray (2.5Y 4/1) clay from 45 to 120 cmbs, and olive brown (2.5Y 4/3) massive clay from 125 to 160 cmbs. Test 5EW2, which is two meters west of XUs 1 and 2, had fill to 45 cmbs, a dark gray (2.5Y 4/1) silty clay from 45 to 55 cmbs, dark grayish brown (2.5Y 4/2) silty clay from 55 to 90 cmbs, and olive brown (2.5Y 4/3) massive clay from 90 to 160 cmbs. In summary, the soil horizons that contained the intact archaeological deposits in XUs 1 and 2 (2.5Y 3/1 and 2.5Y 3/2 silt clay horizons) were absent in these two tests and were probably removed during construction. Tests 5EN5 and 5EE2.5 were similar to XUs 1 and 2, but they were missing the 2.5Y 3/1 silt clay horizon. No artifacts were recovered from any of these adjacent radial tests.

Feature 1 in XUs 1 and 2

Feature 1 was initially identified at 91 cmbd as a large and dark, oval-shaped soil stain with charcoal flecking. The feature is located mostly in the southwest portion of XU 2, with a small portion extending into the unexcavated area west of XU 2. Based on the extent of the feature in planview, most of the feature (c. 80%) was contained in XU 2 and was excavated. A charcoal sample recovered from the feature yielded a radiocarbon date of 1000 +/- 30 RCYBP (Table 16).

The planview and profile of Feature 1 were recorded in illustrations and photos during excavation (Figures 21 to 23). Planviews of the feature at 91 and 93 cmbd were recorded. Feature 1 was oval-shaped and about 75 cm by 52 cm in size. In profile, the feature was nine cm deep, extending from 91 to 100 cmbd, and it had a shallow basin shape. All feature fill (25 liters) was troweled and bagged for flotation. Flotation and analysis of the botanicals recovered from the light and heavy fractions was conducted by Connie Arzigian (paleoethnobotanist) and staff at MVAC.

The slightly darker color of the feature was likely caused by carbon-stained sediments from charcoal. A small amount (less than a teaspoon) of charred wood fragments was recovered from feature fill during excavation and flotation. The feature is interpreted as a fire hearth for cooking or heating, based on the shallow basin shape, presence of charcoal, and lack of FCR. No oxidized (orangish-colored) soil or ash was observed in or around the feature. Feature 1 contained two ceramic sherds that were recovered at 97 cmbd during excavation of the feature fill. Both sherds are thin and grit tempered, with a cordmarked surface on one sherd and undetermined surface on the other. They appear to be Late Woodland ceramics. No artifacts were recovered from the heavy or light fractions during flotation of the feature fill.

A summary of charred botanical materials recovered from feature flotation is presented in Table 20. Small amounts of the following charred plant remains were recovered: unidentified starchy material (possibly from grass seeds, root tubers, or other starchy material); Scirpus sp. (bulrush); and Poaceae (grass family) seed fragments that are similar to wild rice; unidentified charred embryos; and charred wood. Also, many unidentifiable gastropods were present. A small quantity of wood charcoal fragments (0.2 grams) was collected during feature excavation for dating.

Table 20. Site 21HE494 Feature 1 Botanical Summary.

<table>
<tr><th>Provenience</th><th>Soil Volume Floated (liters)</th><th>Light Fraction >10 mesh (% sorted)</th><th>Light Fraction 10-20 mesh (% sorted)</th><th>Light Fraction <20 mesh (% sorted)</th><th>Charred Flora Recovered</th></tr>
<tr><td rowspan="6">Feature 1
91-102 cm</td><td rowspan="6">25</td><td rowspan="6">100%</td><td rowspan="6">100%</td><td rowspan="6">12.5% (1/8)</td><td>Starchy material, possibly from grass seeds, root tubers, or other starchy material; 0.153 grams, 100+ small fragments</td></tr>
<tr><td>Scirpus sp. (bulrush) 5 seeds, suggesting nearby wetlands</td></tr>
<tr><td>Poaceae, grass family: 17 fragments that are similar to Zizania aquatica, wild rice, though somewhat smaller than expected. They are very puffed up, as if charred while moist, and many of the seed fragments are similar to the starchy material tabulated above.</td></tr>
<tr><td>Poaceae, grass family: 3 additional small circular seeds from 10-20 mesh, and 1 (extrapolated to 8) from the <20 mesh sample; these represent a variety of species</td></tr>
<tr><td>Charred embryos, from at least 2 different plants</td></tr>
<tr><td>Small amount of charred wood</td></tr>
</table>

10 mesh = .0787 inches / 2 mm; 20 mesh = .0331 inches / 0.8 mm

10.9 XU 3

XU 3 was placed adjacent to and south of Phase I Shovel Test 5EA, which yielded a ceramic sherd. The unit was in a brushy depression on the east side of the park road. The landscape was fairly level. Excavation was terminated at a depth of 70 cmbs because of the lack of artifacts. A shovel test was placed in the base of the unit and dug to 103 cmbs to examine the soils and ensure that no deeply buried archaeological deposits were present. A summary of artifacts from the XU 3 is presented in Table 21. Only one artifact, a piece of lithic debris, was recovered. A small amount of plastic and glass was observed from 0 to 40 cmbs.

Table 21. Site 21HE494 Summary of Artifacts from XU 3.

Depth (cmbs)	Lithic Debris	Total	%
0-20	-	**0**	**0**
20-30	1	**1**	**100**
30-70	-	**0**	**0**
Total	**1**	**1**	**-**
%	**100**	**-**	**100**

A wall profile from the XU 3 that depicts the soil horizons is presented in Figure 24. The soil profile consists of fill or disturbed soil to a maximum depth of 58 cmbs, based on the following information: a light colored soil lens is present at 43 cmbs, a small amount of plastic and glass was observed from 0 to 40 cmbs, the irregularity of the contact between soil II and III on the east side of the north wall at 58 cmbs indicates mechanical disturbance, probably from heavy equipment during construction in the area; soil III, which contained the intact archaeological deposits in XUs 1 and 2, was not present in XU 3; and the soil structure of soil III has a very strong, medium prismatic structure, which was not present in the soil in XUs 1 and 2 and is likely fill or altered by compaction from heavy construction equipment.

Soil profiles from adjacent shovel tests also indicate substantial disturbance. Test 5EAW5, which is five-meters west of XU 3, had fill with glass and large rocks to 80 cmbs. Test 5EAN5, which is five-meters north of XU 3, had fill with a mop head at 100 cmbs. Test 5EAE5, which is five-meters east of XU 3, had fill to 60 cmbs. No artifacts were recovered from any of these adjacent radial tests.

10.10 Artifact Summary and Analysis

A total of 17 artifacts, weighing 25.2 grams, was recovered from the site during the Phase I survey and Phase II evaluation (Table 22). Artifacts included eight ceramic sherds, five faunal fragments, and four lithics.

Table 22. Site 21HE494 Summary of Artifacts by Count and Weight.

Artifact Type	Total by Count (Weight g)	% by Count (Weight g)
Ceramic	**8 (7.7)**	**47 (31)**
Faunal	**5 (13.1)**	**29 (52)**
Lithic	**4 (4.4)**	**24 (17)**
Total	**17 (25.2)**	**-**
%	-	**100**

Ceramics

A total of eight ceramic body sherds were recovered, and all were from the eastern portion of the site. Six sherds had a smoothed-over, cordmarked surface treatment with grit temper. One sherd had a smooth surface and shell temper, and one sherd had an indeterminate surface treatment with grit temper. All sherds have thin vessel walls (1.9 minimum to 4.0 mm maximum thickness, with an average thickness of 3.3 mm). The ceramics were small fragmentary pieces and included two sherds that were SG2, five sherds SG3, and one sherd SG4. The precise ceramic wares present at the site are unknown because of the absence of rims and decorated sherds. The sherds with the cordmarked surface and grit temper are most similar to Late Woodland types, which is likely Madison ware in this area. A cordmarked sherd was found in association with charcoal from Feature 1 that dated to 1000 +/- 30 RCYBP, which fits the expected age of Madison ware. The sherd with the smooth surface and shell temper is most similar to Oneota types, which is likely Blue Earth ware in this area.

Fauna

Five faunal fragments were recovered, and all were from the western portion of the site. The assemblage includes three fragments from a medium to large-size mammal (including a partially-mineralized long bone fragment) and two fragments unidentifiable as to taxon. Four of the fauna are thermally-altered (calcined and charred), providing conclusive evidence that the bones are associated with human activities. The partially mineralized condition of one bone suggests it is fairly old and not modern. Although the soil context of the bones is partially disturbed, it is similar to the eastern portion of the site where Late Woodland ceramics and a fire hearth were identified. The fauna can't be directly associated with the Late Woodland component in the eastern portion of the site because of the substantial distance between these areas (90 meters) and the soil disturbances in the vicinity of the tests that yielded the fauna. The fauna were small fragmentary pieces that included one SG2 fragment, two SG3 fragments, and two SG4 fragments.

Lithics

The assemblage consists of four pieces of lithic debris (Table 23). The lithic from Test 5EAN5 was recovered from fill, and because of its uncertain provenience, it is not considered part of the site assemblage. The lithic assemblage is very sparse, and the sample size is too small to provide interpretive data on lithic activities. Flake types include bifacial thinning, nonbifacial, and broken flakes. Size grades for the lithics included two pieces that were SG2 and two pieces that were SG3. Three lithics were heat treated.

Lithic materials consisted of Prairie du Chien (oolitic) Chert, unidentified chert, quartzite, and Cedar Valley Chert. Prairie du Chien (oolitic) Chert is locally available. The unidentified chert may be local or exotic. Cedar Valley Chert is a non-local, high-quality material from southeastern Minnesota that was likely acquired through exchange networks or travel.

Table 23. Site 21HE494 Lithic Artifact Summary.

Material	Bifacial Thinning	Nonbifacial	Broken	Total	Size Grade	Heat Treated
Prairie du Chien Chert (oolitic)	-	1	-	1	2	Yes
Cedar Valley Chert*	1	-	-	1	2	Yes
Quartzite	-	1	-	1	3	Yes
Unidentified Chert	-	-	1	1	3	No
Total	**1**	**2**	**1**	**4**	-	-
%	**25**	**50**	**25**	**-**	-	-

* recovered from fill in Test 5EAN5

10.11 Conclusions and Recommendations

Site 21HE494 is a Late Woodland habitation that consists of a very sparse artifact scatter. The site is located within the construction limits on the floodplain on the north side of the Minnesota River. There may be multiple components at the site, as one ceramic sherd is similar to Oneota ware, and the age and cultural context of the fauna in the western portion of the site are unknown. The faunal material, which appears to be in a disturbed context, was recovered 90 meters from the Late Woodland component and is separated from it by a large retaining pond under the I-35W bridge. A fire hearth feature was identified and excavated. A Late Woodland sherd was found in association with charcoal from the feature, which dated to 1000 +/- 30 RCYBP. The primary Late Woodland manifestation in this region is the Effigy Mound Complex with Madison ware ceramics. Artifact density was very low and included eight ceramic sherds, five faunal fragments, and four pieces of lithic debris. Site activities include cooking or heating and lithic reduction. The animal remains suggest subsistence activities.

Phase II evaluation included three (1-x-1 meter) XUs and close-interval shovel tests. Testing revealed that previous construction activities have caused extensive disturbance to the archaeological deposits at the site. The site lacks integrity except for a very small area at XUs 1 and 2.

The research potential of the site is very low because of the lack of integrity and sparse and limited artifact assemblage. The site is not capable of providing important information on relevant research themes for the Late Woodland or precontact period under NRHP Criterion D (See Section 2.3 Research Themes). The site is recommended not eligible for listing on the National Register of Historic Places because it lacks integrity and does not meet National Register Criteria A, B, C, or D. No further archaeological work is recommended at the site.

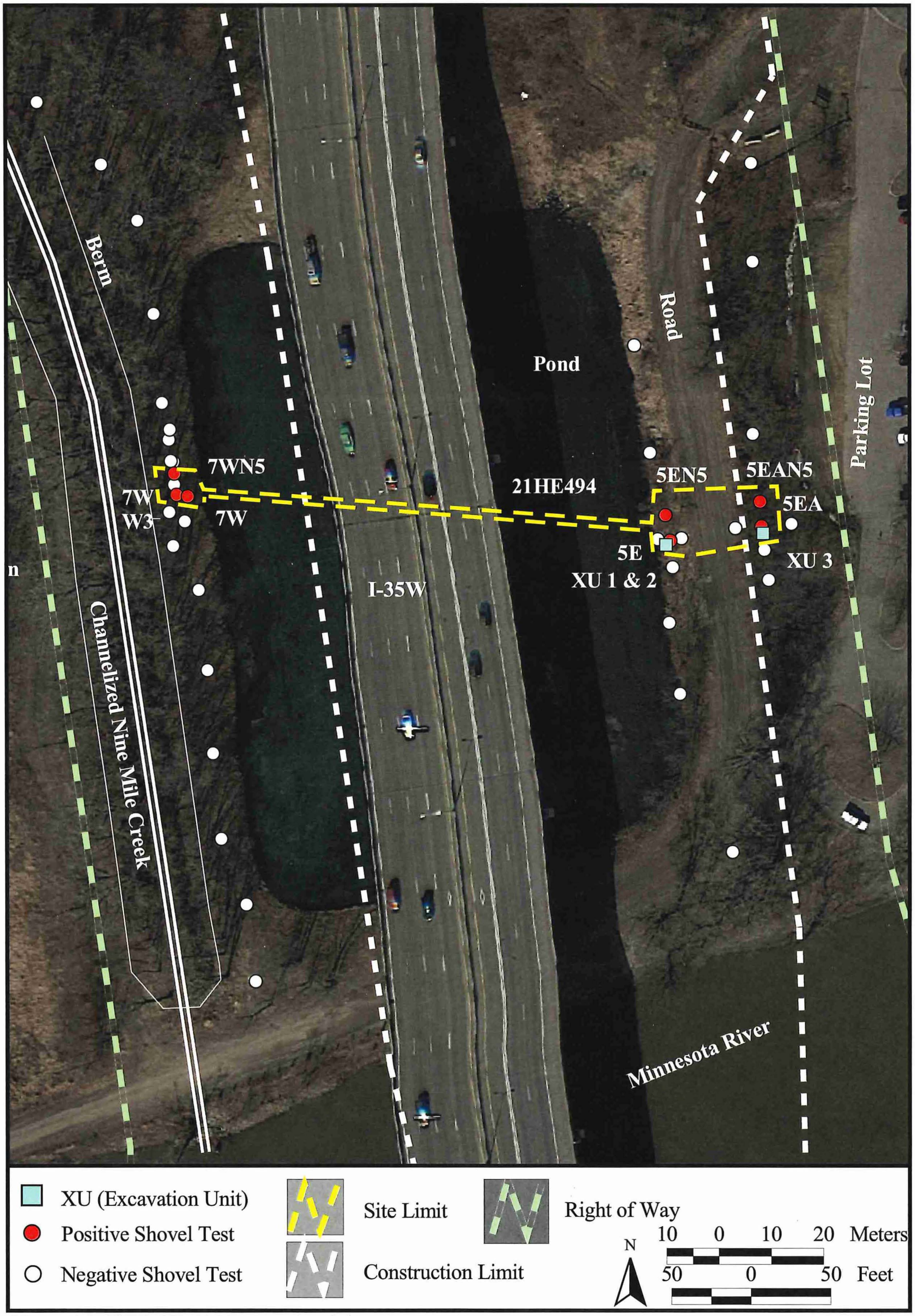


Figure 14. Site 21HE494 Map on Aerial Imagery.

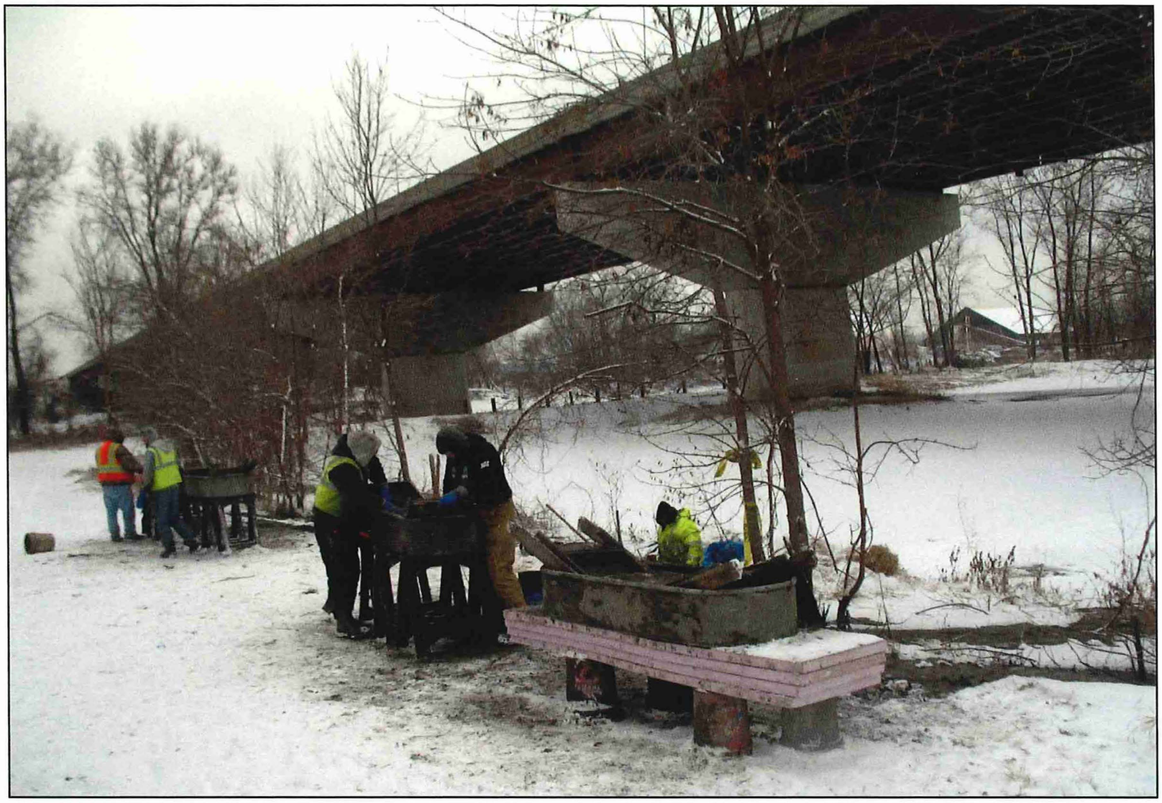


Figure 15. Site 21HE494 Photo of XUs 1 and 2 in Eastern Portion of Site, Facing Southwest.

Figure 16. Site 21HE494 Photo of XUs 1 and 2 in Eastern Portion of Site, Facing Northwest.

Figure 17. Site 21HE494 Photo of Shovel Test 7W Area in Western Portion of Site, Facing North (pond on the right and channelized Nine Mile Creek on left).

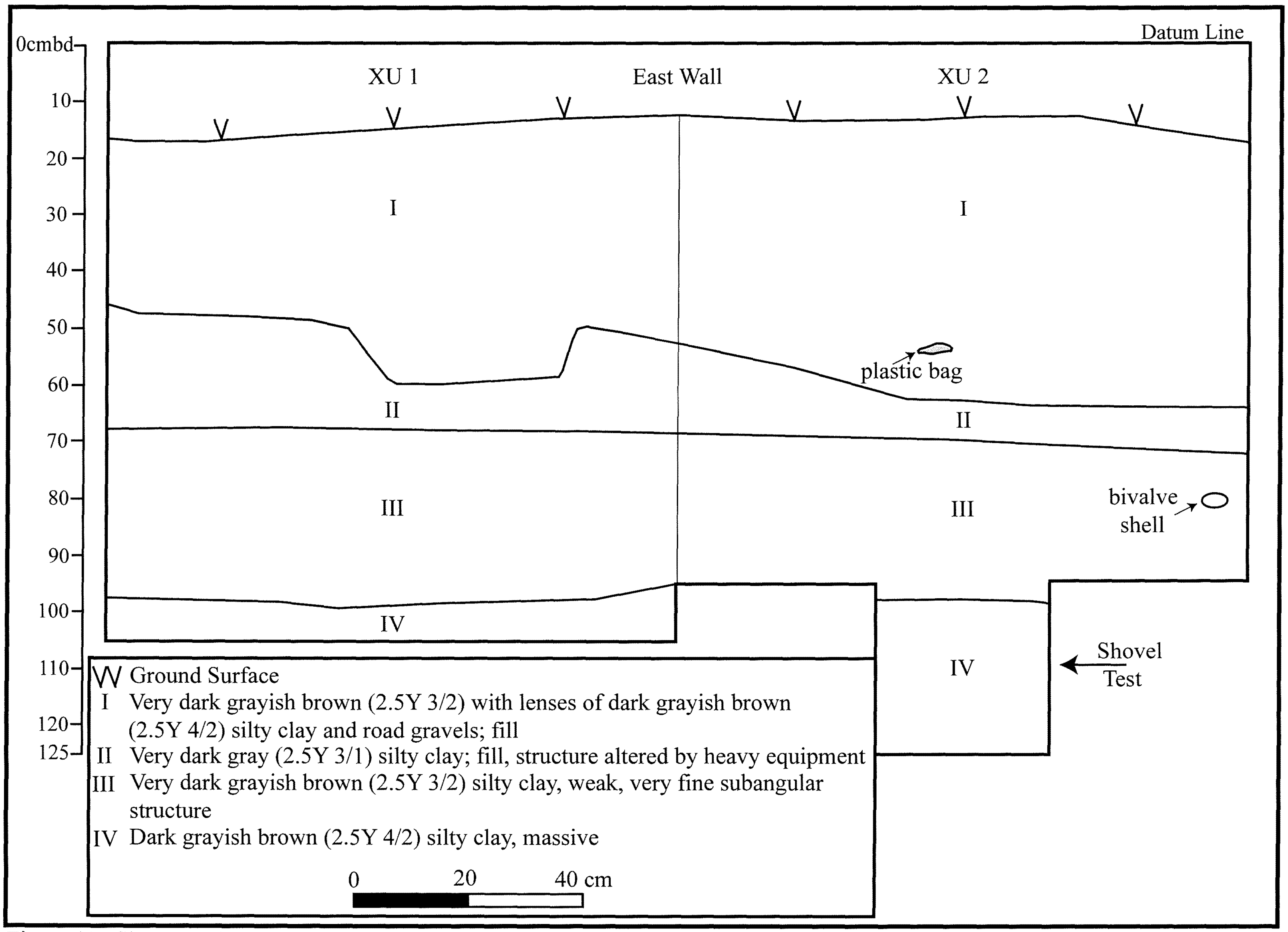


Figure 18. Site 21HE494 XUs 1 and 2 East Wall Profile.

Figure 19. Site 21HE494 Photo XUs 1 and 2 East Wall Profile (mid-section plucked).

Figure 20. Site 21HE494 Photo XUs 1 and 2 East Wall Profile (plucked).

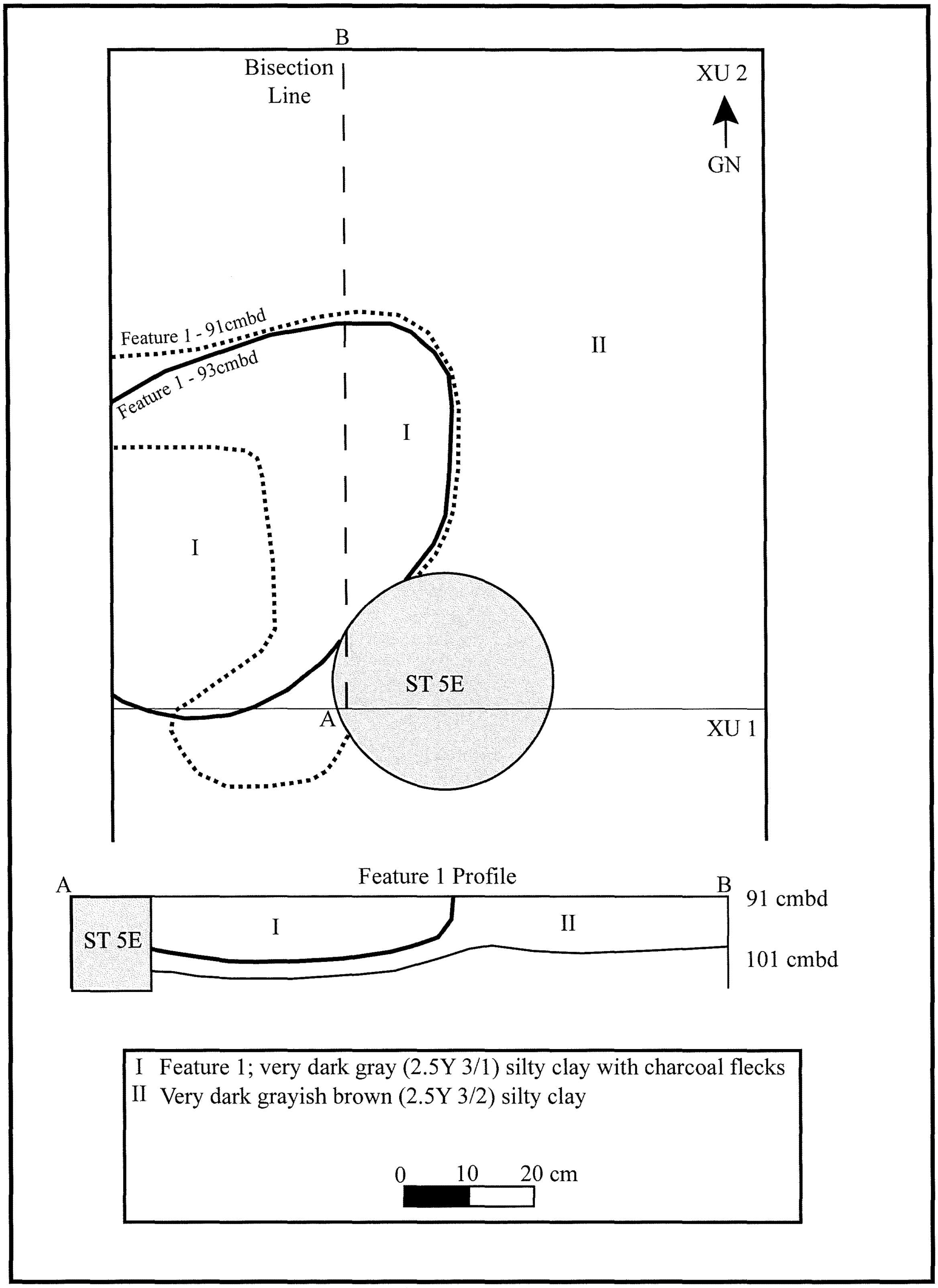


Figure 21. Site 21HE494 Feature 1 Planview and Profile.

Figure 22. Site 21HE494 Photo Feature 1 Planview at 91 cmbd.

Figure 23. Site 21HE494 Photo Feature 1 After Excavation, Maximum Depth 101 cmbd.

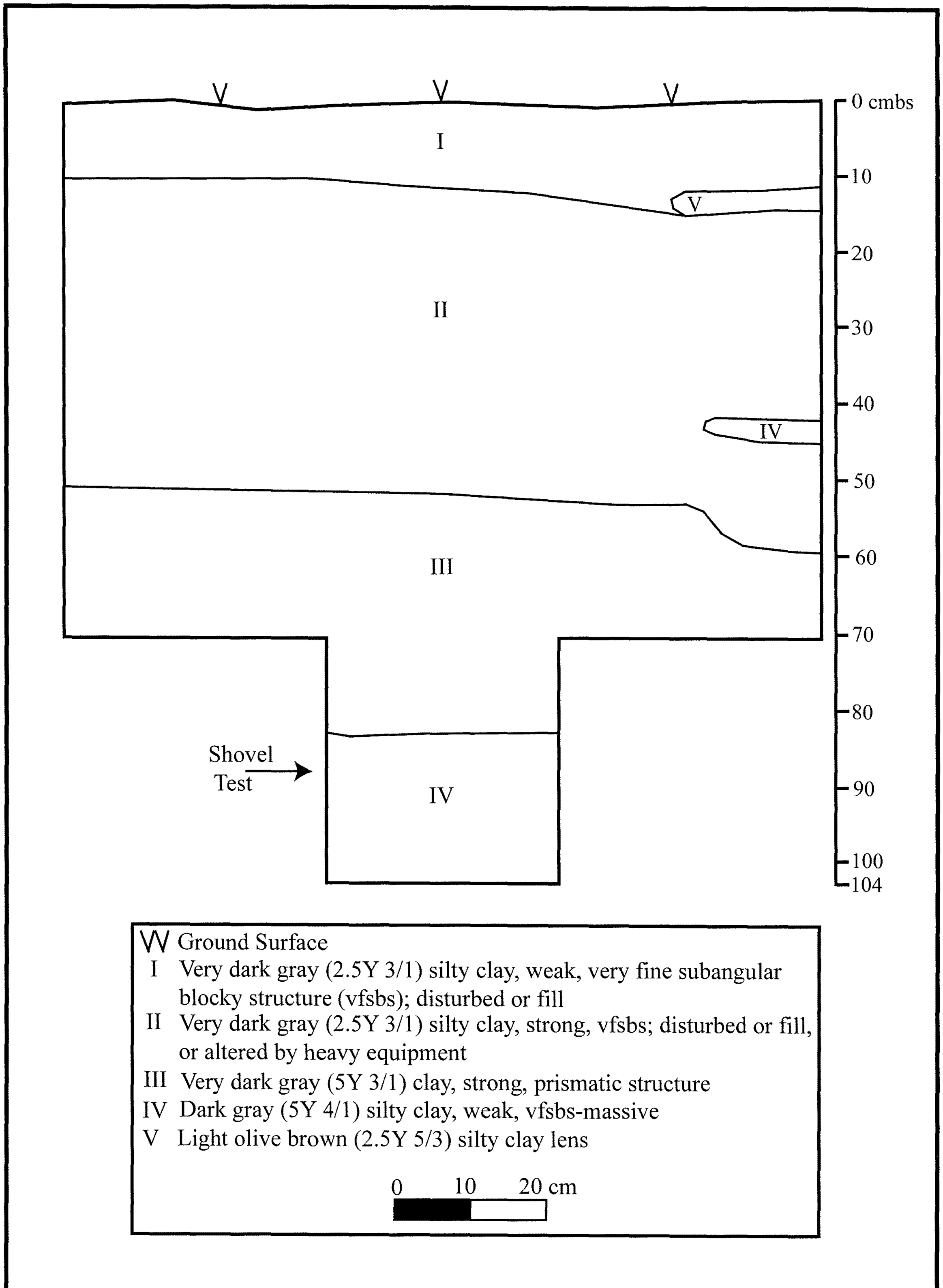


Figure 24. Site 21HE494 XU 3 North Wall Profile.

11. SITE 21HE495

11.1 Overview

Site 21HE495 is a Late Archaic habitation with a sparse artifact scatter that is located on the bluff. No diagnostic artifacts were recovered, but a faunal sample dated to 4690 +/- 30 RCYBP. Other components may also be present. The site is in T27N, R24W, E1/2, NW, SE, SE, Section 21 (Figures 1 and 9) and occupies an area of approximately 110 by 12 meters, encompassing 0.3 acre. The UTM coordinates for the center of the site are E476900 N4961570 (1983 NAD Zone 15). A map of the site on aerial imagery is presented in Figure 25. Photos of the site area are included in Figures 26 and 27.

11.2 Physical Setting

The site is on the bluff edge overlooking the Minnesota River valley. The site extends from the bluff edge back 115 meters. The site is on the west side of I-35W and extends between 56 and 72 meters west of the centerline. The site is bordered by the road cut on the east and River Terrace Drive on the west. The site area is grassy with some brush, and surface visibility was poor (less than 10%).

11.3 Soils

Soils at the site are mapped as Malardi series, which formed in loamy outwash sediments and the underlying sandy and gravelly outwash sediments (Web Soil Survey 2017). A typical profile for this series consists of the following horizons: Ap – from 0 to 25 cm of sandy loam; Bt – from 25 to 38 cm of sandy loam; 2Bt – from 38 to 74 cm of loamy coarse sand; and 2C – from 74 to 200 cm of gravelly sand. The soil profiles from the site had more clay in the upper soil horizons than those described for a typical profile. The fine textured deposits are likely a fining sequence of suspended particles that settled out at the end of the outwash event. However, the basal horizons were similar to those in the Malardi series and consisted of sand and gravelly sand. The soil profiles from the site are provided with the XU discussions below.

11.4 Radiocarbon Dating

A calcined faunal fragment was submitted to Beta for AMS dating, and the results are presented in Table 24.

Table 24. Site 21HE495 Radiocarbon Date.

Material/ Provenience	Beta Lab No.	$^{13}C/^{12}C$ Ratio (o/oo)	Conventional ^{14}C Age B.P.	2 Sigma Calibrated Results (95% Probability)	Historic Context
Calcined (cremated) bone carbonate ST62WS5 0-30 cmbs	454887	-18.6	4690 +/- 30 BP	Cal BC 3625 - 3590 (cal BP 5575 - 5540) and cal BC 3525 - 3485 (cal BP 5475 - 5435) and cal BC 3475 - 3370 (cal BP 5425 - 5320)	Late Archaic

11.5 Phase I Survey Methods and Results

The site was identified during Phase I shovel testing in five and ten-meter intervals. A total of 13 Phase I shovel tests were positive, and 26 artifacts were recovered, including 21 pieces of lithic debris, two stone tools, and three historic or modern items (Table 25). Artifacts were recovered from 0 to 80 cmbs, with most artifacts recovered from 0 to 40 cmbs. Artifacts were recovered from disturbed soil or fill in eight shovel tests (48W, 49W, 70W, 83W, 84W, 87W, 90W, and 91W).

Table 25. Site 21HE495 Summary of Artifacts from Phase I Shovel Tests.

Shovel Test	Depth (cmbs)	Count	Artifact type
48W*	0-15	1	Bifacial thinning flake, Lake Superior Agate
	25-40	1	Broken flake, quartzite
49W*	20-40	1	Decortication flake, Red River Chert
62W	60-80	1	Edge preparation flake, Prairie du Chien Chert (oolitic)
65W	0-20	1	Utilized flake, Red River Chert
		1	Decortication flake, Prairie du Chien Chert (oolitic)
		1	Decortication flake, Swan River Chert
		1	Bifacial shaping flake, unidentified chert
	60-80	1	Broken flake, Prairie du Chien Chert (oolitic)
70W*	20-40	1	Bifacial thinning flake, fusilinid chert
72W	30-40	1	Nonbifacial flake, Red River Chert
		1	Historic, iron, wire fragment
75W	0-40	1	Decortication flake, Red River Chert
		1	Bifacial thinning flake, Prairie du Chien Chert (oolitic)
		1	Broken flake, Prairie du Chien Chert (oolitic)
		1	Historic, iron, washer
81W	20-40	1	Bifacial thinning flake, unidentified chert
83W*	10-40	1	Nonbifacial flake, Prairie du Chien Chert (oolitic)
		1	Broken flake, Prairie du Chien Chert (oolitic)
		1	Other G4 flake, Prairie du Chien Chert (oolitic)
84W*	10-20	1	Decortication flake, Prairie du Chien Chert (oolitic)
		1	Historic, glass, clear bottle fragment
87W*	0-30	1	Side & end scraper, Grand Meadow Chert
90W*	30-45	1	Bifacial thinning flake, Knife Lake Siltstone
91W*	20-45	1	Decortication flake, unidentified chert
		1	Shatter, Prairie du Chien Chert (oolitic)
Total	-	**26**	-

* soil is disturbed or fill

11.6 Phase II Survey Methods and Results

Phase II testing methods consisted of digging close-interval tests adjacent to the positive Phase I tests in order to refine site limits, make a preliminary assessment of site integrity, recover additional artifacts, and provide data on intra-site artifact patterning. The Phase II close-interval radial shovel tests were numbered based on the direction and distance from the Phase I test. For example, Shovel Test 48WS5 is located five meters grid south of Shovel Test 48W. Ten XUs were placed in site areas that offered the greatest research potential, based on the data from the shovel tests.

11.7 Phase II Shovel Testing

Phase II shovel tests were typically dug at five meter intervals in cardinal directions adjacent to the positive Phase I tests. Ten Phase II shovel tests were positive, and 24 artifacts were recovered, including 17 pieces of lithic debris, a core, three fauna, and three historic or modern items (Table 26). Artifacts were recovered from 0 to 80 cmbs. Artifacts were recovered from disturbed soil or fill in three shovel tests (49WN5, 49WS5, and 64WS5).

Table 26. Site 21HE495 Summary of Artifacts from Phase II Shovel Tests.

Shovel Test	Depth (cmbs)	Count	Artifact type
48WS5	70-80	1	Shatter, Swan River Chert
48WN5	35-40	1	Broken flake, Grand Meadow Chert
		1	Historic, clinker fragment
	55-60	1	Nonbifacial flake, Swan River Chert
		1	Historic, iron, wire nail
49WN5*	0-30	1	Broken flake, Prairie du Chien Chert (oolitic)
	30-40	1	Historic, iron, wire nail
49WS5*	20-40	1	Other G4 flake, unidentified chert
62WS5	0-30	1	Shatter, Jasper Taconite
		1	Shatter, Swan River Chert
		3	Medium/large mammal, unidentified fragment, calcined
62WN5	20-35	1	Bipolar flake, quartz
		1	Bifacial shaping flake, Swan River Chert
64WS5*	20-40	1	Decortication flake, quartz
	40-60	1	Nonbifacial flake, Prairie du Chien Chert (oolitic)
65WN5	30-40	1	Bipolar flake, Swan River Chert
	50-60	1	Broken flake, Lake Superior Agate
65WS5	0-20	1	Decortication flake, Prairie du Chien Chert (oolitic)
		1	Nonbifacial flake, quartzite
		1	Shatter, Red River Chert
66WN5	0-20	1	Freehand nonbifacial core, Prairie du Chien Chert (oolitic)
		1	Bifacial shaping flake, Prairie du Chien Chert (oolitic)
Total	-	**24**	-

* soil is disturbed or fill

11.8 Phase II XUs 1 to 10 Artifact Summary and Soils

<u>Overview</u>

Ten XUs were dug at the site, and all were dug in 10-cm levels below the ground surface. XUs were placed adjacent to positive shovel tests that had the most artifacts, faunal material, and offered the greatest potential for recovering artifacts from undisturbed soil. Table 27 summarizes XU location, depth, extent of soil disturbances, and relevant comments. Shovel tests were placed in the base of most XUs to examine the soils and ensure that no deeply buried archaeological deposits were present.

Table 27. Site 21HE495 Summary Data for XUs 1 to 10.

XU #	Adjacent Shovel Test #	Max Depth of XU (cmbs)	Max Depth of ST (cmbs)	Extent of Soil Disturbance	Comments
1	48WN5	70	110	Moderate disturbance from 0 to 17cmbs; minimal disturbance below 17 cmbs	Very compacted soil
2	49W	60	96	Ap horizon, extensive mechanical disturbance from 0 to 35 cmbs; minimal disturbance below 35 cmbs	Very compacted soil
3	65W	70	128	Minimal	Slightly compacted soil
4	66WN5 & XU9	50	105	Minimal	Slightly compacted soil
5	66WS5	50	NA	Ap horizon, extensive mechanical disturbance from c. 0 to 32 cmbs; minimal to moderate rodent burrow disturbance below 32 cmbs	Slightly compacted soil
6	62WS5	60	100	Ap horizon, extensive mechanical disturbance from 0 to 80 cmbs	Very compacted soil
7	75W	60	80	Minimal	Slightly compacted soil
8	65WN5	60	125	Extensive mechanical disturbance from 0 to 60 cmbs	Compacted soil
9	66WN5 & XU4	50	90	Minimal	Slightly compacted soil
10	74W	50	80	Minimal	Slightly compacted soil

Soils Profiles and Disturbances

Wall profiles and photographs from the XUs that depict the soil horizons are presented in Figures 28 to 47. In general, the soil profiles from the units are similar in having fine textured outwash overlying sandy and gravelly outwash. The fine textured deposits are mostly silty clay loam with a small amount of gravel. The sandy outwash occurred as high as 40 cmbs in XUs 4 and 9. In other units (like XU 8), sandy outwash was not encountered, as the overlying fine textured deposits were thicker, extending as deep as 125 cmbs. A typical profile in undisturbed units consists of A and B horizons of silty clay loam outwash overlying 2B and 2C horizons of sandy and gravely outwash.

Disturbance from rodent burrows was observed in most units and assessed as minimal to moderate during excavation. Small tree roots were present in some units. Mechanical disturbances from heavy equipment were observed in some units extending to a depth of 80 cmbs, and they are likely from previous highway construction. Other units appeared to be relatively undisturbed. Information on soil disturbances in the XUs is summarized in Table 27 above.

XU Artifact Summary

A summary of artifacts from XUs 1 to 10 is presented in Table 28. Artifacts consist primarily of lithic debris (n=141), with much smaller amounts of stone tools (n=11, including one core), fauna (n=2), FCR (n=1), and historic/modern items (n=11). No diagnostic artifacts were recovered, and no features were identified. Artifacts were recovered from 0 to 60 cmbs. Most of the artifacts (n=130; 78%) were recovered from 10 to 30 cmbs (Table 29). The vertical distribution of precontact artifacts in the XUs is clustered in a 20-cm thick zone. The small number of artifacts above and below this zone was likely displaced by natural processes and in some XUs by mechanical disturbances. In XUs 1, 3, and 6 historic/modern items were found below precontact artifacts. A summary of artifacts recovered from each of the XUs is presented in Tables 30 to 39. Overall, the amount of artifacts in the XUs was low, with four of the 10 XUs having fewer than 10 artifacts and three XUs having between 10 and 20 artifacts. The XUs with the most artifacts were XUs 4, 8, and 9, which had between 28 and 34 artifacts, although XU 8 was extensively disturbed.

Table 28. Site 21HE495 Artifact Summary for XUs 1 to 10.

XU	Lithic Debris	Lithic Tool	Faunal	FCR	Historic	Total
1	3	1	2	-	2	**8**
2	1	1	-	-	2	**4**
3	15	2	-	-	2	**19**
4	30	1	-	-	1	**32**
5	12	1	-	-	-	**13**
6	7	-	-	-	2	**9**
7	13	1	-	-	-	**14**
8	25	1	-	1	1	**28**
9	32	2	-	-	-	**34**
10	3	1*	-	-	1	**5**
Total	**141**	**11**	**2**	**1**	**11**	**166**

*core

Table 29. Site 21HE495 Summary of Artifacts by Depth for XUs 1 to 10.

Depth (cmbs)	Artifact Count
0-10	3
10-20	66
20-30	64
30-40	26
40-50	3
50-60	4
Total	**166**

Table 30. Site 21HE495 Artifact Summary for XU 1.

Depth (cmbs)	Lithic Debris	Lithic Tool	Faunal	Historic	Total	%
0-30	-	-	-	-	-	-
30-40	1	1	2	-	**4**	**50**
40-50	-	-	-	1	**1**	**13**
50-60	2	-	-	1	**3**	**38**
60-70	-	-	-	-	-	-
Total	**3**	**1**	**2**	**2**	**8**	-
%	**38**	**13**	**25**	**25**	-	**100**

Table 31. Site 21HE495 Artifact Summary for XU 2.

Depth (cmbs)*	Lithic Debris	Lithic Tool	Historic	Total	%
0-20	-	-	-	-	-
20-30	1	1	2	**4**	**100**
30-60	-	-	-	-	-
Total	**1**	**1**	**2**	**4**	-
%	**25**	**25**	**50**	-	**100**

* disturbed soil (Ap horizon) from 0 to 35 cmbs

Table 32. Site 21HE495 Artifact Summary for XU 3.

Depth (cmbs)	Lithic Debris	Lithic Tool	Historic	Total	%
0-10	1	-	-	**1**	**5**
10-20	11	2	-	**13**	**68**
20-30	1	-	2	**3**	**16**
30-40	2	-	-	**2**	**11**
40-70	-	-	-	-	-
Total	**15**	**2**	**2**	**19**	-
%	**79**	**11**	**11**	-	**100**

Table 33. Site 21HE495 Artifact Summary for XU 4.

Depth (cmbs)	Lithic Debris	Lithic Tool	Historic	Total	%
0-10	-	1	1	**2**	**6**
10-20	19	-	-	**19**	**59**
20-30	9	-	-	**9**	**28**
30-40	2	-	-	**2**	**6**
40-50	-	-	-	-	-
Total	**30**	**1**	**1**	**32**	-
%	**94**	**3**	**3**	-	**100**

Table 34. Site 21HE495 Artifact Summary for XU 5.

Depth (cmbs)	Lithic Debris	Lithic Tool	Total	%
0-10	-	-	-	-
10-20	1	-	**1**	**8**
20-30	7	1	**8**	**62**
30-40	4	-	**4**	**31**
40-50	-	-	-	-
Total	**12**	**1**	**13**	-
%	**92**	**8**	-	**100**

Table 35. Site 21HE495 Artifact Summary for XU 6.

Depth (cmbs)*	Lithic Debris	Historic	Total	%
0-10	-	-	-	-
10-20	1	-	**1**	**11**
20-30	1	-	**1**	**11**
30-40	4	-	**4**	**44**
40-50	1	1	**2**	**22**
50-60	-	1	**1**	**11**
Total	**7**	**2**	**9**	-
%	**78**	**22**	-	**100**

* disturbed soil (Ap horizon) from 0 to 80 cmbs

Table 36. Site 21HE495 Artifact Summary for XU 7.

Depth (cmbs)	Lithic Debris	Lithic Tool	Total	%
0-20	-	-	-	-
20-30	10	1	**11**	**79**
30-40	3	-	**3**	**21**
40-60	-	-	-	-
Total	**13**	**1**	**14**	-
%	**93**	**7**	-	**100**

Table 37. Site 21HE495 Artifact Summary for XU 8.

Depth (cmbs)	Lithic Debris	Lithic Tool	FCR	Historic	Total	%
0-10*	-	-	-	-	-	-
10-20	10	1	-	1	**12**	**43**
20-30	11	-	1	-	**12**	**43**
30-40	4	-	-	-	**4**	**14**
40-60	-	-	-	-	-	-
Total	**25**	**1**	**1**	**1**	**28**	-
%	**89**	**4**	**4**	**4**	-	**100**

* disturbed soil from 0 to 80 cmbs

Table 38. Site 21HE495 Artifact Summary for XU 9.

Depth (cmbs)	Lithic Debris	Lithic Tool	Total	%
0-10	-	-	-	-
10-20	17	1	**18**	**53**
20-30	13	-	**13**	**38**
30-40	2	1	**3**	**9**
40-50	-	-	-	-
Total	**32**	**2**	**34**	-
%	**94**	**6**	-	**100**

Table 39. Site 21HE495 Artifact Summary for XU 10.

Depth (cmbs)	Lithic Debris	Lithic Core	Historic	Total	%
0-10	-	-	-	-	-
10-20	2	-	-	**2**	**40**
20-30	1	1	1	**3**	**60**
30-50	-	-	-	-	-
Total	**3**	**1**	**1**	**5**	-
%	**60**	**20**	**20**	-	**100**

11.9 Phase I and II Artifact Summary

A total of 216 artifacts, weighing 443.7 grams, were recovered from the site during the Phase I survey and Phase II evaluation (Table 40). By count and weight, lithics were the most abundant artifact type at the site. Only very small amounts of fauna, FCR, and historics were recovered.

Table 40. Site 21HE495 Summary of Artifacts.

Artifact Type	Total by Count (Weight g)	% by Count (Weight g)
Lithic	193 (356.9)	89 (80)
Faunal	5 (3.3)	2 (1)
FCR	1 (22.6)	<1 (5)
Historic	17 (60.9)	8 (14)
Total	**216 (443.7)**	-
%	-	**100**

11.10 Lithic Analysis

The lithic assemblage consists of 193 artifacts, including 179 pieces of lithic debris, 12 stone tools, and two cores (Table 41). A variety of flake types, tools, cores, and lithic materials are present in the assemblage, which is discussed below.

Table 41. Site 21HE495 Lithic Artifacts by Material, Flake, and Tool/Core Types.

Material, Resource Region, and Source Distance	**Decortication**	**Nonbifacial**	**Bifacial thinning**	**Bifacial Shaping**	**Bipolar Flake**	**Shatter**	**Broken Flake**	**Other Grade 4**	**Edge Preparation**	**Tool/Core**	**Total**	**%**
Prairie du Chien Chert - **Hollandale Region** (local)	14	16	17	11	2	6	35	8	3	1 freehand nonbifacial core; 1 biface, stage 4; 1 side & end scraper; 2 utilized flakes	**117***	**61**
Swan River Chert **South Agassiz Region** (local)	2	2	1	2	1	3	-	3	-	-	**14**	**7**
Quartz - **Multiple Regions** (local)	1	-	-	-	3	1	3	4	-	1 bipolar core	**13**	**7**
Red River Chert **South Agassiz Region** (local)	3	3	-	-	-	2	-	1		2 utilized flakes	**11**	**7**
Grand Meadow Chert **Hollandale Region** (nonlocal)	-	-	1	-	-	-	3	-	2	1 side & end scraper; 1 utilized flake & side scraper; 2 utilized flakes	**10**	**6**
Unidentified chert **Unknown Region** (local or nonlocal)	1	-	1	2	-		1	2	1	-	**8**	**4**
Quartzite **Unknown Region** (local or nonlocal)	1	3	-	-	-	-	1	-	-	-	**5**	**3**
Knife River Flint **Western North Dakota** (nonlocal exotic)	-	-	1	-	-	-	-	-	-	1 utilized flake	**2**	**<1**
Lake Superior Agate **West Superior Region** (local)	-	-	1	-	-	-	1	-	-	-	**2**	**<1**
Jasper Taconite **West Superior Region** (local)	1	-	-	-	-	1	-	-		-	**2**	**<1**
Basaltic **West Superior Region** (local)	1	-	-	-	-	-	-	-	-	-	**1**	**<1**
Knife Lake Siltstone West Superior Region (local)	-	-	1	-	-	-	-	-	-	-	**1**	**<1**

Table 41. Continued.

Material, Resource Region, and Source Distance	Decortication	Nonbifacial	Bifacial thinning	Bifacial Shaping	Bipolar Flake	Shatter	Broken Flake	Other Grade 4	Edge Preparation	Tool/Core	Total	%
Silicified wood **South Agassiz Region** (local)	-	-	-	-	-	1	-	-	-	-	**1**	**<1**
Fusilinid Chert **IA, NE, MO, KS (nonlocal)**	-	-	1	-	-	-	-	-	-	-	**1**	**<1**
Galena Chert **Hollandale Region** (nonlocal)	-	-	1	-	-	-	-	-	-	-	**1**	**<1**
Unidentified material **Unidentified Region** (local)	1	-	-	-	-	-	-	-	-	-	**1**	**<1**
Jasper **Unidentified Region** (local or nonlocal)	-	-	-	-	-	-	-	-	-	1 utilized flake	**1**	**<1**
Lake of the Woods Rhyolite **West Superior Region** (local)	-	1	-	-	-	-	-	-	-	-	**1**	**<1**
Gunflint Silica **West Superior Region** (local)	-	-	-	-	-	-	1	-	-	-	**1**	**<1**
Total	**25**	**25**	**26**	**14**	**6**	**14**	**45**	**18**	**6**	**14**	**193**	**-**
%	**13**	**13**	**13**	**7**	**3**	**7**	**23**	**9**	**3**	**7**	**-**	**100**

*114 are oolitic Prairie du Chien Chert and 3 are non-oolitic

Size Grades and Heat Treatment

Size grade counts for the lithic debris were as follows: SG1 (n=3; 2%); SG2 (n=28; 16%); SG3 (n=120; 67%); and SG4 (n=28; 16%). A total of 32 lithic artifacts were heat treated, with most of these artifacts being Prairie du Chien and Swan River cherts. Probable heat treatment was observed on 21 additional lithics, with most of these also being Prairie du Chien Chert. One piece of silicified wood showed evidence of excessive heating, as indicated by crazing and potlid fractures.

Flake Types

The wide variety of flake types in the assemblage indicates a range of lithic-reduction technologies and stages. Diagnostic flake types, along with their associated technologies and stages of reduction, are summarized in Table 42. Nonbifacial and bifacial technologies are well represented. However, bipolar technology is notably sparse. The assemblage includes lithics from the early, middle, and late stages of reduction. Additional supporting evidence for the various technologies includes: 1) the bipolar core is indicative of bipolar technology; 2) one nonbifacial core and five tools made on nonbifacial flakes (one scrapers and four utilized flakes) are indicative of nonbifacial technology; and 3) two tools (utilized flakes) made on bifacial thinning flakes and one Stage 4 biface are indicative of bifacial technology.

Types of lithic debris that are not indicative of specific technologies or reduction-stages comprise a large percentage of the assemblage and include broken and other SG4 flakes. These nondiagnostic flake types are not included in Table 42.

Table 42. Site 21HE495 Summary of Diagnostic Flake Types, Technologies, and Reduction Stages.

Count & Flake Type	Technology	Stage of Reduction
6 - Bipolar flakes	Bipolar	N/A
25 - Decortication flakes	Nonbifacial	Earliest stage of core reduction and raw material testing
25 - Nonbifacial flakes	Nonbifacial	Cobble testing, reducing unprepared nonbifacial cores for flake blank production, and the early stages of nonbifacial tool reduction (early to middle-stages of reduction)
14 - Shatter	N/A	Mostly from cobble testing, core reduction, and earlier stages of reduction
26 - Bifacial thinning flake	Bifacial	Early to middle-stage of reduction
14 - Bifacial shaping flake	Bifacial	Late-stage of reduction (final shaping or tool maintenance)

Lithic Material Types and Use

Lithic materials consisted primarily of Prairie du Chien Chert (61%), with substantially smaller amounts of many other materials, including Swan River Chert (7%), quartz (7%), Red River Chert (7%), Grand Meadow Chert (6%), unidentified chert (4%), and quartzite (3%). The amounts of other materials are less than one percent. Nearly all of the materials are locally available. The unidentified chert may be local or exotic.

The assemblage contains a small amount of non-local, high-quality materials that were likely acquired through exchange networks or travel, including: 1) Grand Meadow and Galena cherts from southeastern Minnesota; 2) Knife River Flint from western North Dakota; and 3) Fusilinid Chert from parts of Iowa, Missouri, Kansas, and Nebraska.

The lithic data indicates that the raw materials have different debris profiles resulting from differential use, quality of the material, and cobble size. The most notable lithic use characteristics are discussed below for those materials that have adequate sample sizes of diagnostic flakes.

Prairie du Chien Chert occurs in moderate amounts in all diagnostic flake types, including decortication, nonbifacial, bifacial thinning, bifacial shaping, and bipolar flakes. It was used for all stages of lithic reduction and tool production in nonbifacial, bifacial, and bipolar technologies. One core, three flake stone tools, and a Stage 4 biface were manufactured from Prairie du Chien Chert.

The following materials occur in very small amounts, and therefore the validity of any interpretation is tentative and limited by the small sample size. Swan River Chert occurs as a variety of diagnostic flake types, including decortication, nonbifacial, bifacial thinning, and bifacial shaping. No tools or cores were manufactured from this material. Quartz occurs primarily as bipolar flakes and nondiagnostic flake types (broken and Other Grade 4 flakes). Quartz occurs as the only bipolar core at the site, and it is notably absent in bifacial flake types. Red River Chert is notably absent in bifacial flakes but occurs as decortication flakes, nonbifacial flakes, shatter, and two flake stone tools. Grand Meadow Chert occurs as edge preparation flakes, a bifacial thinning flake, and four flake stone tools, which is the highest rate of tool use of any material. Unidentified chert occurs in a variety of flake types including decortication, bifacial thinning, and bifacial shaping. Quartzite occurs as decortication flakes and nonbifacial flakes. Knife River Flint occurs as a bifacial thinning flake, and a flake stone tool.

Stone Tools

Twelve stone tools were recovered, including eight utilized flakes, one multi-purpose utilized flake and scraper, two scrapers, and a Stage 4 biface (late-stage). The nonbifacial tools were made on nonbifacial flakes, bifacial thinning flakes, and broken flakes (Table 43). The Stage 4 biface is made on Prairie du Chien Chert. The flake tools were manufactured from Grand Meadow Chert (n=4), Prairie du Chien Chert (n=3), Red River Chert (n=2), jasper (n=1), and Knife River Flint (n=1).

The Stage 4 biface may be a projectile point preform and could have been used as a cutting tool. Utilized flakes are primarily light-duty cutting and slicing tools used on animal remains, wood, and plants. Scrapers are typically associated with scraping tasks on a variety of soft materials (meat, hides, and plant material) or moderately resistant materials (wood and bone). These tools suggest that site activities included butchering, animal/plant processing, hide working, and bone and woodworking.

Table 43. Site 21HE495 Nonbifacial Flake Tools by Flake Type.

Tool Type	Type of Flake That Tool is Made On			
	Nonbifacial	Bifacial Thinning	Broken	Total
Utilized Flake	3	2	3	**8**
Utilized Flake/Scraper	1	-	-	**1**
Scraper	1	-	1	**2**
Total	**5**	**2**	**4**	**11**

Cores

Two cores were recovered, including a bipolar core and a freehand nonbifacial core that has patterned flaking and unprepared platforms. The bipolar core is made on quartz and the freehand core on Prairie du Chien Chert.

11.11 FCR

Only one piece of FCR was recovered from the site. It is an angular FCR type of granite from XU 8.

11.12 Faunal Analysis

The faunal assemblage contains five small pieces of bone recovered from two tests (Shovel Test 62WS5 and XU 1). The fauna weigh a total of 3.3 grams, and all pieces are SG3. They are unidentifiable fragments from a medium to large mammal, and they are calcined and charred.

11.13 Historic Artifact Analysis

The historic assemblage was sparse and includes 17 items. The assemblage includes a variety of architectural and household items, including three wire nails, two square nails, two unidentified composite items, an earthenware fragment, a window fragment, two glass bottle fragments, one unidentified glass fragment, a fence post staple, a shotgun shell, wire fragment, a metal washer, and a clinker. Most of the historic artifacts are small and fragmentary and were not amenable to precise dating, as they had long manufacturing periods or lacked temporally diagnostic attributes, such as maker's marks or datable elements. These items provide only broad dates and are of limited research value. The general date range for the historic assemblage spans from the mid to late 1800s to the present, based on manufacturing dates of specific artifacts. The artifacts are all less than one inch in size (SG 2 and smaller). Based on the historic map and air imagery review, there are no historic structures located at the site, although there were farmsteads and homes nearby between 1873 and 1950s. The artifacts can't be associated with a specific historic residence, and they are probably refuse or demolition debris from one of the various nearby residences.

11.14 Horizontal and Vertical Artifact Patterning

The horizontal distribution of the precontact artifact classes is similar across the site because the assemblage is fairly homogenous and primarily consists of a sparse scatter of lithic debris, which suggests that activities were generally similar across the site. The XUs (4, 8, and 9) and Shovel Tests (65W, 65WS5, and 67W) with the most artifacts are located at the south end of the site near the bluff edge. Shovel Tests 48WN5, 62WS5, and 62WN5 had moderate amounts of artifacts (three to five each), and they are located near the north end. The other shovel tests had one or two artifacts each. The small amount of fauna at the site was recovered from Shovel Test 62WS5 and XU 1, which are at the north end of the site. The FCR was recovered from XU 8 at the south end of the site.

The vertical distribution of artifacts ranges from 0 to 60 cmbs, with most artifacts (78%) recovered from 10 to 30 cmbs. The small number of artifacts above and below this zone was likely displaced by natural processes and in some XUs mechanical disturbances. There is no evidence to indicate a vertical separation of site components. Either the site represents one component or multiple components overlap.

11.15 Site Integrity

As indicated in Tables 25 to 27, there is extensive disturbance in some areas of the site. Of the ten XUs, four XUs (2, 5, 6, and 8) have extensive disturbance to primary artifact deposits. The XUs were typically placed in locations to avoid disturbances. So, it is noteworthy that extensive disturbances were observed in 26 shovel test profiles across the site, including 11 positive shovel tests. In summary, about half of the site lacks integrity because of mechanical disturbances that are presumed to be from previous highway construction.

11.16 Conclusions and Recommendation

Site 21HE495 is a Late Archaic habitation with a sparse artifact scatter that is located on the bluff. The site is located 30 meters west of the construction limits. No diagnostic artifacts were recovered, but a faunal sample dated to 4690 +/- 30 RCYBP. Other components may also be present. The Phase I and II investigations included 23 positive shovel tests and 10 (1-x-1 meter) XUs. The archaeological deposits in about half the site have been extensively disturbed from previous road construction.

Artifact density was very low, except in a couple locations where slightly higher densities were present. Artifacts recovered from the site consist nearly exclusively of lithic debris (n=179), with a moderate amount of stone tools (n=12) and very small amounts of cores (n=2), faunal fragments (n=5), and FCR (n=1). Site activities consisted primarily of lithic reduction and stone tool manufacture. A variety of flake types are present, indicating a range of lithic-reduction technologies and stages. Bifacial, nonbifacial, and bipolar technologies are all represented. The assemblage includes lithic debris from the early, middle, and late stages of reduction. Lithic raw materials at the site consist primarily of locally available materials, with Prairie du Chien Chert being by far the most abundant. Non-local raw materials, which were procured though long-distance trade networks or possibly travel to source areas, included a small amount of Knife River Flint, Fusilinid Chert, Grand Meadow Chert, and Galena Chert. Stone tools include utilized flakes and scrapers, indicating that site activities likely included butchering, animal/plant processing, hide working, and bone and woodworking. No features were identified. The FCR and thermally-altered faunal material indicate cooking and heating activities, but no features were identified.

The research potential of the site is low because of a lack of integrity in about half the site and the sparse and limited artifact assemblage. The site is not capable of providing important information on relevant research themes for the Late Archaic or precontact period under NRHP Criterion D (See Section 2.3 Research Themes). The site is recommended not eligible for listing on the National Register of Historic Places because it lacks integrity and does not meet National Register Criteria A, B, C, or D. No further archaeological work is recommended at the site.

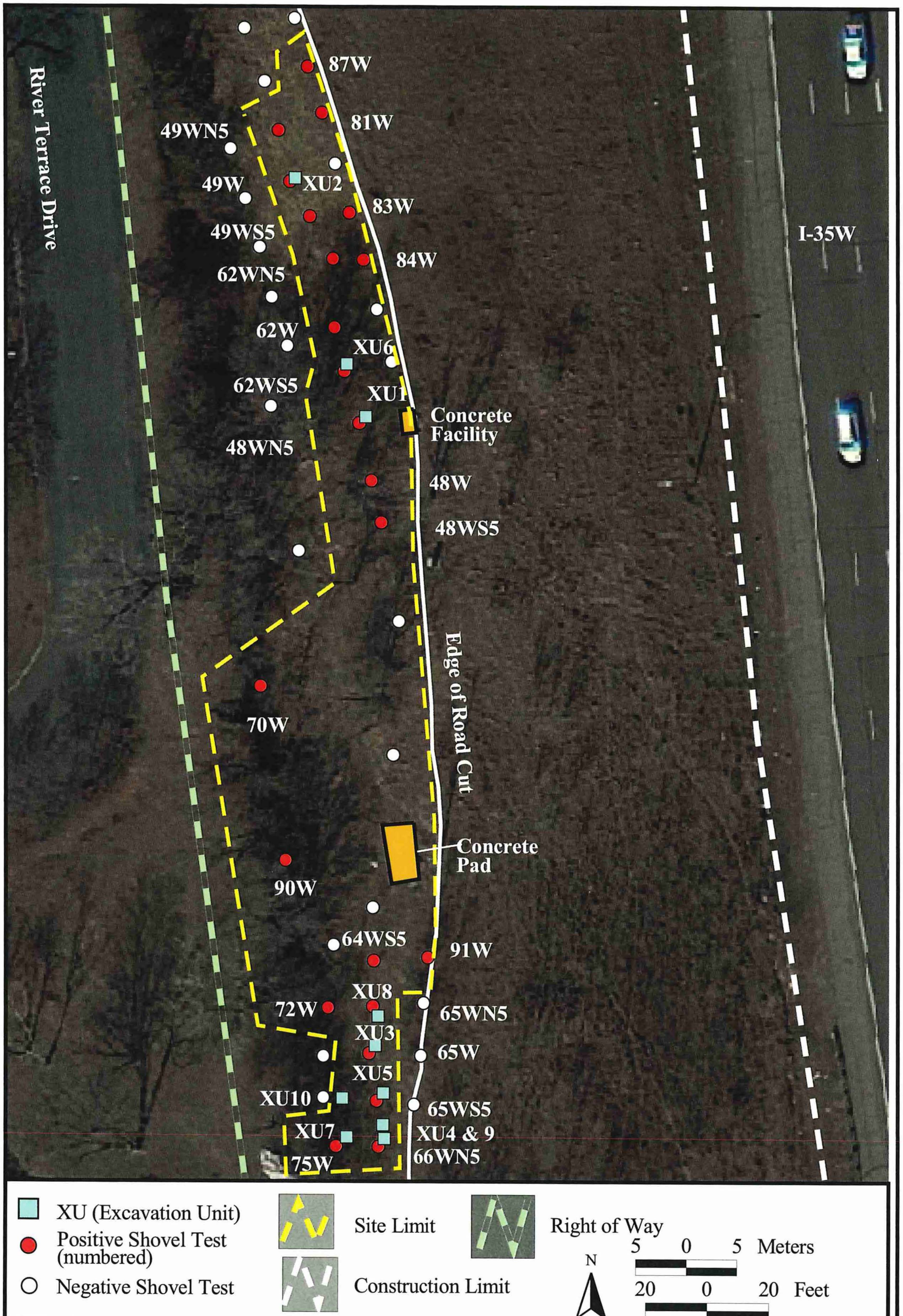


Figure 25. Site 21HE495 Map on Aerial Imagery.

Figure 26. Site 21HE495 Photo from the Middle of the Site, Facing North.

Figure 27. Site 21HE495 Photo from the Middle of the Site, Facing South.

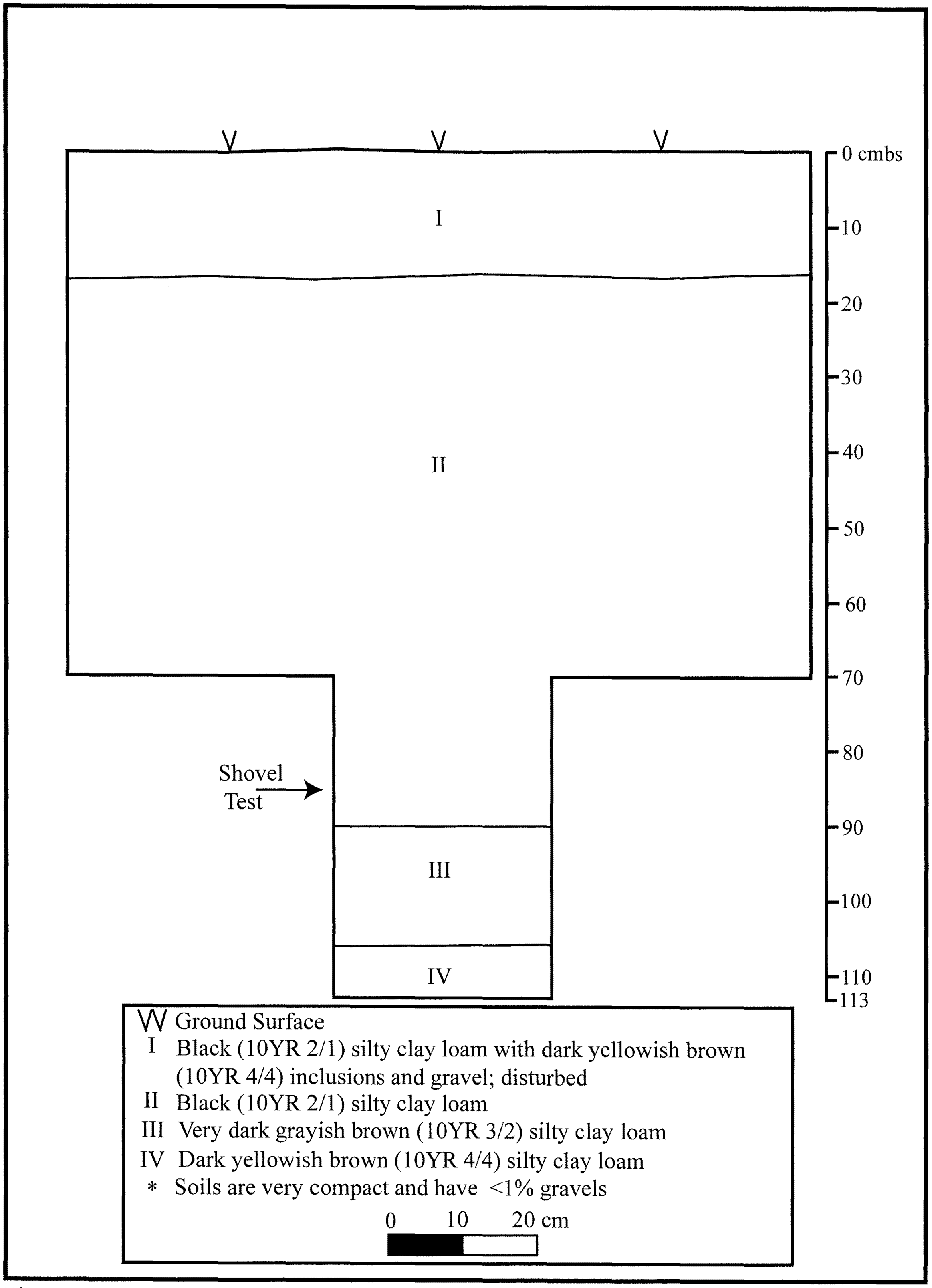


Figure 28. Site 21HE495 XU 1 North Wall Profile.

Figure 29. Site 21HE495 Photo XU 1 North Wall Profile.

Figure 30. Site 21HE495 Photo XU 2 North Wall Profile (note dense gravels at base).

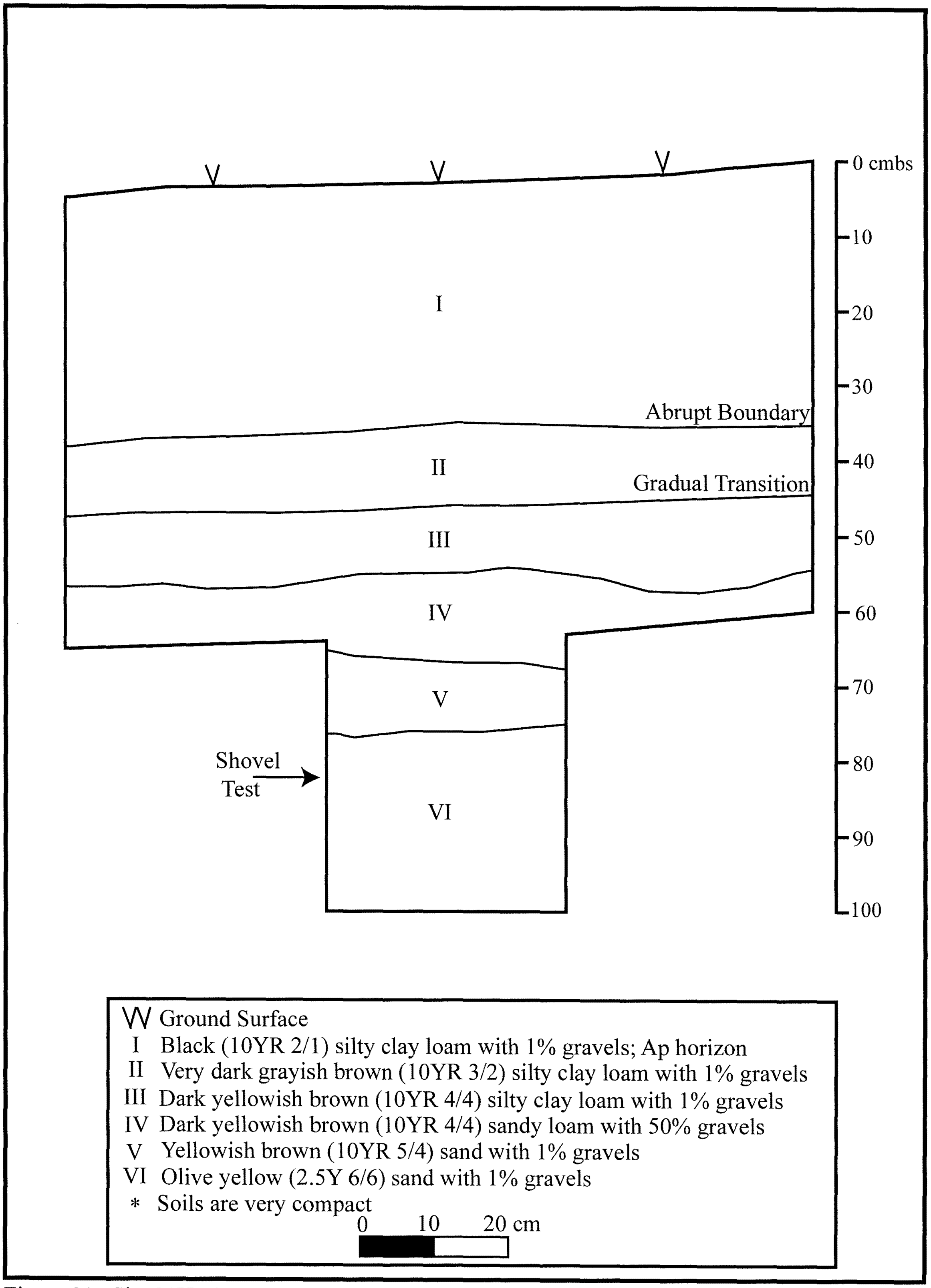


Figure 31. Site 21HE495 XU 2 North Wall Profile.

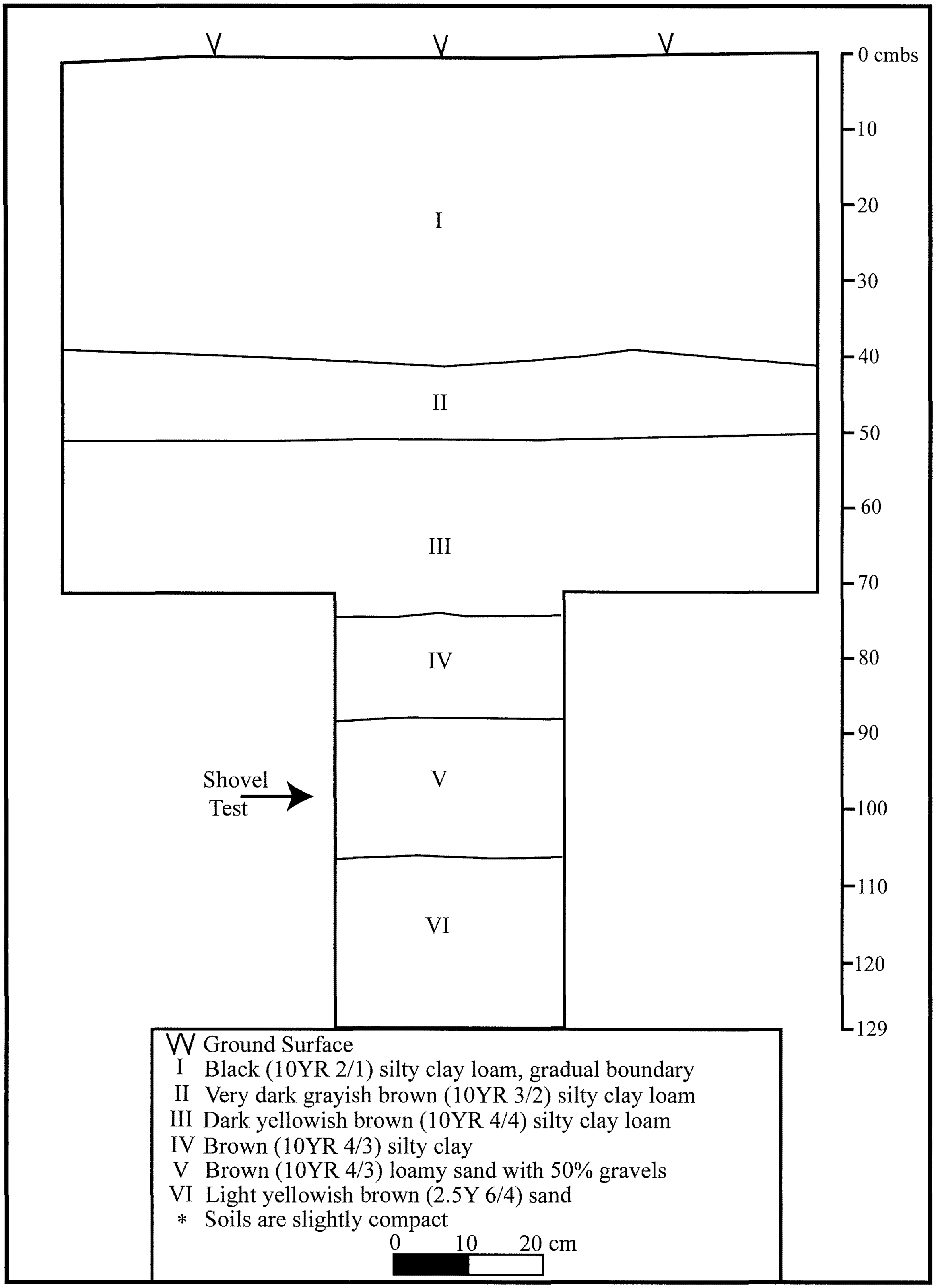
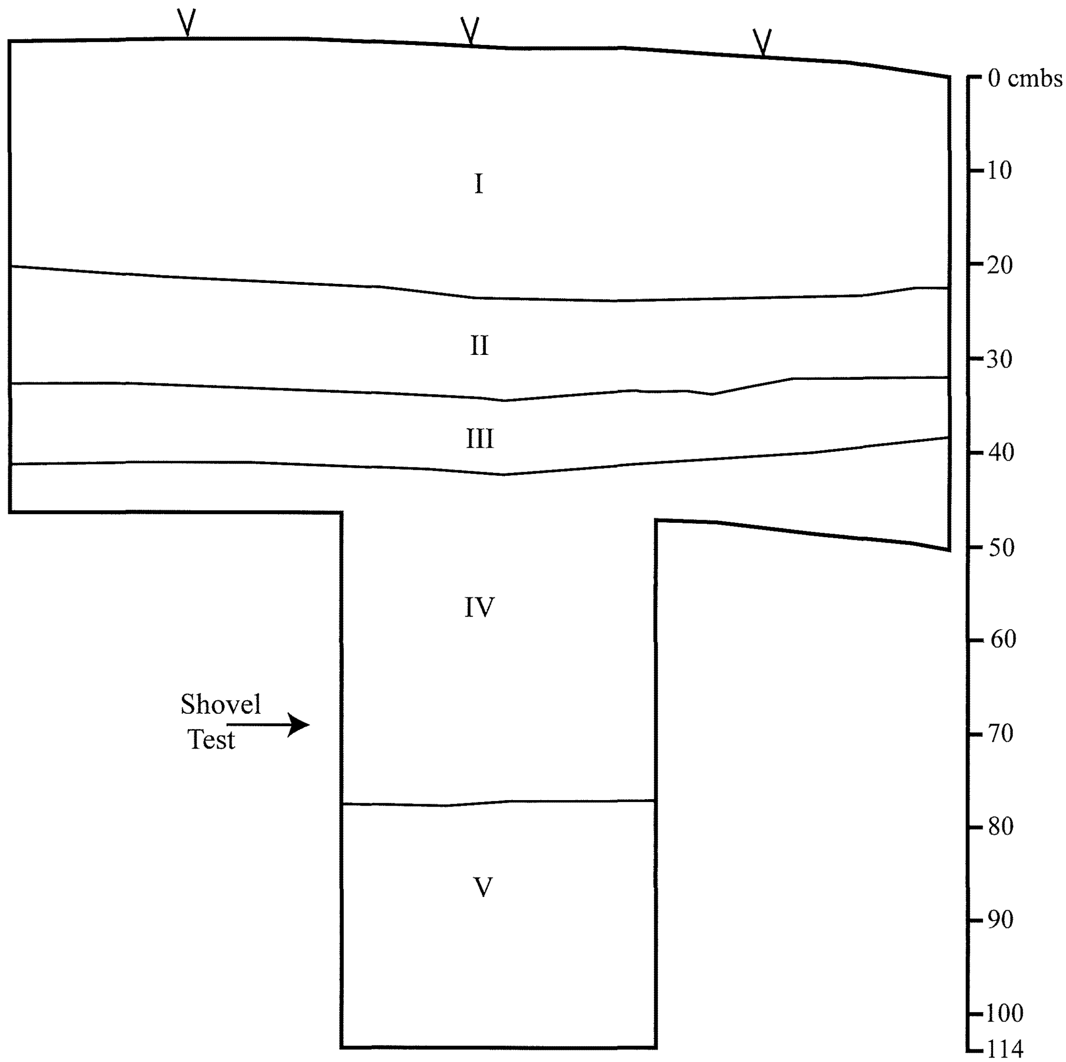


Figure 32. Site 21HE495 XU 3 North Wall Profile.

Figure 33. Site 21HE495 Photo XU 3 North Wall Profile.

Figure 34. Site 21HE495 Photo XU 4 North Wall Profile (note dense gravels at base).



V	Ground Surface
I	Black (10YR 2/1) silty clay loam, gradual boundary
II	Very dark grayish brown (10YR 3/2) silty clay loam
III	Dark yellowish brown (10YR 4/4) silty clay loam
IV	Dark yellowish brown (10YR 4/4) loamy sand with 50% gravels
V	Light yellowish brown (2.5Y 6/4) sand
*	Soils are slightly compact

0 10 20 cm

Figure 35. Site 21HE495 XU 4 North Wall Profile.

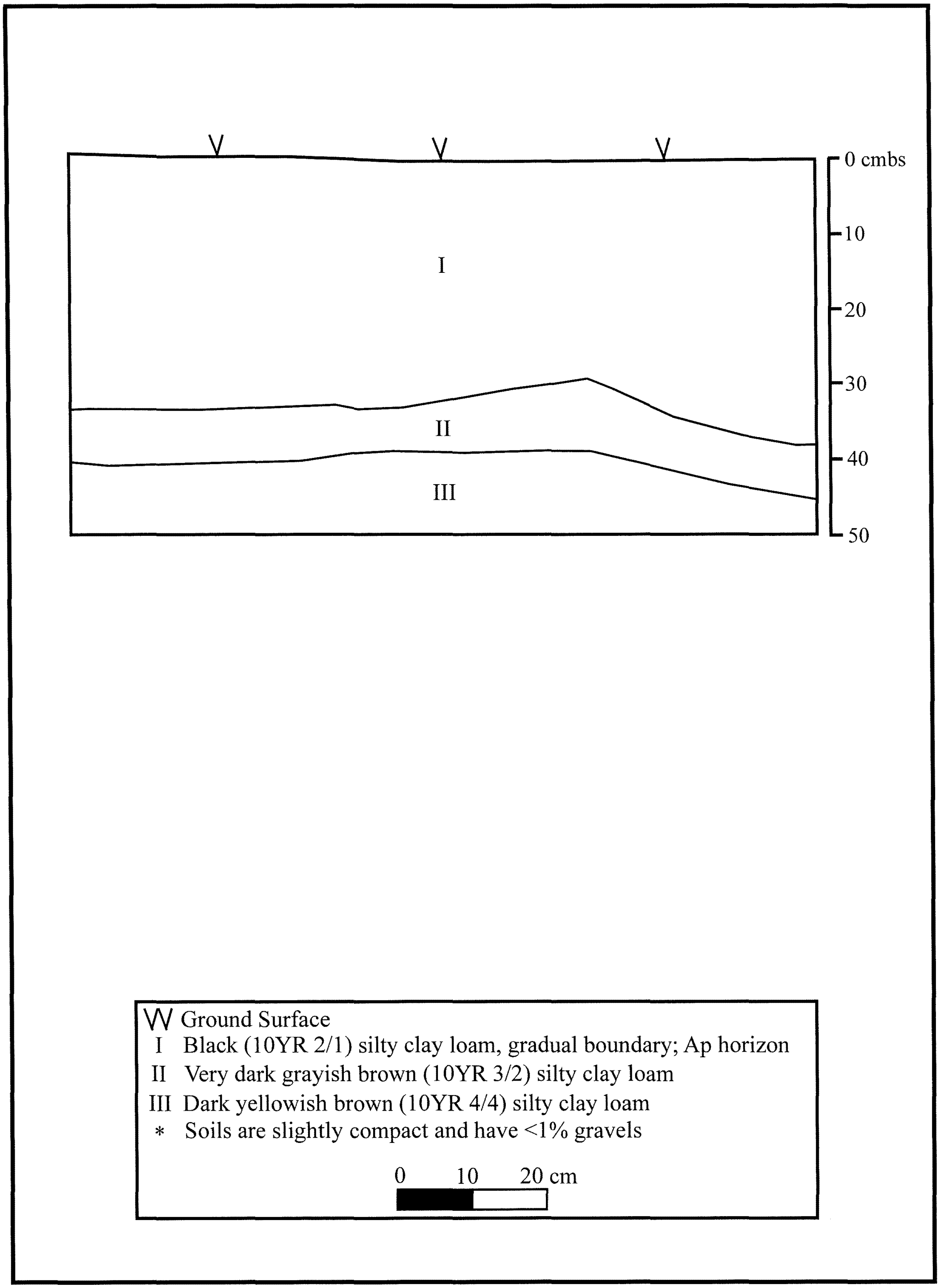


Figure 36. Site 21HE495 XU 5 North Wall Profile.

Figure 37. Site 21HE495 Photo XU 5 North Wall Profile.

Figure 38. Site 21HE495 Photo XU 6 North Wall Profile.

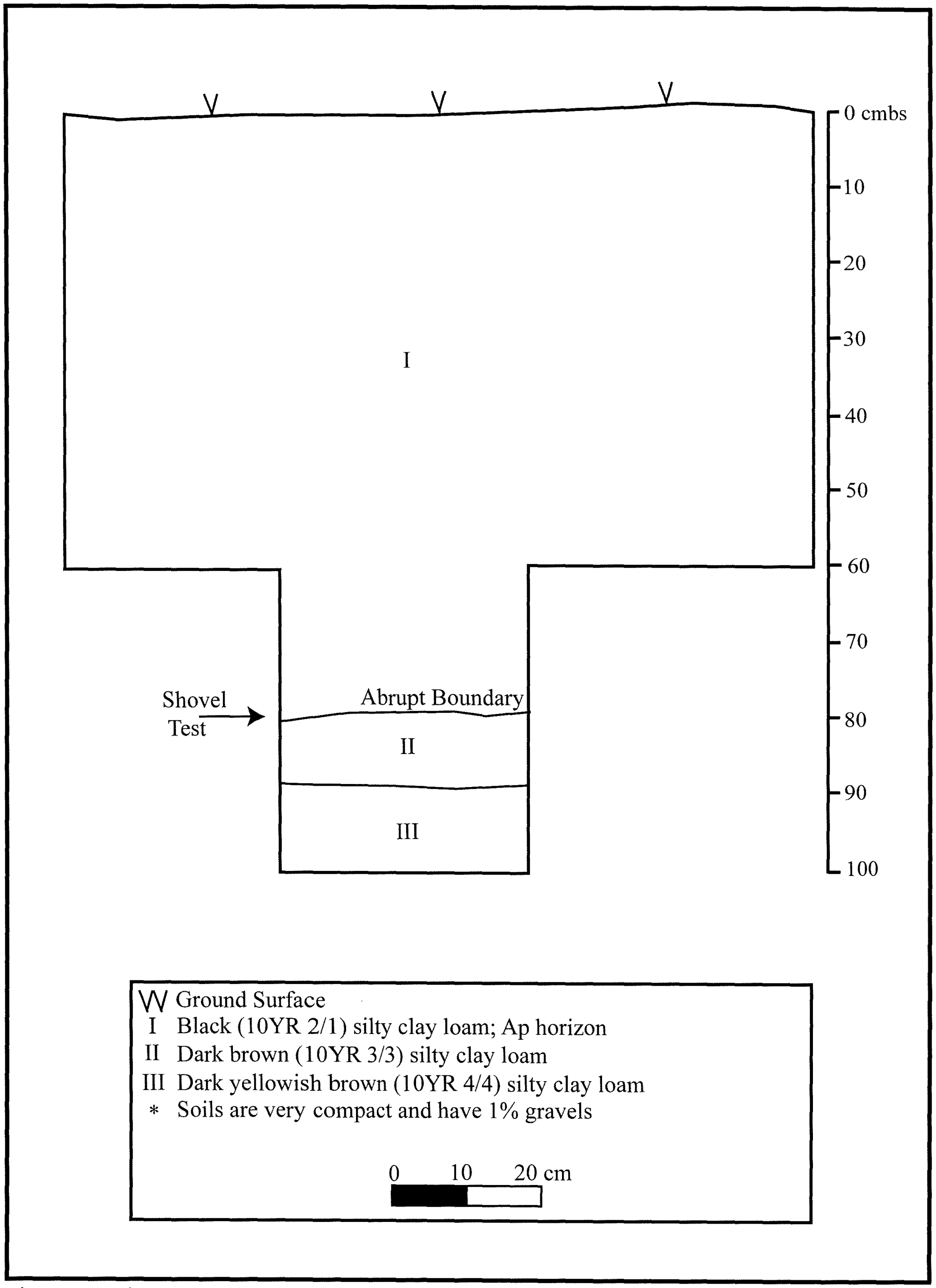


Figure 39. Site 21HE495 XU 6 North Wall Profile.

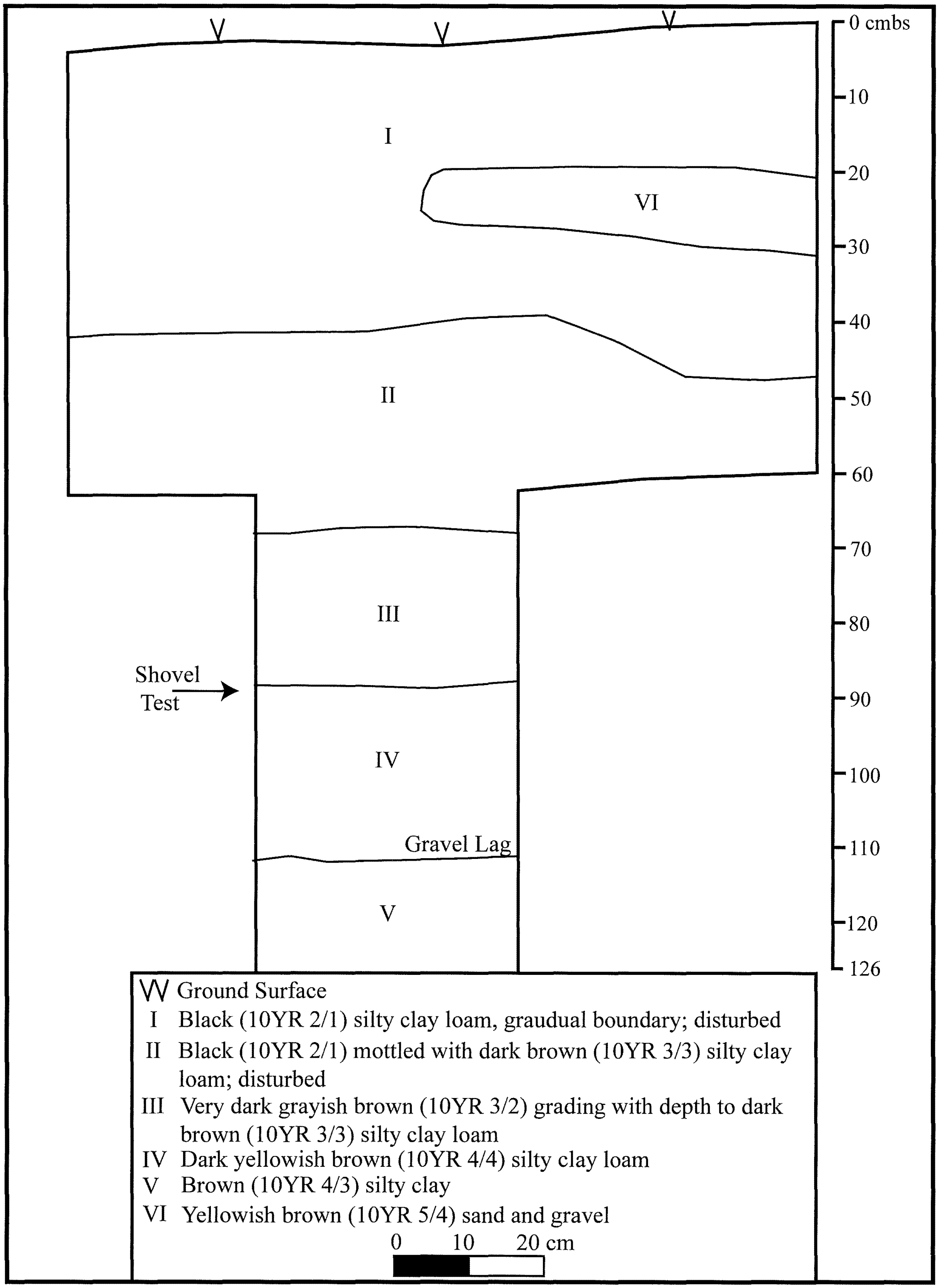


Figure 43. Site 21HE495 XU 8 North Wall Profile.

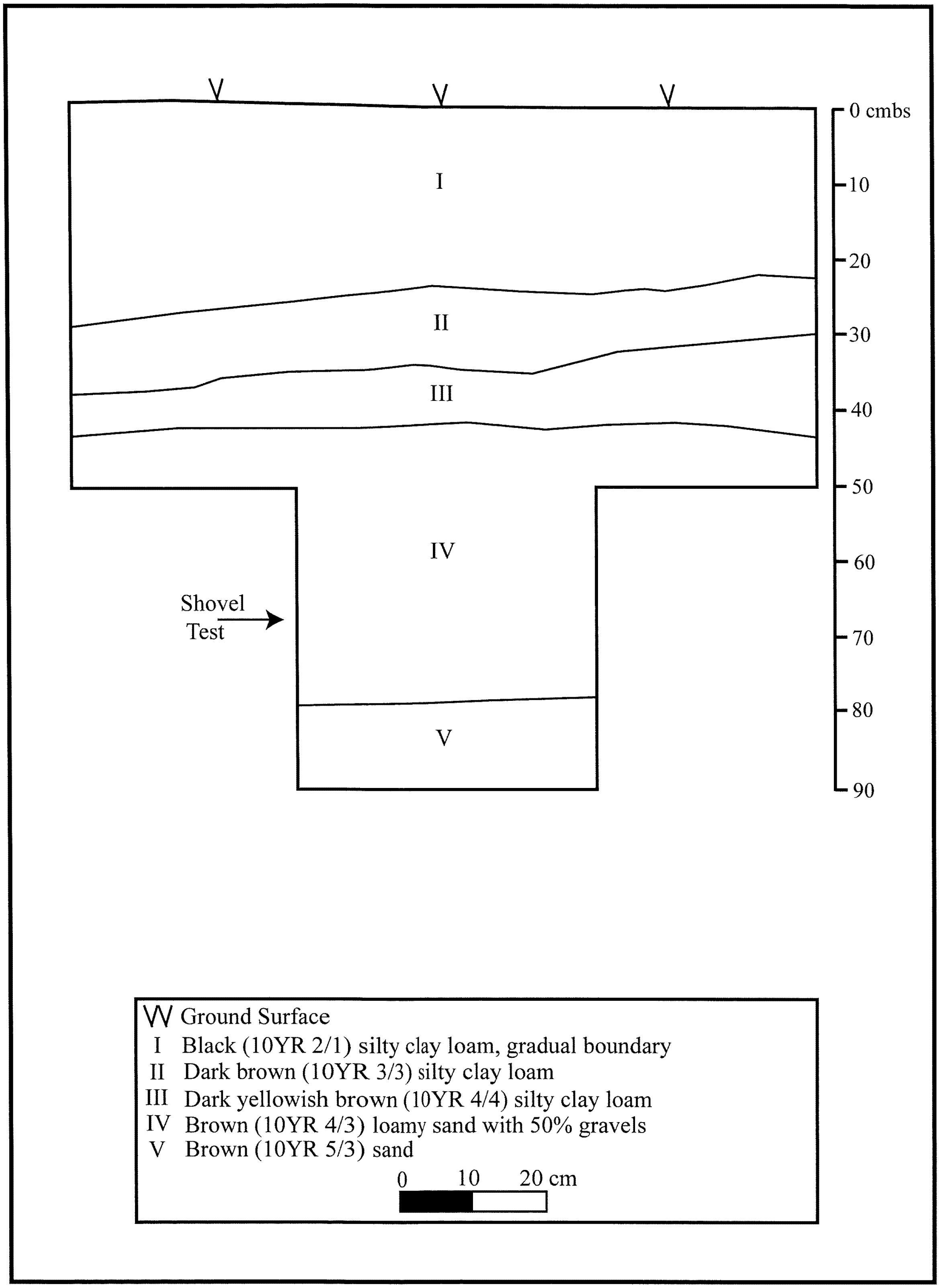


Figure 44. Site 21HE495 XU 9 North Wall Profile.

Figure 45. Site 21HE495 Photo XU 9 North Wall Profile.

Figure 46. Site 21HE495 Photo XU 10 North Wall Profile.

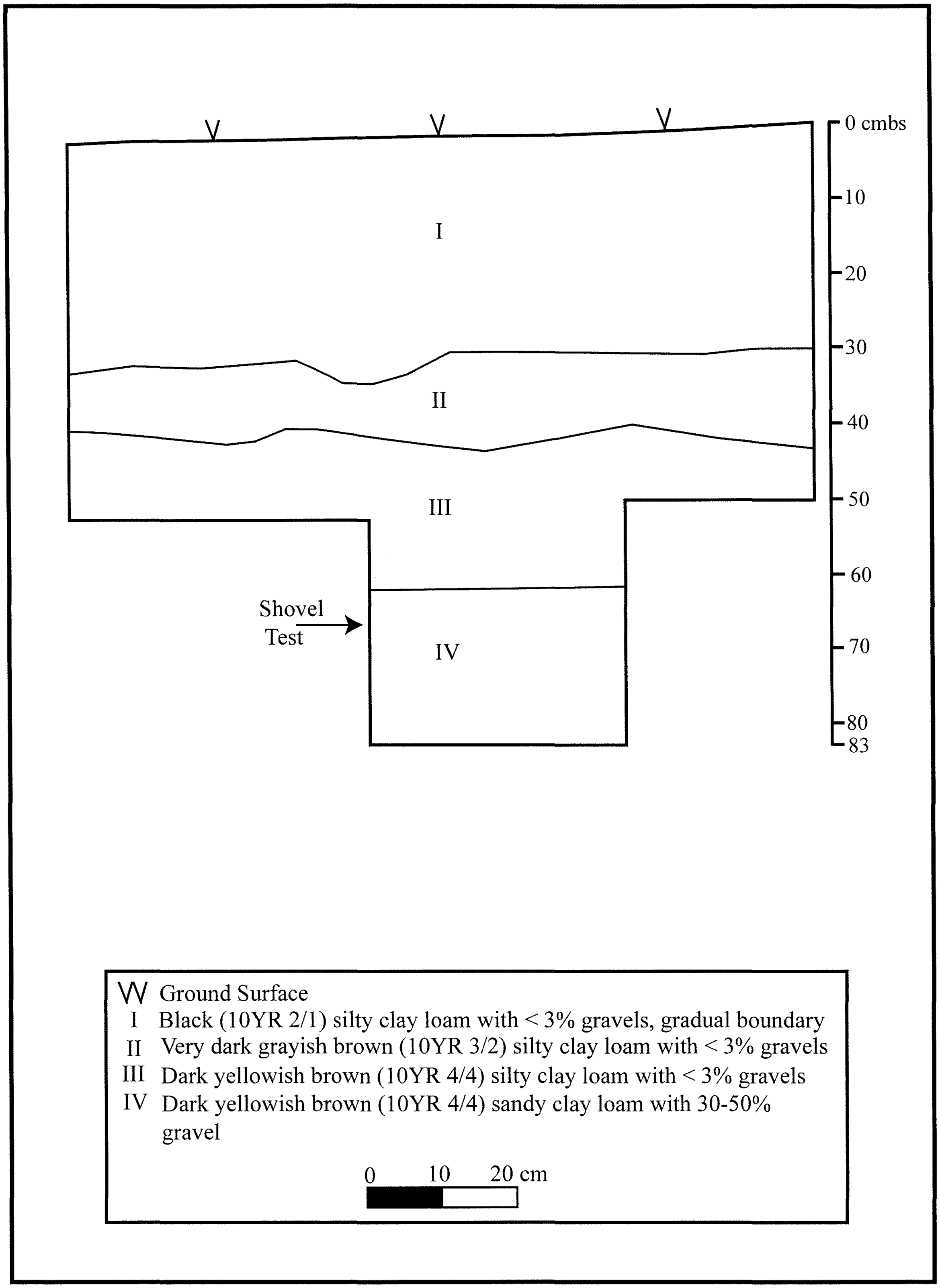


Figure 47. Site 21HE495 XU 10 North Wall Profile.

12. Site 21HE496

12.1 Overview

Site 21HE496 is an Early Woodland habitation with a sparse artifact scatter that is deeply buried at the toe slope of the bluff. A calcined turtle bone recovered from an auger test dated to 1960 +/- 30 RCYBP. Multiple components are present. The cultural affiliations and ages of the other components are unknown because of the absence of diagnostic artifacts or dateable materials. The site is in T27N, R24W, N1/2, SE, SE, SE, Section 21 (Figures 1 and 9) and occupies an area of approximately 95 by 20 meters, encompassing 0.2 acre. The UTM coordinates for the center of the site are E477090 N4961475 (1983 NAD Zone 15). A map of the site on aerial imagery is presented in Figure 48, and a site map is in Figure 49. A photo of the site area is in Figure 50.

12.2 Physical Setting

The site is deeply buried at the toe slope of the bluff of the Minnesota River valley between I-35W and Lyndale Avenue South. The site is on the east side of I-35W and extends between 60 and 155 meters east of the centerline. Lyndale Avenue South is 55 meters east of the site. The site area is wooded. A wooded floodplain wetland is south of the site, and a steep side slope of the valley wall is north of the site. Surface visibility was poor (less than 10%).

12.3 Soils

Soils at the site are mapped as Hawick loamy sand, 20 to 40 percent slopes, which formed in sandy outwash sediments with or without a thin loamy mantle (Web Soil Survey 2017). These soils are on outwash plains, stream terraces and glacial moraines.

A geomorphological investigation of the site was conducted by Strata Morph Geoexploration, Inc. (Appendix A). Three types of deposits were identified in the soils at the site: 1) colluvium; 2) organics; and 3) slackwater lacustrine. Artifacts were mostly recovered from colluvium, with only one artifact from the slackwater lacustrine deposit. A suite of soil profiles from the site is presented with interpretations in the geomorphology report.

12.4 Radiocarbon Dating

A calcined turtle carapace fragment was submitted to Beta for AMS dating, and the results are presented in Table 44.

Table 44. Site 21HE496 Radiocarbon Date.

Material/ Provenience	Beta Lab No.	$^{13}C/^{12}C$ Ratio (o/oo)	Conventional ^{14}C Age B.P.	2 Sigma Calibrated Results (95% Probability)	Historic Context
Calcined (cremated) bone carbonate; ST16 190-200 cmbs	443706	-26.4	1960 +/- 30 BP	Cal BC 40 - AD 85 (cal BP 1990 - 1865)	Early Woodland

12.5 Phase I Survey Methods and Results

The site was identified during Phase I deep auger testing in five and ten-meter intervals. The close-interval radial tests were numbered based on the direction and distance from the Phase I test. For example, Test 7SW5 is located five meters grid southwest of Test 7.

Eight Phase I tests were positive, and 12 artifacts were recovered, including six pieces of lithic debris, one utilized flake, four FCR, and one fauna (Table 45). Artifacts were recovered from 160 to 340 cmbs, with most artifacts recovered below 255 cmbs. Interpretations of the contexst of the artifacts are presented in the geomorphological report in Appendix x. Although the interpretations are not conclusive, good estimates of the artifact contexts were made using deposit types and master soil horizon designations.

In summary, artifacts in colluvium can be transported from upslope to their recovered position as a part of the colluvial deposit, and thus would be in a secondary context. Artifacts in C horizons formed in colluvium are considered to be in secondary contexts because deposition was more rapid, minimizing time at the landscape surface. These artifacts are listed as "No" for primary context in Table 45. Alternately, the position of the artifacts may be the result of an occupation at the location of their recovery, and thus the artifacts would be in primary context. If surface or buried A or AB horizons are present in the portion of the sequence where the artifacts occur, then it is more likely that the artifacts are in primary contexts simply because the deposits were exposed at or near the landscape surface long enough for the A horizon to form. However, it is also possible that the artifacts were transported and ended up near the surface where the soil formed, and thus they would be in a secondary context even though they occur in A or AB horizons. Therefore in Table 45, artifacts are listed as "Maybe" for primary context.

It can be seen from Table 45 that of the 12 artifacts, six are listed as not in primary context, and six are listed as maybe in primary context. Only artifacts from Tests 7SW5, 9W5, 16, and 16SW5 may be in primary context.

Table 45. Site 21HE496 Summary of Artifacts from Phase I Auger Tests.

Auger Test	Depth (cmbs)	Deposit & (Horizon)	Primary Context	Count	Artifact type
5	320 - 330	Colluvium (C)	No	1	FCR, spall, granitic
7SW5	260 - 290	Colluvium (Ab)	Maybe	1	Decortication flake, Red River Chert
9N5	315 - 335	Colluvium (Cg)	No	1	Other G4 flake, Prairie du Chien Chert (oolitic)
9W5	200 - 210	Colluvium (A)	Maybe	1	Broken flake, Prairie du Chien Chert (oolitic)
13	255 - 265	Colluvium (C)	No	1	FCR, angular, unidentified material
16	190 - 200	Colluvium (Ab)	Maybe	1	Turtle carapace, fragment, calcined
16SW5	160 - 180	Colluvium (Ab)	Maybe	1	Bifacial thinning flake, Prairie du Chien Chert (oolitic)
				1	Other G4 flake, Prairie du Chien Chert (oolitic)
	300 - 315	Colluvium (C)	No*	1	FCR, spall, basaltic
	315 - 330			1	Nonbifacial flake, Gunflint Silica
	330 - 340			1	Utilized flake, Swan River Chert
17	160 - 170	Colluvium (C)	No	1	FCR, spall, granitic
Total	-			**12**	-

* The soil profile for this test is different than that described in the geomorphology report for nearby Test 16S. The soil horizon where these artifacts was recovered has a color of 2.5Y 4/2 that would be described as a C horizon, and thus the artifacts are probably not in primary context but redeposited in colluvium. Other tests in this area, such as Test 16, 16S7, 16E5, all had notably different soil horizons in the colluvium with regard to color and texture related to micro-variations in landscape formation processes, suggesting an unstable or uneven landscape.

12.6 Phase II Survey Methods and Results

Phase II testing methods consisted of digging close-interval tests adjacent to the positive Phase I tests in order to refine site limits, make a preliminary assessment of site integrity, recover additional artifacts, and provide data on intra-site artifact patterning. XUs were not dug as part of the Phase II evaluation, because of the highly impractical excavation conditions and the results from the close-interval tests indicated that XUs were not needed to evaluate the site's eligibility. Most of the site is two meters below the water table, and large excavation trenches would be needed for dewatering and shoring the walls. In order to dig such trenches, heavy machinery would need to cross a wetland and stream to reach the site and large trees would need to be removed. Therefore, additional close-interval tests were dug instead.

12.7 Phase II Testing

Phase II tests were dug at three, five, or seven meter intervals adjacent to the positive Phase I tests. Four Phase II tests were positive, and 10 artifacts were recovered, including nine pieces of lithic debris and one FCR (Table 46). Artifacts were recovered from 80 to 325 cmbs, with most artifacts recovered below 190 cmbs. An overview of the geomorphological assessment regarding whether the artifacts are in primary or secondary context is discussed in the Phase I testing section above. It can be seen from Table 46 that of the ten artifacts, four are listed as not in primary context, and six are listed as maybe in primary context. Only artifacts from Tests 5NW3, 9NW7, and 16S3 may be in primary context.

Table 46. Site 21HE496 Summary of Artifacts from Phase II Auger Tests.

Auger Test	Depth (cmbs)	Deposit & (Horizon)	Primary Context	Count	Artifact type
5NW3	120 - 130	Colluvium (Ab)	Maybe	1	Nonbifacial flake, basaltic
	235 - 250	Colluvium (C)	No	1	Other G4 flake, unidentified chert, burned
	295 - 310			1	Nonbifacial flake, basaltic
				1	Shatter, basaltic
9NW7	140 - 150	Colluvium (A)	Maybe	1	Other G4 flake, Prairie du Chien Chert (oolitic)
	190 - 200			1	Nonbifacial flake, Swan River Chert
	205 - 220			1	FCR, spall, igneous
12S5	240 - 250	Slackwater (Cg)	No	1	Broken flake, basaltic
16S3	80 - 90	Colluvium (Ab)	Maybe	1	Broken flake, Prairie du Chien Chert (oolitic)
	315 - 325	Colluvium(ABb)		1	Other G4 flake, Prairie du Chien Chert (oolitic)
Total	-			**10**	-

12.8 Phase I and II Artifact Summary

A total of 22 artifacts, weighing 166.7 grams, was recovered from the site during the Phase I survey and Phase II evaluation (Table 47). By count, lithics were the most numerous artifact type. By weight, FCR is more abundant than lithics. Fauna is by far the least abundant artifact type.

Table 47. Site 21HE496 Summary of Artifacts by Count and (Weight).

Artifact Type	Total by Count (Weight g)	% by Count (Weight g)
Lithic	**16 (66.9)**	**72 (40)**
FCR	**5 (99.4)**	**23 (59)**
Fauna	**1 (0.4)**	**5 (1)**
Total	22 (166.7)	-
%	-	100

12.9 Lithic Analysis

The lithic assemblage consists of 16 artifacts, including 15 pieces of lithic debris and one stone tool (Table 48). A variety of flake types and lithic materials are present in the assemblage, which is discussed below.

Table 48. Site 21HE496 Lithic Artifacts by Material, Flake, and Tool/Core Types.

Material, Resource Region, and Source Distance	Decortication	Nonbifacial	Bifacial thinning	Bifacial Shaping	Bipolar Flake	Shatter	Broken Flake	Other Grade 4	Tool/Core	Total	%
Prairie du Chien Chert - **Hollandale Region** (local)	-	-	1	-	-	-	2	4	-	**7**	**44**
Swan River Chert **South Agassiz Region** (local)	-	1	-	-	-	-	-	-	1 utilized flake	**2**	**13**
Red River Chert **South Agassiz Region** (local)	1	-	-	-	-	-	-	-	-	**1**	**6**
Unidentified chert **Unknown Region** (local or nonlocal)	-	-	-	-	-	-	-	1	-	**1**	**6**
Basaltic **West Superior Region** (local)	-	2	-	-	-	1	1	-	-	**4**	**25**
Gunflint Silica **West Superior Region** (local)	-	1	-	-	-	-	-	-	-	**1**	**6**
Total	**1**	**4**	**1**	**-**	**-**	**1**	**3**	**5**	**1**	**16**	**-**
%	6	25	6	-	-	6	19	31	6	-	100

*all are oolitic Prairie du Chien Chert

Size Grades and Heat Treatment

Size grade counts for the lithic debris were as follows: SG1 (n=1; 7%); SG2 (n=3; 20%); SG3 (n=6; 40%); and SG4 (n=5; 33%). Two Swan River Chert lithics were heat treated, and one unidentified chert flake had evidence of excessive heating, as indicated by crazing and potlid fractures.

Flake Types

The limited variety of flake types in the assemblage indicates a limited range of lithic-reduction technologies and stages. The small sample size limits the validity of interpretations. Diagnostic flake types, along with their associated technologies and stages of reduction, are summarized in Table 49. Nonbifacial and bifacial technologies are represented, but bipolar technology is absent. The assemblage includes lithics from the early and middle stages of reduction. Types of lithic debris that are not indicative of specific technologies or reduction-stages comprise a large percentage (50%) of the assemblage and include broken and other SG4 flakes. These nondiagnostic flake types are not included in Table 49.

Table 49. Site 21HE496 Summary of Diagnostic Flake Types, Technologies, and Reduction Stages for All Lithics.

Count & Flake Type	Technology	Stage of Reduction
1 - Decortication flake	Nonbifacial	Earliest stage of core reduction and raw material testing
4 - Nonbifacial flakes	Nonbifacial	Cobble testing, reducing unprepared nonbifacial cores for flake blank production, and the early stages of nonbifacial tool reduction (early to middle-stages of reduction)
1 - Shatter	N/A	Mostly from cobble testing, core reduction, and earlier stages of reduction
1 - Bifacial thinning flake	Bifacial	Early to middle-stage of reduction

Diagnostic flake types of those artifacts that may be in a primary context are summarized in Table 50. The sample is very small and suggests only that bifacial and nonbifacial technology are represented.

Table 50. Site 21HE496 Summary of Diagnostic Flake Types, Technologies, and Reduction Stages for Lithics that May Be in Primary Context.

Count & Flake Type	Technology	Stage of Reduction
1 - Decortication flake	Nonbifacial	Earliest stage of core reduction and raw material testing
2 - Nonbifacial flakes	Nonbifacial	Cobble testing, reducing unprepared nonbifacial cores for flake blank production, and the early stages of nonbifacial tool reduction (early to middle-stages of reduction)
1 - Bifacial thinning flake	Bifacial	Early to middle-stage of reduction

Lithic Material Types and Use

Lithic materials consisted primarily of Prairie du Chien Chert, with substantially smaller amounts of many other materials, including basalt, Swan River Chert, Red River Chert, unidentified chert, and Gunflint Silica. All of the materials are locally available. The unidentified chert may be local or exotic. The sample size is too small to validly assess the relationships between specific raw materials, technology, and reduction stages, as indicated by flake types.

The raw materials of those lithics that may be in a primary context include six Prairie du Chien Chert (oolitic) and one each of Swan River Chert, Red River Chert, and basaltic.

Stone Tools

One utilized flake of Prairie du Chien Chert was recovered from a nonprimary context. Utilized flakes are primarily light-duty cutting and slicing tools used on animal remains, wood, and plants.

12.10 FCR

Five pieces of FCR were recovered from five different tests across the site. However, only one FCR may be in a primary context. The FCR assemblage consists of four spalls and one angular type. Raw materials include igneous, granitic, unidentified material, and basaltic. FCR size grades are two SG1, two SG2; and one SG3.

12.11 Faunal Analysis

Faunal material consists of one calcined turtle carapace fragment from Test 16 that may be in a primary context. It weighs 0.4 gram and is SG2.

12.12 Horizontal and Vertical Artifact Patterning

As previously noted, half of the artifacts (n=11) are probably transported from upslope and are not in primary context in the colluvium. The patterning of redeposited artifacts is not indicative of human activities at the site. Therefore, only artifacts from Tests 5NW3, 7SW5, 9NW7, 9W5, 16, 16S3, and 16SW5, which may be in primary context, will be discussed in this section. Eleven artifacts were recovered from these tests. So, the sample size is quite small for a fairly large site area. Artifacts from these tests consist of nine pieces of lithic debris, one FCR, and one calcined bone. There is no notable horizontal patterning except that lithic debris occurs in scattered tests across the site. The FCR and faunal fragment were recovered from the middle of the site. Artifacts occur on the toe slope and the alluvial fan.

Artifacts that may be in primary context were recovered from 80 to 325 cm below surface. It is not easy to determine how the depths of artifacts relate to site occupations, although it is clear that multiple components are present because Test 16 and adjacent Tests 16S3 and 16SW5 had artifacts from a wide range of depths, including 80-90, 160-180, 190-200, and 315-325 cmbs. There appear to be at least three components represented by these depths in this area of the site. Tests 9W5 and 9NW7 had artifacts from a wide range of depths, including 140-150, 190-200, 200-210, and 205-220 cmbs. There appear to be at least two components represented by these depths in this area of the site.

12.13 Site Integrity

As previously noted, half the artifacts (n=11) are probably transported from upslope and not in primary context. Therefore at least half of the artifacts lack integrity. The other artifacts may be in primary context, although they are also contained in colluvium and may have been redeposited. Site 21HE497 is located on the terrace directly above the site, and the ravine that formed the alluvial fan at the site cuts directly through the western edge of site 21HE497. Therefore, site 21HE497 was a likely source for some of the translocated artifacts in colluvium.

12.14 Conclusions and Recommendation

Site 21HE496 is an Early Woodland habitation with a sparse artifact scatter that is deeply buried at the base of the bluff. Most of the site is within the construction limits. A calcined turtle bone dated to 1960 +/- 30 RCYBP. Artifacts were recovered from 80 to 340 cm below surface. At least three components are present, based on the vertical distribution of artifacts. The cultural affiliations and ages of the other components are unknown because of the absence of diagnostic artifacts or dateable materials.

A geomorphological investigation was conducted by Strata Morph Geoexploration, Inc. Of the 22 artifacts recovered from the site, half are probably redeposited in colluvium and are not in primary context. The other artifacts may be in primary context, although they are also contained in colluvium and may have been redeposited.

The Phase I and II investigations included 12 positive tests with 22 artifacts, including 15 pieces of lithic debris, five FCR, one utilized flake, and one calcined turtle bone. Artifacts that may be in primary context include nine pieces of lithic debris, one FCR, and one calcined bone. Artifact density was very low, considering that half the artifacts are not in primary context and the remaining eleven artifacts are from at least three components.

Site activities inferred from those artifacts that may be in a primary context include lithic reduction, stone tool manufacture, and cooking/heating. Bifacial and nonbifacial technologies are represented. Lithic raw materials at the site consist of locally available materials, with Prairie du Chien Chert being the most abundant.

The site lacks the potential to provide important information under Criterion D for the Early Woodland or precontact period (See Section 2.3 Research Themes) because half of the artifacts lack integrity and the other artifacts consist of a very sparse and limited artifact assemblage from multiple components. The site is recommended not eligible for listing on the NRHP because it lacks integrity and does not meet National Register Criteria A, B, C, or D. No further archaeological work is recommended at the site.

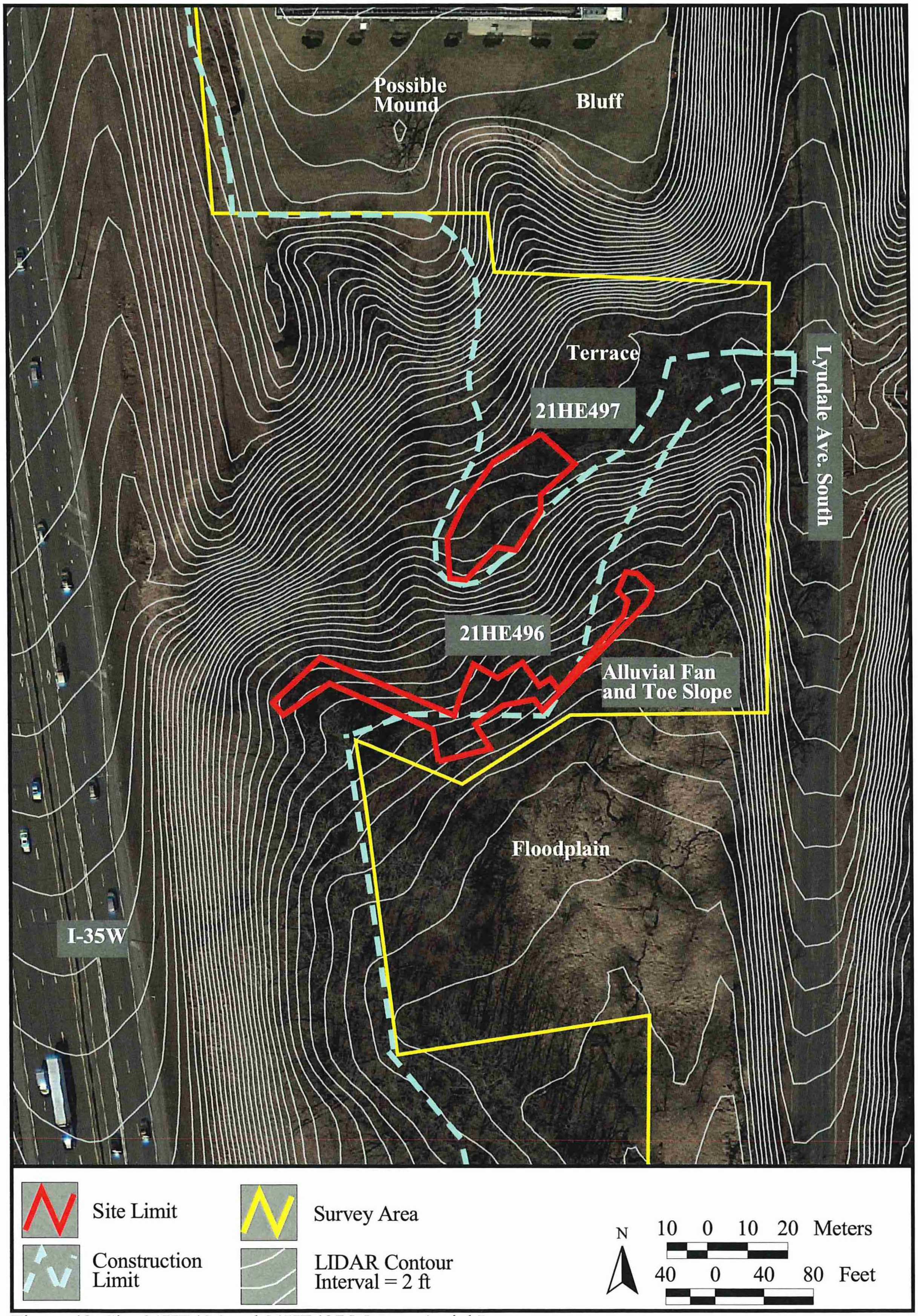


Figure 48. Site 21HE496 and 21HE497 Map on Aerial Imagery.

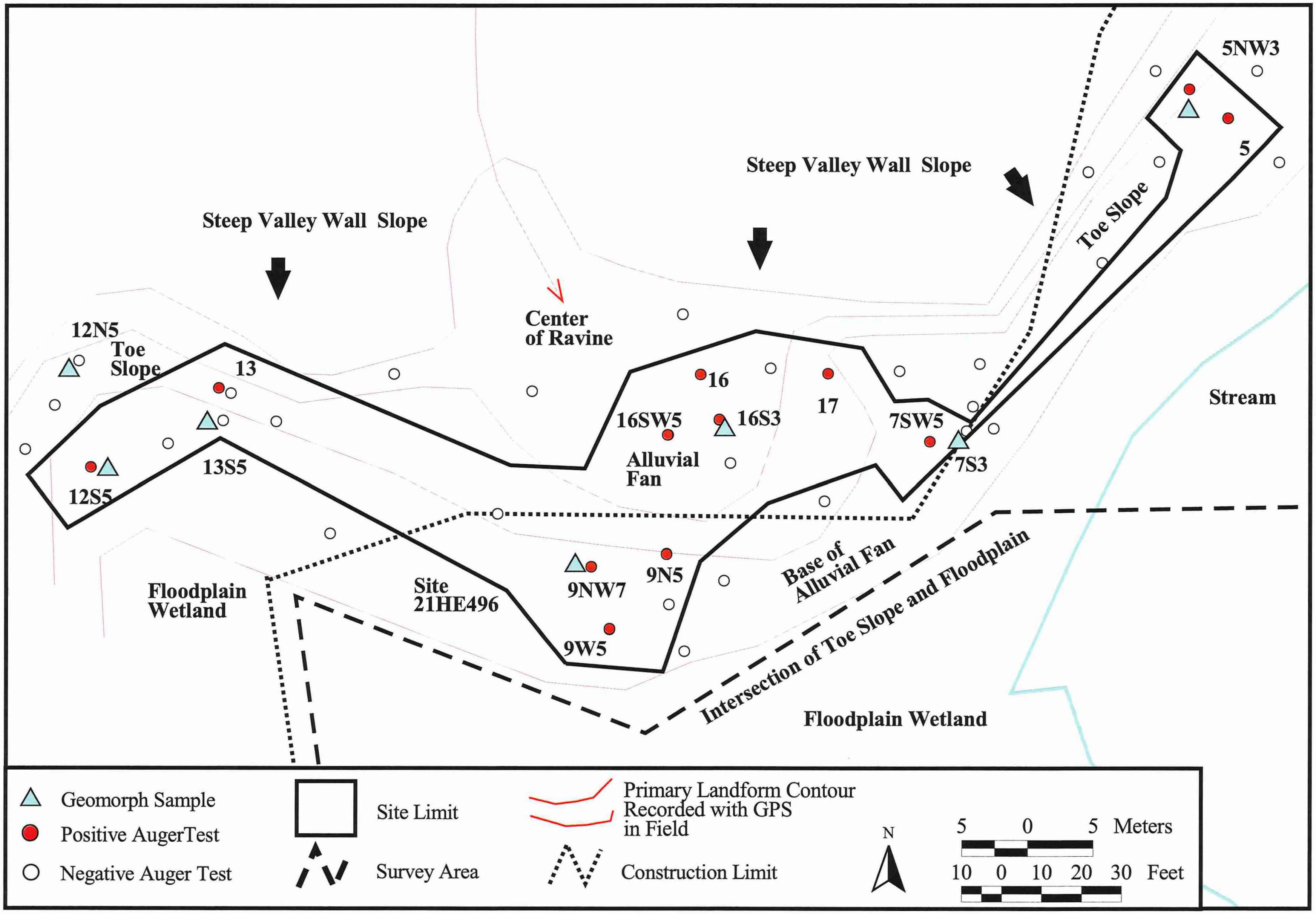


Figure 49. Site 21HE496 Map.


Figure 50. Site 21HE496 Photo.

13. SITE 21HE497

13.1 Overview

Site 21HE497 is a small multicomponent Woodland period habitation with a moderately dense artifact scatter on a high terrace of the Minnesota River. Early Woodland, Transitional Woodland, and Late Woodland components are present, based on radiometric dates and diagnostic artifacts that include Late Woodland Madison ware, St. Croix Stamped ware, two small Late Woodland side-notched points, and two Early Woodland Waubesa points. The site is in T27N, R24W, SE, NE, SE, SE, Section 21 (Figures 1 and 9) and occupies an area of approximately 40 by 15 meters, encompassing 0.1 acre. The UTM coordinates for the center of the site are E477095 N4961520 (1983 NAD Zone 15). A map of the site on aerial imagery is presented in Figure 48, and a general site map is in Figure 51. Photos of the site area are included in Figures 52 and 53. North in the following text and figures refers to grid north, which was about 30 degrees east of magnetic north.

13.2 Physical Setting

The site is on a narrow terrace inset about half way up the Minnesota River valley wall. This terrace likely correlates with the t1 terrace that was formed by Glacial River Warren in the Early Holocene (see Section 7.3 Physiography). The terrace is approximately 50 feet above the valley floor. The site is on the east side of I-35W and extends between 100 and 140 meters west of the centerline. Lyndale Avenue South is 55 meters east of the site. The site area is wooded, and surface visibility was poor (less than 10%). Topographic features and soil profiles indicate that a filled-in ravine is located just west of the site. It is likely that the ravine cut through the west end of the site.

13.3 Soils

Soils at the site are mapped as Hawick loamy sand, 20 to 40 percent slopes, which formed in sandy outwash sediments with or without a thin loamy mantle (Web Soil Survey 2017). These soils are on outwash plains, stream terraces and glacial moraines. A typical profile for this series consists of the following horizons: Ap from 0 to 20 cm of loamy sand; Bw from 20 to 41 cm of gravelly loamy coarse sand; and C from 41 to 201 cm of gravelly coarse sand. The soil profiles from the site consisted of more loamy soil in the upper soil horizons than those described for a typical profile, and a buried soil or anthrosol was present in portions of the site. The fine textured deposits above the sand and gravel are likely colluvium and a fining sequence of suspended particles that settled out at the end of the outwash event. Significant processes at the site that affected soil formation after the initial formation of the terrace include deposition from slopewash and erosion from a ravine. The soil profiles from the site are provided with the XU discussions below.

13.4 Radiocarbon Dating

Seven samples were submitted to Beta for AMS dating, and the results are presented in Table 51 and Appendix x. The samples were selected to obtain dates on the various site components. In summary, the dates indicate multiple occupations at the site during the Woodland period except for a wood charcoal sample from Feature 6 W1/2 90-115 cmbd (Beta 457226) that yielded a modern date, indicating the material was translocated down into the feature. Most of the dates appear to be relatively accurate in dating the components at the site, based on the artifact types present and their correlation with established dates reported from other sites.

Table 51. Site 21HE497 Radiocarbon Dates.

Material/ Provenience	Beta Lab No.	$^{13}C/^{12}C$ Ratio (o/oo)	Conventional ^{14}C Age B.P.	2 Sigma Calibrated Results (95% Probability)	Historic Context
Potsherd residue XU13 50-60 cmbd	455235	-25.7	1280 +/- 30 BP	Cal AD 665 - 775 (cal BP 1285 - 1175)	Late Woodland
Wood charcoal (charred material) Feature 6 E1/2 80-119 cmbd	457227	-26.1	1270 +/- 30 BP	Cal AD 670 - 775 (cal BP 1280 - 1175)	Transitional Woodland
Wood charcoal (charred material) Feature 6 W1/2 90-115 cmbd	457226	-26.8	129.4 +/- 0.5 pMC (Modern)	NA - Modern	-
Wood charcoal (charred material) Feature 5 E1/2 70-79 cmbd	457225	-25.5	1080 +/- 30 BP	Cal AD 895 - 1020 (cal BP 1055 - 930)	Late Woodland
Bone collagen ST30NE7 30-50 cmbs	458050	-19.7	1150 +/- 30 BP	Cal AD 775 - 975 (cal BP 1175 - 975)	Late Woodland (probable)
Bone collagen XU3 50-60 cmbd	457515	-21.1	870 +/- 30 BP	Cal AD 1050 - 1085 (cal BP 900 - 865) and cal AD 1125 - 1140 (cal BP 825 - 810) and cal AD 1150 - 1225 (cal BP 800 - 725)	Late Woodland
Wood charcoal (charred material) Feature 7 88-102 cmbd	457514	-26.2	1690 +/- 30 BP	Cal AD 255 - 295 (cal BP 1695 - 1655) and cal AD 320 - 415 (cal BP 1630 - 1535)	Early Woodland

One problematic date is from the charred residue on a Late Woodland Madison ware sherd from XU 13 at 50-60 cmbd that dated 1280 +/- 30 RCYBP. The similarities of that date and the wood charcoal from Feature 6 (in XU 13) E1/2 80-119 cmbd, which dated 1270 +/- 30 RCYBP, would appear to indicate that the potsherd is the same age as the feature. However, this is not supported by four lines of evidence: 1) the top depth of the feature is below the component with the Late Woodland Madison ware; 2) the ceramics (St. Croix Stamped) in the feature are a Transitional Woodland type; 3) the date on the wood charcoal from the feature fits dates for St. Croix Stamped ware; and 4) the date on the Late Woodland Madison ware is at the very earliest end of a series of over 100 dates for this type of ceramic ware, and the other dates from the Late Woodland component at the site are later and more reasonable. The date on the sherd is interpreted as being too old, perhaps because of "old carbon", as discussed below.

Erroneously old dates on ceramic residue that hves incorporated ancient carbon from cooked aquatic sources, such as fish and shells, have been reported (Fischer and Heinenmeier 2003; Hohman-Caine and Syms 2012). The process of aquatic freshwater animals incorporating ancient carbon is known as the freshwater reservoir effect. The fresh water effect has been studied and validated in lab tests when fish contribute large percentages of the resources cooked in a pot (Hart et al. 2013). However, the archaeological implications are more complicated, and tests of residue from sherds in New York and other sites in eastern North America indicate ancient carbon is not a problem in that region, although it has calcareous bedrock and till (Hart et al. 2013).

A recent study on Brainerd ware resulted in the conclusion that for about half of the dated sherds: "It is obvious that several of the existing and newly acquired dates from burned food residues are skewed because of some sort of Freshwater Reservoir Effect. The exact causal agents in this skewing, however, are not definable at the present state of our understanding" (Hohman-Caine and Syms 2012:75). The Minnesota River and its western tributaries would likely have incorporated ancient carbon as the drainage basins flow through calcareous till. Further studies are needed in Minnesota to assess the potential for old dates caused by the freshwater reservoir effect.

13.5 Phase I Survey Methods and Results

The site was identified during Phase I shovel testing in five and ten-meter intervals. Twelve Phase I shovel tests were positive, and 47 artifacts were recovered, including 22 pieces of lithic debris, 11 faunal fragments, six FCR, three stone tools, two ceramics, and three historic or modern items (Table 52). Artifacts were recovered from 0 to 130 cmbs.

Table 52. Site 21HE497 Summary of Artifacts from Phase I Shovel Tests.

Shovel Test	Depth (cmbs)	Count	Artifact Type
21	20-30	1	Historic, coal fragment
		1	Side and end scraper, Prairie du Chien Chert
		2	Medium/large Mammal unidentifiable fragment
30	30-50	1	Historic, aluminum wire fragment
		1	Bifacial shaping flake, Grand Meadow Chert
	50-70	1	Fire-cracked rock, quartzite
		1	Decortication flake, Grand Meadow Chert
	70-90	1	Fire-cracked rock, unidentified material
		1	Bivalve, unidentifiable fragment
		1	Bifacial shaping flake, Prairie du Chien Chert (oolitic)
		1	Ceramic (precontact)
30E5	60-70	1	Bipolar flake, quartz
	70-80	1	Bipolar flake, quartz
		1	Nonbifacial flake, Swan River Chert
		1	Broken flake, Prairie du Chien Chert (oolitic)
		2	Bipolar flake, Swan River Chert
30S5	80-90	1	Nonbifacial flake, Prairie du Chien Chert
	95-105	1	Broken flake, Grand Meadow Chert
	100-110	1	Other G4 flake, quartz
30NE7	30-50	1	Utilized flake, Swan River Chert
		1	Odocoileus virginianus (white-tailed deer) right metacarpal proximal fragment
		1	Large Mammal longbone shaft fragment
		5	Mammalian, unidentifiable fragment, burned
		1	Vertebrata, unidentifiable fragment
	50-80	1	Nonbifacial flake, unidentified chert
31S5	120-130	1	Broken flake, Galena Chert
32	0-20	1	Ceramic (precontact)

Table 52. Continued.

Shovel Test	Depth (cmbs)	Count	Artifact Type
32E5	90-100	1	Bifacial thinning flake, Swan River Chert
32S5	0-20	1	Bifacial thinning flake, Prairie du Chien Chert (oolitic)
	20-40	2	Fire-cracked rock, granitic and basaltic
		3	Bipolar flake, quartz and metamorphic
		1	Decortication flake, Red River Chert
		1	Other G4 flake, quartz
		1	Broken flake, quartz
34	40-50	1	Side and end scraper, Prairie du Chien Chert (oolitic)
34W5	50-60	1	Fire-cracked rock, granitic
34NW5	60-70	1	Fire-cracked rock, quartzite
		1	Historic shell button
Total	-	**47**	-

13.6 Phase II Survey Methods

No additional shovel tests were dug during Phase II testing, as close-interval testing was conducted during the Phase I survey, which provided sufficient data on intra-site artifact patterning and site integrity. A total of 13 XUs were placed in site areas that offered the greatest research potential, based on the data from the shovel tests. Four features were identified (Features 1, 5, 6, and 7). Features numbers 2, 3, or 4 were assigned to dark stains during excavation, but they were subsequently determined to be non-features.

13.7 XUs 1, 2, and 13

XUs 1, 2, and 13 were contiguous units with the southeast corner of XU 13 placed on Phase I Shovel Test 30, which yielded three pieces of lithic debris, two FCR, one ceramic, and one mussel shell. Excavation was conducted in 10-cm levels below a unit datum. The landscape sloped very slightly to the southeast. Excavation was terminated at 120 cmbd in XU 1, 110 cmbd in XU 2, and 125 cmbd in XU 13 because of the lack of artifacts and dense gravels. A shovel test was placed in the base of the XUs to 140 cmbd to examine the soils and ensure that no deeply buried archaeological deposits were present. A summary of artifacts recovered in the units is presented in Tables 53 and 54. The artifact data for XU 13 is presented separately from XUs 1 and 2 because the soil horizons occur at slightly different depths in XU 13. Feature 6, a cooking/heating pit, was identified in XU 13 and is discussed below.

Layout of XUs 1, 2, and 13 (grid north facing up).

13	1	2

Table 53. Site 21HE497 Summary of Artifacts from XUs 1 and 2.

Depth (cmbd)	Component*	FCR	Ceramic	Lithic Debris	Lithic Tool	Faunal Thermally Altered CT (WT g)	Faunal CT (WT g)	Total	%
0-40	Fill	-	-	-	-	-	-	-	-
40-50	LW	-	-	1	-	-	1 (.2)[4]	**2**	**1**
50-60	LW	-	2[1]	7	-	-	1 (.2)[5]	**10**	**6**
60-70	LW	3	8[1]	24	2	-	14 (1.2)[6]	**51**	**29**
70-80	LW/ TW	5	4[1]	36	1	2 (.2)[3]	2 (53.1)[7]	**50**	**28**
80-90	TW	5	2[2]	20	3	-	3 (40.9)[8]	**33**	**19**
90-100	TW	5	-	19	-	-	-	**24**	**13**
100-110	TW	4	1[2]	2	-	-	-	**7**	**4**
110-120	TW	-	-	1	-	-	-	**1**	**1**
Total	**-**	**22**	**17**	**110**	**6**	**2**	**21**	**178**	**-**
%	**-**	**12**	**10**	**62**	**3**	**1**	**12**	**-**	**100**

*LW=Late Woodland and TW=Transitional Woodland; [1] Late Woodland Madison ware - thin walls with woven fabric cord impressions; [2] Transitional Woodland St. Croix Stamped ware – thicker walls with nondistinct cord markings; [3] Vertebrata; [4] Medium/large mammal; [5] Muskrat; [6] Rodentia, muskrat, plains pocket gopher and vertebrata; [7] Mussel shell from base of level where Transitional Woodland Feature 6 would have extended into XU 1. [8] Mussel shell from top of level where Feature 6 would have extended into XU 1. Shell typically consists of many tiny fragments Size Grade 3 and smaller that were given a count of "1" per similar group in the catalog.

Table 54. Site 21HE497 Summary of Artifacts from XU 13, Excluding Feature 6.

Depth (cmbd)	Component*	FCR	Ceramic	Lithic Debris	Lithic Tool	Faunal Thermally Altered	Faunal[3] CT (WT g)	Total	%
0-20	Fill	-	-	-	-	-	-	-	-
20-30	Fill	1	-	3	1	-	-	**5**	**4**
30-40	LW	-	3[1]	2	-	-	1 (.1)	**6**	**5**
40-50	LW	-	8[1]	4	-	-	2 (5)	**14**	**11**
50-60	LW	1	27[1]	2	-	-	3 (28.5)	**33**	**25**
60-70	LW?	1	1[1]	7	-	-	1 (1.2)	**10**	**8**
70-80	?	-	-	6	-	-	1 (.4)	**7**	**5**
80-90	TW	1	-	6	-	-	-	**7**	**5**
90-100	TW	2	-	10	-	-	-	**12**	**9**
100-110	TW	6	3[2]	17	-	-	-	**26**	**20**
110-120	TW	3	4[2]	5	-	-	-	**12**	**9**
120-125	-	-	-	-	-	-	-	-	-
Total	**-**	**15**	**46**	**62**	**1**	**-**	**8**	**132**	**-**
%	**-**	**11**	**35**	**47**	**1**	**-**	**6**	**-**	**100**

*LW=Late Woodland and TW=Transitional Woodland; [1] Late Woodland Madison ware - thin walls with woven fabric cord impressions; [2] Transitional Woodland St. Croix Stamped ware – thicker walls with nondistinct cord markings; [3] Faunal is all shell that typically consists of many tiny fragments Size Grade 3 and smaller that were given a count of "1" per similar group in the catalog.

Artifact Summary and Vertical Distribution for XUs 1, 2, and 13

A total of 178 artifacts were recovered from XUs 1 and 2, including 110 pieces of lithic debris, 23 faunal fragments (two are thermally-altered), 22 FCR, 17 ceramics, six stone tools (three utilized flakes, a retouched flake, a scraper, and a manuport) (Table 53). A total of 132 artifacts were recovered from XU 13 (exclusive of Feature 6), including 62 pieces of lithic debris, 46 ceramics, 15 FCR, 8 faunal fragments, and one stone tool (Stage 1 unfinished biface) (Table 54).

Two different ceramic wares were recovered, indicating two separate occupations. The ceramics from 50 to 80 cmbd in XUs 1 and 2 and from 30 to 70 cmbd in XU 13 were thin (mostly between 2.9 and 3.9 mm), had a fine grit temper, and cordmarked surfaces, with some sherds having woven fabric impressions. A diagnostic rim sherd from XU 13 indicates that these ceramics are Late Woodland Madison ware. The ceramics from 80 to 110 cmbd in XUs 1 and 2 and below 100 cmbd in XU 13 were thicker (5.3 to 7.3 mm), had a coarse grit temper, and had indistinct cordmarkings that lacked woven fabric impressions. Diagnostic sherds from Feature 6 in XU 13 indicate these ceramics are probably Transitional Woodland St. Croix Stamped ware. Ceramics from the site are discussed in detail in a subsequent section.

Artifacts were recovered between 40 and 120 cmbd in XUs 1 and 2 and between 20 and 120 cmbd in XU 13. The zone with the greatest artifact density in XUs 1 and 2 occurs between 60 and 80 cmbd, with a moderate amount from 80 to 100 cmbd. In XU 13, there were two zones with the greatest artifact density: an upper zone from 50 to 60 cmbd and a lower zone from 100 to 110 cmbd. Artifacts occur slightly deeper in XU 13 because of the thicker buried soils above the sand and gravel layer, as it appears there was more sediment deposition in XU 13. The smaller number of artifacts above and below these primary artifact zones were likely displaced by natural causes, such as freeze-thaw and bioturbation from rodent runs, which were common.

Based on the vertical patterning of the artifacts (particularly ceramic wares) and examination of soil horizon depths, the artifact zone from 40 and 80 cmbd in XUs 1 and 2 and from 30 to 70 cmbd in XU 13 is a Late Woodland component. However, the bottom of the 70 to 80 cmbd level in XU 1 contained shell from a feature that is associated with the underlying Transitional Woodland component that occurs in and below a buried soil, which is slightly higher in the western portion of XU 1, where it occurs at 80 cmbd compared to 85 cmbd in XU 2. The 70 to 80 cmbd level in XUs 1 and 2 is interpreted to contain mostly Late Woodland component artifacts. The lower artifact zone from 80 and 120 cmbd in XUs 1, 2, and 13 is a Transitional Woodland component.

The Late Woodland component occurs in A and AB horizons above the buried soil. The Transitional Woodland component occurs in and below a thin buried soil that occurs from 80 to 95 cmbd in XUs 1 and 2. However, in XU 13 artifacts from the Transitional Woodland component are mostly below the buried soil, which occurs from 73 to 90 cmbd, sloping downward from northwest to southeast. These artifacts have likely been displaced downward below the buried soil by rodent burrowing.

Charred residue from a Late Woodland Madison ware sherd from XU 13 at 50 to 60 cmbd dated to 1280 +/- 30 RCYBP, and charcoal from Feature 6 at 90 to 115 cmbd in XU 13 dated to 1270 +/- 30 RCYBP. The dates would seem to indicate that Feature 6 is associated with the Late Woodland component and is the same age as that component. However, as discussed in the Radiocarbon Dating

Section 13.4, the date on the sherd is interpreted as being too old. Also, the vertical patterning of the components indicates that the top of the Feature 6 at 80 cmbd is below the Late Woodland component, which in XU 13 does not extend below 70 cmbd (and perhaps only 60 cmbd). Also, Transitional Woodland St. Croix Stamped ceramics were recovered from Feature 6 in situ between 92 and 95 cmbd. The date from charcoal in Feature 6 fits well with the Transitional Woodland St. Croix Stamped ware.

The artifact assemblages from the components are generally similar, with each having a moderate quantity of lithic debris, and small amounts of FCR, stone tools, ceramics, and mussel shells. The small mammal remains in the Late Woodland component may be non-cultural. In XU 13, there were more ceramics in the Late Woodland component, but the Transitional Woodland component had more lithic debris and FCR. A review of artifact types and lithic materials is conducted below to examine vertical patterning from each component and assist in defining components.

<u>Review of Flake Types by Depth for XUs 1, 2, and 13</u>
A review of diagnostic flake types and tools by depth indicates that there is some patterning by depth related to components (Tabled 55 and 56), although the sample size is somewhat small. In XUs 1 and 2, bipolar flakes occur nearly exclusively in the Late Woodland component, and nonbifacial and decortication flakes occur mostly above 80 cmbd, which is also likely from the Late Woodland component. Bifacial thinning flakes are most abundant in the Transitional Woodland component, while bifacial shaping flakes occur in both components.

In XU 13, bifacial thinning flakes are most abundant between 80 and 120 cmbd in the Transitional Woodland component, and bifacial shaping flakes are slightly more numerous from 80 to 100 cmbd. The transitional level from 70 to 80 cmbd had the most decortication flakes, but it is uncertain if these are from the Transitional or Late Woodland components. Notable amounts of bifacial thinning and nonbifacial flakes were also recovered from this level. The other flake types occur in similar amounts in both components in XU 13.

Table 55. Site 21HE497 Diagnostic Lithic Debris and Tools by Depth in XUs 1 and 2.

Depth cmbs	Bipolar Flakes	Bifacial Shaping Flakes	Bifacial Thinning Flakes	Decortication Flakes	Nonbifacial Flakes	Shatter	Tools
0-50*	-	-	-	-	-	-	-
50-60	-	4	1	-	-	-	-
60-70	5	8	-	-	5	1	1 utilized flake; 1 retouched flake
70-80	-	2	5	5	4	1	1 end scraper
80-90	1	4	5	1	1	1	1 manuport; 2 utilized flakes
90-100	-	2	7	1	-	1	-
100-110	-	-	-	-	-	-	-
110-120	-	-	1	-	-	-	-

* Fill layer from 0 to 40 cmbd

Table 56. Site 21HE497 Diagnostic Lithic Debris and Tools by Depth in XU 13.

Depth cmbs	Bipolar Flakes	Bifacial Shaping Flakes	Bifacial Thinning Flakes	Decortication Flakes	Nonbifacial Flakes	Shatter	Tools
0-20*	-	-	-	-	-	-	-
20-30*	-	1	-	-	-	-	1 biface
30-40	-	-	1	-	1	-	-
40-50	-	-	-	-	3	-	-
50-60	-	-	1	1	-	-	-
60-70	-	1	1	-	-	-	-
70-80	-	-	4	-	-	-	-
80-90	-	1	2	1	-	-	-
90-100	-	3	3	-	-	1	-
100-110	-	-	7	1	2	-	-
110-120	-	-	4	1	-	-	-

* Fill layer

Review of Raw Material Types by Depth for XUs 1, 2, and 13

Lithic raw materials show discrete vertically patterning related to site components for a few materials, but most materials occur in similar amounts in both components or in very small quantities (Tables 57 and 58). In XUs 1 and 2, quartz is notably most abundant from 60 to 80 cmbd in the Late Woodland component. Knife River Flint, basalt, and Gunflint Silica also only occur in small amounts from 60 to 80 cmbd. Unidentified materials and metamorphic rock occurs only below 80 cmbd in the Transitional Woodland component. In XU 13, Prairie du Chien Chert is notably most abundant below 90 cmbd in the Transitional Woodland component. The other materials occur in similar amounts in both components, in undefined levels between components, or in very small quantities.

Table 57. Site 21HE497 Raw Materials by Depth in XUs 1 and 2.

Depth cmbd	Prairie du Chien Chert	Quartz	Unid. Chert	Grand Meadow Chert	Swan River Chert	Unid. Material	Quartzite	Red River Chert	Knife River Flint	Basaltic & Gunflint Silica	Meta-morphic
0-40*	-	-	-	-	-	-	-	-	-	-	-
40-50	1	-	-	-	-	-	-	-	-	-	-
50-60	3	1	1	1	-	-	1	-	-	-	-
60-70	9	8	4	-	2	-	1	-	-	2	-
70-80	16	14	3	1	1	-	-	1	1	-	-
80-90	10	4	3	-	-	3	1	1	-	-	1
90-100	12	2	1	2	2	-	-	-	-	-	-
100-110	2	-	-	-	-	-	-	-	-	-	-
110-120	-	-	-	1	-	-	-	-	-	-	-

* Fill Layer

Table 58. Site 21HE497 Raw Materials by Depth in XU 13.

Depth cmbd	Prairie du Chien Chert	Grand Meadow Chert	Unid. Chert	Quartz	Swan River Chert	Knife River Flint	Red River Chert	Quartzite	Unid. Material
0-20*	-	-	-	-	-	-	-	-	-
20-30*	3	-	-	-	-	-	-	1	-
30-40	-	-	1	1	-	-	-	-	-
40-50	-	4	-	-	-	-	-	-	-
50-60	1	-	-	-	-	-	1	-	-
60-70	-	4	2	-	1	-	-	-	-
70-80	1	3	-	-	1	1	-	-	-
80-90	3	1	1	1	-	-	-	-	-
90-100	8	1		-	-	-	-	-	1
100-110	11	4	1	1	-	-	-	-	-
110-120	3	2	-	-	-	-	-	-	-

* Fill Layer

Soils and Stratigraphy for XUs 1, 2, and 13

The soil horizons from XUs 1, 2, and 13 are depicted in wall profiles and photographs in Figures 54 to 58. The soil profiles consist of fill overlying a truncated silt loam A horizon, sandy clay loam AB horizon, sandy loam buried A horizon, loamy sand B horizon, and gravelly sand C horizon. The sand and gravel content increases significantly in the horizons below the buried soil. The presence of the buried soil indicates that in this area there was a period of stability coinciding with the Transitional Woodland occupation, and subsequently there was deposition before and during the Late Woodland occupation. Buried soils were not present in other site areas, and the unique depositional history in this area is probably related to the nearby ravine just west of the site.

The soils are fairly undisturbed below the fill. There is a minimal to moderate amount of rodent burrows. As a result of the natural slope of the topography, the soils have a gentle slope downward from northwest to southeast. In XU 13, the B horizon soil below the buried A horizon is thicker than in XUs 1 and 2, presumably from greater deposition.

Feature 6 in XU 13

Feature 6 was initially identified at 78 cmbd in XU 13 and formally mapped and defined at 80 cmbd as a dark, oval-shaped soil stain with concentrations of whole and fragmentary mussel shells at the top of the feature. Shell was largely absent from the rest of the feature. At 90 cmbd the feature was more clearly defined, more circular, and slightly larger. The eastern portion of the feature extended into XU 1 but was not identified because of an indiscernible pattern of dark soil stains in the western portion of this unit that obscured the feature. However, mussel shells were mapped and recovered from XU 1 along the middle of the west wall from 76 to 80 cmbd, where the top of the feature was located, and dark soil staining was also present. All feature fill (49.5 liters) was troweled and bagged for flotation. Analysis of the botanicals recovered from the light and heavy fractions was conducted by Connie Arzigian (paleoethnobotanist) and staff at MVAC. One charcoal sample recovered from the feature dated to 1270 +/- 30 RCYBP (Table 51). Another charcoal sample yielded a modern date, indicating the material was translocated down into the feature.

Planviews and profiles of Feature 6 were recorded in illustrations and photos during excavation (Figures 58 to 64). Planviews of the feature at 80 and 90 cmbd were recorded. At 80 cmbd, the feature was oval in planview and about 35 cm in width, with an unknown length because the portion in XU 1 had not been identified. At 90 cmbd, the feature was larger and more circular in planview, measuring about 55 cm in width. In the feature bisection profile in XU 13, the feature was 34 cm deep, extending from 82 to 116 cmbd, and had a deep basin shape. The base of the feature from 107 to 116 consisted of a very homogenous black (10YR 2/1) zone that was darker than the rest of the feature fill. The feature is also clearly visible in the west wall profile of XU 1 from 82 to 116 cmbd.

The dark color of the feature was likely caused by carbon-stained sediments from charcoal and probably infilling with topsoil. A small amount (less than a teaspoon) of charcoal fragments was recovered from the feature fill during flotation. The feature is interpreted as a cooking and/or heating pit, based on the mussel shells, presence of charcoal and carbon-stained sediments, and small amount thermally-altered bone and FCR in the feature and adjacent areas. The feature does not fit one of the typical cooking facilities described in the FCR Analysis Section 4.4. No oxidized (orangish-colored) soil or ash was observed in or around the feature.

A summary of the charred botanical materials recovered from feature flotation is presented in Table 59. The only charred plant remains were wood charcoal and charred starchy fragments, possibly from an acorn cap. Seven uncharred modern weed seeds and chenopodium were also present.

Table 59. Site 21HE497 Feature 6 Botanical Summary.

Provenience	Soil Volume Floated (liters)	Light Fraction >20 mesh (% sorted)	Light Fraction <20 mesh (% sorted)	Charred Flora Recovered
E 1/2 80-119 cmbd	18	100	50	3 fragments (0.002 gm) of charred starchy fragment, possibly from an acorn cap; small fragments of charred wood – an AMS sample 0.064 gm wood charcoal sent for dating
W 1/2 80-117 cmbd	12	100	100	small fragments of charred wood
W 1/2 90-115 cmbd	19.5	100	50	2 fragments (0.009 gm) charred starchy fragments, possibly from an acorn cap; small fragments of charred wood - AMS sample 0.063 g wood charcoal sent for dating

20 mesh = .0331 inches / 0.8 mm

A total of 121 artifacts were recovered from the heavy and light fractions during flotation of the Feature 6 fill (Table 60), including 63 fauna (including many small fragments of shell that were counted as "1" per similar type), 35 ceramic body sherds (all but one are SG 3 or 4), 19 pieces of lithic debris (13 Other G4 flakes, two biface shaping and one biface thinning flakes, one shatter, and two broken flakes), and four FCR (SG 2 and 3). The greater number of artifacts recovered from the feature than from the surrounding XU soil is largely because the heavy fraction of the feature fill was screened through 1/16" mesh, thus recovering more small-sized artifacts.

The fauna consisted of nine different species of freshwater mussels (clams), 15 burned vertebrata, one unburned vertebrata, and one rodent bone, which is likely noncultural. The ceramics include three Transitional Woodland St. Croix ware sherds with stamped decoration. The other sherds from the feature are thicker than the Madison ware from the overlying component, and they have different cordmarking and larger grit temper. These sherds are interpreted to be St. Croix ware.

Table 60. Site 21HE497 Summary of Artifacts from Feature 6.

Provenience	Count and Weight (g)	Artifact description
E1/2 80-85 cmbd	4 (126.3g)	Actinonaias ligamentina (mucket mussel) fragments, valves, left and right
	4 (71.8g)	Amblema plicata (threeridge) fragments, valves left
	1 (34.0g)	Fusconaia flava (Wabash pigtoe), complete valve left
	1 (6.4g)	Lampsilis sp. (freshwater mussel) fragment, valve right
	1 (12.6g)	Lasmigona sp. (freshwater mussel) fragment, valve right
	2 (6.7g)	Leptodea fragilis (fragile papershell) fragment valve right
	7 (132.9g)	Molluscan, fragment, valves left and right
E1/2 80-119 cmbd	23 (10.8g)	Ceramic body, grit temper, cord marked
	5 (2.1g)	Ceramic body, grit temper, undetermined surface
	3 (2.6g)	Ceramic body, grit temper, stamped decoration, St. Croix ware, smooth
	2 (0.2g)	Bifacial shaping flake, Prairie du Chien Chert (oolitic)
	2 (0.4g)	Broken flake, quartz
	3 (0.1g)	Other G4 flake, quartz
	6 (0.1g)	Other G4 flake, Prairie du Chien Chert (oolitic)
	3 (2.9g)	Fire-cracked rock, 2 spall and 1 crumb, basaltic, and granitic unidentified material
	1 (32.2g)	Molluscan fragment, shell
	8 (0.1g)	Vertebrata fragment, unidentifiable, burned
	1 (0.0g)	Vertebrata fragment, unidentifiable
W1/2 80-85 cmbd	3 (92.6g)	Amblema plicata (threeridge) fragment, valves left and right
	2 (111.7g)	Amblema plicata (threeridge), complete, valve left
	1 (5.8g)	Fusconaia flava (Wabash pigtoe) fragment, valve right
	2 (44.9g)	Lampsilis cardium (plain pocketbook) fragment, valves left and right
	3 (123.6g)	Lampsilis siliquoidea (fatmucket clam) fragment, valves left and right
	1 (7.0g)	Lampsilis teres (yellow sandshell) fragment, valve, left
	1 (6.7g)	Lasmigona sp. (freshwater mussel) fragment, valve, left
	5 (14.6g)	Leptodea fragilis (fragile papershell) fragment, valves left and right
	4 (84.0g)	Molluscan fragment, valve, right, shell
	1 (11.4g)	Obliquaria reflexa (threehorn wartyback) fragment, valve, left
W1/2 80-117 cmbd	1 (13.8g)	Molluscan fragment, shell
	1 (2.1g)	Fire-cracked rock, spall, unidentified material
W1/2 90-115 cmbd	2 (1.4g)	Ceramic body, grit temper, cord marked
	2 (0.3g)	Ceramic body, grit temper, undetermined surface
	4 (0.2g)	Other G4 flake, Prairie du Chien Chert (oolitic)
	1 (1.0g)	Bifacial thinning flake, Prairie du Chien Chert (oolitic)
	1 (0.5g)	Shatter, quartz
	1 (0.2g)	Molluscan fragment, shell
	1 (0.1g)	Rodentia fragment, tooth, incisor
	7 (0.2g)	Vertebrata fragments, unidentifiable, burned
Total	**121 (964.3g)**	

13.8 XUs 3, 4, 9, and 10

XUs 3 and 4 were contiguous units with the northeast corner of XU 4 placed adjacent to Phase I Shovel Test 30NE7, which yielded eight faunal fragments and two pieces of lithic debris. XUs 9 and 10 are west of and adjacent to XUs 3 and 4, but they were dug with a different datum. Excavation was conducted in 10-cm levels below a unit datum. The landscape sloped slightly to the south. Excavation was terminated at 90 cmbd in XU 3, 80 cmbd in XU 4, 105 cmbd in XU 9, and 90 cmbd in XU 10 because of the lack of artifacts and dense gravels. A summary of artifacts recovered in the units is presented in Tables 61 to 64. The results are presented separately for each XU, as the datum elevations of the XUs in relation to the natural soil horizons are not the same between units because of the sloping ground. Features 1, 5, and 7 (cooking and/or heating pits) were identified and are discussed below.

Layout of XUs 3, 4, 9, and 10 (grid north facing up).

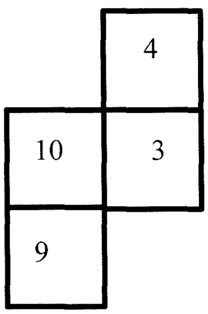


Table 61. Site 21HE497 Summary of Artifacts from XU 3, Excluding Feature 1.

Depth (cmbd)	FCR	Ceramic	Lithic Debris	Lithic Tool	Faunal Thermally Altered	Faunal	Total	%
0-40	-	-	-	-	-	-	-	-
40-50	-	7	4	-	-	-	**11**	**12**
50-60	14	41	8	-	2	1	**66**	**70**
60-70	1	4	8	2	-	-	**15**	**16**
70-80	-	-	1	-	-	1	**2**	**2**
80-90	-	-	-	-	-	-	-	-
Total	**15**	**52**	**21**	**2**	**2**	**2**	**94**	**-**
%	**16**	**55**	**22**	**2**	**2**	**2**	**-**	**100**

Table 62. Site 21HE497 Summary of Artifacts from XU 4, Excluding Feature 1.

Depth (cmbd)	FCR	Ceramic	Lithic Debris	Lithic Tool	Faunal Thermally Altered	Faunal	Total	%
0-30	-	-	-	-	-	-	-	-
30-40	-	1	2	-	-	-	**3**	**10**
40-50	2	2	3	5*	-	1	**13**	**43**
50-60	5	-	3	3**	-	1	**12**	**40**
60-70	-	-	2	-	-	-	**2**	**7**
70-80	-	-	-	-	-	-	-	-
Total	**7**	**3**	**10**	**8**	**-**	**2**	**30**	**-**
%	**23**	**10**	**33**	**27**	**-**	**7**	**-**	**100**

* Small, side-notched Late Woodland projectile point; ** Small, side-notched Late Woodland projectile point and a probable broken Waubesa Early Woodland point

Table 63. Site 21HE497 Summary of Artifacts from XU 9, Excluding Feature 7.

Depth (cmbd)	FCR	Ceramic	Lithic Debris	Lithic Tool	Faunal Thermally Altered	Faunal	Total	%
0-40	-	-	-	-	-	-	-	-
40-50	-	4	1	-	-	-	**5**	**2**
50-60	-	36	7	-	-	-	**43**	**19**
60-70	10	113	18	-	5	-	**146**	**63**
70-80	2	13	7	3	-	-	**25**	**11**
80-90	3	-	2	-	-	-	**5**	**2**
90-100	6	-	-	1*	-	-	**7**	**3**
100-105	-	-	-	-	-	-	-	-
Total	**21**	**166**	**35**	**4**	**5**	**-**	**231**	**-**
%	**9**	**72**	**15**	**2**	**2**	**-**	**-**	**100**

* Core

Table 64. Site 21HE497 Summary of Artifacts from XU 10, Excluding Feature 5.

Depth (cmbd)	FCR	Ceramic	Lithic Debris	Lithic Tool	Faunal Thermally Altered	Faunal	Total	%
0-40	-	-	-	-	-	-	-	-
40-50	-	3	2	-	-	-	**5**	**7**
50-60	5	17	1	1	1	-	**25**	**37**
60-70	5	12	4	1	2	-	**24**	**35**
70-80	-	13	1	-	-	-	**14**	**21**
80-90	-	-	-	-	-	-	-	-
Total	**10**	**45**	**8**	**2**	**3**	**-**	**68**	**-**
%	**15**	**66**	**12**	**3**	**4**	**-**	**-**	**100**

<u>Artifact Summary and Vertical Distribution for XUs 3, 4, 9 and 10</u>

A total of 94 artifacts were recovered from XU 3, including 52 ceramics, 21 pieces of lithic debris, 15 FCR, four faunal fragments (two are thermally-altered), and two stone tools (utilized flakes) (Table 61). A total of 30 artifacts were recovered from XU 4 including ten pieces of lithic debris, eight stone tools (three projectile points, one broken point fragment, two nonutilitarian stones, a utilized flake, and a hammerstone), seven FCR, three ceramics, two faunal fragments (two are thermally-altered), and (Table 62). A total of 231 artifacts were recovered from XU 9, including 166 ceramics, 35 pieces of lithic debris, 21 FCR, five thermally-altered faunal fragments, and four stone tools (utilized flakes and a core) (Table 63). A total of 68 artifacts were recovered from XU 10, including 45 ceramics, ten FCR, eight pieces of lithic debris, three thermally-altered faunal fragments, and two stone tools (broken point fragment and Stage 4 biface) (Table 64).

The projectile points include two small, side-notched Late Woodland types from 40 to 60 cmbd in XU 4, a probable broken Waubesa Early Woodland type from 50 to 60 cmbd in XU 4, and two nondiagnostic broken projectile point blade fragments from 50 to 60 cmbd in XU 4 and 60 to 70 cmbd in XU 10. A Waubesa Early Woodland point was also recovered at 102 cmbd in Feature 7 in XU 9 (discussed below and not included above). The two tools classified as nonutilitarian items are nearly identical small circular stones from recovered 40 to 50 cmbd. They are likely nonutilitarian items such as game pieces or special stones with perhaps symbolic or spiritual significance.

All of the ceramic sherds recovered from these XUs are Late Woodland Madison ware. They are thin (mostly between 3.3 and 4.6 mm), have a fine grit temper, and cordmarked surfaces, with many sherds having woven fabric impressions. Several sherds had punctate decorations. The ceramics are very similar to the Late Woodland Madison ware from XUs 1, 2, and 13.

Artifacts were recovered between 40 and 80 cmbd in XU 3, 30 to 70 cmbd in XU 4, 40 to 100 cmbd in XU 9, and 40 to 80 cmbd in XU 10. Each XU has a single zone (10 to 20 cm thick) with the greatest artifact density, except XU 10 which has a more diffuse vertical distribution. These zones of greatest artifact density occur in XU 3 from 50 to 60 cmbd (70%), XU 4 from 40 to 60 cmbd (83%), XU 9 from 60 to 70 cmbd (63%), and XU 10 from 50 to 70 cmbd (72%).

Except in XU 4, the main artifact zones in each of these XUs have high percentages of ceramics, indicating that they are a Late Woodland component. XU 4 has a sparse quantity of artifacts, with a smaller percentage of ceramics than the other XUs, but it also has two Late Woodland projectile points. The small numbers of artifacts above and below these zones were likely displaced by natural processes, although some of the vertical distribution is related to the age of the occupations, as older artifacts are subject to a greater amount of displacement over time and have a greater tendency to move downwards and occur at deeper depths.

Diagnostic artifacts indicate that Late Woodland and Early Woodland components are present despite the lack of bimodal vertical distributions. The differential vertical patterning of artifact types suggests the presence of two components, although there is also likely to be overlap of these components in the main artifact zones defined above, as indicated by the small, side-notched Late Woodland point and Waubesa Early Woodland point that were both recovered from 50 to 60 cmbd. A review of the vertical patterning of artifact types, which suggests there are two components, is summarized as follows: in XU 3, lithic debris and tools occur in disproportionately greater amounts below the main artifact zone than the other artifacts; in XU 4, there are slightly more ceramics in the upper portion of the main artifact zone and slightly more FCR in the lower portion of the zone; and in XU 9, FCR and lithic debris and tools occur in disproportionately greater amounts below the main artifact zone than the other artifacts. In summary, the data indicates that lithic debris, lithic tools, and FCR occur in disproportionately greater amounts below the main artifact zone or in the lower portion of the zone than other artifacts, which are primarily Late Woodland ceramics. This pattern suggests that a Late Woodland component overlies an Early Woodland component, which is defined by the Waubesa point.

XU 10 does not appear to have any relevant patterning below the main artifact zone, except that the ceramics occur deeper than in the other XUs in this block, and they occur in relatively equal amounts over a 30-cm deep span, whereas most of the ceramics in the other XUs are concentrated in a 10-cm level. The broad vertical ceramic distribution in XU 10 may have been caused by the moderate amount of rodent runs that were observed.

The artifact assemblage of each component is generally similar, except that only Late Woodland ceramics occur and not any earlier types. The exact artifact assemblage from each component is not clear because of the vertical overlap of the components. Each component has a fairly sparse amount of lithic debris, FCR, stone tools, and faunal material. Ceramics are the most abundant artifact type. A review of artifact types and lithic materials is conducted below to examine vertical patterning from each component and assist in defining components.

Review of Flake Types by Depth for XUs 3, 4, 9 and 10

A review of diagnostic flake types and tools by depth does not provide much firm evidence for delineating components based on depth of flake and tool types, in part because of the low sample size and overlap of components (Tables 65 to 68). In XUs 3 and 9, tools were recovered below the main artifact zones, which were defined above. In XUs 4 and 10, tools were recovered from the main artifact zones. In summary, all diagnostic flake type occur in the main artifact zone as well as above and below this zone. There are a variety of flake types in the assemblage that indicate a range of lithic-reduction technologies, including bipolar, nonbifacial, and bifacial. The assemblage includes lithics from the early, middle, and late stages of reduction

Table 65. Site 21HE497 Diagnostic Lithic Debris and Tools by Depth in XU 3.

Depth cmbs	Bipolar Flakes	Bifacial Shaping Flakes	Bifacial Thinning Flakes	Decortication Flakes	Nonbifacial Flakes	Shatter	Tools
0-40	-	-	-	-	-	-	-
40-50	1	-	2	-	-	-	-
50-60	-	-	2	1	-	-	-
60-70	-	-	-	1	2	-	2 utilized flakes
70-80	-	1	-	-	-	-	-
80-90	-	-	-	-	-	-	-

Table 66. Site 21HE497 Diagnostic Lithic Debris and Tools by Depth in XU 4.

Depth cmbs	Bipolar Flakes	Bifacial Shaping Flakes	Bifacial Thinning Flakes	Decortication Flakes	Nonbifacial Flakes	Shatter	Tools
0-40	-	-	-	-	-	-	-
40-50	-	-	1	-	-	-	1 projectile point, 2 manuport, 1 utilized flake, 1 hammerstone
50-60	-	-	-	1	-	-	3 projectile points
60-70	-	-	-	-	-	1	-
70-80	-	-	-	-	-	-	-

Table 67. Site 21HE497 Diagnostic Lithic Debris and Tools by Depth in XU 9.

Depth cmbs	Bipolar Flakes	Bifacial Shaping Flakes	Bifacial Thinning Flakes	Decortication Flakes	Nonbifacial Flakes	Shatter	Tools
0-50	-	-	-	-	-	-	-
50-60	1	1	1	1	2	-	-
60-70	3	4	1	-	4	1	-
70-80	1	3	1	1	-	-	3 utilized flakes
80-90	-	-	-	-	-	-	-
90-100	-	-	-	-	-	-	1 core
100-105	-	-	-	-	-	-	-

Table 68. Site 21HE497 Diagnostic Lithic Debris and Tools by Depth in XU 10.

Depth cmbs	Bipolar Flakes	Bifacial Shaping Flakes	Bifacial Thinning Flakes	Decortication Flakes	Nonbifacial Flakes	Shatter	Tools
0-40	-	-	-	-	-	-	-
40-50	-	-	-	-	-	1	-
50-60	-	-	-	-	-	-	1 Stage 4 biface
60-70	-	-	1	1	1	1	1 Projectile point
70-80	-	-	1	-	-	-	-
80-90	-	-	-	-	-	-	-

Review of Raw Materials by Depth for XUs 3, 4, 9 and 10

A review of the lithic raw materials by depth indicates some discrete vertically patterning that may be related to site components, although the sample size is small, and therefore the following discussion focuses on materials that have more than one count per level (Tables 69 top 72). In XU 3, a greater amount of quartz was recovered below the main artifact zone. In XU 9, Burlington Chert was recovered below the main artifact zone. In XU 10, Burlington Chert was recovered in the lower portion of the main artifact zone, and Knife River Flint was recovered below it. However, XU 10 had a broad vertical span of Late Woodland ceramics extending below the main artifact zone, as discussed above. Materials recovered from below the main artifact zones are inferred to more likely be from the Early Woodland component, as the main zone appears to contain Early and Late Woodland components. There is no clear vertical patterning of the other materials, which occur in very small amounts or approximately equal amounts in and adjacent to the main artifact zone.

Table 69. Site 21HE497 Raw Materials by Depth in XU 3.

Depth cmbd	Prairie du Chien Chert	Quartz	Grand Meadow Chert	Unid. Chert	Red River Chert	Quartzite	Swan River Chert	Gunflint Silica
0-40	-	-	-	-	-	-	-	-
40-50	-	-	2	-	-	-	1	1
50-60	4	1	1	2	-	-	-	-
60-70	1	5	2	-	1	1	-	-
70-80	1	-	-	-	-	-	-	-
80-90	-	-	-	-	-	-	-	-

Table 70. Site 21HE497 Raw Materials by Depth in XU 4.

Depth cmbd	Unid. Chert	Prairie du Chien Chert	Grand Meadow Chert	Quartz	Granitic	Quartzite	Berlington Chert	Basaltic	Swan River Chert	Lake of the Woods Rhyolite
0-30	-	-	-	-	-	-	-	-	-	-
30-40	-	1	-	1	-	-	-	-	-	-
40-50	-	2	2	-	1	-	-	2	-	1
50-60	2	1	-	-	-	1	1	-	1	-
60-70	-	-	1	1	-	-	-	-	-	-
70-80	-	-	-	-	-	-	-	-	-	-
80-90	-	-	-	-	-	-	-	-	-	-

Table 71. Site 21HE497 Raw Materials by Depth in XU 9.

Depth cmbd	Prairie du Chien Chert	Grand Meadow Chert	Quartz	Red River Chert	Unid. Chert	Jasper Tac-onite	Swan River Chert	Fus-ilinid Chert	Knife Lake Silt-stone	Bur-lington Chert	Tongue River Silica	West River Group
0-40	-	-	-	-	-	-	-	-	-	-	-	-
40-50	-	-	-	1	-	-	-	-	-	-	-	-
50-60	1	-	2	-	1	-	1	1	1	-	-	-
60-70	4	1	4	-	3	2	3	-	-	-	-	1
70-80	2	1	3	-	-	-	-	-	-	3	1	-
80-90	-	1	1	-	-	-	-	-	-	-	-	-
90-100	-	-	1	-	-	-	-	-	-	-	-	-
100-105	-	-	-	-	-	-	-	-	-	-	-	-

Table 72. Site 21HE497 Raw Materials by Depth in XU 10.

Depth cmbd	Quartz	Prairie du Chien Chert	Knife River Flint	Red River Chert	Unid. Chert	Western River Group	Burlington Chert
0-40	-	-	-	-	-	-	-
40-50	2	-	-	-	-	-	-
50-60	1	1	-	-	-	-	-
60-70	-	1	-	1	1	1	1
70-80	-	-	1	-	-	-	-
80-90	-	-	-	-	-	-	-

Soils and Stratigraphy for XUs 3, 4, 9, and 10

The soil horizons from XUs 3, 4, 9, and 10 are depicted in wall profiles and photographs in Figures 65 to 68. Because of ground slope, the soil horizons are sloping to the south at a rate of 10 to 15 cm over two meters. The soil profiles consist of fill overlying a truncated sandy loam A horizon, loamy sand B1 horizon, gravelly loamy sand B2 horizon (gravel lag deposit), gravelly sand BC horizon, and gravelly sand C horizon. The sand and gravel content increases significantly with depth, with the highest content of gravel in the lag deposit. The soils are fairly undisturbed below the fill. There is a minimal to moderate amount of rodent burrows.

Feature 1 in XUs 3 and 4

Feature 1 was identified at 60 cmbd in XU 4 as a small dark, circular-shaped soil stain that measured 28 by 30 cm in diameter. The planview and profile of Feature 1 were recorded in illustrations and photos during excavation (Figures 69 to 71), and planviews were recorded at 60, 67, and 80 cmbd because the southern portion of the feature expanded with depth, increasing to 40 cm in width. In profile, the feature was 29 cm deep, extending from 65 to 94 cmbd, and had a deep basin shape. All feature fill (30.75 liters) was troweled and bagged for flotation. No charcoal or other artifacts were observed. Flotation and analysis of the botanicals recovered from the light and heavy fractions was conducted by Connie Arzigian (paleoethnobotanist) and staff at MVAC. There was not sufficient charcoal or fauna recovered from the feature for dating.

The dark color of the feature was likely caused by carbon-stained sediments from charcoal and probably infilling with topsoil. A small amount (less than teaspoon) of charcoal fragments was recovered from feature fill during flotation. The feature is interpreted as a cooking and/or heating pit based on the presence of charcoal and carbon-stained sediments and the thermally-altered bone and small amount of FCR in adjacent areas. The feature does not fit one of the typical cooking facilities described in the FCR Analysis Section 4.4. No oxidized (orangish-colored) soil or ash was observed in or around the feature. Artifacts recovered from the heavy and light fractions during flotation of the Feature 1 fill include one bifacial shaping flake and two unidentifiable faunal fragments (one is burned) (Table 73).

Table 73. Site 21HE497 Summary of Artifacts from Feature 1.

Provenience	Count and Weight (g)	Artifact Description
S1/2 60-76 cmbd	1 (0.1g)	Bifacial shaping flake, Prairie du Chien Chert
	1 (0.1g)	Vertebrata, unidentifiable fragment, burned
S1/2 80-93 cmbd	1 (0.1g)	Vertebrata, unidentifiable fragment
Total	**3 (0.3g)**	-

A summary of charred botanical materials recovered from feature flotation is presented in Table 74. The only charred remains were very small fragments of wood charcoal. Two uncharred (modern) chenopodium seeds were also recovered.

Table 74. Site 21HE497 Feature 1 Botanical Summary.

Provenience	Soil Volume Floated (liters)	Light Fraction >20 mesh (% sorted)	Light Fraction <20 mesh (% sorted)	Charred Flora Recovered
N1/2 64-76 cmbd	11.25	100	100	only a few small fragments of charred wood
N1/2 77-93 cmbd	7.25	100	100	only a few small fragments of charred wood
S1/2 60-76 cmbd	3.75	100	100	only a few small fragments of charred wood
S1/2 60-80 cmbd	2.75	100	100	only a few small fragments of charred wood
S1/2 67-75 cmbd	2.75	100	100	only a few small fragments of charred wood
S1/2 80-93 cmbd	3	100	100	only a few small fragments of charred wood

20 mesh = .0331 inches / 0.8 mm

Feature 5 in XU 10

Feature 5 was first identified at 68 cmbd in XU 10 and was mapped at 70 cmbd as a dark oval-shaped soil stain that measured 53 by 30 cm in diameter. The western portion had a darker, circular-shaped stain that was 20 cm in diameter, which seemed to be the main locus of the feature. The planview and profile of Feature 5 were recorded in illustrations and photos during excavation (Figures 72 to 74). In profile, the feature was 12 cm deep, extending from 70 to 82 cmbd, and had a shallow basin shape. All feature fill (6.6 liters) was troweled and bagged for flotation. No charcoal or other artifacts were observed. Flotation and analysis of the botanicals recovered from the light and heavy fractions was conducted by Connie Arzigian (paleoethnobotanist) and staff at MVAC. A charcoal sample from the feature dated to 1080 +/- 30 RCYBP (Table 51).

The dark color of the feature was likely caused by carbon-stained sediments from charcoal and probably infilling with topsoil. A small amount (c. tablespoon) of charcoal fragments was recovered from feature fill during flotation. The feature is interpreted as a cooking and/or heating pit based on the presence of charcoal and carbon-stained sediments, thermally-altered bone, and small amount of FCR in the feature and adjacent areas. The feature does not fit one of the typical cooking facilities described in the FCR Analysis Section 4.4. No oxidized (orangish-colored) soil or ash was observed in or around the feature. Artifacts recovered from the heavy and light fractions during flotation of the Feature 5 fill include three ceramics (thin and cordmarked Late Woodland ware), one FCR, and 68 faunal fragments (40 are burned), including turtle and bullhead catfish (Table 75).

Table 75. Site 21HE497 Summary of Artifacts from Feature 5.

Provenience	Count and Weight (g)	Artifact description
72 cmbd	2 (0.2g)	Turtle, peripheral fragment, burned
79 cmbd	1 (48g)	FCR cobble with spall, unidentified material
	1 (2.3g)	Ceramic body, grit temper, cord marked
E1/2 70-79 cmbd	1 (1.6g)	Wood charcoal
	2 (0.7g)	Ceramic body, grit temper, cord marked
	1 (0.1g)	Emydidae (pond turtle), neural fragment, burned
	1 (0.1g)	Emydidae (pond turtle), carapace fragment, burned
	2 (0.1g)	Turtle, carapace/plastron fragment, burned
	4 (0.1g)	Vertebrata, unidentifiable fragment
W1/2 70-90 cmbd	1 (0.2g)	Ameiurus sp. (bullhead catfish), pectoral spine, right, fragment
	1 (0.1g)	Turtle, ilium, left, fragment
	5 (0.3g)	Turtle, carapace/plastron fragment, burned
	4 (0.4g)	Turtle carapace/plastron fragment
	1 (0.1g)	Chrysemys picta (painted turtle), entoplastron fragment, burned
	28 (0.4g)	Vertebrata, unidentifiable fragment, burned
	18 (0.3g)	Vertebrata, unidentifiable fragment
Total	**73 (55g)**	-

A summary of charred botanical materials recovered from feature flotation is presented in Table 76. The only charred remains were very small fragments of wood charcoal and possible charred seed embryo fragments. There were also four uncharred (modern) grass seeds and one uncharred unidentified seed.

Table 76. Site 21HE497 Feature 5 Botanical Summary.

Provenience	Soil Volume Floated (liters)	Light Fraction >20 mesh (% sorted)	Light Fraction <20 mesh (% sorted)	Charred Flora Recovered
E1/2 70-79 cmbd	4.2	100	100	2 unidentified seed embryo fragments, possibly charred; AMS sample of 0.16 gm wood charcoal
W1/2 70-79 cmbd	2.4	100	100	small fragments of charred wood

20 mesh = .0331 inches / 0.8 mm

Feature 7 in XU 9

Feature 7 was identified at 88 cmbd in XU 9 as a dark, oval-shaped soil stain that measured 70 by 42 cm in diameter. In profile, the feature was 17 cm deep, extending from 88 to 105 cmbd, and had a shallow basin shape. All feature fill (27.65 liters) was troweled and bagged for flotation. No charcoal was observed. A Waubesa point was recovered from the base of the feature at 102 cmbd. Flotation and analysis of the botanicals recovered from the light and heavy fractions was conducted by Connie Arzigian (paleoethnobotanist) and staff at MVAC. A charcoal sample from the feature dated to 1690 +/- 30 RCYBP (Table 51).

The planview and profile of Feature 7 were recorded in illustrations and photos during excavation (Figures 75 to 77). The dark color of the feature was likely caused by carbon-stained sediments from charcoal and probably infilling with topsoil. A small amount (c. teaspoon) of charcoal fragments was recovered from the feature fill during flotation. The feature is interpreted as a cooking and/or heating pit, based on the presence of charcoal and carbon-stained sediments and the thermally-altered bone and small amount of FCR in adjacent areas. The feature does not fit one of the typical cooking facilities described in the FCR Analysis Section 4.4. No oxidized (orangish-colored) soil or ash was observed in or around the feature. Artifacts recovered from the heavy and light fractions during flotation of the Feature 7 fill, include two pieces of lithic debris (Table 77). A Waubesa projectile point was recovered from the base of the feature at 102 cmbd during excavation.

Table 77. Site 21HE497 Summary of Artifacts from Feature 7.

Provenience	Count and Weight (g)	Artifact description
102 cmbd	1 (4.7g)	Waubesa projectile point, Tongue River Silica
N1/2 88-102 cmbd	1 (0.0g)	Other G4 flake, quartz
S1/2 88-102 cmbd	1 (1.7g)	Bipolar flake, quartz
Total	**3 (5.8g)**	

A summary of the charred botanical materials recovered from feature flotation is presented in Table 78. Small amounts of the following charred plant remains were recovered: a Cyperaceae (Sedge family) seed (probably charred) and small fragments of wood charocal. The type of sedges growing in Minnesota were likely not a food source, but probably used for fiber (basketry) or medicine (Moerman 1998:137-138). Sedge would have likely been obtained from the wetland at the base of the bluff below the terrace. Also present were three uncharred (modern) chenopodium and two uncharred weed seeds.

Table 78. Site 21HE497 Feature 7 Botanical Summary.

Provenience	Soil Volume Floated (liters)	Light Fraction >20 mesh (% sorted)	Light Fraction <20 mesh (% sorted)	Charred Flora Recovered
N1/2 88-102 cmbd	11.25	100	100	1 Cyperaceae (Sedge family) seed, probably charred; small fragments of charred wood
S1/2 88-102 cmbd	16.4	100	100	Small fragments of charred wood

20 mesh = .0331 inches / 0.8 mm

13.9 XUs 5 and 6

XUs 5 and 6 were contiguous units centered on Shovel Test 32, which yielded a ceramic sherd. Excavation was conducted in 10-cm levels below a unit datum. The landscape sloped slightly to the southeast. Excavation was terminated at 40 cmbd because of the lack of artifacts and dense gravels. A summary of artifacts recovered in the units is presented in Table 79.

Table 79. Site 21HE497 Summary of Artifacts from XUs 5 and 6.

Depth (cmbd)	FCR	Lithic Debris	Faunal	Total	%
0-10	3	5	-	**8**	**22**
10-20	19	6	1	**26**	**70**
20-30	1	-	-	**1**	**3**
30-40	2	-	-	**2**	**5**
Total	**25**	**11**	**1**	**37**	**-**
%	**68**	**30**	**3**	**-**	**100**

Artifact Summary and Vertical Distribution

A total of 37 artifacts were recovered from XUs 5 and 6, including 25 FCR, 11 pieces of lithic debris, and one faunal fragment (Table 79). Artifacts were recovered between 0 and 40 cmbd. The zone with the greatest artifact density occurs between 10 and 20 cmbs and contained 70 percent of the artifacts. The tight vertical cluster could suggest a single component, although the ratio of flakes to FCR in the 0 to 10 level is much greater than the 10 to 20 cmbd level, which perhaps indicates multiple components. The XUs are located on a landscape position that received less deposition or more erosion than other site areas, and therefore the artifact zone is expected to be more compressed than in other areas.

Soils and Stratigraphy

The soil horizons from the XUs are depicted in a wall profile and photograph in Figures 78 and 79. The soil profile consists of a sandy loam A horizon, overlying a sandy loam AB horizon, loamy sand B horizon, and gravelly sand BC horizon. The gravelly sand BC horizon is much closer to the surface in these XUs than in others, because of its landscape position on the edge of the terrace where it had less deposition or more erosion. The soils are fairly undisturbed, as only very slight modern impacts were observed and only a minimal amount of rodent burrows were present.

13.10 XUs 7 and 8

XUs 7 and 8 were contiguous units, and XU 8 was placed adjacent to Shovel Test 34NW5, which yielded an FCR and historic shell button. Excavation was conducted in 10-cm levels below a unit datum. The landscape sloped slightly to the southeast. Excavation was terminated at 70 cmbd because of the lack of artifacts and dense gravels. A summary of artifacts recovered in the units is presented in Table 80.

Table 80. Site 21HE497 Summary of Artifacts from XUs 7 and 8.

Depth (cmbd)	FCR	Lithic Debris	Total	%
0-30	-	-	-	-
30-40	3	1	**4**	**33**
40-50	3	2	**5**	**42**
50-60	1	1	**2**	**17**
60-70	-	1	**1**	**8**
Total	**7**	**5**	**12**	**-**
%	**58**	**42**	**-**	**100**

Artifact Summary and Vertical Distribution

Twelve artifacts were recovered from XUs 7 and 8, including seven FCR and five pieces of lithic debris (Table 80). Artifacts were recovered between 0 and 70 cmbd. The zone with the greatest artifact density occurs between 30 and 50 cmbs and contained 75 percent of the artifacts. Artifact density is very low and the tight vertical cluster could suggest a single component. The small amount of artifacts below the primary artifact zone was likely displaced by natural causes, such as freeze-thaw and bioturbation from rodent runs.

Soils and Stratigraphy

The soil horizons from the XUs are depicted in a wall profile and photograph in Figures 80 and 81. The soil profile consists of a fill overlying a sandy loam A horizon, sandy loam AB horizon, loamy sand B horizon, gravelly sand BC horizon, and gravelly sand C horizon. The soils are fairly undisturbed below the fill. Disturbance from rodent burrows was minimal to moderate.

13.11 XUs 11 and 12

XUs 11 and 12 were contiguous units, with XU 11 placed adjacent to Shovel Test 30E5, which yielded six pieces of lithic debris. Excavation was conducted in 10-cm levels below a unit datum. The landscape sloped to the southeast. Excavation was terminated at 90 cmbd because of the lack of artifacts and dense gravels. A shovel test was placed in the base of the XUs to 112 cmbd to examine the soils and ensure that no deeply buried archaeological deposits were present. A summary of artifacts recovered in the units is presented in Table 81.

Table 81. Site 21HE497 Summary of Artifacts from XUs 11 and 12.

Depth (cmbd)	FCR	Ceramic	Lithic Debris	Lithic Tool	Total	%
0-36	-	-	-	-	-	-
36-40	1	1	-	1*	**3**	**3**
40-50	-	15**	12	2*	**29**	**34**
50-60	4	9	3	1*	**17**	**20**
60-70	7	-	8	2	**17**	**20**
70-80	8	-	5	-	**13**	**15**
80-90	2	-	5	-	**7**	**8**
Total	**22**	**25**	**33**	**6**	**86**	**-**
%	**26**	**29**	**38**	**7**	**-**	**100**

* One core; ** One Late Woodland Madison rim

Artifact Summary and Vertical Distribution

A total of 86 artifacts were recovered from XUs 11 and 12, including 33 pieces of lithic debris, 25 ceramics, 22 FCR, six stone tools (three cores, a retouched flake, a utilized flake, and a utilized flake & side/end scraper) (Table 81). Artifacts were recovered between 36 and 90 cmbd. The zone with the greatest artifact density occurs between 40 and 50 cmbd, but there are moderate amounts from 40 and 80 cmbd.

All of the ceramics are Late Woodland Madison ware, as indicated by a rimsherd recovered from XU 11 at 40 to 50 cmbd and the attributes of the other sherds, which are thin (mostly between 2.7 and 4.3 mm), have a fine grit temper, and cordmarked surfaces, with many sherds having woven fabric impressions. The ceramics are very similar to the Late Woodland Madison ware from the other XUs.

The vertical patterning of different artifact types indicates two components are present, although perhaps with some slight overlap of these components between 50 and 60 cmbd. Ceramics are concentrated from 40 to 50 cmbd in an upper Late Woodland component. FCR is concentrated from 60 to 80 cmbd in a lower undefined component, which is likely the Early or Transitional Woodland, based on the presence of these components in the other adjacent XUs. Lithic debris shows a bimodal distribution with a spike at 40 to 50 cmbd and another increase below 60 cmbd.

The small amounts of artifacts above and below these zones were likely displaced by natural processes, although some of the vertical distribution is related to the age of the occupations, as older artifacts are subject to a greater amount of displacement over time and have a greater tendency to move downwards and occur at deeper depths.

The artifact assemblage of each component is generally similar, except that only Late Woodland ceramics occur and not any earlier types. Each component has a fairly sparse amount of lithic debris, FCR, and stone tools. A review of artifact types and lithic materials is conducted below to examine vertical patterning from each component and assist in defining components.

Review of Flake Types by Depth for XUs 11 and 12

A review of diagnostic flake types and tools by depth indicates some discrete vertical patterning that may be related to the site components defined above, although the sample size is small (Table 82). Bifacial thinning, nonbifacial, and decortication flakes occur only in the lower component below 50 cmbd. The lower component contains a variety of flake types, indicating a range of lithic-reduction technologies, including bipolar, nonbifacial, and bifacial. The assemblage includes lithics from the early and middle stages of reduction and tool production. In the upper component, bipolar flakes are the only diagnostic flake type present. Two utilized flakes are in the lower component, and two cores and a retouched flake are in the upper component.

Table 82. Site 21HE497 Diagnostic Lithic Debris and Tools by Depth in XUs 11 and 12.

Depth cmbs	Bipolar Flakes	Bifacial Shaping Flakes	Bifacial Thinning Flakes	Decortication Flakes	Nonbifacial Flakes	Shatter	Tools
0-36	-	-	-	-	-	-	-
36-40	-	-	-	-	-	-	1 bipolar core
40-50	2	-	-	-	-	1	1 core; 1 retouched flake
50-60	-	-	2	1	-	-	1 bipolar core
60-70	2	-	1	1	-	1	2 utilized flakes
70-80	-	-	1	-	2	-	-
80-90	1	-	1	1	-	-	-

Review of Raw Materials by Depth for XUs 11 and 12

A review of the lithic raw materials by depth indicates some discrete vertical patterning that may be related to site components defined above, although the sample size is small (Table 83). Unidentified chert was present only in the lower component from 70 to 90 cmbd. Red River Chert occurs in both components with slightly more in the lower component, and Prairie du Chien Chert occurs in both components with slightly more in the upper component. There is no clear vertical patterning of the other materials, which occur in very small amounts or in approximately equal amounts.

Table 83. Site 21HE497 Raw Materials by Depth in XUs 11 and 12.

Depth cmbd	Quartz	Prairie du Chien Chert	Red River Chert	Unid. Chert	Swan River Chert	Western River Group	Tongue River Silica
0-36	-	-	-	-	-	-	-
36-40	1	-	-	-	-	-	-
40-50	5	6	1	-	1	1	-
50-60	2	-	2	-	-	-	-
60-70	5	3	-	2	-	-	-
70-80	-	1	-	2	1	-	1
80-90	1	1	2	-	1	-	-

Soils and Stratigraphy
The soil horizons from the XUs are depicted in a wall profile and photograph in Figures 82 and 83. The soil profile consists of fill overlying a truncated sandy loam A horizon, a loamy sand AB horizon, gravelly sand B horizon, and sand BC horizon. The soils are relatively undisturbed below fill except for the moderate amount of rodent burrows that were present in all levels.

13.12 Phase I and II Artifact Summary

A total of 1,115 artifacts, weighing 7,717.1 grams, were recovered from the site during the Phase I survey and Phase II evaluation (Table 84). By count, ceramics (35%) and lithics (33%) were the most abundant artifact types with smaller amounts of fauna (17%) and FCR (14%). By weight, FCR was most abundant (60%) with significantly small amounts of lithics (21%), fauna (14%), and ceramics (6%).

Table 84. Site 21HE497 Summary of Artifacts.

Artifact Type	Total by Count (Weight g)	% by Count (Weight g)
Ceramic	**394 (445.7)**	**35 (6)**
Lithic	**372 (1605)**	**33 (21)**
Fauna	**194 (1090.4)**	**17 (14)**
FCR	**155 (4576)**	**14 (60)**
Total	**1,115 (7717.1)**	**-**
%	**-**	**100**

13.13 Lithic Analysis

The lithic assemblage consists of 372 artifacts, including 339 pieces of lithic debris, 29 stone tools, and four cores (Table 85). A variety of flake types, tools, cores, and lithic materials are present in the assemblage, which is discussed below.

Size Grades and Heat Treatment
Size grade counts for the lithic debris were as follows: SG1 (n=1; <1%); SG2 (n=41; 12%); SG3 (n=180; 53%); and SG4 (n=117; 35%). A total of 41 lithic artifacts were heat treated, with most of these artifacts being Prairie du Chien and Swan River cherts. Probable heat treatment was observed on 10 additional lithics in a wide variety of materials. Eleven lithics (mostly unidentified chert and Grand Meadow Chert) showed evidence of excessive heating, as indicated by crazing and potlid fractures.

Table 85. Site 21HE497 Lithic Artifacts by Material, Flake, and Tool/Core Types.

Material, Resource Region, & Source Distance	Decorticatio n	Nonbifacial	Bifacial Thinning	Bifacial Shaping	Bipolar Flake	Shatter	Broken Flake	Other Grade 4	Edge Preparation	Potlid Flake	Unidentified	Tool/Core	Total	%
Prairie du Chien Chert - **Hollandale Region** (local)	2	8	31	25	-	1	18	32	5	1	2	1 end scraper; 2 projectile points; 1 retouched flake; 2 side & end scrapers; 1 bifacial core; 2 stage 4 bifaces; 3 utilized flakes	**137***	**37**
Quartz - **Multiple Regions** (local)	11	6	-	3	21	9	17	16	-	-	-	3 bipolar cores	**86**	**23**
Grand Meadow Chert **Hollandale Region (**nonlocal)	2	5	14	2	-	1	8	4	-	-	-	4 utilized flakes	**40**	**11**
Unidentified chert **Unknown Region** (local or nonlocal)	1	7	5	5	-	-	3	8	-	2	-	1 utilized flake & side/end scraper; 1 projectile point	**33**	**9**
Swan River Chert **South Agassiz Region** (local)	-	2	3	1	2	-	5	5	1	-	1	1 utilized flake; 1 retouched flake; 1 projectile point	**23**	**6**
Red River Chert **South Agassiz Region** (local)	3	-	3	-	1	1	1	2	-	-	1	1 utilized flake	**13**	**3**
Quartzite **Unknown Region** (local or nonlocal)	1	2	-	-	-	-	2	2	-	-	-	-	**7**	**2**
Tongue River Silica **South Agassiz Region** (local)	-	1	1	-	-	-	-	-	-	-	-	1 projectile point	**3**	**1**
Burlington Chert Iowa/Illinois (nonlocal exotic)	-	-	1	2	-	-	-	-	-	-	-	1 projectile point; 1 utilized flake	**5**	**1**
Knife River Flint **Western North Dakota** (nonlocal exotic)	-	-	2	1	-	-	-	-	-	-	-	-	**3**	**1**
Basaltic **West Superior Region** *(local)*	-	-	-	-	-	-	-	-	-	-	-	2 nonutilitarian; 1 utilized flake	**3**	**1**
Metamorphic Unknown Region (local or nonlocal)	-	-	-	-	1	-	-	-	-	-	-	1 manuport	**2**	**1**

Table 85. Continued.

Material, Resource Region, & Source Distance	Decortication	Nonbifacial	Bifacial Thinning	Bifacial Shaping	Bipolar Flake	Shatter	Broken Flake	Other Grade 4	Edge Preparation	Potlid Flake	Unidentified	Tool/Core	Total	%
Jasper Taconite **West Superior Region** *(local)*	-	-	-	2	-	-	-	-	-	-	-	-	**2**	**1**
Knife Lake Siltstone **West Superior Region** *(local)*	-	1	-	-	-	-	-	-	-	-	-	-	**1**	**<1**
Cedar Valley Chert **Hollandale Region** (nonlocal)	-	-	-	-	-	-	-	1	-	-	-	-	**1**	**<1**
Fusilinid Chert **IA, NE, MO, KS (nonlocal)**	-	-	1	-	-	-	-	-	-	-	-	-	**1**	**<1**
Galena Chert **Hollandale Region** (nonlocal)	-	-	-	-	-	-	1	-	-	-	-	-	**1**	**<1**
Western River Group **South Agassiz Region** (local)	1	-	-	-	-	-	1	1	-	-	-	-	**3**	**1**
Unidentified material **Unidentified Region** (local)	1	-	-	-	-	1	-	2	-	-	-	-	**4**	**1**
Granitic **Unidentified Region** (local)	-	-	-	-	-	-	-	-	-	-	-	1 hammerstone	**1**	**<1**
Lake of the Woods Rhyolite **West Superior Region** *(local)*	-	-	-	-	-	-	-	1	-	-	-	-	**1**	**<1**
Gunflint Silica **West Superior Region** *(local)*	-	-	-	-	2	-	-	-	-	-	-	-	**2**	**1**
Total	**22**	**32**	**61**	**41**	**27**	**13**	**56**	**74**	**6**	**3**	**4**	**33**	**372**	**-**
%	**6**	**9**	**16**	**11**	**7**	**3**	**15**	**20**	**2**	**1**	**1**	**9**	**-**	**100**

*113 are oolitic Prairie du Chien Chert and 24 are non-oolitic

Flake Types

The wide variety of flake types in the assemblage indicates a range of lithic-reduction technologies and stages. Diagnostic flake types, along with their associated technologies and stages of reduction, are summarized in Table 86. Nonbifacial, bifacial, and bipolar technologies are well-represented. The assemblage includes lithics from the early, middle, and late stages of reduction. Additional supporting evidence for the various technologies includes: 1) three bipolar cores are indicative of bipolar technology; 2) one nonbifacial core and seven tools made on nonbifacial flakes (scrapers, utilized flakes, and retouched flakes) are indicative of nonbifacial technology; and 3) eight tools (utilized flakes) made on bifacial thinning flakes, two Stage 4 biface, and two projectile points are indicative of bifacial technology. Patterns of diagnostic flakes by component are discussed above with the XU results.

Types of lithic debris that are not indicative of specific technologies or reduction-stages comprise a large percentage of the assemblage and include broken and other SG4 flakes. These nondiagnostic flake types are not included in Table 86.

Table 86. Site 21HE497 Summary of Diagnostic Flake Types, Technologies, and Reduction Stages.

Count & Flake Type	**Technology**	**Stage of Reduction**
27 - Bipolar flakes	Bipolar	N/A
22 - Decortication flakes	Nonbifacial	Earliest stage of core reduction and raw material testing
32 - Nonbifacial flakes	Nonbifacial	Cobble testing, reducing unprepared nonbifacial cores for flake blank production, and the early stages of nonbifacial tool reduction (early to middle-stages of reduction)
13 - Shatter	N/A	Mostly from cobble testing, core reduction, and earlier stages of reduction
61 - Bifacial thinning flake	Bifacial	Early to middle-stage of reduction
41 - Bifacial shaping flake	Bifacial	Late-stage of reduction (final shaping or tool maintenance)

Lithic Material Types and Use

Lithic materials consisted primarily of Prairie du Chien Chert (37%) and quartz (23%), with substantially smaller amounts of many other materials, including Grand Meadow Chert (11%), unidentified chert (9%), Swan River Chert (6%). The amounts of other materials are three percent or less. Nearly all of the materials are locally available. The unidentified chert may be local or exotic. Patterns of raw material use by component are discussed above with the XU results.

The assemblage contains a small amount of non-local, high-quality materials that were likely acquired through exchange networks or travel, including: 1) Grand Meadow, Cedar Valley, and Galena cherts from southeastern Minnesota; 2) Knife River Flint from western North Dakota; 3) Burlington Chert from southeastern Iowa and west-central Illinois; and 4) Fusilinid Chert from parts of Iowa, Missouri, Kansas and Nebraska.

The lithic data indicates that the raw materials have different debris profiles resulting from differential use, quality of the material, and cobble size. The most notable lithic use characteristics are discussed below for those materials that have adequate sample sizes of diagnostic flakes. However, most materials lack an adequate sample size.

Prairie du Chien Chert occurs in all flake types except bipolar flakes, and it is most numerous in bifacial technology debris as bifacial thinning and bifacial shaping flakes. It occurs in much smaller amounts in unifacial technology as decortication and nonbifacial flakes. Although it was used for all stages of lithic reduction and tool production, it was most commonly used in the middle stage of bifacial reduction and late stage of tool production or resharpening. Two projectile points, two Stage 4 bifaces, seven flake stone tools, and one core were manufactured from Prairie du Chien Chert.

Grand Meadow Chert occurs in all diagnostic flake types except bipolar flakes, and it is most numerous in bifacial technology debris as bifacial thinning flakes. It occurs in much smaller amounts in unifacial technology as decortication and nonbifacial flakes. Although it was used for all stages of lithic reduction and tool production, it was most commonly used in the middle stage of bifacial reduction. Three utilized flakes were manufactured from Grand Meadow Chert.

Quartz occurs in moderate or large amounts in most flake types, but is notably absent in bifacial thinning flakes and only very sparsely present in bifacial shaping flakes, indicating it was not typically employed for bifacial technology. The use of quartz was likely limited by its flaking qualities. Quartz occurs most abundantly as bipolar flakes and decortication flakes. Three bipolar cores were manufactured from quartz. Unidentified chert is sparsely represented but occurs in relatively equal amounts of nonbifacial flakes, bifacial thinning flakes, and bifacial shaping flakes.

The following materials occur in very small amounts, and therefore the validity of any interpretation is tentative and limited by the small sample size. Swan River Chert occurs as a variety of diagnostic flake types, including nonbifacial, bipolar, bifacial thinning, and bifacial shaping. One projectile point and two flake stone tools were made from it. Red River Chert occurs in small amounts as decortication and bifacial thinning flakes. Quartzite occurs in very small amounts as decortication and nonbifacial flakes. Burlington Chert and Knife River Flint occur in very small amounts as bifacial thinning and shaping flakes, which is expected for exotic materials found a long distance from their source. Basalt occurs as two circular stones (nonutilitarian items) and a utilized flake. Granite occurs as a hammerstone.

Stone Tools

A total of 29 stone tools were recovered (Table 87), including 11 utilized flakes, six projectile points (and fragments), three scrapers, two retouched flakes, two Stage 4 bifaces (late-stage), two nonutilitarian stones, one hammerstone, one manuport, and one multi-purpose utilized flake and scraper.

The Stage 4 bifaces were made on Prairie du Chien Chert. Flake tools (scrapers, utilized flakes, and retouched flakes) were made on Prairie du Chien Chert, Grand Meadow Chert, Swan River Chert, Red River Chert, Burlington Chert, unidentified chert, and basalt. Projectile points (and fragments) were made on Prairie du Chien Chert, Burlington Chert, Tongue River Silica, Swan River Chert, and unidentified chert. It is clear that high quality raw materials were selected for lithic reduction and tools. The nonbifacial flake tools were made mostly on bifacial thinning flakes, with smaller amounts on decortication, nonbifacial flakes and broken flakes (Table 88).

The Stage 4 biface may be a projectile point preform and could have been used as a cutting tool. Utilized flakes are primarily light-duty cutting and slicing tools used on animal remains, wood, and plants. Scrapers are typically associated with scraping tasks on a variety of soft materials (meat, hides, and plant material) or moderately resistant materials (wood and bone). These tools suggest that site activities included butchering, animal/plant processing, hide working, and bone and woodworking.

Two circular basalt stones were classified as nonutilitarian items, and they may be game pieces or special stones with perhaps symbolic or spiritual significance. They have the following dimensions: stone one is 44 x 35 mm in diameter and 16.5 mm in thickness and stone two is 42 x 37 mm in diameter and 17.1 mm in thickness.

Table 87. Site 21HE497 Tool Type by Material Type.

Materials	**Utilized flake & side/end scraper**	**Utilized Flake**	**Retouched Flake**	**Scraper**	**Projectile Point**	**Unfinished Biface, Stage 4**	**Hammerstone**	**Manuport**	**Nonutilitarian**	**Total**
Basaltic	-	1	-	-	-	-	-	-	2	**3**
Swan River Chert	-	1	1	-	1	-	-	-	-	**3**
Prairie du Chien Chert*	-	3	1	3	2	2	-	-	-	**11**
Burlington Chert	-	1	-	-	1	-	-	-	-	**2**
Tongue River Silica	-	-	-	-	1	-	-	-	-	**1**
Granitic	-	-	-	-	-	-	1	-	-	**1**
Metamorphic	-	-	-	-	-	-	-	1	-	**1**
Unid. Chert	1	-	-	-	1	-	-	-	-	**2**
Grand Meadow Chert	-	4	-	-	-	-	-	-	-	**4**
Red River Chert	-	1	-	-	-	-	-	-	-	**1**
Total	**1**	**11**	**2**	**3**	**6**	**2**	**1**	**1**	**2**	**29**

*10 Prairie du Chien Chert (oolitic) & 1 Prairie du Chien Chert

Table 88. Site 21HE497 Nonbifacial Flake Tools by Flake Type.

Tool Type	**Type of Flake That Tool is Made On**				
	Decortication	**Nonbifacial**	**Bifacial Thinning**	**Broken**	**Total**
Utilized Flake	1	-	8	2	**11**
Utilized Flake/Scraper	-	1	-	-	**1**
Retouched Flake	1	1	-	-	**2**
Side/End scraper	1	1	-	-	**2**
End scraper	-	1	-	-	**1**
Total	**3**	**3**	**8**	**2**	**17**

Early Woodland – Waubesa Projectile Points

A Waubesa projectile point made of heat-treated Tongue River Silica was recovered from Feature 7 in XU 9 at 102 cmbd (Figure 84; Catalog # 74.1). The point is manufactured from a biface by random percussion flaking. Final shaping was done by pressure flakes that occur around the margins. The blade form is triangular, and the shoulders are prominent. The basal portion is a contracting stem that tapers evenly from the shoulder/stem juncture down to a semi-rounded base. The stem is not ground and does not have the alternate unifacial retouch or a rhomboidal cross-section noted on Adena and Waubesa from the Upper Mississippi River Valley (Morrow et al. 2016:202). In cross-section, the point is symmetrical with a lenticular shape. The tip is broken. The point is 33.4 mm long (estimated original length is 40.0 mm with tip), the maximum width at the shoulder above the stem is 22.7 mm, and the thickness is 7.0 mm.

A probable Waubesa projectile point fragment made of heat-treated Swan River Chert was recovered from XU 4 from 50 to 60 cmbd (Figure 84; Catalog # 22.6). The point is manufactured from a biface by random percussion flaking. Final shaping was done by pressure flakes that occur around the margins. The blade form is convex. The point is broken at the tip and also the juncture of the blade and stem. In cross-section, the point is mostly symmetrical with a thick lenticular shape. The point is 29.0 mm long (estimated original length is at least 40.0 mm), the maximum width at the shoulder above the stem is 19.5 mm, and the thickness is 8.7 mm.

A time frame of 500 B.C. to A.D. 300 (2500 to 1700 BP) for Waubesa points is proposed by Morrow et al. (2016:208). Goldstein and Osborn (1988:44) suggest a Late Archaic through Middle Woodland affiliation for Waubesa points in Wisconsin. Morrow et al. (2016) do not believe that Waubesa extends to the Late Archaic in Minnesota, even though the similar Gary type is associated with the Late Archaic in the Southeast. Morrow (1984:53) previously placed the type in the Early and Middle Woodland times in Iowa (500 B.C. to A.D. 500 / 2500 to 1500 BP). Waubesa points are a common type of point in Wisconsin, Iowa, and southern Minnesota. Similar or identical types include Adena Stemmed (in the eastern United States), Mason Contracting Stem, Gary, and Dickson.

Terminal Woodland - Small Side-Notched Projectile Point

A small, side-notched Late Woodland point made of Prairie du Chien Chert (oolitic) was recovered from XU 4 from 40 to 50 cmbd (Figure 84; Catalog # 21.11). The point is made on a flake and has fine, pressure-flaking on both faces along the base and blade margins. The blade form is triangular, and the base is straight and unground. In cross-section, the point is thin and flat. The side notches are very small, narrow, and shallow. The point is widest at the base ears below the side notches. The point is 16.2 mm long, the shoulder width above the notches is 13.5 mm, the basal ear width is 15.1 mm, the width between the notches is 11.4 mm, and the thickness is 2.6 mm. The point is similar to the Prairie Side-Notched (A.D. 700 and 1300 / 1300 to 700 BP) and Plains Side-Notched (A.D. 1300 to 1500 / 700 to 500 BP) types. The point is most similar to the Des Moines type in Iowa that is illustrated in Morrow (1984:83), which is subsumed under the Prairie Side-Notched type in a more recent publication (Morrow et al. 2016). However, the point has a high degree of symmetry in the outline of its blade and base, which is reportedly uncommon for the Prairie Side-Notched type (Kehoe 1973). A Plains Side-Notched designation is unlikely, as that type occurs farther west in the Prairie Lakes region and Plains and dates later than the site components.

A small, side-notched Terminal Woodland point made of unidentified chert was recovered from XU 4 from 50 to 60 cmbd (Figure 84; Catalog # 22.7). The point is made on a flake and has fine, pressure-flaking primarily on one side along the base and blade margins. The other side is mostly unflaked. The blade form is convex, and the base is straight and unground. In cross-section, the point is thin and slightly convex on one side and flat on the other. The side notches are very small, narrow, and shallow. The corner of the base is broken on one side. The point is widest at the blade just above the side notches. The point is 19.6 mm long, the shoulder width above the notches is 13.3 mm, the basal ear width is 12.0 mm, the width between the notches is 10.5 mm, and the thickness is 3.2 mm. Although the specific type of this point is uncertain, it is similar to the small, side-notched points of the Terminal Woodland and Late Prehistoric periods in the Midwest (such as the Avonlea and Prairie Side-Notched types), based on morphological and technological attributes (Kehoe 1973; Morrow 1984; Morrow et al. 2016).

Biface

A late-stage biface (Stage 4) of Prairie du Chien Chert (oolitic) was recovered in XU 13 from 23 to 30 cmbd. The biface contains semi-patterned percussion flaking on both sides with well-executed pressure-flaking along the entire margin on one side. The other side contains pressure-flaking on about half of the margin. In cross-section, the biface has a thick lenticular shape. The biface is 68.0 mm long, the maximum width is 34.5 mm, and the thickness is 11.4 mm. This artifact was recovered from fill.

Cores

Four cores were recovered, including three bipolar cores of quartz and a freehand nonbifacial core of Prairie du Chien Chert that has unpatterned flaking and unprepared platforms.

13.14 FCR

A total of 155 pieces of FCR were recovered (Table 89). FCR was found across the site area and occurs in all XUs and about one-third of positive shovel tests. The FCR are mostly small-sized pieces, and none are larger than SG1. The angular FCR type (23%) was the most numerous, followed by crumbs (8%) and angular/spalls (7%) with smaller amounts of other types. Most of the FCR is granitic (34%) and basaltic (26%), with smaller amounts of unidentified materials (14%) and igneous rock (14%). Very small amounts of metamorphic, quartzite, and sandstone FCR were recovered.

Table 89. Site 21HE497 FCR Count by Material, Size, and Type.

Material	Size Grade (SG)						FCR Type										Total	%
	00	0	1	2	3	4	Angular	Friable Rounded	Split Cobble	Cobble (friable)	Cobble (nonfriable)	Angular/Spall	Cobble with Spall	Cobble with Angular	Crumb	Spall		
Granitic	-	-	24	19	10	-	12	3	3	3	1	4	1	-	8	18	**53**	**34**
Quartzite	-	-	3	3	2	-	3	-	-	-	-	1	-	-	-	4	**8**	**5**
Metamorphic	-	-	4	4	3	-	3	-	2	-	-	-	-	-	-	6	**11**	**7**
Unid. Material	-	-	3	13	5	-	4	-	-	-	-	-	1	-	-	16	**21**	**14**
Basaltic	-	-	9	20	11	-	6	-	1	-	-	3	2	-	4	24	**40**	**26**
Sandstone	-	-	1	-	-	-	-	-	-	-	1	-	-	-	-	-	**1**	**1**
Igneous	-	-	4	14	3	-	7	-	-	-	-	3	-	-	-	11	**21**	**14**
Total	-	-	**48**	**73**	**34**	-	**35**	**3**	**6**	**3**	**2**	**11**	**4**	-	**12**	**79**	**155**	-
%	-	-	**31**	**47**	**22**	-	**23**	**2**	**4**	**2**	**1**	**7**	**3**	-	**8**	**51**	-	**100**

13.15 Faunal Analysis by Steven Kuehn

The faunal assemblage contains 194 pieces of bone and shell with a total weight of 1,090.4 g (Table 90). Freshwater mussel shell predominates, although the majority of specimens are small shell fragments that cannot be specifically identified. Faunal preservation is fair to moderate, with a limited number of specimens identifiable to the genus or species level. Eighty-nine specimens are burned or calcined. None of the faunal remains exhibit butchery marks, and no modified bone or shell artifacts were observed.

Table 90. Site 21HE497 Faunal Remains.

Taxon	NISP	MNI	Wgt (g)	Burned
White-tail deer (*Odocoileus virginianus*)	1	1	4.6	0
Muskrat (*Ondatra zibethicus*)	4	1	0.8	0
Plains pocket gopher (*Geomys bursarius*)	2	1	0.3	0
Rodent, indet. (Rodentia)	2	--	0.2	0
Large Mammal	1	--	2.4	
Medium-large mammal	5	--	2.8	1
Small-sized mammal	1	--	0.2	0
Mammal, indet.	6	--	1.2	5
Painted turtle (*Chrysemys picta*)	1	1	0.1	1
Pond/box turtle, indet. (Emydidae)	2	--	0.2	2
Turtle, indet.	20	--	1.5	15
Bullhead, indet. (*Ameiurus* sp.)	1	1	0.2	0
Threeridge (*Amblema plicata*)	9	6	276.1	0
Fragile papershell (*Leptodea fragilis*)	7	4	21.3	0
Mucket (*Actinonaias ligamentina*)	4	3	126.3	0
Fatmucket (*Lampsilis siliquoidea*)	3	2	123.6	0
Wabash pigtoe (*Fusconaia flava*)	2	2	39.8	0
Plain pocketbook (*Lampsilis cardium*)	2	1	44.9	0
Heelsplitter, indet. (*Lasmigona* sp.)	2	1	19.3	0
Threehorn wartyback (*Obliquaria reflexa*)	1	1	11.4	0
Yellow sandshell (*Lampsilis teres*)	1	1	7.0	0
Fatmucket/pocketbook, indet. (*Lampsilis* sp.)	2	--	8.7	0
Bivalve	1	--	0.0	0
Mussel, indet.	28	--	395.3	0
Taxon indet. (Vertebrata)	86	--	2.2	65
Total	**194**	**26**	**1090.4**	**89**

13.15.1 Results

Vertebrata

A total of 86 pieces of bone cannot be identified to element or taxon and are listed as taxon indeterminate (Vertebrata).

Mammals

Twenty-two pieces of mammal bone are present in the assemblage. One white-tail deer (*Odocoileus virginianus*) right metacarpal proximal fragment was recovered. Muskrat (*Ondatra zibethicus*) bones recovered consist of two left maxillary incisors, one left femur fragment, and the anterior portion of a left mandible. Two teeth (an incisor and a cheek tooth fragment) are from a plains pocket gopher (*Geomys bursarius*). Two additional incisor fragments are classified as indeterminate rodent (Rodentia). One large mammal longbone shaft fragment was recovered. Five bone fragments are listed as medium-large mammal, one femur fragment is categorized as small-sized mammal, and six specimens are classified as indeterminate mammal. White-tailed deer occur in a variety of habitats but prefer forest-edge settings (Jackson 1961). Muskrats inhabit streams, rivers, marshes, lakes and other aquatic settings, while plains pocket gophers are found in prairies and grasslands (Jackson 1961).

Reptiles and Amphibians

Twenty-three turtle remains and one fish bone were recognized in the assemblage. One entoplastron fragment is identifiable as painted turtle (*Chrysemys picta*), and one neural and a carapace fragment as classified as indeterminate pond/box turtle (Emydidae). All three specimens are burned, and were recovered from Feature 5. Another 20 carapace and plastron fragments, most of which are from Feature 5, are categorized as indeterminate turtle. Painted turtles are found in a variety of settings including rivers, streams, ponds, and wetlands (Phillips et al. 1999).

Fish

One right pectoral spine fragment from Feature 5 was classified as indeterminate bullhead (*Ameiurus* sp.). Bullheads inhabit lakes, creeks, and ponds (Smith 1979). No other fish remains were recognized in the assemblage.

Freshwater Mussels

Freshwater mussels account for 62 specimens, although 27 remains consist of small, non-diagnostic shell fragments that are listed as indeterminate mussel. These shells typically consist of many tiny fragments Size Grade 3 and smaller that were given a count of "1" in the catalog per similar group. Specifically identified mussels include threeridge (*Amblema plicata*), fragile papershell (*Leptodea fragilis*), mucket (*Actinonaias ligamentina*), fatmucket (*Lampsilis siliquoidea*), Wabash pigtoe (*Fusconaia flava*), plain pocketbook (*Lampsilis cardium*), threehorn wartyback (*Obliquaria reflexa*), and yellow sandshell (*Lampsilis teres*). Two valve fragments are classified as indeterminate heelsplitter (*Lasmigona* sp.), and likely represent creek heelsplitter (*Lasmigona compressa*). Two other valve fragments are categorized as indeterminate fatmucket/pocketbook/sandshell (*Lampsilis* sp.), and two bivalve indeterminate fragments were also recovered. Threeridges, muckets, yellow sandshells, and threehorn wartybacks are found in medium to large rivers in a variety of substrates (Cummings and Mayer 1992). Fatmuckets are most common in lakes and small to medium-sized streams, while fragile papershells are found in streams of all sizes. Wabash pigtoes and plain pocketbooks inhabit creeks to large rivers in mud, sand, or gravel (Cummings and Mayer 1992). The various types of heelsplitters occur in streams, creeks, and small through large rivers, depending on the species. All of the mussels identified in the assemblage would have been obtainable from the Minnesota River, Nine Mile Creek, and other nearby tributaries and backwater settings.

13.15.2 Distribution

Faunal material was recovered from four features, four shovel tests, and eight excavation units, with the remains slightly more abundant in the features (Table 91). The majority of remains were found in Features 5 and 6 and XU1, with most of the material consisting of non-diagnostic vertebrata and mussel shell fragments. All but one of the specifically identifiable mussels were recovered from Feature 6. The only specifically recognized mammals were obtained from ST 30NE7 and XU1, and only Feature 5 contained identifiable fish and turtle remains. Small amounts of bone and shell, mostly non-diagnostic, were recovered from the other features, excavation units, and shovel tests, precluding any detailed comparison of faunal representation between these areas.

Table 91. 21HE497 Distribution of Remains by Feature, Excavation Unit (XU), and Shovel Test (ST).

Taxon	Feature				XU							
	1	5	6	7	1	2	3	4	5	9	10	13
White-tail deer (*Odocoileus virginianus*)	--	--	--	--	--	--	--	--	--	--	--	--
Muskrat (*Ondatra zibethicus*)	--	--	--	--	4	--	--	--	--	--	--	--
Plains pocket gopher (*Geomys bursarius*)	--	--	--	--	2	--	--	--	--	--	--	--
Rodent, indet. (Rodentia)	--	--	1	--	1	--	--	--	--	--	--	--
Large mammal	--	--	--	--	--	--	--	--	--	--	--	--
Medium-large mammal	--	--	--	--	--	1	1	1	--	--	--	--
Small-sized mammal	--	--	--	--	1	--	--	--	--	--	--	--
Mammal, indet.	--	--	--	--	--	--	--	1	--	--	--	--
Painted turtle (*Chrysemys picta*)	--	1	--	--	--	--	--	--	--	--	--	--
Pond/box turtle, indet. (Emydidae)	--	2	--	--	--	--	--	--	--	--	--	--
Turtle, indet.	--	14	--	--	--	--	2	--	--	2	2	--
Bullhead, indet. (*Ameiurus* sp.)	--	1	--	--	--	--	--	--	--	--	--	--
Threeridge (*Amblema plicata*)	--	--	9	--	--	--	--	--	--	--	--	--
Fragile papershell (*Leptodea fragilis*)	--	--	7	--	--	--	--	--	--	--	--	--
Mucket (*Actinonaias ligamentina*)	--	--	4	--	--	--	--	--	--	--	--	--
Fatmucket (*Lampsilis siliquoidea*)	--	--	3	--	--	--	--	--	--	--	--	--
Wabash pigtoe (*Fusconaia flava*)	--	--	2	--	--	--	--	--	--	--	--	--
Plain pocketbook (*Lampsilis cardium*)	--	--	2	--	--	--	--	--	--	--	--	--
Heelsplitter, indet. (*Lasmigona* sp.)	--	--	2	--	--	--	--	--	--	--	--	--
Fatmucket/pocketbook, indet. (*Lampsilis* sp.)	--	--	1	--	--	--	--	--	--	--	--	1
Threehorn wartyback (*Obliquaria reflexa*)	--	--	1	--	--	--	--	--	--	--	--	--
Yellow sandshell (*Lampsilis teres*)	--	--	1	--	--	--	--	--	--	--	--	--
Bivalve	--	--	--	--	--	--	--	--	--	--	--	--
Mussel, indet.	--	--	14	--	5	--	1	--	1	--	--	7
Taxon indet. (Vertebrata)	4	50	16	2	9	--	--	--	--	3	1	--
Total	**4**	**68**	**63**	**2**	**22**	**1**	**4**	**2**	**1**	**5**	**3**	**8**

Table 91. (continued).

Taxon	ST			Grand Total for All Proveniences
	21	30	30NE7	
White-tail deer (*Odocoileus virginianus*)	--	--	1	**1**
Muskrat (*Ondatra zibethicus*)	--	--	--	**4**
Plains pocket gopher (*Geomys bursarius*)	--	--	--	**2**
Rodent, indet. (Rodentia)	--	--	--	**2**
Large mammal	--	--	1	**1**
Medium-large mammal	2	--	--	**5**
Small-sized mammal	--	--	--	**1**
Mammal, indet.	--	--	5	**6**
Painted turtle (*Chrysemys picta*)	--	--	--	**1**
Pond/box turtle, indet. (Emydidae)	--	--	--	**2**
Turtle, indet.	--	--	--	**20**
Bullhead, indet. (*Ameiurus* sp.)	--	--	--	**1**
Threeridge (*Amblema plicata*)	--	--	--	**9**
Fragile papershell (*Leptodea fragilis*)	--	--	--	**7**
Mucket (*Actinonaias ligamentina*)	--	--	--	**4**
Fatmucket (*Lampsilis siliquoidea*)	--	--	--	**3**
Wabash pigtoe (*Fusconaia flava*)	--	--	--	**2**
Plain pocketbook (*Lampsilis cardium*)	--	--	--	**2**
Heelsplitter, indet. (*Lasmigona* sp.)	--	--	--	**2**
Threehorn wartyback (*Obliquaria reflexa*)	--	--	--	**1**
Yellow sandshell (*Lampsilis teres*)	--	--	--	**1**
Fatmucket/pocketbook, indet. (*Lampsilis* sp.)	--	--	--	**2**
Bivalve	--	1	--	**1**
Mussel, indet.	--	--	--	**28**
Taxon indet. (Vertebrata)	--	--	1	**86**
Total	**2**	**1**	**8**	**208**

13.15.3 Discussion

The faunal assemblage is dominated by freshwater mussel remains, which account for 98.5 percent of the remains by weight. The mussels indicate procurement in the nearby Minnesota River, Nine Mile Creek, and adjacent aquatic habitats. It is likely that the bullheads, muskrats, and turtles recognized in the assemblage were likewise obtained from these habitat settings. Although no specific seasonal indicators were observed, the prevalence of freshwater mussel remains in conjunction with fish, turtle, and aquatic mammal elements suggests an open-water season of use. Overall, the composition of the faunal assemblage reflects exploitation of upland resources (deer) and nearby aquatic resources and may represent seasonal procurement activity.

13.16 Ceramic Analysis

A total of 394 ceramics were recovered from the site. The ceramics include Late Woodland Madison ware and Transitional (Middle to Late) Woodland St. Croix Stamped ware. Based on provenience and sherd attributes, 312 sherds are Madison ware and 45 are St. Croix Stamped ware. These ceramic wares are distinguished by several traits and provenience data as discussed below.

<u>Madison Ware Undecorated Sherds</u>
Madison Ware at the site consists of two distinct cordmarked surface treatments. Some sherds have cord markings that appear to be from a cord-wrapped paddle, and other sherds have distinct cord markings from a woven fabric, which fit the Madison Fabric Impressed type. Vertical cordmarking was present on the rim sherds. These sherds have fine grit temper and thin vessel walls, and decorations that include semi-circular and triangular punctates, lip notching, cord-wrapped stick impressions on lip, and cord-wrapped stick impression. Based on a sample of about 250 sherds, the thickness on body sherds ranged from 2.6 to 5.3 mm with an average between approximately 3.0 and 4.0 mm. Some of the rims and decorated near rims had a tendency to be a bit thicker than the body sherds and ranged from 5 to 6 mm. Madison ware was recovered from XUs 1-4 and 9-13 above St. Croix ware.

<u>Madison Ware Rim Sherds</u>
A rim sherd with vertical cordmarking and fine grit temper was recovered in XU 9 from 60 to 70 cmbd (Figure 85; Catalog # 34.136). This rim is from the same vessel as the rim from XU 13 (Figure 86; Catalog # 55.27) or is from a nearly identical vessel. Decoration consists of two horizontal rows of semi-circular punctates on the exterior and "u" shaped notching on the lip edge. The spacing between each row of punctates is about 5.5 mm, and the spacing between each punctate is about 5.2 mm. The diameter of each punctate is about 3.0 mm. The punctates appear to have been made with a hollow, rounded tool, like a reed, that was impressed into the clay at a slight angle. The punctates are shallow and do not produce a boss on the interior. The lip is very narrow and slightly round. The rim is too small to determine profile shape, rim angle, or diameter of the rim. Rim thickness is 3.1 mm at lip and 4.6 mm one cm below lip. This rim fits the description of Madison Punctate (Hurley 1975). Lip decoration on Madison ware occurs on the Folded Lip and Cordmarked varieties and includes "u" shaped impressions (or notches) made with a cord-wrapped stick (Hurley 1975). It is uncertain what specific type of tool was used for making the "u" shaped notches on the rims from the site, but it does not appear to have been a cord-wrapped stick.

A rim sherd with vertical cordmarking and fine grit temper was recovered in XU 11 from 40 to 50 cmbd (Figure 86; Catalog # 43.17). Decoration consists of horizontal cord-wrapped stick impressions below the rim on the exterior and oblique cord-wrapped stick impressions on the lip. The lip is slightly rounded and folded over on the exterior, producing a slight ridge along the lip edge. The rim has a slight excurvate profile but is too small to determine rim angle or diameter of the rim. Rim thickness is 4.2 mm at the lip and 5.5 mm one cm below the lip. This rim fits the description of Nininger Cord-Wrapped Stick Impressed, a variant of Madison Cord Impressed (Anfinson 1979:74).

A rim sherd with vertical cordmarking and fine grit temper was recovered in XU 13 from 50 to 60 cmbd (Figure 86; Catalog # 55.27). Decoration consists of two horizontal rows of semi-circular punctates on the exterior and "u" shaped notching on the lip edge. Some of the crests (top) on the notches are broken off. The spacing between each row of punctates is about 4.0 mm, and the spacing between each punctate is about 5.0 mm. The diameter of each punctate is about 3.1 mm. The punctates appear to have been made with a hollow, rounded tool, like a reed, that was impressed into the clay at a slight angle. The punctates are shallow and do not produce a boss on the interior. The lip is very narrow and slightly round. The rim has a slight excurvate profile but is too small to determine rim angle or diameter of the rim. Rim thickness is 3.0 mm at the lip and 5.0 mm two cm below the lip.

This rim fits the description of Madison Punctate (Hurley 1975). The "u" shaped notching along the lip is very similar to a Madison ware rim recovered near Shakopee Minnesota at site 21CR156 (Florin et al. 2013).

Madison Ware Decorated Sherds in XU 3

Three sherds decorated with punctates were recovered in XU 3 from 50 to 60 cmbd (Figure 85), which fit the description of Madison Punctate (Hurley 1975). The similarity of the sherds and their close association suggests they may be from the same or a similar vessel. The first sherd (Catalog # 17.51) is very near the rim, as it contains a remnant of slight thickening where the lip was folded over on the exterior. This sherd has a horizontal row of semi-circular punctates on the interior. The spacing between each punctate is about 7.4 mm, and the diameter of each punctate is about 4.2 by 3.3 mm. The punctates appear to have been made with a non-hollow, rounded tool that was impressed into the clay at a slight angle. The punctates are shallow but produce a very slight boss on the interior. The exterior has a cordmarked surface that is partially smoothed-over. Interior punctates do not appear to be common on Madison ware. The sherd is 5.8 mm thick.

The second sherd (Catalog # 17.50) has two rows of semi-circular punctates on the exterior and a cordmarked surface treatment. The spacing between each punctate is about 7.5 mm, and the diameter of each punctate is about 4.2 by 3.3 mm. The punctates appear to have been made with a non-hollow, rounded tool that was impressed into the clay at a slight angle. The punctates are shallow but produce a very slight boss on the interior. The sherd is 5.1 mm thick.

The third sherd (Catalog # 17.52) has two rows of small triangular punctates and a connecting row of triangular punctates offset at a 45 degree angle. The punctates are on the exterior, and the surface is cordmarked. The spacing between the two rows of punctates is about 5.5 mm, and the spacing between each punctate is about 4.0 mm. The diameter of each punctate is about 2.6 mm. The punctates appear to have been made with a non-hollow tool that was impressed into the clay at an angle. The punctates are shallow and do not produce a boss on the interior. Triangular punctates are not common. The sherd is 5.3 mm thick. This sherd is similar to the triangular punctate sherd in XU 10 discussed below.

Madison Ware Decorated Sherds in XU 9 and 10

A decorated sherd with cordmarked surface and grit temper was recovered in XU 9 from 60 to 70 cmbd (Figure 85; Catalog # 34.135). The sherd has two rows of semi-circular punctates on the exterior. The spacing between the two rows of punctates is about 5.9 mm, and the spacing between each punctate is about 6.7 mm. The diameter of each punctate is about 4.3 by 3.6 mm. The punctates appear to have been made with a non-hollow, rounded tool that was impressed into the clay at a slight angle. The punctates are shallow, and do not produce a boss on the interior. The sherd is 5.0 mm thick.

A decorated sherd with cordmarked surface and grit temper was recovered in XU 10 from 50 to 60 cmbd (Figure 85; Catalog # 39.2). The sherd has two rows of small triangular punctates on the exterior. The sherd break is along the middle of one row, making it difficult to discern the row. The spacing between the two rows of punctates is about 4.7 mm, and the spacing between each punctate is about 5.0 mm. The diameter of each punctate is about 3.0 mm. The punctates appear to have been made with a non-hollow tool that was impressed into the clay at an angle. The punctates are shallow and do not produce a boss on the interior. Triangular punctates are not common. The sherd is 6.2 mm thick. This sherd is similar to the triangular punctate sherd in XU 3 discussed above.

St. Croix Stamped Undecorated Sherds

The cordmarking on the St. Croix ware typically has thicker cords that are more lightly impressed than on the Madison ware, and St. Croix ware lacks the woven fabric impressions that are common on the Madison ware. The temper in St. Croix ware consists of larger pieces of grit than in the Madison ware.

The vessel walls are thicker than the Madison ware, ranging from 5.3 to 7.3 mm, with an average of 6.1 mm. A total of 15 sherds had intact interior and exterior surfaces and provided thickness measurements of 5.3, 5.4, 5.5, 5.8 (2), 5.9, 6.1, 6.2 (2), 6.3 (2), 6.4, 6.6, 6.8, and 7.3 mm. St. Croix ware was recovered only from XUs 1 and 13 and Feature 6 (in XU 13), where they occur below Madison ware. Most of the sherds (n=35) were very small fragments (Size Grade 3 and smaller) recovered from Feature 6.

St. Croix Stamped Decorated Sherds

In Feature 6 from 80 to 119 cmbd, there were three small sherds that had dentate stamp impressions (Figure 86; Catalog # 71.51-53). One of the sherds has two parallel rows of dentate stamped impressions, and the other sherds have a single row. The sherds have a smooth surface, which is typical of the decorated area near the rim. The sherds are grit tempered. All the sherds lacked an interior surface, and the thickness is 5.8, 6.2, and 6.6 mm. The stamp was made with a tool that was carved with small rectangular designs. The dentate stamp impressions are nearly identical to, but slightly smaller than, those illustrated in *A Handbook of Minnesota Prehistoric Ceramics* (George 1979).

Phytolith Analysis

Five Madison ware sherds with charred residue from XU 13, 50-60 cmbd were examined by Robert Thompson for phytolith analysis. The sherds were from the same provenience and were treated as part of the same vessel. Residue from the sherds was divided into two <1gm samples. The samples were processed by procedures detailed in publications. In summary, the food residues were treated with nitric acid and then hydrogen peroxide to remove organic material. The resulting material was rinsed repeatedly with distilled water, then acetone, and finally saved in ethanol. Two slides of the recovered material were prepared, and each slide was scanned at 400 X magnification with an Amscope 290xl biological grade scope. The only biogenic material observed consisted of a few rods and blocky cells. Neither of these types is diagnostic of any particular plant. All of the samples contained abundant silica grit. This is consistent with the use of grindstones in food preparation.

13.17 Horizontal and Vertical Artifact Patterning

The site is small, measuring 40 by 15 meters. The horizontal distribution of artifact classes is biased to some extent by the locations where the XUs were placed. However, the XUs were placed in locations where artifact density in shovel tests was highest and most diverse. Fauna was recovered only from the central portion of the site (the area from XU 3 to XU 13). Ceramics were recovered from the western portion of the site (the area from XU 3 to Shovel Test 32). FCR and lithic debris were recovered from across the site area, with the highest density in the central portion of the site.

The vertical distribution of artifacts ranges from 0 to 130 cmbs. Artifact depths are highly variable across the site and are dependent on landscape position and amount of fill. A 30 to 50-cm-thick fill layer covers the site, except for the south end. Below the fill, the soils consist of a 30 to 50-cm thick sequence of A, AB, and B horizons that formed in fine to moderately fine textured sediment (silt loam, sandy clay loam, sandy loam and loamy sand) that overlie very coarse-textured sediment (gravelly sand BC and C horizons). Almost all of the artifacts were recovered in the A, AB, and B horizons above the gravelly sand BC and C horizons. A buried soil was identified at only one location (in XUs 1, 2, and 13), where the soil sequence is thicker because of the greater amount of deposition than in the other site areas. In general, the site area on the terrace appears to contain a small amount of soil deposited during the Woodland period in most locations. The Late Woodland and Transitional Woodland components in XUs 1, 2, and 13 are clearly vertically-separated, as sediment deposition occurred between occupations, and the buried soil indicates landscape stability between depositional events. The vertical separation of components is also apparent in XUs 11 and 12 and to a much lesser degree in XUs 3, 4, and 9.

13.18 Site Integrity

Aside from the truncation of the A horizon below the fill layer, the soils at the site appear to be relatively undisturbed. Rodent runs are minimal to moderate. The overall vertical patterning of artifacts (particularly ceramics, which can be used as a tracer) indicates that site components in general have tight vertical patterning, which is indicative of the integrity of the deposits. Faunal preservation is fair to moderate.

13.19 Conclusions and Recommendation

Site 21HE497 is a small multicomponent Woodland period habitation with a moderately dense artifact scatter on a high terrace of the Minnesota River. Early Woodland, Transitional Woodland, and Late Woodland components are present based on radiometric dates and diagnostic artifacts that include Late Woodland Madison ware, St. Croix Stamped ware, two small Late Woodland side-notched points, and two Early Woodland Waubesa points.

Six radiocarbon dates were obtained from wood charcoal and animal bone at the site yielding dates in RCYBP of 1690 +/- 30, 1280 +/- 30, 1270 +/- 30, 1150 +/- 30, 1080 +/- 30, and 870 +/- 30. The date of 1280 +/- 30 RCYBP on a Late Woodland Madison ware sherd appears to be too old based on the context of the sherd and established dates for the ware. A date of 1270 +/- 30 RCYBP was obtained from wood charcoal from a feature that contained St. Croix Stamped ware, which fits with the expected date for this ware. A date of 1690 +/- 30 RCYBP was obtained from wood charcoal in a feature that contained a Waubesa point. Dates of 1150 +/- 30, 1080 +/- 30, and 870 +/- 30 RCYBP were obtained from XUs (and an adjacent shove test) with Late Woodland Madison ware and small side-notched points, and these dates appear to be a good match for the Late Woodland component.

Four features, interpreted as cooking and/or heating pits, were identified. There was only a very sparse amount of charred botanical materials in the features, which consisted mostly of wood charcoal along with a possible acorn cap and seed from the Sedge family. One feature dated to 1080 +/- 30 RCYBP and contained a small amount of Late Woodland ceramics. A second feature dated to 1270 +/- 30 RCYBP and contained Transitional Woodland St. Croix ware. A third feature dated to 1690 +/- 30 RCYBP and contained a Waubesa point in the bottom of the feature. If the point and feature are in direct association as it appears, then that date is about 200 years later than expected based on the Early Woodland dates proposed from southwest Wisconsin (Stevenson et al. 1997:150). Alternately, Waubesa points may occur in later cultures and need to be included in Middle, Transitional, or Late Middle Woodland components. Unfortunately, there is no clear evidence to resolve the cultural association of the Waubesa point at the site. Based only on the ceramic evidence, it is possible that the point is associated with the Transitional Woodland St. Croix ware that was recovered nearby. No Early or Middle Woodland ceramics were recovered.

The Phase I and II investigations included twelve positive shovel tests and 13 1-x-1 meter XUs. Artifacts were recovered from 0 to 130 cmbs. In some XUs, the Woodland components are vertically separated and in other XUs they overlap. Artifact density was moderate in the central portion of the site and lower along the margins. Artifacts recovered include ceramics, FCR, lithic debris, stone tools, cores, and a sparse amount of faunal material. Site activities include hunting, animal/plant processing, lithic reduction, stone tool manufacture, and cooking/heating. Some of the faunal material was thermally-altered.

Identifiable fauna included white-tail deer, muskrat, turtle, bullhead, and several varieties of freshwater mussels, which were the most abundant fauna recovered. Most of the mussels were recovered from a Transitional Woodland feature that also contained St. Croix Stamped ware. The faunal assemblage may represent seasonal procurement activity and reflects exploitation of upland resources and nearby aquatic resources. The prevalence of freshwater mussel remains in conjunction with fish, turtle, and muskrats suggests an open-water season of use. The aquatic remains would have been harvested from Nine Mile Creek or the Minnesota River and carried from the floodplain up to the terrace.

Bipolar, bifacial, and nonbifacial reduction technologies are present at the site and include the early, middle, and late stages of reduction. In XUs 1, 2, and 13 Late Woodland lithic technologies consist primarily of bipolar, nonbifacial, and late-stage bifacial shaping. In contrast, middle and late-stage bifacial thinning and shaping are more prevalent in the Transitional Woodland. In XUs 9 and 10, Burlington Chert occurs in small amounts and appears to be associated with the Early or Transitional Woodland components. Prairie du Chien Chert is the most abundant material in all site components. Other nonlocal materials that occur without any clear component associations include Knife River Flint and Grand Meadow, Cedar Valley, Burlington, Fusilinid, and Galena cherts. These non-local materials were procured though long-distance trade networks or possibly travel to source areas. Stone tools include projectile points, utilized flakes, scrapers, late-stage bifaces, two small circular stones (nonutilitarian), and a hammerstone.

Aside from the truncation of the A horizon below the fill layer, the soils at the site appear to be relatively undisturbed. Rodent runs are minimal to moderate at the site. The overall vertical patterning of artifacts (particularly ceramics, which can be used as a tracer) indicates that site components have tight vertical patterning, which is indicative of the integrity of the deposits.

The site is recommended eligible for listing on the NRHP under Criterion D because it has integrity and is likely to yield important information on the Early Woodland, Transitional Woodland, and Late Woodland periods. The site contains data that could provide significant information on the following Woodland period research themes, which are discussed in Section 2.3.2:

- Age and regional chronology
- Technology and Material Culture - full range of material culture for each complex needs to be described (diagnostic and nondiagnostic artifacts)
- Ceramic Data - refining typologies, regional distribution, and temporal changes
- Lithic Data – obtain data on tools, diagnostic points, manufacturing debris, and raw materials
- Subsistence strategy and settlement pattern
- Geographic distribution
- Regional interaction and trade
- Defining the Complexes – the definition of each complex needs to be refined
- Site formation processes and geomorphology

The current project design will avoid the site (Figure 87). The construction limits near the site will be fenced prior to construction. However, if the project design changes or if other projects adversely affect the site, then a Phase III data recovery is recommended to mitigate the project's effects.

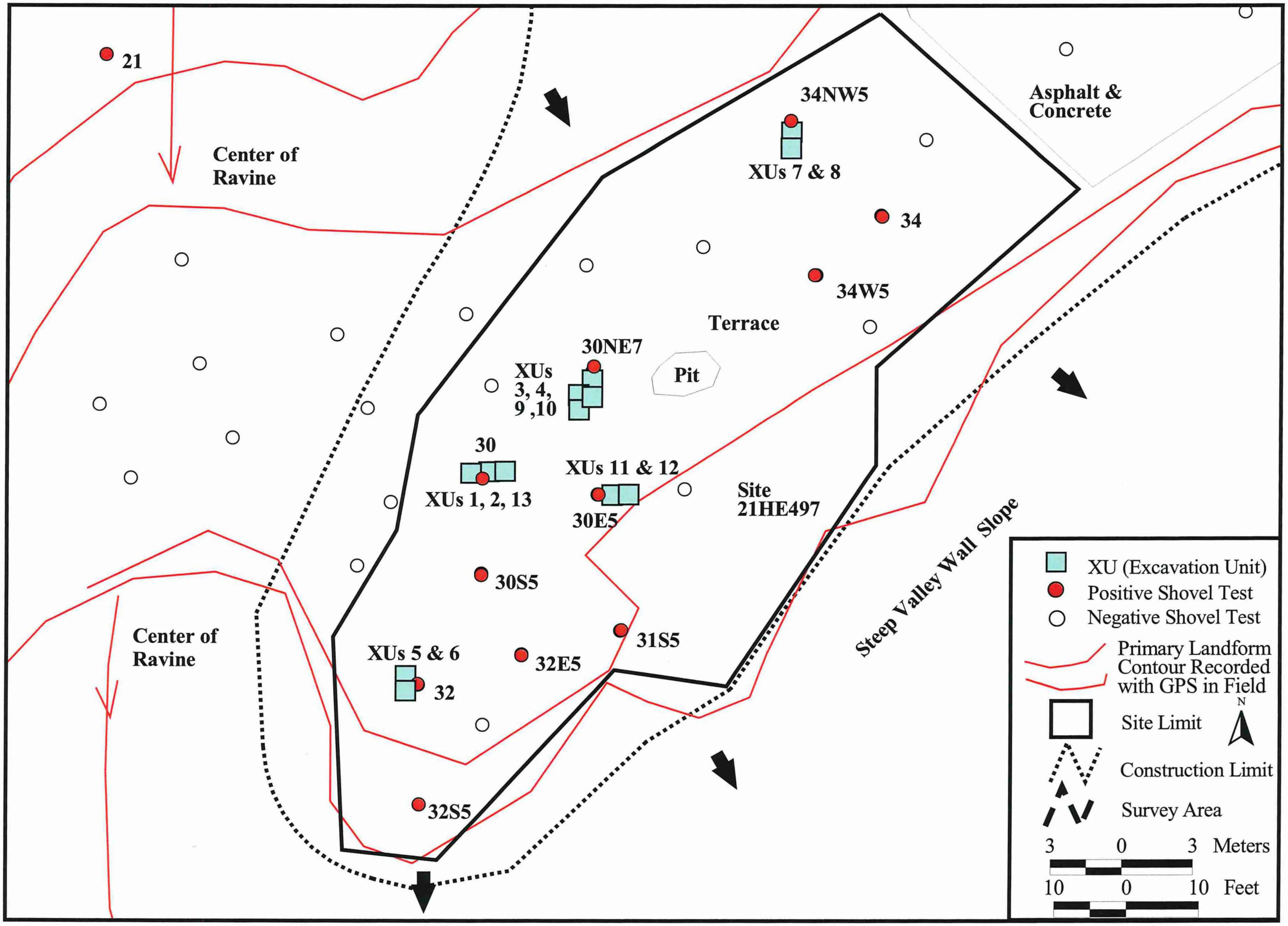


Figure 51. Site 21HE497 Map.

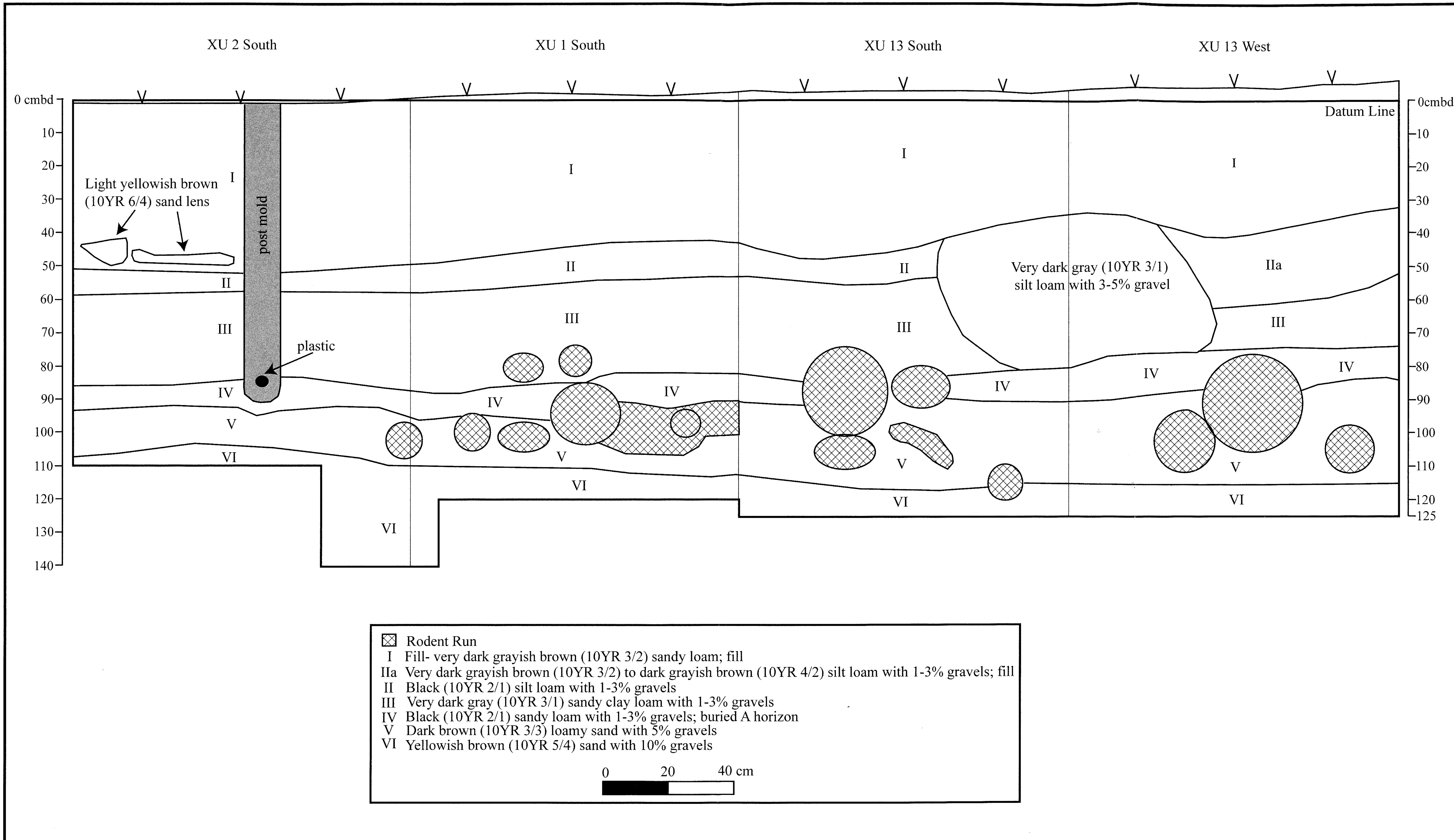


Figure 54. Site 21HE497 XUs 1, 2, and 13 South Wall Profile and XU 13 West Wall Profile.


Figure 55. Site 21HE497 Photo XUs 1 and 2 South Wall Profile.

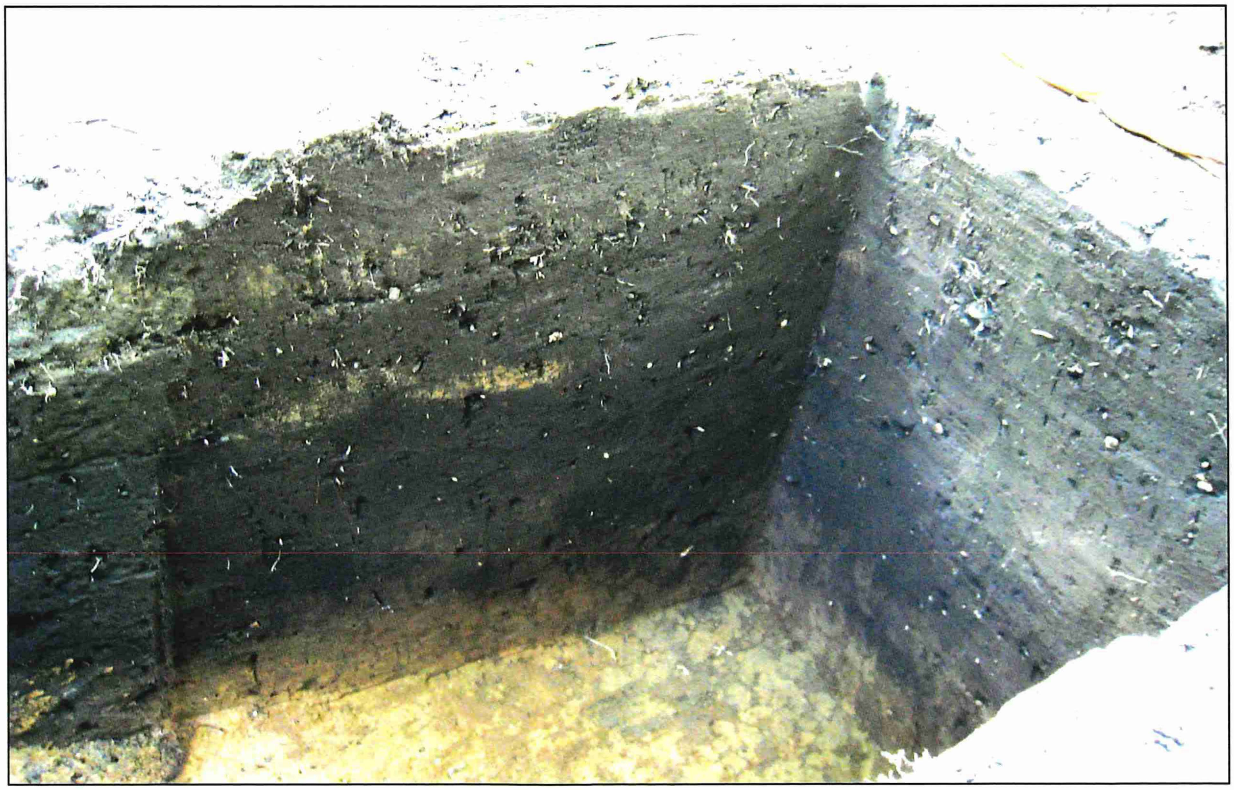
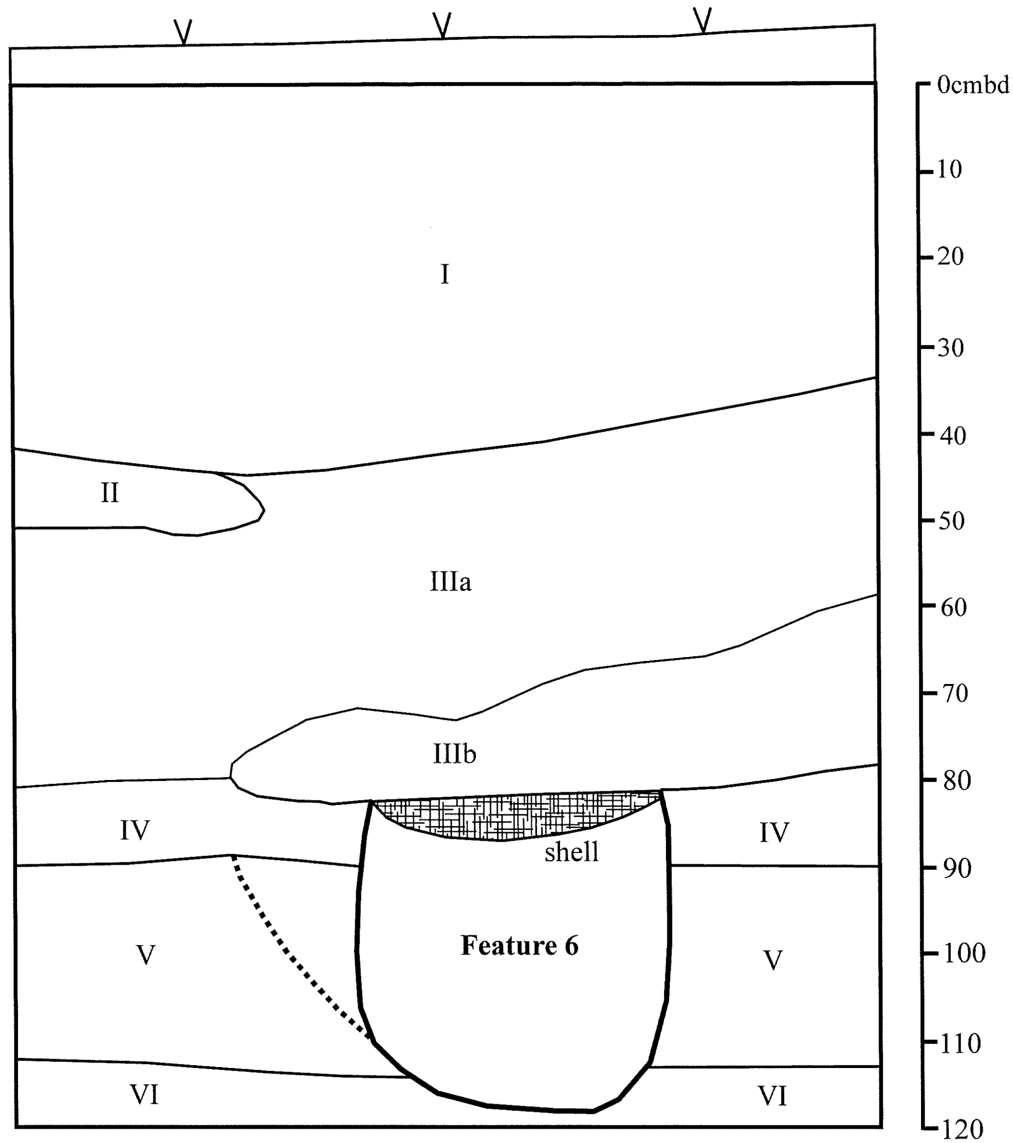


Figure 56. Site 21HE497 Photo XU 13 South Wall Profile.

Figure 57. Site 21HE497 Photo XU 13 West Wall Profile.



W Ground Surface ▦ Shell concentration
I Very dark grayish brown (10YR 3/2) sandy loam; fill
II Black (10YR 2/1) silt loam
IIIa Very dark gray (10YR 3/1) silt loam with 1-3% gravels
IIIb Very dark grayish brown (2.5Y 3/2) sandy loam with 3-5% gravels
Feature 6 Black (10YR 2/1) and very dark gray (10YR 3/1) sandy clay loam
IV Black (10YR 2/1) sandy loam; buried A horizon
V Dark brown (10YR 3/3) loamy sand with 5% gravels
VI Yellowish brown (10YR 5/4) sand with 10% gravels

0 10 20 cm

Figure 58. Site 21HE497 XU 1 West Wall Profile and Feature 6 Profile.

Figure 59. Site 21HE497 Photo XU 1 West Wall Profile and Feature 6 Profile.

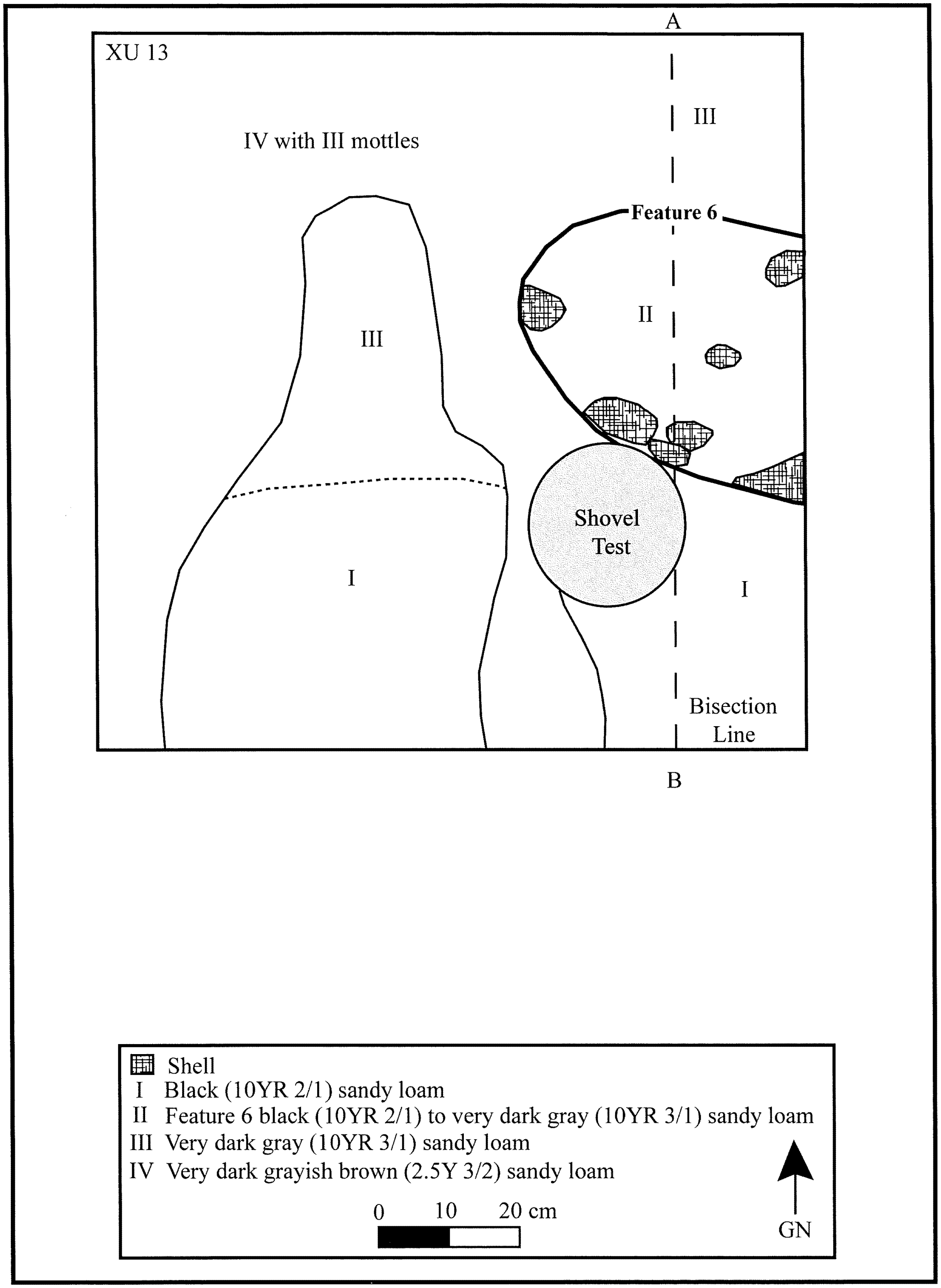


Figure 60. Site 21HE497 Feature 6 Planview at 80 cmbd.

Figure 61. Site 21HE497 Photo Feature 6 Planview at 80 cmbd (North to Top of Page).

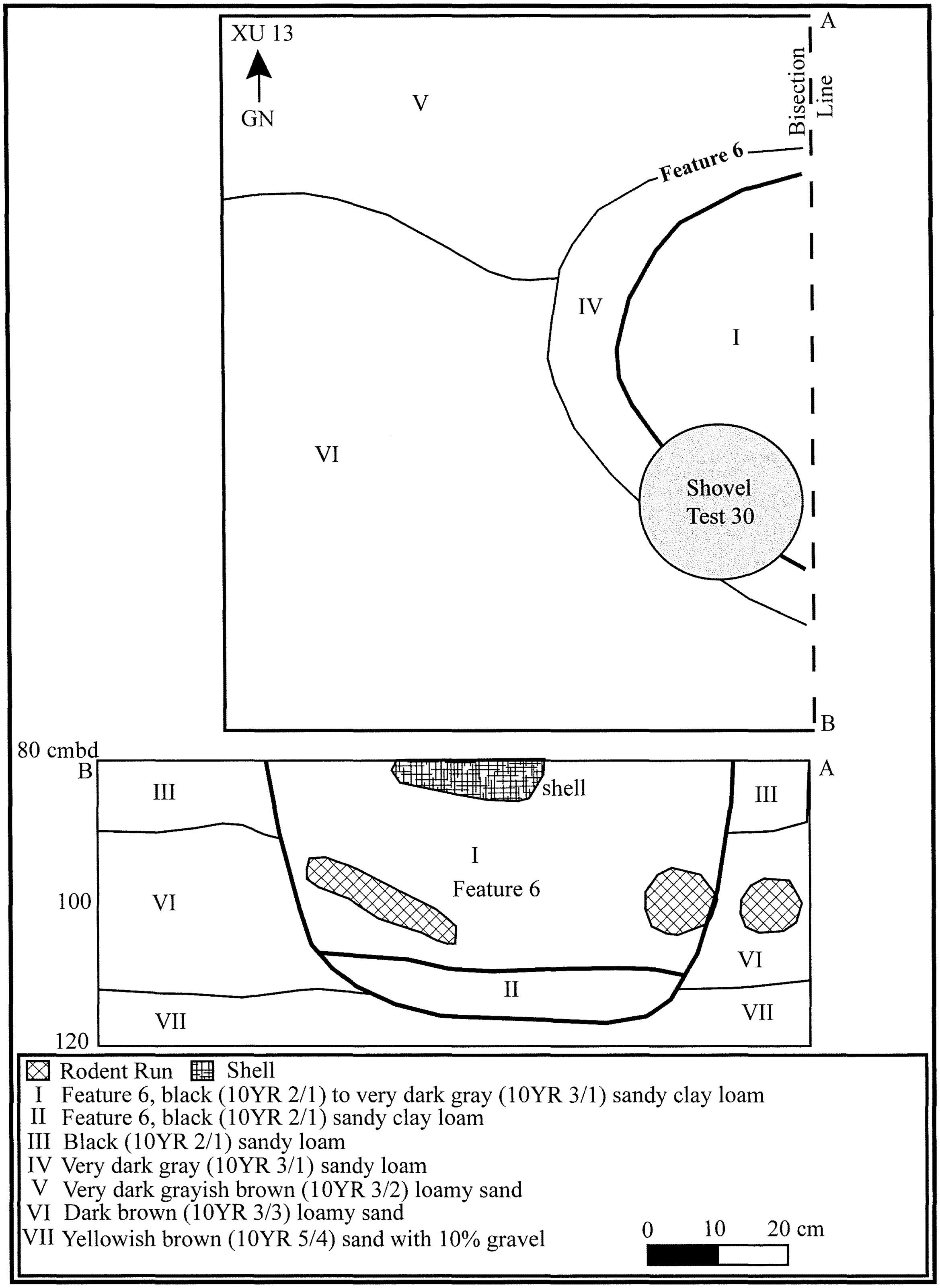


Figure 62. Site 21HE497 Feature 6 Bisection Profile and Planview at 90 cmbd .

Figure 63. Site 21HE497 Photo of Feature 6 Bisection Profile from 80 to 120 cmbd.

Figure 64. Site 21HE497 Photo of Feature 6 Planview at 90 cmbd (North to Top of Page).

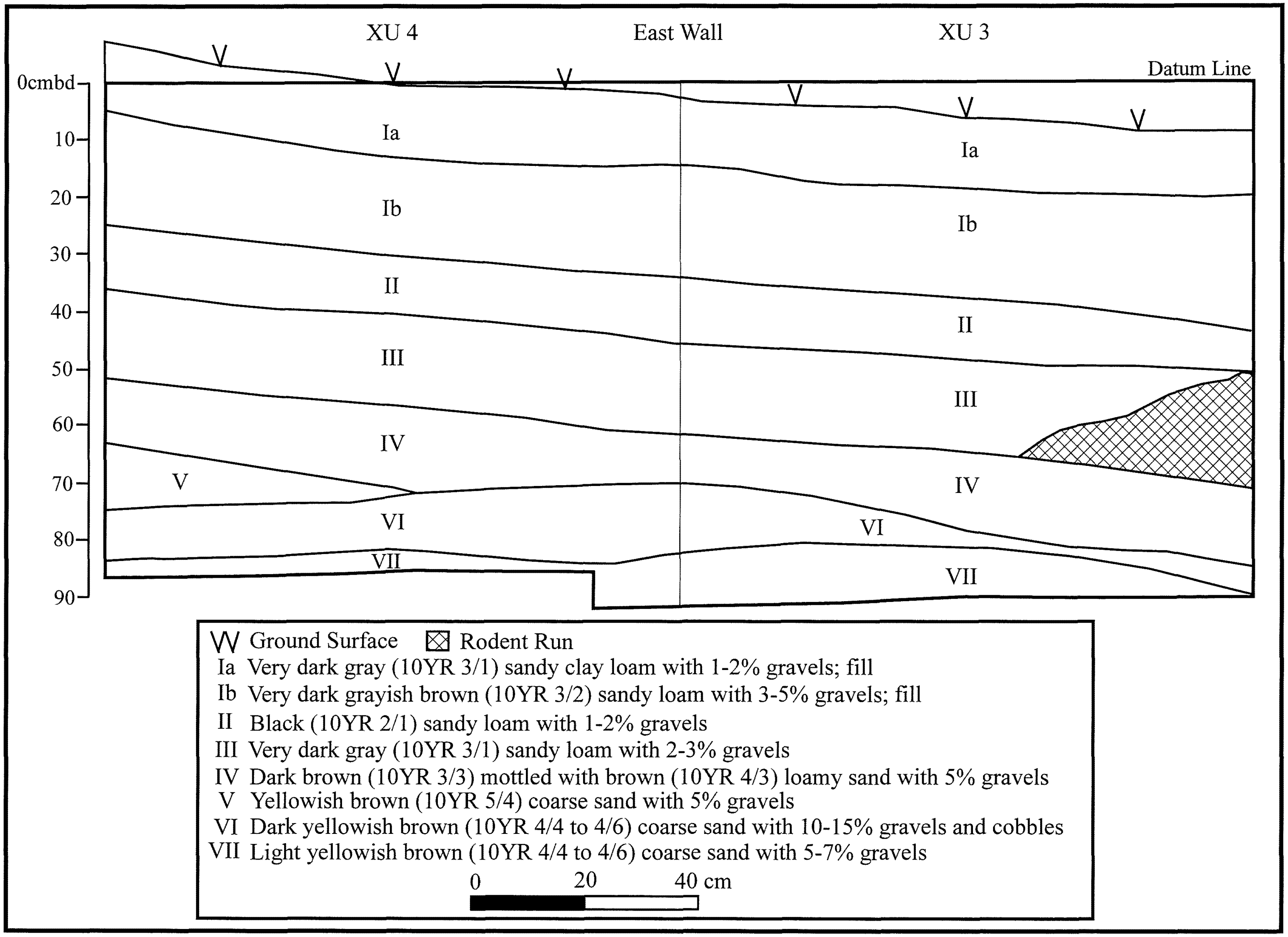


Figure 65. Site 21HE497 XUs 3 and 4 East Wall Profile.

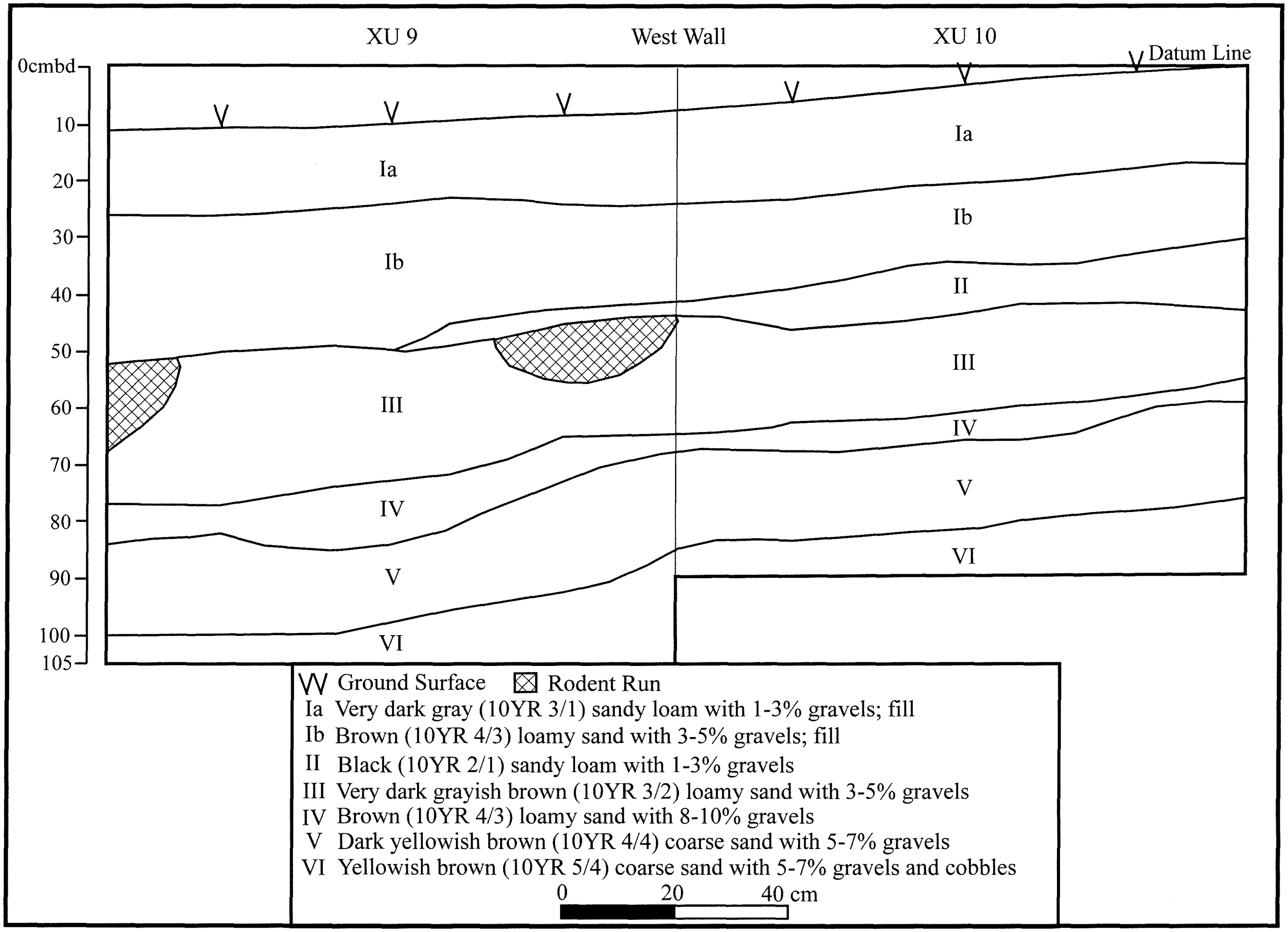
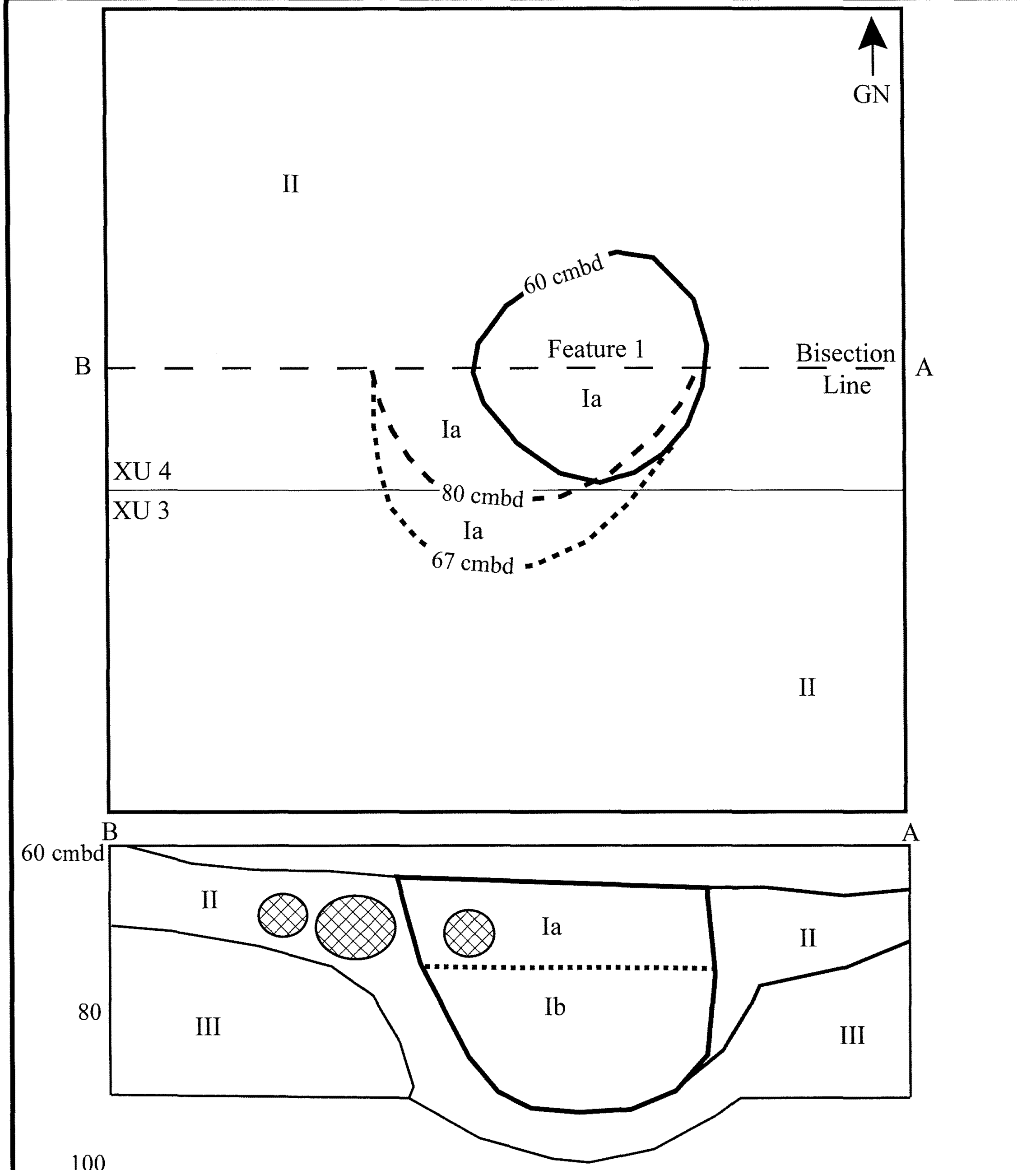


Figure 66. Site 21HE497 XUs 9 and 10 West Wall Profile.

Figure 67. Site 21HE497 Photo XUs 3 and 4 East Wall Profile.

Figure 68. Site 21HE497 Photo XUs 9 and 10 West Wall Profile.



⊠ Rodent Run
Ia Feature 6, very dark gray (10YR 3/1) sandy loam with 1-3% gravels
Ib Feature 6, very dark grayish brown (10YR 3/2) sandy loam with 1-3% gravels
II Dark brown (10YR 3/3) loamy sand with 5% gravels
III Dark yellowish brown (10YR 4/4) to light yellowish brown (10YR 6/4) coarse sand with 5-10% gravels

0 10 20 cm

Figure 69. Site 21HE497 Feature 1 Profile and Planview at 60, 67, and 80 cmbd.

Figure 70. Site 21HE497 Photo of Feature 1 Planview at 60 cmbd (Arrow Shows Magnetic North).


Figure 71. Site 21HE497 Photo of Feature 1 Profile from 60 to 89 cmbd.

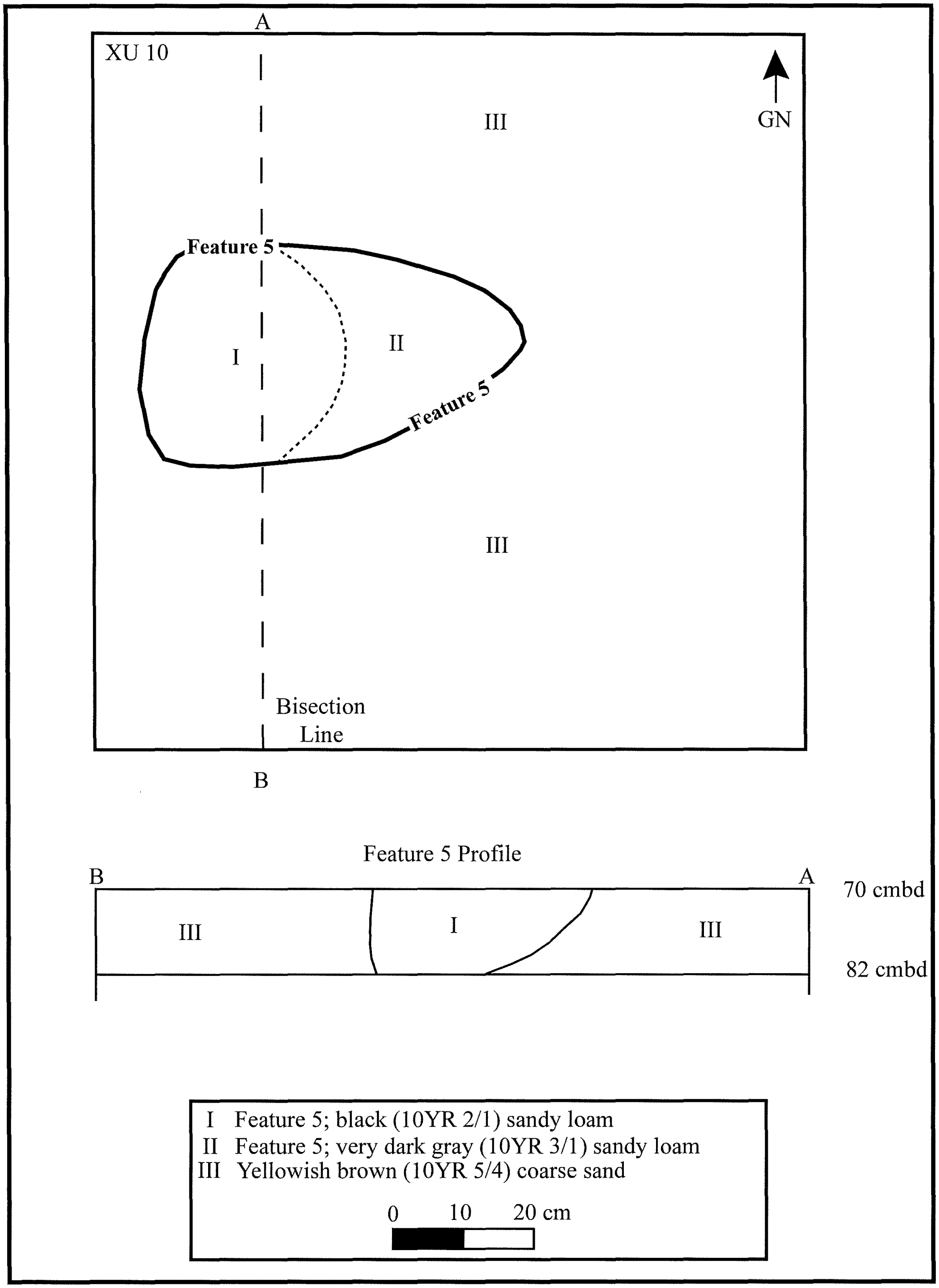


Figure 72. Site 21HE497 Feature 5 Profile and Planview at 70 cmbd.

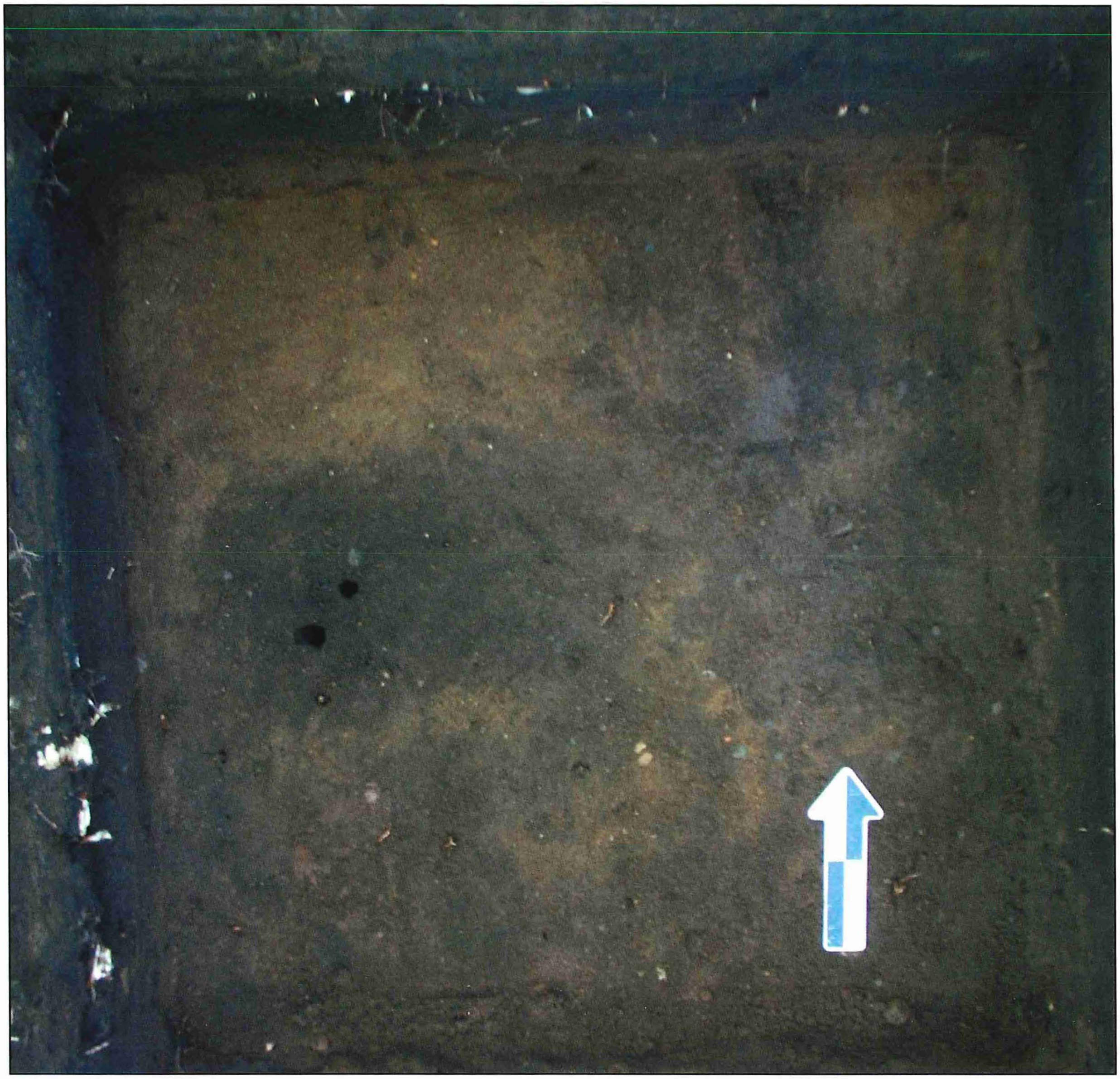


Figure 73. Site 21HE497 Photo Feature 5 Planview at 70 cmbd.

Figure 74. Site 21HE497 Photo Feature 5 Profile from 70 to 82 cmbd.

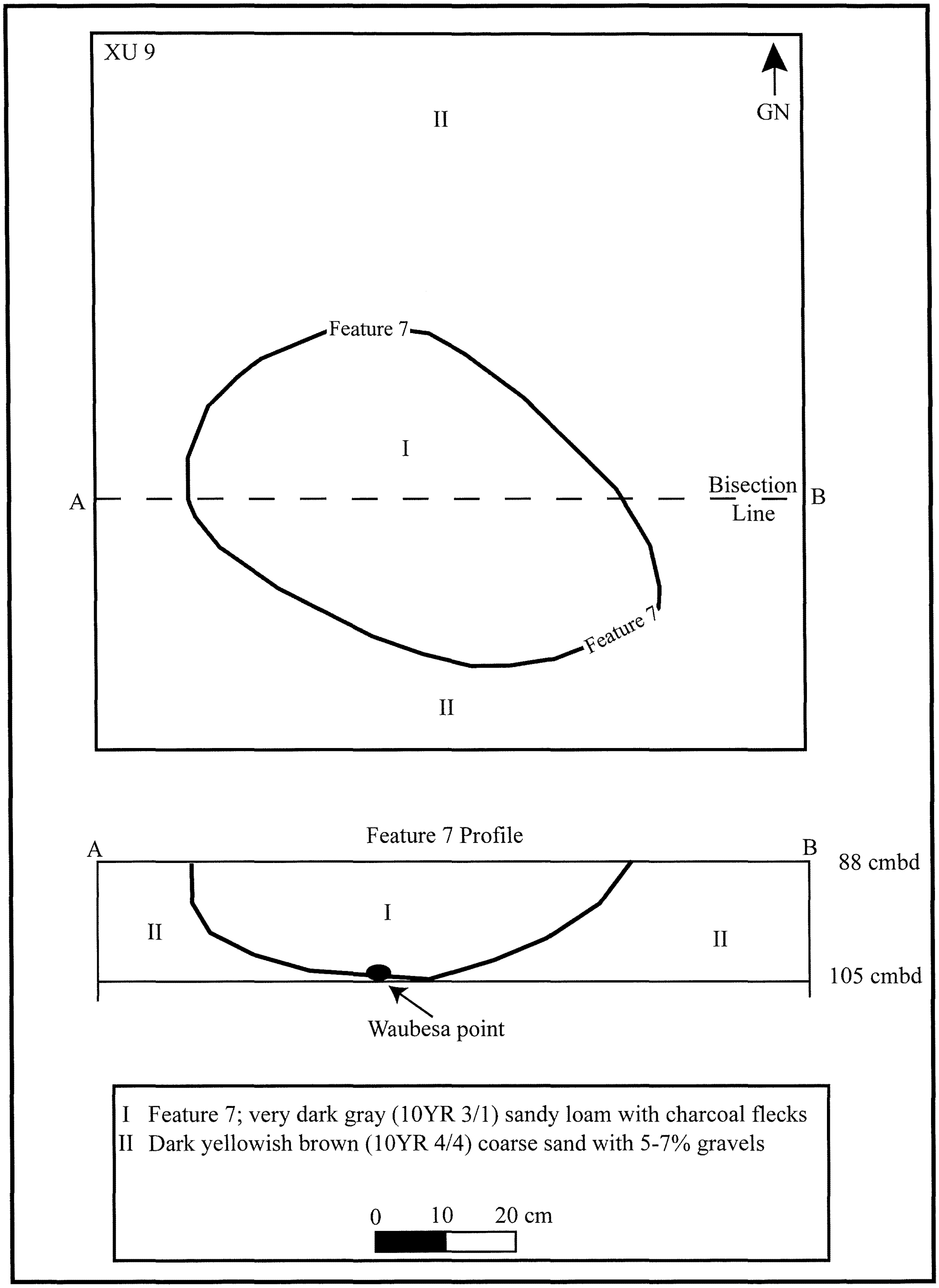


Figure 75. Site 21HE497 Feature 7 Profile and Planview at 88 cmbd.

Figure 76. Site 21HE497 Photo Feature 7 Planview at 88 cmbd.

Figure 77. Site 21HE497 Photo Feature 7 Profile from 88 to 105 cmbd.

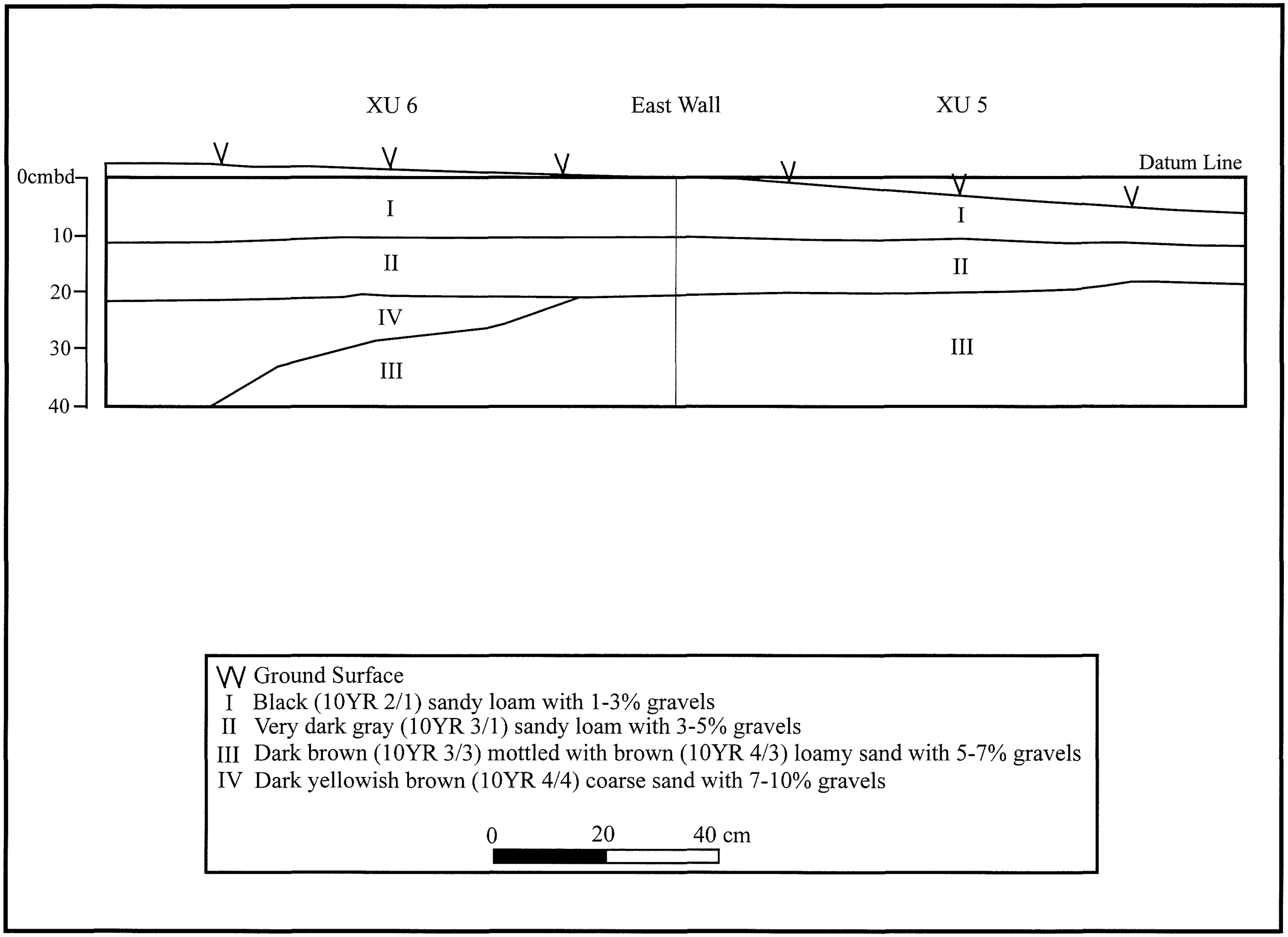


Figure 78. Site 21HE497 XUs 5 and 6 East Wall Profile.

Figure 79. Site 21HE497 Photo XUs 5 and 6 East Wall Profile.

Figure 80. Site 21HE497 Photo XUs 7 and 8 West Wall Profile.

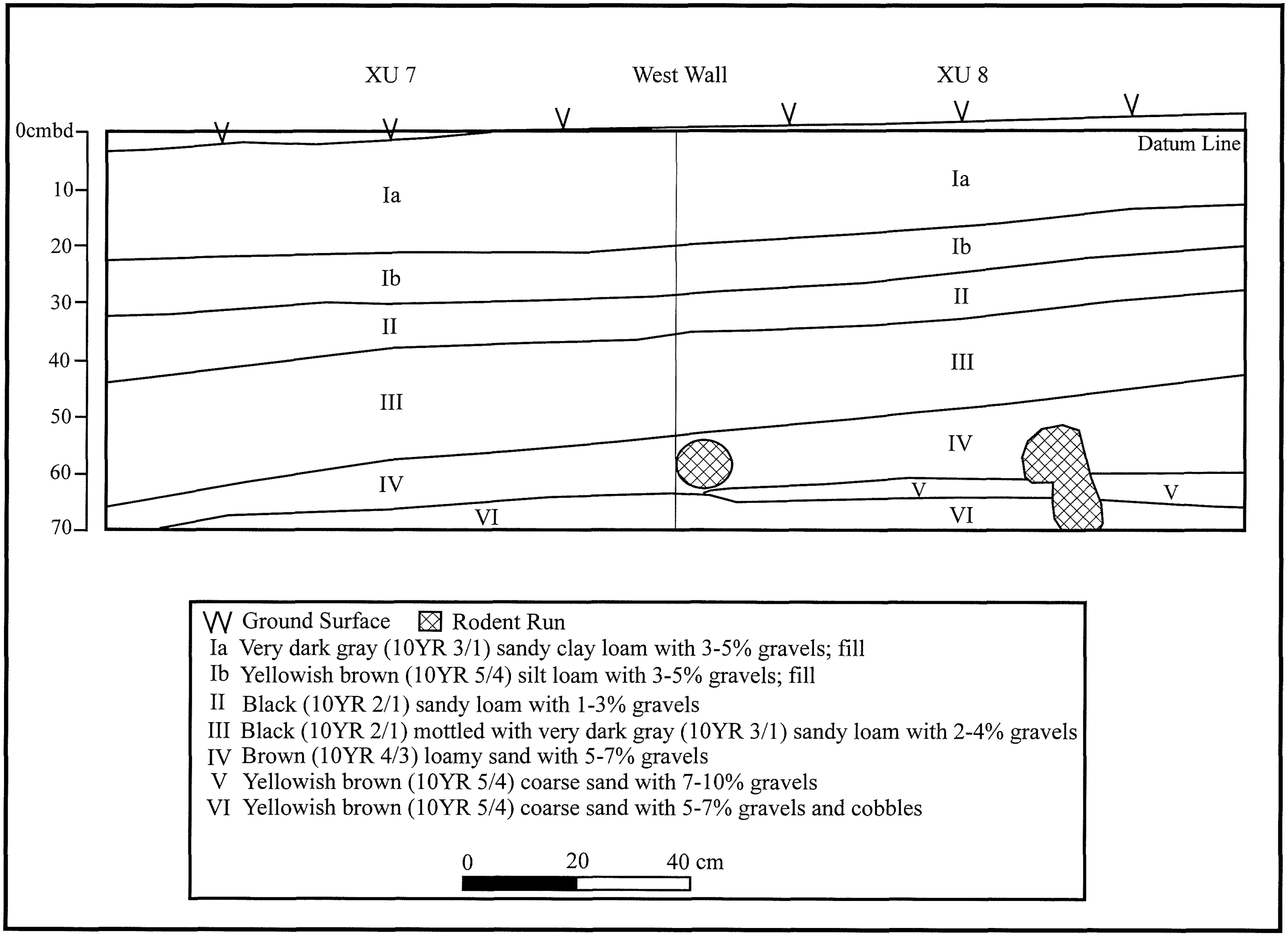


Figure 81. Site 21HE497 XUs 7 and 8 West Wall Profile.

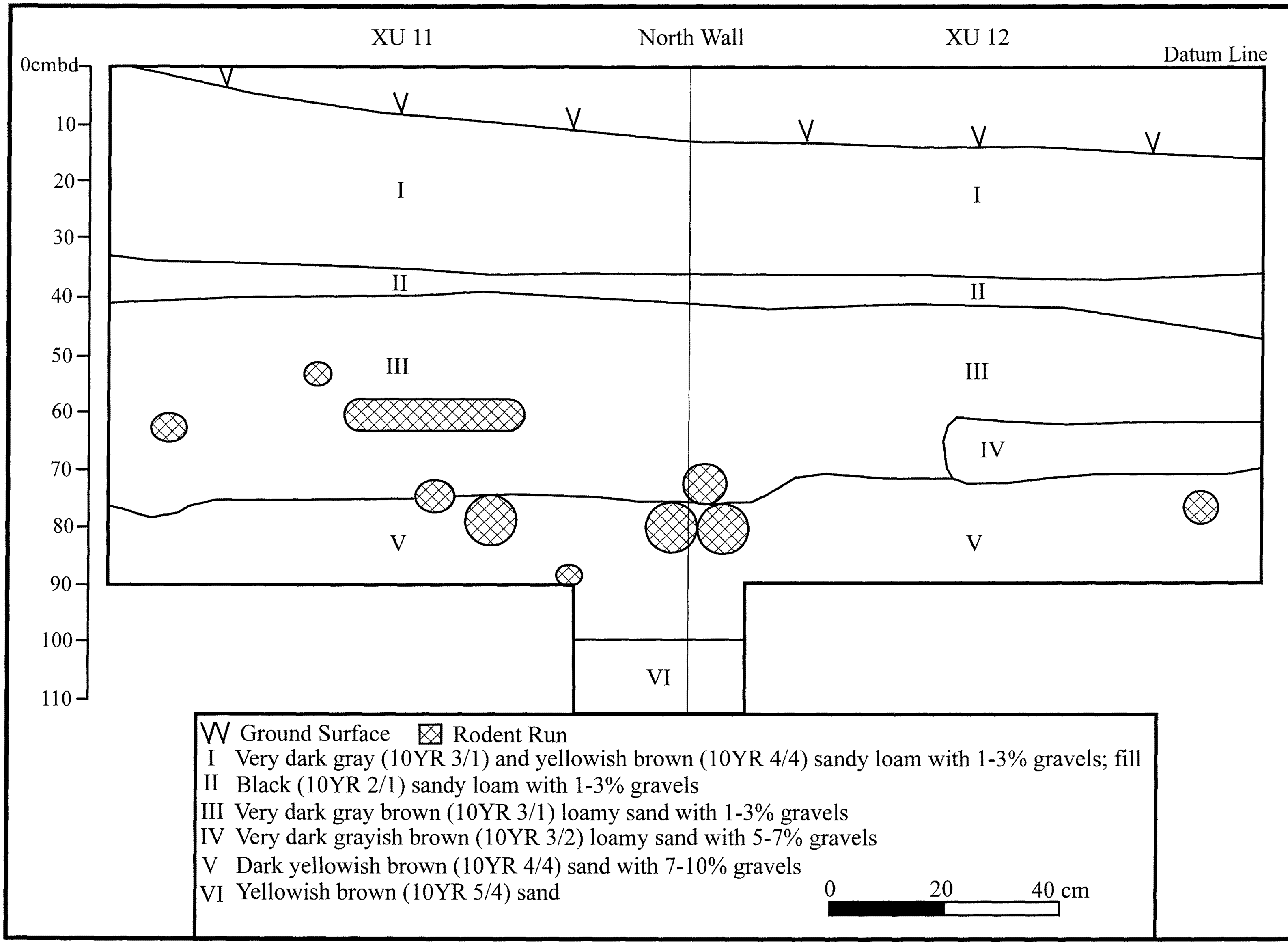
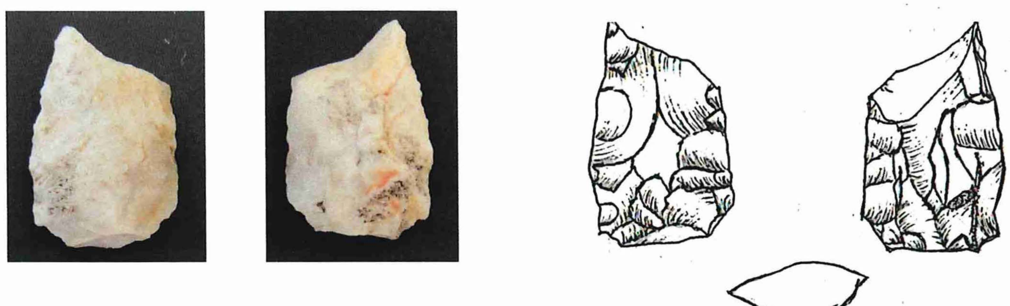


Figure 82. Site 21HE497 XUs 11 and 12 North Wall Profile.

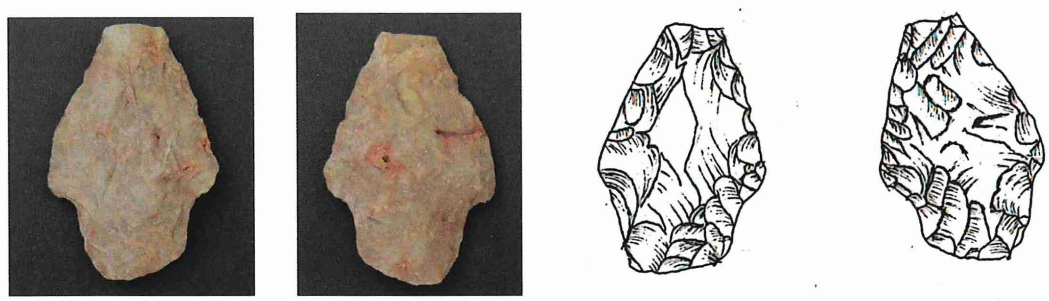

Figure 83. Site 21HE497 Photo XUs 11 and 12 North Wall Profile.

Catalog # 21.11; XU 4 (40-50 cmbd); projectile point, small side-notched type, Prairie du Chien Chert (oolitic)



Catalog # 22.6; XU 4 (50-60 cmbd); projectile point, probable Waubesa type, Swan River Chert

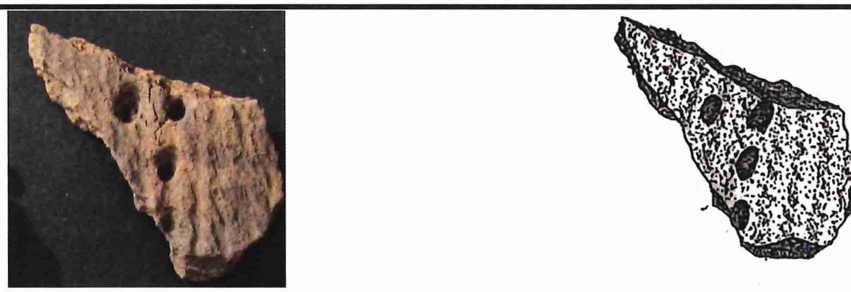
Catalog # 22.7; XU 4 (50-60 cmbd); projectile point, small side-notched type, unidentified chert



Catalog # 74.1; F 7 (102 cmbd); projectile point, Waubesa type, Tongue River Silica

0 Centimeters 5

Figure 84. Site 21HE497 Photos and Illustrations of Projectile Points.

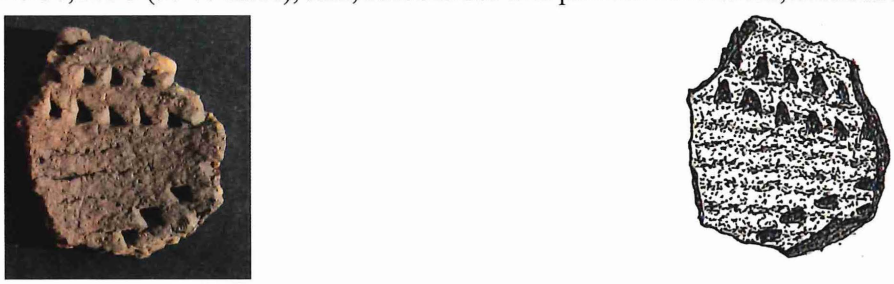


Catalog # 17.50; XU 3 (50-60 cmbd); Neck, cord marked with punctate decorations; Madison Punctate

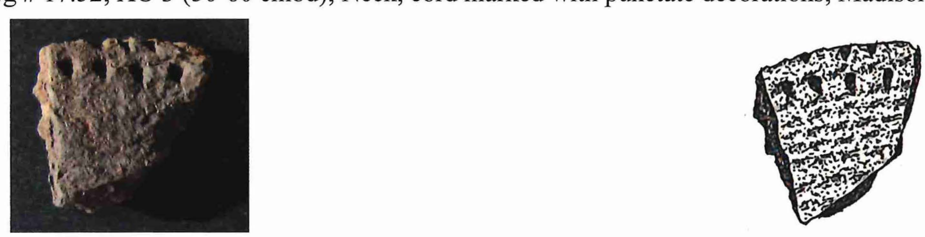
Catalog #17.51; XU 3(50-60 cmbd); Rim,cord marked with interior punctate decorations;Madison Punctate

Catalog # 34.135; XU 9 (60-70 cmbd); Neck, cord marked with punctate decorations

Catalog # 34.136; XU 9 (60-70 cmbd); Rim, cord marked with punctate decorations; Madison Punctate



Catalog # 17.52; XU 3 (50-60 cmbd); Neck, cord marked with punctate decorations; Madison Punctate

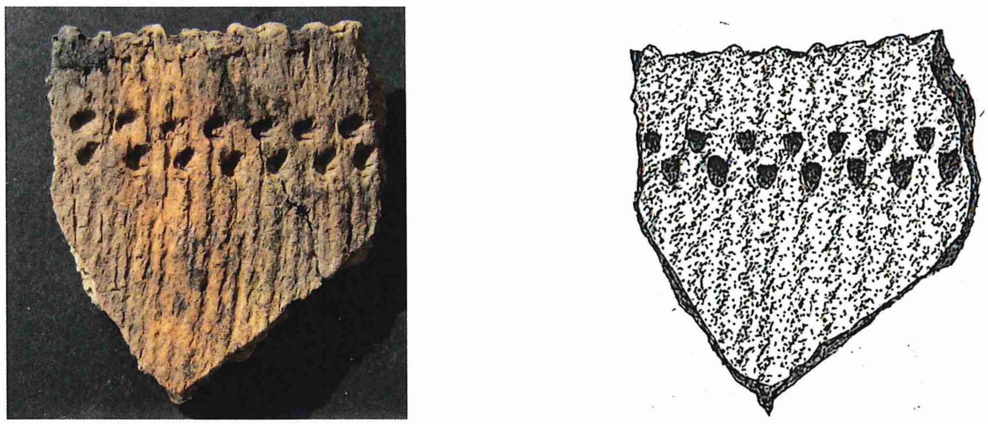


Catalog # 39.2 ; XU 10 (50-60 cmbd); Neck, cord marked with triangular punctate decorations; Madison Punctate

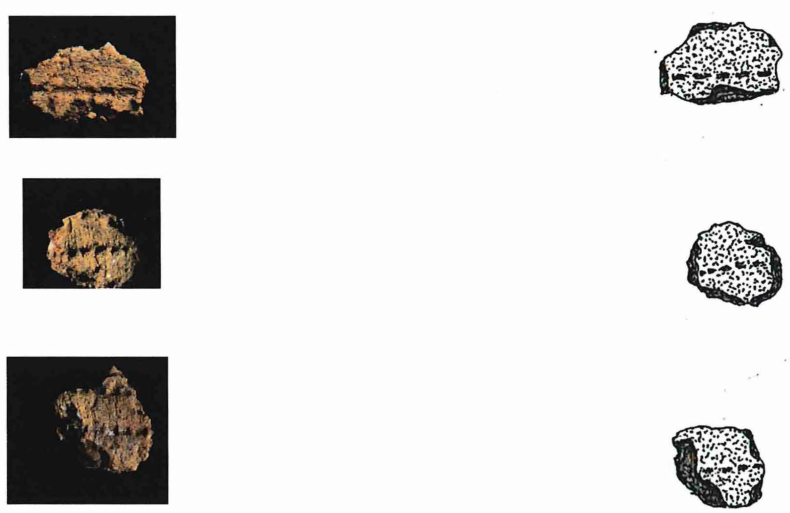
0 Centimeters 5

Figure 85. Site 21HE497 Photos and Illustrations of Ceramics from XUs 3, 9, and 10.

Catalog # 43.17; XU 11 (40-50 cmbd); Rim, cord marked with cord wrapped stick; Madison-Nininger Cord-Wrapped Stick



Catalog # 55.27; XU 13 (50-60 cmbd); Rim, cord marked with punctate decorations; Madison Punctate



Catalog # 71.51-53; F 6E1/2 (80-119 cmbd); Body, smooth with stamped decorations; St. Croix Stamped

0 Centimeters 5

Figure 86. Site 21HE497 Photos and Illustrations of Ceramics from XUs 11, 13, and Feature 6.

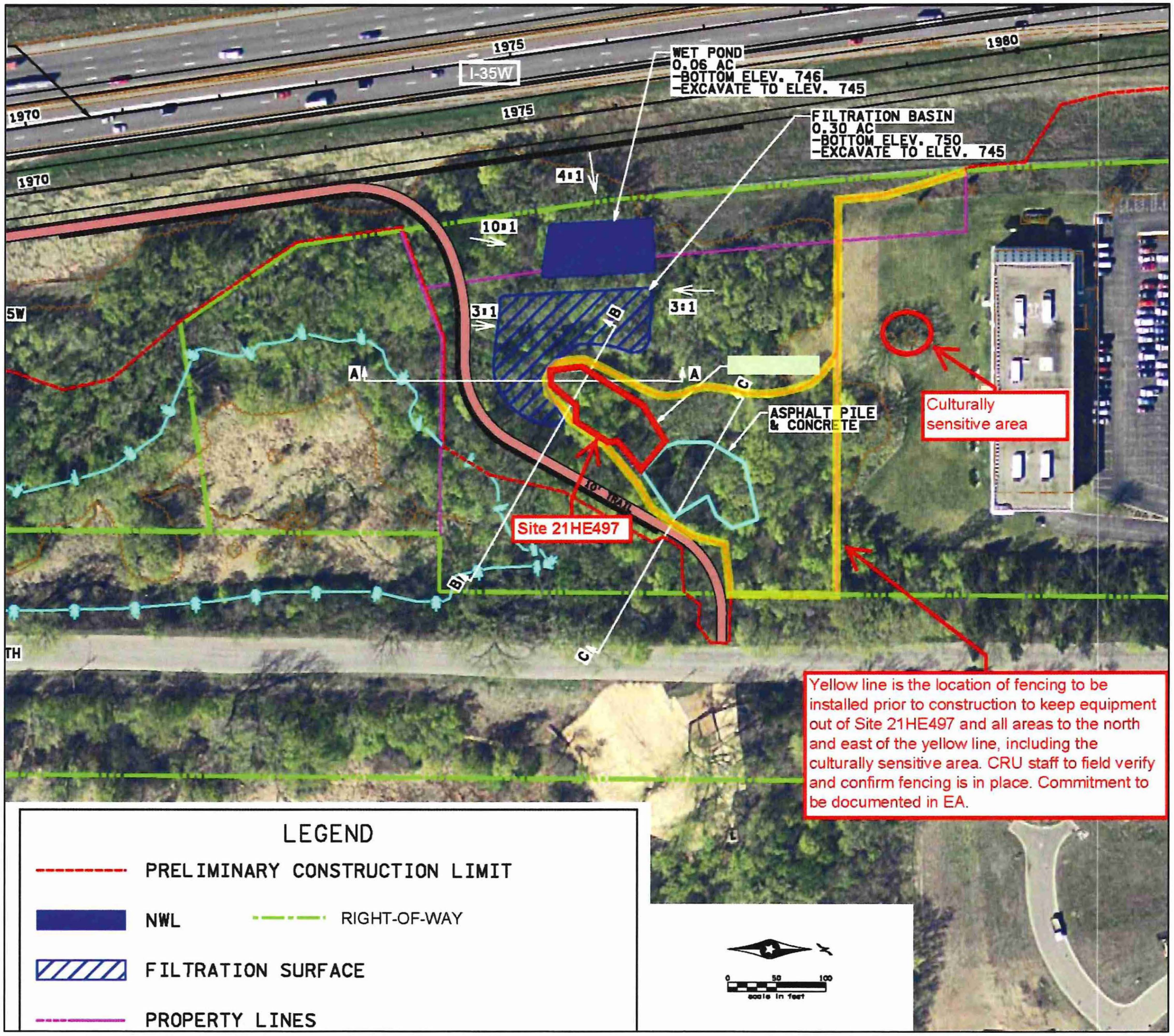


Figure 87. Final Project Design Showing Avoidance of Site 21HE497.

14. SUMMARY AND RECOMMENDATIONS

Four new precontact sites (Figure 88) were identified and evaluated to determine if they were eligible for listing on the NRHP (21HE494, 21HE495, 21HE496 and 21HE497). Sites 21HE494, 21HE495, and 21HE496 are recommended not eligible for listing on the National Register of Historic Places (NRHP). Site 21HE497 is recommended eligible but will be avoided by the project. It is the opinion of FCRS that no historic properties eligible for or listed on the NRHP will be affected by this project. A summary of the sites, their NRHP status, and recommendations is presented in Table 92. Also a possible burial mound identified outside of but adjacent to the construction limits will be fenced off prior to construction.

Table 92. Site Summary and Recommendations.

Site	Cultural Context, Function, & Type	2 Sigma Calibrated Date	Eligible for NRHP	Project Affect	Recommendation
21HE494	Late Woodland, habitation, sparse subsurface artifact scatter	AD 990 – 1145	No	No effect	No further archaeology work
21HE495	Late Archaic, habitation, moderate to sparse subsurface artifact scatter	3625 – 3370 BC	No	No effect	No further archaeology work
21HE496	Early Woodland, habitation, sparse subsurface artifact scatter	40 BC - AD 85	No	No effect	No further archaeology work
21HE497	Early Woodland, habitation, subsurface artifact scatter	AD 255 - 415	Yes	No effect	No further archaeology work; Site will be fenced-off prior to construction
	Transitional Woodland, habitation, subsurface artifact scatter	AD 670 - 775			
	Late Woodland, habitation, subsurface artifact scatter	AD 895 -1225			
-	Possible burial mound	-	-	No effect	No further archaeology work; Mound will be fenced-off prior to construction

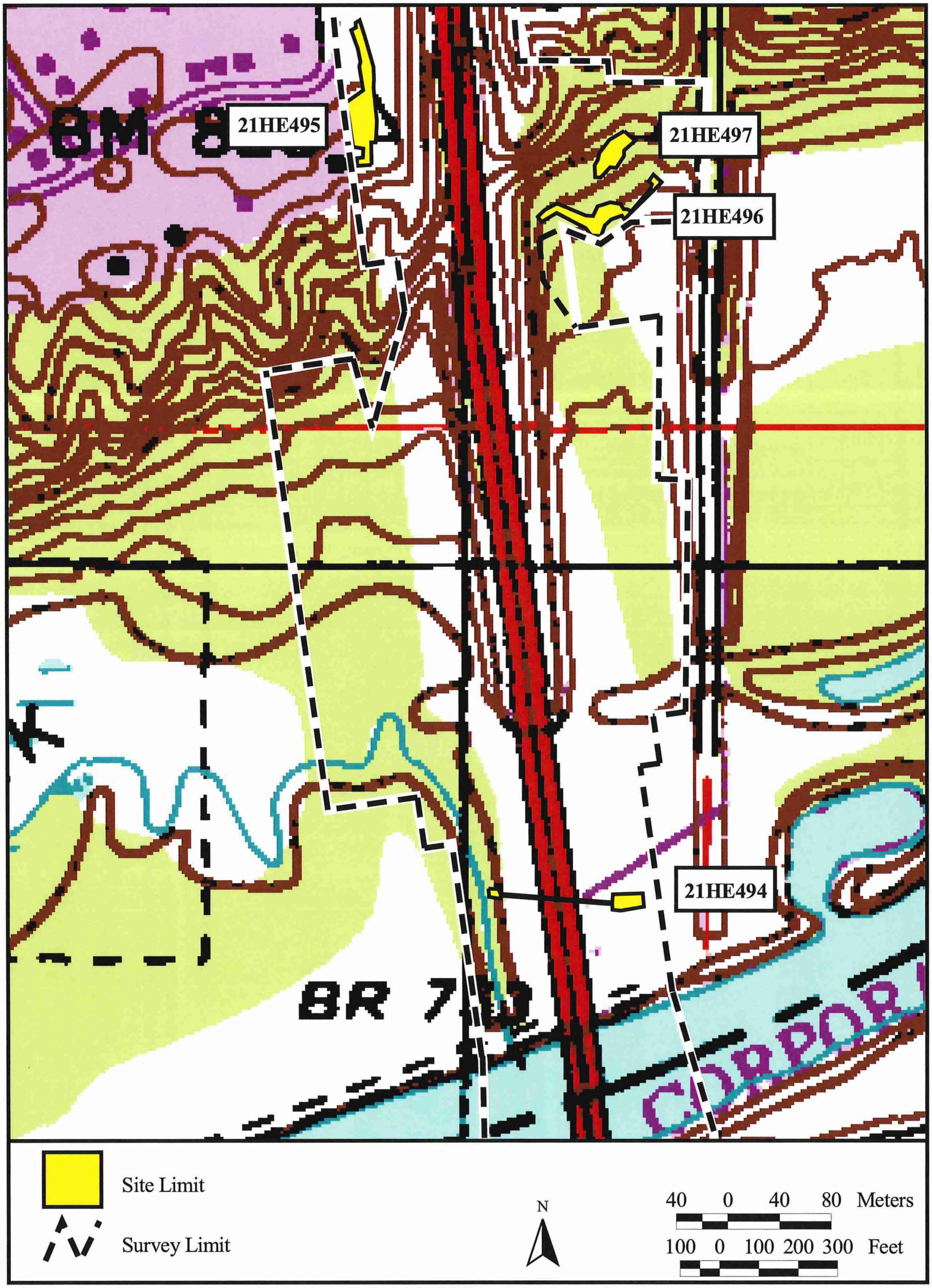


Figure 88. Location of Sites on Enlarged USGS 7.5' Bloomington Quad.

15. References Cited

Ahler, S.
1989 Mass Analysis of Flaking Debris: Studying the Forest Rather Than the Tree. In *Alternative Approaches to Lithic Analysis*, edited by D. Henry and G. Odell, pp. 85-118. Archaeological Papers of the American Anthropological Association 1.

Ahler, S., M. Root, and E. Feiler
1994 Methods for Stone Tool Analysis. In *A Working Manual for Field and Laboratory Techniques and Methods for the 1992-1996 Lake Ilo Archaeological Project*, edited by Stanley A. Ahler, pp. 27-121. Quaternary Studies Program, Northern Arizona University, Flagstaff, Arizona. Submitted to the U. S. Department of the Interior, Fish and Wildlife Service, Denver.

Alex, L.
2000 *Iowa's Archaeological Past*. University of Iowa Press, Iowa City, Iowa.

Amundson, D. and H. E. Wright, Jr.
1979 Forest Changes in Minnesota at the End of the Pleistocene. *Ecological Monographs* 49(1):1-16.

Andreas, A. T.,
1874a *Hennepin County, Minnesota State Atlas.* A. T. Andreas.

1874b *Dakota County, Minnesota State Atlas.* A. T. Andreas.

Andrefsky, W., Jr. (Editor)
2001 *Lithic Debitage: Context, Form, and Meaning*. University of Utah Press, Salt Lake City.

Andrefsky, W., Jr.
2005 *Lithics: Macroscopic Approaches to Analysis* (2nd Edition). Cambridge University Press, New York.

Anfinson, S.
1994 Thematic Context: Lithic Scatter. Draft. Copy on file at the State Historic Preservation Office, St. Paul, Minnesota.

1997 *Southwestern Minnesota Archaeology: 12,000 Years in the Prairie Lake Region*. Minnesota Historical Society Press, St. Paul.

Anfinson, S. (editor)
1979 A Handbook of Minnesota Prehistoric Ceramics. *Occasional Publications in Minnesota Anthropology* No. 5. Minnesota Historical Society, St. Paul.

Arzigian, C.
2008 *Minnesota Statewide Multiple Property Documentation Form for the Woodland Tradition.* Mississippi Valley Archaeology Center at the University of Wisconsin-LaCrosse.

Bakken, K.
1997 Lithic Raw Material Resources in Minnesota. *The Minnesota Archaeologist* 56:51-83.

2000 Lithic Technologies and Raw Material Economies in Mille Lacs Area Archaeological Sites. In *The Lake Onamia - Trunk Highway 169 Data Recovery Project, Mille Lacs County, Minnesota*, by D. Mather and E. Abel. Loucks Project Report 96506-1. Loucks & Associates, Inc., Maple Grove.

2011 *Lithic Raw Material Use Patterns in Minnesota*. Unpublished Ph.D. Dissertation, Department of Anthropology, University Of Minnesota

Benn, D., and J. Thompson
2009 Archaic Periods in Eastern Iowa. In *Archaic Societies: Diversity and Complexity Across the Midcontinent*, edited by T. E. Emerson, D. L McElrath, and A. C. Fortier, pp. 491-561. State University of New York Press, Albany.

Birk, Douglas A.
1993 *Gideon H. Pond and Agnes Hopkins Pond House and Farm Site. Archaeological and Historic Resource Survey – Phase I.* Institute for Minnesota Archaeology, St. Paul.

Bleed, P.
1969 *The Archaeology of Petaga Point: The Preceramic Component*. Minnesota Prehistoric Archaeology Series Number 2. Minnesota Historical Society Press, St. Paul.

Blegen, T.
1975 *Minnesota: A History of the State*. University of Minnesota Press, Minneapolis.

Boszhardt, R.
2003 *A Projectile Point Guide for the Upper Mississippi River Valley.* University of Iowa Press, Iowa City.

Boudin, M., M. Van Strydonck, P. Crombé, W. De Clercq, R. van Dierendonck, H. Jongepier, A. Ervynck, and A. Lentacker
2010 Fish Reservoir Effect on Charred Food Residue 14C Dates: Are Stable Isotope Analyses the Solution? *Radiocarbon* 52:697–705.

Bradbury, A. and P. Carr
1995 *Flake Typologies and Alternative Approaches: An Experimental Assessment.* Lithic Technology 20(2):100-116.

Brink, J., M. Wright, B. Dawe, and D. Glaum
1986 *Final Report of the 1984 Season at Head-Smashed-In Buffalo Jump*. Alberta. Manuscript Series No.9, Archaeological Survey of Alberta, Edmonton.

BRW, Inc.
1994 *Geoarcheaological Data Recovery, East Terrace Site (21BN6) and Gardner Site (21SN14), Benton and Stearns Counties, Minnesota.* BRW, Inc., Minneapolis.

Buhta, A., J. Hofman, E. Grimm, R. Mandel, and L. Hannus
2011 *Investigating the Earliest Human Occupation of Minnesota: A Multidisciplinary Approach to Modeling Landform Suitability and Site Distribution Probability for the State's Early Paleoindian Resources*. Archeological Contract Series 248. Archeology Laboratory Augustana College, Sioux Falls, South Dakota

Caine, C. (also cited as Hohman-Caine)
1966 The Neubauer Late Woodland Site in Pine County, Minnesota: An Analysis Showing Temporal and Spatial Relationships. *The Minnesota Archaeologist* 28(2):74–105.

1969 *The Archaeology of the Snake River Valley.* M.A. Thesis, University of Minnesota, Minneapolis.

1974 The Archaeology of the Snake River Region in Minnesota. *In Aspects of Upper Great Lakes Anthropology:* Papers in Honor of Lloyd A. Wilford, edited by E. Johnson. Minnesota Prehistoric Archaeology Series Number 11. Minnesota Historical Society, St. Paul.

1979 St. Croix Stamped Series. In *A Handbook of Minnesota Prehistoric Ceramics*, compiled and edited by S.F. Anfinson, pp. 169-174. Occasional Publications in Minnesota Anthropology No. 5. Minnesota Archaeological Society, St. Paul.

1983 *Normative Typological and Systemic Stylistic Approaches to the Analysis of North Central Minnesota Ceramics*. Ph.D. Dissertation, University of Minnesota, Minneapolis.

Caine, C., and G. Goltz
1995 Brainerd Ware and the Early Woodland Dilemma. *The Minnesota Archaeologist* 54: 109-129.

Callahan, E.
1979 The Basics of Biface Knapping in the Eastern Fluted Point Tradition: A Manual for Flintknappers and Lithic Analysts. *Archaeology of Eastern North America 7:1-180.*

Chamberlin, P., editor
1972 *Hennepin County Mound Site Resurvey, Conducted by Minnesota Archaeology Society, Interim Report No. 1.*

Christiansen G. W. III
1990 "A Preliminary Report on the 1990 Test Excavations at the Peterson Site (21YM47): Yellow Medicine County, Minnesota". Institute for Minnesota Archaeology, Minneapolis.

Clayton, L., and S. Moran
1982 Chronology of Late Wisconsinan Glaciation in Middle North America. *Quaternary Science Reviews* 1:55-82.

Cotterell, B., and J. Kamminga
1987 The Formation of Flakes. *American Antiquity* 52:675-708.

Crabtree, D.
1972 An *Introduction* to *Flintworking.* Occasional Papers of the Idaho State Museum, No. 28, Pocatello.

Cummings, K., and C. Mayer
1992 *Field Guide to Freshwater Mussels of the Midwest.* Manual 5. Illinois Natural History Survey, Champaign, Illinois.

Dahl, P. M.
1898 *Plat Book of Hennepin County, Minnesota.* Northwestern Map Publishing Co., Minneapolis.

Dickinson, D.
1968 *The Vineland Bay Site: An Analysis.* Unpublished Master's thesis, Department of Anthropology, University of Minnesota, Minneapolis.

Dobbs, C.
1988 *Outline of Historic Contexts for the Prehistoric Period (ca. 12,000 B.P. - A.D. 1700).* Reports of Investigation Number 37. Institute for Minnesota Archaeology, Minneapolis.

ca. 1988 *Historic Context Outlines: The Contact Period Contexts (ca. 1630 A.D. -1820 A.D.).* Reports of Investigation Number 39. Institute for Minnesota Archaeology, Minneapolis. Copy available at Minnesota State Historic Preservation Office.

Dobbs, C. and S. Anfinson
1990 *Outline of Historic Contexts for the Prehistoric Period (ca. 12,000 BP – AD 1700).* Reports of Investigations, no. 37. Institute for Minnesota Archaeology, Minneapolis.

Driver, H. and W. Massey
1957 Comparative Studies of North American Indians. *Transactions of the American Philosophical Society, New Series 47(2):165-456.*

Ellis, L.
1997 Hot Rock Technology. In: Black, Stephen L., Linda W. Ellis, Darrell G. Creel, Glenn T. Goode (Eds.), *Hot Rock Cooking on the Greater Edwards Plateau: Four Burned Rock Midden Sites in West Central Texas, Studies in Archeology 22.* Texas Archeological Research Laboratory, The University of Texas at Austin and Archeological Studies Program, Report 2, Texas Department of Transportation, Environmental Affairs Division, Austin, pp. 43–81.

Ernst, C. and L. French
1977 Mammals of Southwestern Minnesota. *Minnesota Academy of Science,* vol. 43, no. 1: 28-31.

Fischer, A. and J. Heinemeier
2003 Freshwater Reservoir Effect in 14C Dates of Food Residue on Pottery. *Radiocarbon* 45(3):449-466.

Flenniken, J.
1981 *Replicative Systems Analysis: A Model Applied to the Vein Quartz Artifacts from the Hoko River Site.* Washington State University Laboratory of Anthropology. Reports of Investigation No, 59, Pullman.

Flenniken, J., T. Ozbun, C. Fulkerson, and C. Winkler
1990 *The Diamond Lil Deer Kill Site: A Data Recovery Project in the Western Oregon Cascade Mountains.* Report on file at the State Office of Historic Preservation, Salem, Oregon.

Florin, F.
1996 *Late Paleo-Indians of Minnesota and Vegetation Changes from 10,500-8000 BP.* M.A. Thesis, University of Minnesota, Minneapolis.

Florin, F., J. Lindbeck, B. Wergin, and M. Kolb
2013 *Phase I Archaeological Survey and Phase II Evaluation of Sites 21CR154, 21CR155, and 21CR156 for the TH101 / CSAH 61 Southwest Reconnection Project in Scott and Carver Counties, Minnesota*. Florin Cultural Resource Services, LLC, Boyceville, WI. Reports of Investigation # 107. Prepared for the Minnesota Department of Transportation and Carver County.

Florin, F., K. Bakken, J. Lindbeck, and B. Wergin
2015 *Phase III Data Recovery at Site 21CR155 for the TH 101 / CSAH 61 Southwest Reconnection Project in Carver County, Minnesota.* Reports of Investigation # 115. Florin Cultural Resource Services, LLC Boyceville. Report prepared for Carver County. Copy on file at MnHPO.

George, D.
1979 Clam River Ware. In *A Handbook of Minnesota Prehistoric Ceramics*, compiled and edited by S. F. Anfinson, pp. 67-72. Occasional Publications in Minnesota Anthropology No. 5. Minnesota Archaeological Society, St. Paul.

Gibbon, G.
1981 *Archaeological Test Excavations at the Gideon Point House, Bloomington, Minnesota*. Department of Anthropology, University of Minnesota, Minneapolis.

1986 Does Minnesota Have an Early Woodland? In *Early Woodland Archaeology,* edited by K. B. Farnsworth and T. E. Emerson, pp. 84–91. Kampsville Seminars in Archeology No. 2. Center for American Archeology, Kampsville, Illinois.

1994 Cultures of the Upper Mississippi River Valley and Adjacent Prairies in Iowa and Minnesota. In *Plains Indians, A.D. 500-1500: The Archaeological Past of Historic Groups,* edited by C. Schleiser. University of Oklahoma Press, Norman.

2012 Archaeology of Minnesota, the Prehistory of the Upper Mississippi River Region. University of Minnesota Press, Minneapolis.

Gibbon, G. and S. Anfinson
2008 *Minnesota Archaeology: The First 13,000 Years.* Publications in Anthropology No. 6, University of Minnesota, Minneapolis.

Gibbon G., and C. Caine
1980 The Middle to Late Woodland Transition in Eastern Minnesota. *Midcontinental Journal of Archaeology* 5(1):57-72.

Gilbertson, J.
1990 Quaternary Geology Along the Eastern Flank of the Coteau Des Prairies, Grant County, South Dakota. Unpublished M.S. thesis, Department of Geology, University of Minnesota, Minneapolis.

Goldstein, L. and S. Osborn
1988 *A Guide to Common Prehistoric Projectile Points in Wisconsin.* Milwaukee Public Museum.

Gonsior, L.
1992 Lithic Materials of Southeastern Minnesota. *The Platform* 4 (1-4). Minnesota Knappers Guild, Duluth, Minnesota.

Harrison, C.
2007 *Report on Archaeological Investigation Conducted Along a Proposed Minnesota River Valley Trail Reroute, City of Bloomington, Hennepin County Minnesota.* Archaeological Research Services, Minneapolis.

Harrison, C., and K. Bakken
2016 *Long Meadow Lake Bridge Enhancements Project: Site 21HE483 Phase I and II Survey Reports.* Conducted for the City of Bloomington and U.S. Fish and Wildlife Service. Prepared by Archaeological Research Services, Minneapolis.

Harrison, C., E. Redepenning, C. Hill, G. Rapp, Jr., S. Aschenbrenner, J. Huber, S. Mulholland
1995 *The Paleo-Indian of Southern St. Louis Co., Minnesota: The Reservoir Lakes Complex.* University of Minnesota, Duluth.

Hart, J., W. Lovis, G. Urquhart, and E. Reber
2013 Modeling Freshwater Reservoir Offsets on Radiocarbon-Dated Charred Cooking Residues. *American Antiquity* 78(3):536–552.

Hayden, B., and W. Hutchings
1989 Whither the Billet Flake? In *Experiments in Lithic Technology*, edited by Daniel S. Amick and Raymond P. Mauldin, pp. 235-257. BAR International Series 528, Oxford, U.K.

Herrick, C.
1892 *The Mammals of Minnesota.* Geological and Natural History Survey of Minnesota, Bulletin 7:1-299. Johnson, Smith, and Harrison, State Printers, Minneapolis.

Higginbottom, D.
1996 *An Inventory of Fluted Projectile Points from Minnesota.* Paper distributed at the 54th Annual Plains Conference, Iowa City, Iowa.

Hixson, W. W., and Company
1916 *Plat Book of the State of Minnesota.* W. W. Hixson & Co., Rockford, Illinois.

Hobbs, H., S. Aronow, and C. Patterson
1990 Surficial geology, plate 3 *in* Geologic atlas of Dakota County, Minnesota: Minnesota Geological Survcy County Al1as Series C-6, scale 1:100.000.

Hobbs, H. and J. Goebel
1982 *Geologic Map of Minnesota: Quaternary Geology* . State Map Series S-1, Minnesota Geological Survey, St. Paul.

Hohman-Caine, C. and E. Syms
2012 *The Age of Brainerd Ceramics.* Minnesota Historical Society Contract No. 4107232 Prepared by Soils Consulting, Hackensack, MN.

Hoisington, D.
1994 *Evaluation of the Historic Significance of the Hopkins Ferry Landing and Chatelle Landing, Minnesota Valley National Wildlife Refuge Hennepin County, Minnesota.* Tellus Consultants, Minneapolis.

Homsey, L.
2009 *The Identification and Prehistoric Selection Criteria of FCR: An Example from Dust Cave, Alabama.* Southeastern Archaeology Vol. 28(1). Gainesville, FL.

House, J. and J. Smith
1975 Experiments in the Replication of FCR. In *The Cache River Archaeological Project: An Experiment in Contract Archaeology.* The Arkansas Archaeological Survey, Fayetteville, AR. http://herb.umd.umich.edu, accessed November 2008.

Hudak, J., E. Hobbs, A. Brooks, C. Sersland, and C. Phillips (editors)
2002 *Mn/Model: A Predictive Model of Precontact Archaeological Site Location for the State of Minnesota Final Report 2002.* CD version. Minnesota Department of Transportation.

Hurley, W.
1975 *An Analysis of Effigy Mound Complexes in Wisconsin.* Anthropological Papers 59. Museum of Anthropology, University of Michigan, Ann Arbor.

Inizan, M., M. Reduron-Ballinger, H. Roche, and J. Tixier
1999 *Technology and Terminology of Knapped Stone: Followed by a Multilingual Vocabulary Arabic, English, French, German, Greek, Italian, Portuguese, Spanish.* Préhistoire De La Pierre Taillée 5. Cercle de Recherches et d'Etudes Préhistoriques, Nanterre, France .

Jackson, H.
1961 *Mammals of Wisconsin.* University of Wisconsin Press, Madison.

Jackson, M.
1997 Feature and Fire-Cracked Rock Analyses: A Search for Site Function Data from Site in the Tobacco Plains, Middle Kootenai River Valley, Northwest Montana. Manuscript on file at the Center for Environmental Archaeology, Texas A&M University, College Station.

1998 *Nature and Fire-Cracked Rock: New Insights from Ethnoarchaeological and Laboratory Experiments*. Unpublished Master's Thesis, Department of Anthropology, Texas A&M University, College Station.

Johnson, C. (editor)
1994 *Geoarchaeological Data Recovery, East Terrace Site (21BN6) and Gardner Site (21SN14), Benton and Stearns Counties, Minnesota.* Prepared for the Minnesota Department of Transportation by BRW, Inc., with contributions by Foth and Van Dyke. Copy on file, State Historic Preservation Office, St. Paul.

Johnson, E.
1973 *The Arvilla Complex.* Minnesota Prehistoric Archaeology Series 9. Minnesota Historical Society, St. Paul.

1984 *Cultural Resource Survey of the Mille Lacs Area.* University of Minnesota, Minneapolis. Report prepared for the Minnesota Historical Society, St. Paul.

Justice, N.
1987 *Stone Age Spear and Arrow Points of the Midcontinental and Eastern United States.* Indiana University Press, Bloomington.

Keeley, L.
1980 *Experimental Determination of Stone Tool Uses: A Microwear Analysis.* University of Chicago Press.

Kehoe, T.
1966 The Small Side-Notched Point System of the Northern Plains. *American Antiquity* 57:827-839.

1973 *The Gull Lake Site: A Prehistoric Bison Drive in Southwestern Saskatchewan.* Milwaukee Public Museum, Publications in Anthropology and History No. 1.

1974 The Large Corner-Notched Point System of the Northern Plains and Adjacent Woodlands. In *Aspects of Upper Great Lakes Anthropology: Papers in Honor of Lloyd A. Wilford*, edited by Elden Johnson, pp. 103-115. Minnesota Prehistoric Archaeology Series No. 11. Minnesota Historical Society, St. Paul.

Kooyman, B.
2000 *Understanding Stone Tools and Archaeological Sites.* University of Calgary Press, Alberta.

Kuehn, S.
2010 Late Paleoindian Strategies in the Western Great Lakes Region. In *Foragers of the Terminal Pleistocene in North America*, edited by R. B. Walker and B. N. Driskell. University of Nebraska Press.

Latas, T.
1992 An Analysis of Fire-Cracked Rock: A Sedimentological Approach. In *Deciphering a Shell Midden,* edited by J. K. Stein, pp. 211-237. Academic Press, San Diego.

Lewis, S. and P. Heikes
1990 A Preliminary Report on a Paleo-Indian Bison Kill Site (21YM47) Near Granite Falls, Minnesota. *IMA Quarterly Newsletter* (Institute for Minnesota Archaeology) 5(3):4-5.

Logan, W.
1976 *Woodland Complexes in Northeastern Iowa*. Publications in Archaeology 15. U. S. Department of the Interior, National Park Service, Washington, D.C.

Lovick, S.
1983 Fire-Cracked Rock as Tools: Wear-Pattern Analysis. *Plains Anthropologist* 28(99):41-52.

Lusardi, B.
1997 *Surficial Geologic Map of the Shakopee Quadrangle, Carver, Scott, and Hennepin Counties, Minnesota*. Scale 1:24,000. Miscellaneous Map Series M-87. University of Minnesota, Minnesota Geological Survey.

Madigan, T., A. Mathys, M. Murray, and B. Perkl
1998 *Mound Verification at 21HE21 (Feldman Mound Group), Settler's Ridge Residential Development, Eden Prairie, Minnesota.*

Magne, M.
1985 *Lithics and Livelihood: Stone Tool Technologies of Central and Southern Interior British Columbia.* National Museum of Man, Mercury Series. Archaeological Survey of Canada, Paper No. 133, Ottawa.

1989 Lithic Reduction Stages and Assemblage Formation Processes. In *Experiments in Lithic Technology*, edited by Daniel S. Amick and Raymond P. Mauldin, pp. 15-31. BAR International Series 528, Oxford, England.

Malik, R. and K. Bakken
1993 *Archaeological Data Recovery at the Bradbury Brook Site, 21 ML 42, Mille Lacs County, Minnesota.* Bradbury Brook Data Recovery Project, Archaeology Department, Minnesota Historical Society, St. Paul.

1999 The Bradbury Brook Site, 21ML42. *The Minnesota Archaeologist* 58:134-171.

Marschner, F.
1974 *The Original Vegetation of Minnesota: Compiled from U.S. General Land Office Survey Notes.* Map published by the North Central Forest Experiment Station, St. Paul. Originally published in 1930.

Mason, R.
1981 *Great Lakes Archaeology.* Academic Press, New York.

1997 The Paleo-Indian Tradition. *The Wisconsin Archeologist* 78(½):78-111.

Matsch, C.
1983 River Warren, the Southern Outlet of Glacial Lake Agassiz. In *Glacial Lake Agassiz*, edited by J. T. Teller and Lee Clayton, pp. 231-244. Geological Association of Canada Special Paper 26. Department of Geology, Memorial University of Newfoundland, St. John's.

McDowell-Loudan, E.
1983 FCR: Preliminary Experiments to Determine Its Nature and Significance in Archaeological Contexts. *Chesopiean* Vol. 21, pp.20-29.

McParland, P.
1977 *Experiments in the Firing and Breaking of Rocks.* The Calgary Archaeologist, Vol. 5. The University of Calgary, Alberta, Canada.

Meyer, G. and H. Hobbs
1989 Surficial Geology, Plate 3 in Balaban, N.H., ed., Geologic Atlas of Hennepin County, Minnesota: Minnesota Geological Survey County Atlas Series C-4 (scale 1:100,000).

Michlovic, M. and K. Schmitz.
1996. Report on the Rustad Quarry Site (32RI775). *North Dakota Archaeological Association Newsletter* 17(2):6-10.

Minnesota DNR (Department of Natural Resources)
1998 Ecological Classification System, URL: http://www.dnr.state.mn.us/ebm/ecs/

Minnesota Historical Society
2007 Collections, Original Land Survey Maps. Electronic document, http://www.mnhs.org/collections/digitalmaps/index.htm, accessed September, 2007.

Mitchell M. and C. Johnston
2012 Technological Analysis of the Modified Stone Assemblage. In *Agate Basin Archaeology at Beacon Island, North Dakota,* edited by Mark D. Mitchell. Submitted to the State Historical Society of North Dakota and the U. S. Department of the Interior, National Park Service. Paleocultural Research Group, Research Contribution No. 86, Arvada, Colorado.

Moerman, D.
1998 *Native American Ethnobotany.* Timber Press, Portland, Oregon.

Morrow, T.
1984 *Iowa Projectile Points.* University of Iowa, Iowa City.

1994 A Key to the Identification of Chipped-Stone Raw Materials Found on Archaeology Sites in Iowa. *Journal of the Iowa Archaeology Society* 41:108-129.

Morrow, T. and J. Behm
1986 Descriptions of Common Lithic Raw Materials Encountered on Wisconsin Archaeological Sites. Paper presented at the Fall Meeting of the Wisconsin Archaeological Survey, Madison.

Morrow, T., S. Anfinson, K. Bakken, G. Gibbon, M. Giller, J. Hahn, D. Higginbottom, C. Johnson
2015 *Stone Tools of Minnesota.* Wapsi Valley Archaeology, Inc. Anamosa, Iowa.

National Park Service
1991 *How to Apply the National Register Criteria for Evaluation.* National Register Bulletin 15. National Register Branch, Interagency Resources Division, National Park Service.

Neetzel, J.
1969 *A Development Proposal for the Minnesota River Valley.* Conservation Volunteer March/April 1969, Minnesota Department of Natural Resources, St. Paul.

Odell, G.
1989 Experiments in Lithic Reduction. In *Experiments in Lithic Technology*, edited by Daniel S. Amick and Raymond P. Mauldin, pp. 163-198. BAR International Series 528, Oxford, England.

1996 *Stone Tools and Mobility in the Illinois Valley.* International Monographs in Prehistory, Archaeological Series 10, Ann Arbor, Michigan.

2003 *Lithic Analysis.* Springer Science+Business Media, Inc., New York.

Overstreet, D.
1993 *Chesrow: A Paleoindian Complex in the Southern Lake Michigan Basin.* Case Studies in Great Lake Archaeology Number 2. Great Lakes Archaeological Press, Milwaukee.

1996 A Tusk Tip from Hebior Mammoth (47 Kn 265), Kenosha County, Wisconsin. *The Wisconsin Archeologist* 77(1-2):87-93.

Ozbun, T.
1987 *Technological Analysis of the Lithic Assemblage from the Buttonhole Rockshelter/Quarry Site, Northeastern New Mexico*. Master's Thesis, Washington State University, Pullman.

Perkl, B.
1998 *Cucurbita pepo* from King Coulee, Southeastern Minnesota. *American Antiquity* 63(3):279-288.

Peterson, C.
1995 *Artifact Identification Guide for Iowan Historical Archaeology*. Office of the State Archaeologist, University of Iowa, Iowa City

Phillips, C., R. Brandon, and E. Moll
1999 *Field Guide to Amphibians and Reptiles of Illinois*. Manual 8. Illinois Natural History Survey, Champaign, Illinois.

Pielou, E.
1991 *After the Ice Age: The Return of Life to Glaciated North America*. The University of Chicago Press, Chicago.

Pinkney, B.
1896 *Plat book of Dakota County, Minnesota.* Union Publishing Company, Philadelphia.

Pleger. T. and J. Stoltman
2009 The Archaic Tradition in Wisconsin. In *Archaic Societies: Diversity and Complexity Across the Midcontinent*, edited by T. E. Emerson, D. L McElrath, and A. C. Fortier, pp. 697-723. State University of New York Press, Albany.

Rand, McNally and Company
1911 *Dakota County Map.*

Ready, T. and S. Anfinson
1979 Onamia Series. In S. F. Anfinson (ed.), *A Handbook of Minnesota Prehistoric Ceramics*, pp. 149-155. Occasional Publications in Minnesota Anthropology, no. 5. Minnesota Historical Society, St. Paul.

Reitz, E. and E. Wing
1999 *Zooarchaeology*. Cambridge University Press, Cambridge.

Roberts, N.
1993 *A Lower Minnesota River Valley Cultural Resource Study and Interpretive Plan for the Minnesota Valley Trail.* Prepared for the Minnesota DNR. Historical Research, Inc., St. Paul.

Roetzel, K., R. Strachan, and C. Broste
1994 *An Archaeological Report of a Limited Phase III Mitigation of the Fritsche Creek Bison Kill Site in Nicollet County, Minnesota*. Impact Services Incorporated, Mankato, Minnesota.

Root, M.

1992 *The Knife River Flint Quarries: The Organization of Stone Tool Production*. Ph.D dissertation, Washington State University, Pullman. University Microfilms, Ann Arbor.

1997 Production for Exchange at the Knife River Flint Quarries, North Dakota. *Lithic Technology* 21:33-50.

1999 Methods and Techniques for Lithic Analysis: Alliance Pipeline Archaeological Project. Draft copy, Ms. on file at Minnesota Archaeology Consulting, Inc., Minneapolis.

2001 Stone Tools and Flake Debris from 32RI785. In *Alliance Pipeline L.P.: Excavations at 32RI785, Richland County, North Dakota*, edited by Clark A Dobbs. Hemisphere Field Services Reports of Investigation Number 614, Minneapolis.

2004 Technological Analysis of Flake Debris and the Limitations of Size-Grade Techniques. In *Aggregate Analysis in Chipped Stone*, edited by C. T. Hall and M. L. Larson, Pp. 65–94. University of Utah Press, Salt Lake City.

Schalk, R. and D. Meatte

1988 The Archaeological Features. In *The Archaeology of Chester Morse Lake: The 1986-87 Investigations for the Cedar Falls Improvement Project,* edited by R. F. Schalk and R. L. Taylor, pp. *8.1 - 8.8.* Center for Northwest Anthropology, Washington State University, Seattle Research Unit, Seattle.

Schirmer, R., C. Wittkop, J. B. Anderson, J. C. Anderson, A. Brown, E. Evenson, C. Nowak, K. Reinhardt, and J. Reichel

2014 *Archeological Survey of Le Sueur County.* Department of Anthropology, Minnesota State University Mankato.

Schoen, C.

2006 *Phase I and II Archaeological Investigations of Alternative Route Corridors for Trunk Highway 41 Near Chaska, Carver and Scott Counties, Minnesota.* Louis Berger Group, Marion, Iowa

Semenov, S.

1976 *Prehistoric Technology: An Experimental Study of the Oldest Tools and Artefacts from Traces of Manufacture and Wear*. Barnes and Noble Books, Totowa, New Jersey.

Shay, C.

1971 *The Itasca Bison Kill Site: An Ecological Analysis*. Minnesota Historical Society, St. Paul.

Shen, C.

1999 Were "Utilized Flakes" Utilized? An Issue of Lithic Classification in Ontario Archaeology. *Ontario Archaeology* 68:63-73.

Smith, P.

1979 *The Fishes of Illinois*. University of Illinois Press, Urbana.

Spector, J.
1993 *What This Awl Means: Feminist Archaeology at a Wahpeton Dakota Village.* Minnesota Historical Society Press, St. Paul.

Steinbring, J.
1974 The Preceramic Archaeology of Northern Minnesota. In *Aspects of Upper Great Lakes Anthropology: Papers in Honor of Lloyd A. Wilford*, edited by E. Johnson, pp. 64-73. Minnesota Prehistoric Archaeology Series Number 11. Minnesota Historical Society, St. Paul.

Stevenson, K., R. Boszhardt, C. Moffat, P. Salkin, T. Pleger, J. Theler, and C. Arzigian
1997 The Woodland Tradition. *Wisconsin Archaeologist* 78(1/2):140-201.

Stoltman, J. and G. Christiansen.
2000. The Late Woodland Stage in the Driftless Area of the Upper Mississippi Valley. In T. E. Emerson, D. L. McElrath, and A. C. Fortier (eds.), *Late Woodland Societies: Tradition and Transformation Across the Midcontinent*, pp. 497-524. University of Nebraska Press, Lincoln.

Sugita, S.
1994 Pollen Representation of Vegetation in Quaternary Sediments: Theory and Method in Patchy Vegetation. *Journal of Ecology* Vol. 82, No. 4 (Dec., 1994), pp. 881-897.

Taggart, D.
1981 Notes on the Comparative Study of Fire-Cracked Rock. In *Report of Phase I and II Archaeological Survey 0/ Proposed M-275 Right-of Way Through Western Oakland County,* edited by D. Ozker and D. W. Taggart, pp. 142-152. Museum of Anthropology, University of Michigan ,Ann Arbor.

Terrell, M., J. Kloss, and M. Kolb
2005 *Trunk Highway 14 – New Ulm to North Mankato Cultural Resources Survey, Nicollet County, Minnesota.* Two Pines Resource Group, LLC, Shafer, Mn.

Theler, J.
1987 Woodland Tradition Economic Strategies: *Animal Resource Utilization in Southwestern Wisconsin and Northeastern Iowa.* Report 17. Office of the State Archaeologist, University of Iowa, Iowa City.

Theler, J. and R. Boszhardt
2006 Collapse of Crucial Resources and Culture Change: A Model for the Woodland to Oneota Transformation in the Upper Midwest. *American Antiquity* 71(3):433-472.

Thoms, A.
2007 *Fire-Cracked Rock Features on Sandy Landforms in the Northern Rocky Mountains: Toward Establishing Reliable Frames of Reference for Assessing Site Integrity.* Geoarchaeology: An International Journal, Vol. 22, No. 5, 477–510.

2008a *The Fire Stones Carry: Ethnographic Records and Archaeological Expectations for Hot-Rock Cookery in Western North America.* Journal of Anthropological Archaeology Science Vol. 27, pp. 443-460.

2008b *Ancient Savannah Roots of the Carbohydrate Revolution in South-Central North America.* Plains Anthropologist, Vol. 53, No. 205, pp. 121–136.

2009 *Rocks of Ages: Propagation of Hot-Rock Cookery in Western North America.* Journal of Archaeological Science Vol. 36, pp. 573-591.

Thomas, M.

2000 The Prehistoric Ceramic Record of the Mille Lacs Region. In *The Lake Onamia - Trunk Highway 169 Data Recovery Project, Mille Lacs County, Minnesota*, by D. Mather and E. Abel. Loucks Project Report 96506-1. Loucks & Associates, Inc., Maple Grove.

Tomka, S.

1989 Differentiating Lithic Reduction Techniques: An Experimental Approach. In *Experiments in Lithic Technology*, edited by Daniel S. Amick and Raymond P. Mauldin, pp. 137-161. BAR International Series 528, Oxford, England.

Umbanhowar, C.

2004 Interaction of Fire, Climate and Vegetation Change at a Large Landscape Scale in the Big Woods of Minnesota, USA. *The Holocene* 14,5 (2004) pp. 661–676.

University of Utah, U.S. Bureau of Land Management, and U.S. Forest Service

1992 *Intermountain Antiquities Computer System (IMACS) User's Guide: Instructions and Computer Codes for Use with the IMACS Site Forms* (Revised 1992).

Vaughan, P.

1985 *Use-Wear Analysis of Flaked Stone Tools.* University of Arizona Press, Tucson.

Wandsnider, L.

1997 The roasted and the boiled: food composition and heat treatment with special emphasis on pit-hearth cooking. *Journal of Anthropological Archaeology* 16, 1–48.

Web Soil Survey

2017 Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Available online at http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx. Accessed 10/29/2015.

Webb Publishing Co.

1916 *Dakota County Outline Map.* Webb Publishing Company, St. Paul.

Webb, T., III.

1981 The Past 11,000 Years of Vegetational Change in Eastern North America. *BioScience* 31:501-506.

Webb, T., III, E. Cushing, and H. E. Wright, Jr.

1983 Holocene Changes in the Vegetation of the Midwest. In *Late-Quaternary Environments of the United States*, vol. 2, *The Holocene*, edited by H. E. Wright, jr., pp. 142-165. University of Minnesota Press, Minneapolis.

Wendt, D.

1988 Applications of Shovel Testing and Spatial Analysis to a Disturbed Limited Activity Woodland Site in Anoka County, Minnesota. *Minnesota Archaeologist* Vol. 47, pp.3-33.

Wentworth, C.

1922 A Scale and of Grade and Class Terms for Clastic Sediments. *Journal of Geology* 30:377-392.

Whittaker, W.
1994 The Cherokee Excavations Revisited: Bison Hunting on the Eastern Plains. *North American Archaeologist* 19(4):293-316.

Wilford, L.
1954c The LaMoille Rock Shelter. *The Minnesota Archaeologist* 19(2):17–21.

Williams, J., B. Shuman, and P. Bartlein
2009 Rapid Responses of the Prairie-Forest Ecotone to Early Holocene Aridity in Mid-Continental North America. *Global and Planetary Change* 66 (2009) 195–207.

Winchell, N.
1911 *The Aborigines of Minnesota.* Minnesota Historical Society, St. Paul.

Wright, G.
1873 *Map of Hennepin County, Minnesota.* George B. Wright and G. Jay Rice, St. Paul.

Wright, H. E., Jr.
1972a Quaternary History of Minnesota in P. K. Sims, and G. B. Morey, eds., *Geology of Minnesota: A Centennial Volume*, Minnesota Geological Survey, (St. Paul: University of Minnesota, 1972), pp. 515-47.

1972b Physiography of Minnesota. In *Geology of Minnesota: A Centennial Volume,* edited by P. K. Sims and G. B. Morey. Minnesota Geological Survey, University of Minnesota, St. Paul.

1974 The Environment of Early Man in the Great Lakes Region. In *Aspects of Upper Great Lakes Anthropology: Papers in Honor of Lloyd A. Wilford*, edited by Elden Johnson, pp. 8-14. Minnesota Prehistoric Archaeology Series No. 11. Minnesota Historical Society, St. Paul.

1976a Ice Retreat and Revegetation of the Western Great Lakes Area. In *Quaternary Stratigraphy of North America*, edited by W. C. Malaney, pp. 119-132. Dowden, Hutchison, and Ross, Stroudsberg (PA).

1976b. The Dynamic Nature of Holocene Vegetation. *Quaternary Research* 6:581-596.

1992 Patterns of Holocene Climatic Change in the Midwestern United States. *Quaternary Research* 38:129-134.

Wright, H. E., Jr., and W. A. Watts
1969 Glacial and Vegetational History of Northeastern Minnesota. *Minnesota Geological Survey Special Publication, Series SP-11,* Minneapolis.

Yansa, C.
2007 Lake Records of Northern Plains Paleoindian and Early Archaic Environments: The "Park Oasis" Hypothesis. *Plains Anthropologist*, Vol. 52, No. 201, pp.109-144.

Yerkes, R.
1987 *Prehistoric Life on the Mississippi Floodplain: Stone Tool Use, Settlement Organization, and Subsistence Practices at the Labras Lake Site, Illinois.* University of Chicago Press.

Yerkes, R. and P. Kardulias
1993 Recent Developments in the Analysis of Lithic Artifacts. *Journal of Archaeological Research* 1:89-119.

Yohe, R.
1998 *The Introduction of the Bow and Arrow and Lithic Resource Use at Rose Spring (CA-INY-372).* Journal of California and Great Basin Anthropology Vol. 20, No. I, pp. 26-52 (1998).

Young, D. and D. Bamforth
1990 On the Macroscopic Identification of Used Flakes. *American Antiquity* 55:403-440.

Zurel, R.
1979 Brief Comments Regarding the Nature of Fire Cracked Rock on Aboriginal Sites in the Great Lakes Area. Working Papers in Archaeology No.3, Laboratory of Archaeology, Oakland University, Rochester, Michigan.

1982 An Additional Note on the Nature of FCR. Paper prepared for distribution at the October 9th Meeting of the Conference on Michigan Archaeology.

APPENDIX A:
GEOMORPHOLOGICAL INVESTIGATION BY STRATA MORPH GEOEXPLORATION, INC.

Geomorphological Investigation in Conjunction with the Archaeological Phase II Evaluation of Site 21HE496 for the Replacement of the I35W Bridge Over the Minnesota River in Hennepin County, Minnesota.

Prepared by:

Michael F. Kolb
Strata Morph Geoexploration, Inc.

Prepared for:
Florin Cultural Resource Services, LLC
Boyceville, WI

Report of Investigation No. 281

February 2017

Introduction

The geomorphological investigation consists of examining (1) bag samples taken from shovel test augers at site 21HE496 by the project archaeologists and (2) extant maps. Test locations discussed in this report are depicted on the site map in the archaeology report. The site is located on the steep bluff face slopes on the north side of the Minnesota River valley on the east side of Interstate 35W. Streams draining the uplands in the vicinity are deeply incised. The slope in the project area is dissected by steep, short, first order channels (ravines) that extend only to the edge of the uplands. An alluvial fan is present at the mouth of the 1st order valley. The alluvial fan, valley slopes and a main valley terrace were mapped in the field by the archaeologists and will be used as a part of the geomorphic analysis. The uplands at the head of the valley are urbanized and were likely farmed prior to urbanization. This has resulted in a period of geomorphic instability that likely reshaped the valley morphology relative to its pre-settlement form.

The upland north of the project area is mapped as the Langdon terrace (West Campus Formation) with a narrow area of Twin Cities Member till at base of the bluff (Meyer and Lusardi 2000). The Langdon Terrace is sand and gravelly sand outwash. The Twin Cities Member consists of a sandy loam to loam pebbly diamicton. The slope is cut into the stratigraphic sequence beneath the terrace that includes these two units and possibly others not mapped because they are not exposed on the surface.

Methods

Sample bags were laid out on a core board and described in order by depth using standard systems from soils (Schoeneberger et al. 1998, Soil Survey Staff 1975) and geology (Collinson and Thompson 1982, Folk 1974). Samples range in size from 50-250 ml. The lithology of the samples was examined in detail to determine the mechanism of deposition. Sand and gravel sizes and percentages were estimated by visually comparing samples to standard charts. Sand size designations follow the USDA system (vf = very fine, f = fine, m = medium, c = coarse and vc = very coarse). Gravel in these small samples all fell into the granules (2-4 mm, gr) and fine pebbles range (generally less than 100 mm cm in diameter, p). In a few samples larger pebbles were encountered. A 10% solution of HCl was used to determine if the soils were leached of free carbonates.

Results

Deposits

Three types of deposits are identified in the shovel test sequences: (1) colluvium, (2) organics, and (3) slackwater lacustrine. The colluvium consists of poorly sorted sediment with textures that fall in the center of the textural triangle (silt loam, sandy loam, sandy clay loam, clay loam, and loam). It also often contains small amounts of granules and gravel. The colluvium is the result of mass-wasting on the slopes of the small watershed resulting in valley wall slope retreat and headward extension of the valley. Deposit lithology depends on the source, slope gradient, and the amount of water present during deposition. Colluvium is a general term for hillslope deposits. The lithologies in a colluvial sequence depend on the amount of water present during transport and deposition. High water content results in well sorted and stratified deposits (fluvial). Moderate water content results in more poorly sorted less distinct stratification (hyper-concentrated flows to debris flows) and low water content resulting in poorly sorted and unstratified deposits.

Organic deposits consist of muck deposited in wetlands. Muck is fine-grained organic sediment with small amounts of identifiable plant fragments (fiber) that is the result of in situ decomposition. It may also contain small amounts of sand or fine gravel. Muck forms in wetlands where the water table retreats below the surface periodically causing the organic sediment to partially decompose.

The slackwater lacustrine deposits consist of bedded silt loam and silty clay loam generally with a very fine sand fraction. It contains traces of gravel in some locations and has platy or laminated intervals. These deposits are likely an erosional remnant left when the overlying valley fill was removed by catastrophic flooding in the late Pleistocene and early Holocene.

Shovel Test 12N5

Shovel Test 12N5 is located at the base of the alluvial fan. Stratigraphy consists of colluvium over slackwater lake/lacustrine deposits (Table 1). The colluvium extends from the surface to a depth of 1.3 m. Lithology is typical for the site: poorly sorted loams, silt loam, and sandy loams with small amounts of gravel. Soil formed in the colluvium consist of C horizons at the surface over weakly developed buried ACb horizons over a better developed Ab-C horizon sequence formed in siltier sediment.

The slackwater lake sediment extends from the base of the colluvium to a depth of 2.2 m (Table 1). It has a series of Cg horizons formed in silt loam and silty clay loam.

Table 1. Lithology and soil determined for samples from Shovel Test 12N5. Heavy line separates deposit types.

Deposit (Soil Horizon)	Top (cm)	Base (cm)	Munsell	Texture	Sand Size	Sand %	Gravel Size	Gravel %	Leached?
Colluvium (C)	0	15	10YR 3/1	sandy loam	m	*	*	*	no
Colluvium (C)	15	30	10YR 3/2	sandy loam	m	*	p	tr	no
Colluvium (C)	30	45	10YR 3/2	sandy loam	m	*	gr & p	tr	no
Colluvium (AC)	45	60	10YR 2/1-3/1	silt loam - loam	m	*	p	tr	no
Colluvium (AC)	60	70	10YR 2/1-3/1	silt loam - loam	m	*	*	*	no
Colluvium (Ab)	90	100	10YR 2/1-3/1	silt loam	m	*	*	*	no
Colluvium (Ab)	100	115	10YR 2/1-3/1	silt loam	m	*	p	1	no
Colluvium (C1)	115	125	10YR 4/2 -5/3	silt loam	m	10	p	tr	no
Colluvium (C2)	125	130	10YR 4/2 -5/3	silt loam	f	10	*	*	no
Slackwater (Cg)	130	140	2.5Y 5/2	silt loam	vf	25	*	*	no
Slackwater (Cg)	140	150	2.5Y 5/2	c silt & v f sand	vf	40	*	*	no
Slackwater (Cg)	150	160	2.5Y 4/3	silty clay loam	*	*	*	*	no
Slackwater (Cg)	160	175	2.5Y 4/3 & 4/1	silt loam	vf	10	*	*	no
Slackwater (Cg)	175	185	2.5Y 4/3 & 4/1	silty clay loam	*	*	*	*	no
Slackwater (Cg)	185	200	2.5Y 4/3 & 4/1	silty clay loam	*	*	*	*	no
Slackwater (Cg)	200	210	2.5Y 4/3	silt loam	vf	15	*	*	no
Slackwater (Cg)	210	220	2.5Y 4/3	c silt & v f sand	vf	50	*	*	no

The entire sequence is unleached, indicating these deposits have not been exposed at a landscape surface for a long period of time. This and the weak soil development in the colluvial sequence might indicate the colluvial deposits are young, historic – late Holocene.

Shovel Test 12S5

Shovel Test 12S5 is down slope about 8 m from Shovel Test 12N5. Stratigraphy consists of colluvium to a depth of 1.9 m over slackwater lake deposits to a depth of 2.6 m (Table 2). A soil formed in the colluvium consists of a 0.7 m thick A horizon over an AB horizon and then a series of C and Cg horizons to a depth of 1.9 m. The A horizon is cumulic, indicating a low sedimentation rate during ongoing pedogenesis. Most of the A horizon is also leached as opposed to the underlying deposits. The slackwater lake deposits are again silt loam and silty clay loam with a very fine sand component but with traces of granules and fine pebbles.

Table 2. Lithology and soil determined for samples from Shovel Test 12S5. Heavy line separates deposit types and bold text indicates intervals where artifacts were recovered.

Deposit (Soil Horizon)	Top (cm)	Base (cm)	Munsell	Texture	Sand Size	Sand %	Gravel Size	Gravel %	Leached?
Colluvium (A)	0	15	10YR 3/1	silt loam	m&f	25	gr	1	yes
Colluvium (A)	15	30	10YR 2/1	silt loam	m&f	15	gr	tr	yes
Colluvium (A)	30	45	10YR 2/1	silt loam	f-m	15	gr	tr	yes
Colluvium (A)	45	60	10YR 2/1-3/1	silt loam	f-m	15	gr	1	yes
Colluvium (A)	60	70	10YR 2/1-3/1	silt loam	f-m	15	gr	tr	yes
Colluvium (AB)	70	80	10YR 3/1 -3/2	silt loam	f&m	20	gr	tr	no
Colluvium (AB)	80	90	10YR 3/1 -3/2	silt loam	f&m	15	gr	tr	no
Colluvium (C)	90	100	10YR 3/1 -3/2	silt loam - loam	m	*	*	*	no
Colluvium (C)	100	120	10YR 3/1 -3/2	silt loam - loam	m	*	gr	1	no
Colluvium (C)	120	130	10YR 3/2	silt loam - loam	m	*	p	tr	no
Colluvium (C)	130	145	10YR 4/3	silt loam	f&m	30	fp	tr	no
Colluvium (Cg)	145	160	2.5Y 5/2-5/3	silt loam	f&vf	25	gr	tr	no
Colluvium (Cg)	160	170	2.5Y 5/2-4/2	loam	m	*	gr	tr	no
Colluvium (Cg)	170	180	2.5Y 5/2-4/2	loam	m	*	gr	tr	no
Colluvium (Cg)	180	190	2.5Y 5/2-4/2	loam	m	*	gr	tr	no
Slackwater (Cg)	190	200	2.5Y 5/2-5/3	silt loam	vf	15	p	tr	no
Slackwater (Cg)	200	210	2.5Y 4/2	heavy silt loam	vf	10	*	*	no
Slackwater (Cg)	210	220	2.5Y 5/2-4/4	silt loam	vf	5	p	tr	no
Slackwater (Cg)	220	230	2.5Y 5/2-4/2	silt loam to silty clay loam	vf	5	gr	tr	no
Slackwater (Cg)	230	240	2.5Y 4/34	silt loam to silty clay loam	vf	5	gr	tr	no
Slackwater (Cg)	**240**	**250**	**2.5Y 5/2-4/4**	**silt loam to silty clay loam**	**vf**	**5**	**gr**	**tr**	**no**
Slackwater (Cg)	250	260	10YR 4/3	silty clay loam	vf	2	p	tr	no

A broken basaltic flake was recovered in the archaeological test between 2.40 and 2.50 m below the surface. This depth interval falls within the slackwater lacustrine interval. The artifact is not in primary context. The subaqueous depositional environment and the lack of indicators of subaerial exposure (soils) in the sequence indicate the flake is in secondary context.

Shovel Test 13S5

Shovel Test 13S5 is 8 m northeast of ST 12S5 on the same landform. Stratigraphy consists of organic deposits to a depth of 0.6 m over colluvium to a depth of 3.0 m (Table 3). Soil consists of an O horizon (muck) formed in the organic deposits over an Ab-ABb-C-Cg horizon sequence formed in the colluvium. The entire sequence is leached of carbonates. The buried Ab horizon is cumulic, indicating slow sedimentation rates with ongoing pedogenesis.

Table 3. Lithology and soil determined for samples from Shovel Test 13S5. Heavy line separates deposit types and bold text indicates intervals where artifacts were recovered.

Deposit (Soil Horizon)	Top (cm)	Base (cm)	Munsell	Texture	Sand Size	Sand %	Gravel Size	Gravel %	Leached?
Organic (O)	0	15	10YR 2/1	muck	*	*	*	*	yes
Organic (O)	15	30	10YR 2/1	muck	*	*	*	*	yes
Organic (O)	30	45	10YR 2/1&3/1	mucky sandy loam	m	*	*	*	yes
Organic (O)	45	60	10YR 2/1	mucky sandy loam	m	1	*	*	yes
Colluvium (Ab)	60	70	10YR 2/1	sandy loam	m	15	gr	tr	yes
Colluvium (Ab)	70	85	10YR 2/1	sandy loam	m&c	*	*	*	yes
Colluvium (Ab)	85	100	10YR 2/1	sandy loam	m&c	*	gr & p	tr	yes
Colluvium (Ab)	100	115	10YR 2/1 -3/1	sandy loam	m&c	*	gr & p	*	yes
Colluvium (Ab)	115	130	10YR 2/1	sandy loam	m&c	*	gr & p	1	yes
Colluvium (Ab)	130	145	10YR 2/1	sandy loam	m&c	*	gr & p	tr	yes
Colluvium (Ab)	145	160	10YR 2/1	sandy loam	m&c	*	gr & p	tr	yes
Colluvium (ABb)	160	175	10YR 2/1-3/1	sandy loam	m&c	*	gr & p	tr	yes
Colluvium (ABb)	175	190	10YR 3/1	sandy loam	m&c	*	gr & p	tr	yes
Colluvium (C)	190	205	10YR 4/2	silty clay loam - clay loam	f - c	25	gr & p	2	yes
Colluvium (C)	205	215	10YR 4/2	silty clay loam - clay	f - m	25	*	*	yes
Colluvium (C)	215	225	10YR 4/2	silty clay loam - clay	f - m	25	*	*	yes
Colluvium (C)	225	235	10YR 4/2	silty clay loam - clay	f - m	25	gr & p	tr	yes
Colluvium (C)	235	245	10YR 4/2	silty clay loam - clay	f - m	25	*	*	yes
Colluvium (C)	245	255	10YR 4/2-4/3	silty clay loam - clay	f	1	*	*	yes
Colluvium (C)	**255**	**265**	**10YR 4/2**	**silty clay loam**	**vf**	**tr**	**gr**	**1**	**yes**
Colluvium (C)	265	270	10YR 4/2	silty clay loam	*	*	gr	1	yes
Colluvium (Cg)	270	280	2.5Y 4/2	silty clay loam	*	*	*	*	yes
Colluvium (Cg)	280	290	2.5Y 4/2	silty clay loam	c	tr	*	*	yes
Colluvium (Cg)	290	300	2.5Y 4/2	silty clay loam	*	*	*	*	yes

A piece of fire-cracked rock of unidentified lithology was located in a shovel test 5 m north of Shovel Test 13S5 at a depth of 2.55 to 2.65 m. This depth interval correlates with the C horizon formed in colluvium in Shovel Test 13S5 (Table 3). The artifact was likely a part of the original colluvial deposit and is in secondary context.

Shovel Test 9NW7

Shovel Test 9NW7 is at the base of the alluvial fan. Stratigraphy consists of a 3.55 m thick sequence of colluvium (Table 4). All of the colluvial deposits are poorly sorted and contain gravel. There is a broad trend of fining upward from predominately sandy loam to silt loam. Slight changes in the lithology of the deposits indicates the sequence is bedded.

Table 4. Lithology and soil determined for samples from Shovel Test 9NW7. Bold text indicates intervals where artifacts were recovered.

Deposit (Soil Horizon)	Top (cm)	Base (cm)	Munsell	Texture	Sand Size	Sand %	Gravel Size	Gravel %	Leached?
Colluvium (A)	0	15	10YR 2/1	silt loam	m	30	*	*	no
Colluvium (A)	15	30	10YR 2/1	silt loam	m	30	*	*	no
Colluvium (A)	30	45	10YR 2/1	silt loam	m&f	30	gr&p	tr	no
Colluvium (A)	45	60	10YR 2/1	sandy loam	m&f	*	gr	tr	no
Colluvium (A)	60	75	10YR 2/1-3/1	sandy loam	f-m	*	gr	1	yes
Colluvium (A)	75	90	10YR 2/1-3/1	silt loam	f-m	35	gr&p	1	yes
Colluvium (A)	90	100	10YR 2/1-3/1	silt loam	f-m	*	gr	tr	yes
Colluvium (A)	100	110	10YR 2/1	silt loam	f-m	25	gr	tr	yes
Colluvium (A)	110	120	10YR 2/1	silt loam	f-m	20	*	*	yes
Colluvium (A)	120	130	10YR 2/1	silt loam	f-m	25	gr&p	tr	yes
Colluvium (A)	130	140	10YR 2/1	silt loam	f-m	25	gr&p	tr	yes
Colluvium (A)	**140**	**150**	**10YR 2/1**	**silt loam -loam**	**f-m**	**20**	**gr&p**	**1**	**yes**
Colluvium (A)	150	160	10YR 2/1	silt loam -loam	f-m	25	gr	tr	yes
Colluvium (A)	160	170	10YR 2/1	silt loam -loam	f-m	25	gr	tr	yes
Colluvium (A)	170	180	10YR 2/1	silt loam -loam	f-m	25	gr	tr	yes
Colluvium (A)	180	190	10YR 2/1	silt loam -loam	f-m	30	gr	tr	yes
Colluvium (A)	**190**	**195**	**10YR 2/1**	**silt loam -loam**	**f-m, c**	**25**	**gr&p**	**1**	**yes**
Colluvium (A)	195	205	10YR 2/1	loam	f-m, c	35	gr&p	2	yes
Colluvium (A)	**205**	**220**	**10YR 2/1**	**loam**	**m-c**	**40**	**gr&p**	**tr**	**yes**
Colluvium (AB)	220	235	10YR 2/1-3/1	loam	m-c	40	gr&p	tr	yes
Colluvium (AB)	235	245	10YR 2/1-3/1	loam	m-c	40	gr&p	tr	yes
Colluvium (C)	245	255	10YR 3/1	sandy loam	m-c	*	gr&p	tr	yes
Colluvium (C)	255	265	10YR 3/1	sandy loam	m-c	*	gr&p	1	yes
Colluvium (C)	265	280	10YR 3/1	sandy loam	m-c	*	gr&p	3	yes
Colluvium (Cg)	280	305	2.5Y 4/2&4/1	sandy loam	m	*	gr&p	tr	yes
Colluvium (Cg)	**305**	**320**	**2.5Y 4/2&4/1**	**sandy loam**	**m**	*	**gr&p**	**tr**	**yes**
Colluvium (Cg)	**320**	**330**	**2.5Y 4/2**	**sandy loam**	**m-c**	*	**gr&p**	**tr**	**yes**
Colluvium (Cg)	**330**	**345**	**2.5Y 4/2**	**sandy loam**	**m**	*	**gr&p**	**tr**	**yes**
Colluvium (Cg)	345	355	2.5Y 4/2	sandy loam	m-c	*	gr&p	tr	yes

Soil consists of a very thick (2.2 m) cumulic A horizon over an AB horizon over a C and Cg horizons. The upper 0.6 m of A horizon is unleached, indicating it may be a recent deposit.

Two flakes and a piece of FCR were recovered in the lower half of the cumulic A horizon at depth of 1.40 -1.50 m, 1.90-2.00 m, and 2.05-2.20 m (Table 4). These artifacts may have been moved with the colluvium to where they were recovered and are in secondary context or they may have been deposited during occupations on alluvial fan surface during the slow process of cumulization and therefore is in primary context.

Flakes were also recovered in nearby shovel tests (9N5 and 9W5), with one flake at a depth of 2.00 – 2.10 m and a second flake at a depth 3.15-3.35 m. The shallower depth interval correlates with the lower cumulic A horizon formed in colluvium and with the Cg horizon also formed in colluvium in Shovel Test 9NW7. The flake in the A horizon may have been moved with the colluvium to where it was recovered and is in secondary context or it may have been deposited during an occupation on the alluvial fan surface during the early stages of cumulization and therefore may be in primary context. The more deeply buried flake is in the Cg horizon formed in the lower sandier colluvium and is likely in secondary context. No paleosols are present in the lower part of the colluvial sequence, indicating more rapid deposition with limited subaerial exposure.

Shovel Test 16S3

Shovel Test 16S3 is on the alluvial fan. Stratigraphy consists of a 3.55 m thick sequence of colluvium (Table 5). The deposits are slightly finer-grained, mostly unleached, and lighter colored in the upper 0.7 m, indicating they may be historic. Below 0.7 m the colluvium is sandy loams and loams that are black and very dark gray. It is a very thick cumulic A horizon with perhaps some intervals or beds indicating higher sedimentation rates. The sequence below 0.6 m is all leached of free carbonates. A radiocarbon date of 1960±30 RCYBP was obtained on bone in the middle of the Ab horizon (190-200 cmbs).

Table 5. Lithology and soil determined for samples from Shovel Test 16S3. Bold text indicates intervals where artifacts were recovered.

Deposit (Soil Horizon)	Top (cm)	Base (cm)	Munsell	Texture	Sand Size	Sand %	Gravel Size	Gravel %	Leached?
Colluvium (A)	0	15	10YR 2/1-3/1	silt loam -sandy loam	f-m	30	gr	tr	no
Colluvium (A)	15	30	10YR 2/1-3/1	silt loam - sandy loam	f-m	30	gr	tr	no
Colluvium (C)	30	45	10YR 3/1-3/2	silt loam-sandy loam	f-m	40	gr&p	tr	no
Colluvium (C)	45	60	10YR 3/1-3/2	sandy loam	m	*	gr	tr	yes
Colluvium (C)	60	70	10YR 3/2	sandy loam	m	*	gr	tr	yes
Colluvium (Ab)	**80**	**90**	**10YR 2/1**	**sandy loam**	**m**	*	**gr&p**	**2**	**yes**
Colluvium (Ab)	90	100	10YR 2/1 -3/1	sandy loam	m	*	gr&p	2	yes
Colluvium (Ab)	100	110	10YR 2/1 -3/1	sandy loam	m	*	gr&p	tr	yes
Colluvium (Ab)	110	120	10YR 2/1 -3/1	sandy loam	m	*	gr&p	tr	yes
Colluvium (Ab)	120	130	10YR 2/1 -3/1	sandy loam	m	*	gr&p	tr	yes
Colluvium (Ab)	130	140	10YR 2/1 -3/1	sandy loam	m	*	gr	tr	yes
Colluvium (Ab)	140	150	10YR 2/1	sandy loam-loam	m	*	gr	tr	yes
Colluvium (Ab)	150	165	10YR 2/1	sandy loam-loam	m	*	gr&p	tr	yes
Colluvium (Ab)	165	180	10YR 2/1	sandy loam-loam	m	*	gr&p	tr	yes
Colluvium (Ab) 1960±30 RCYBP	180	190	10YR 2/1-3/1	loam	m	*	gr&p	tr	yes
Colluvium (Ab)	190	200	10YR 2/1	loam	m&c	*	gr	tr	yes
Colluvium (Ab)	200	210	10YR 2/1	sandy loam-loam	m&c	*	gr	tr	yes
Colluvium (Ab)	210	220	10YR 2/1	sandy loam-loam	m&c	*	gr&p	tr	yes
Colluvium (Ab)	220	235	10YR 2/1	sandy loam-loam	m&c	*	gr	1	yes
Colluvium (Ab)	235	250	10YR 2/1	sandy loam-loam	m&c	*	gr	1	yes
Colluvium (Ab)	250	265	10YR 2/1	sandy loam-loam	m&c	*	gr&p	3	yes
Colluvium (Ab)	265	275	10YR 2/1	sandy loam-loam	m&c	*	gr&p	tr	yes
Colluvium (Ab)	275	290	10YR 2/1	sandy loam-loam	m&c	*	gr&p	1	yes
Colluvium (Ab)	290	310	10YR 2/1	sandy loam-loam	m&c	*	gr&p	3	yes
Colluvium (ABb)	**310**	**320**	**10YR 2/1-3/1**	**loam**	**m&c**	*	**gr&p**	**3**	**yes**
Colluvium (ABb)	**320**	**340**	**10YR 2/1-3/1**	**sandy loam**	**m&c**	*	**gr&p**	**5**	**yes**
Colluvium (ABb)	340	355	10YR 3/1	sandy loam - loam	m&c	*	gr&p	1	yes

A flake was recovered at a depth of 0.8 – 0.9 at the top of the Ab horizon (Table 5). The Ab horizon is formed in colluvium so the flake may have been moved with the colluvial deposits, but its association with a buried soil increases the likelihood it is in primary context. Another flake was recovered at a depth of 3.15 – 3.25 m in an ABb horizon formed in colluvium. This flake may also have been moved to its position of recovery as a part of the colluvium and is in secondary context or, because it is in a soil that may have been at or near the landscape surface may be in primary context.

Shovel Test 7S3

Shovel Test 7S3 is located on the footslope just above the floodplain. Stratigraphy consists of poorly drained, unleached, colluvium to a depth of 1.0 m over organic deposits to a depth of 1.9 m over another sequence of colluvium to a depth of 3.5 m (Table 6). The upper colluvial unit has weak soil development and is unleached, indicating it may be historic in age. A series of Ob horizons have formed in the organic deposits and an Ab-ABb horizon sequence has formed in the underlying colluvium.

Table 6. Lithology and soil determined for samples from Shovel Test 7S3. Heavy line separates deposit types and bold text indicates intervals where artifacts were recovered.

Deposit (Soil Horizon)	Top (cm)	Base (cm)	Munsell	Texture	Sand Size	Sand %	Gravel Size	Gravel %	Leached?
Colluvium (AC)	0	15	10YR 3/2	silt loam	m	30	p	tr	no
Colluvium (C)	15	30	2.5Y 4/2	silt loam - sandy loam	m	35	gr&p	tr	no
Colluvium (C)	30	45	2.5Y 4/2	sandy loam	m	*	gr&p	1	no
Colluvium (C)	45	60	2.5Y 4/2-4/3	sand	f&m	*	gr&p	1	no
Colluvium (C)	60	75	2.5Y 4/1	sandy loam	f-m	*	gr	1	no
Colluvium (C)	75	90	2.5Y 4/2	sandy loam	f-m	*	gr&p	tr	no
Colluvium (C)	90	100	2.5Y 4/2-3/2	sandy loam	f&m	*	gr&p	5	yes
Organic (Ob)	100	110	N2.5/	muck	vf	tr	*	*	yes
Organic (Ob)	110	115	N2.5/	muck	vf-vc	1	gr&p	tr	yes
Organic (Ob)	115	120	N2.5/	muck	vf-vc	tr	*	*	yes
Organic (Ob)	120	135	N2.5/	muck	vf-vc	1	*	*	yes
Organic (Ob)	135	140	N2.5/	muck	vf-vc	tr	*	*	yes
Organic (Ob)	140	150	10YR 2/1	muck	vf-vc	10	gr&p	tr	yes
Organic (Ob)	150	160	10YR 2/1	muck	vf-vc	8	gr&p	tr	yes
Organic (Ob)	160	170	10YR 2/1	mucky silt loam	m&c	15	*	*	yes
Organic (Ob)	170	180	10YR 2/1	muck	m	5	*	*	yes
Organic (Ob)	180	190	10YR 2/1	muck	f	10	*	*	yes
Colluvium (Ab)	190	200	10YR 2/1	mucky silt loam	f-c	15	gr&p	1	yes
Colluvium (Ab)	**200**	**210**	**10YR 2/1**	**silt loam**	**f**	**25**	*	*	**yes**
Colluvium (Ab)	210	225	10YR 2/1	loam	f-m	25	gr&p	1	yes
Colluvium (Ab)	225	240	10YR 2/1-3/1	loam	f-m	25	gr&p	2	yes
Colluvium (Ab)	240	250	10YR 2/1-3/1	loam	f-m	30	*	*	yes
Colluvium (Ab)	250	260	10YR 2/1-3/1	loam	f-m	30	*	*	yes

Colluvium (Ab)	260	275	10YR 2/1	loam	f-m	30	*	*	yes
Colluvium (Ab)	275	285	10YR 2/1	sandy loam	m	*	*	*	yes
Colluvium (Ab)	285	295	10YR 2/1-3/1	sandy loam	m	*	gr&p	1	yes
Colluvium (Ab)	295	305	10YR 2/1-3/1	sandy loam	m	*	p	tr	yes
Colluvium (Ab)	305	310	10YR 3/1	sandy loam	m	*	gr	1	yes
Colluvium (ABb)	**310**	**320**	**10YR 3/1**	**loamy sand**	**m**	*	**gr&p**	**5**	**yes**
Colluvium (ABb)	**320**	**335**	**10YR 3/1**	**sandy loam**	**m**	*	**gr&p**	**5**	**yes**
Colluvium (ABb)	335	340	10YR 3/1	sandy loam	m	*	gr&p	5	yes
Colluvium (ABb)	340	350	10YR 3/1	sandy loam	m	*	gr&p	5	yes

Shovel Test 5NW3

Shovel Test 5NW3 is located on the footslope along the valley margin. Stratigraphy consists of colluvium to a depth of 1.0 m over a thin unit of organic sediment to a depth of 1.1 m over colluvium to a depth of 3.5 m (Table 7). The upper colluvial sequence is not pedogenically altered (all C horizons). An O horizon is formed in muck that overlies an Ab-ABb-C horizon sequence formed in colluvium. The lower colluvium is stratified, consisting of poorly sorted silt loam and sandy clay loam over a sequence of silt loam without gravel that may be alluvium over poorly sorted silty clay and clay loam with gravel.

Four artifacts were recovered in Shovel Test 5NW3 at three depths: 1.20-1.30 m, 2.35-2.50 m, and 2.95-3.10 m (Table 7). The flake recovered in the upper interval is located in an Ab horizon formed in colluvium. It may have been moved with the colluvium to where it was recovered and is in secondary context or it may have been deposited during an occupation on the alluvial fan surface during the early stages of cumulization and therefore may be in primary context. Flakes and shatter in the lower interval are located in C horizons formed in colluvium and are likely in secondary contexts. No paleosols are present in the lower part of the colluvial sequence, indicating more rapid deposition with limited subaerial exposure.

A piece of granitic fire-cracked rock was located in a shovel test within 5 m north of Shovel Test 5NW3 at a depth of 3.20 to 3.30 m. This depth interval correlated with the C horizon formed in colluvium in Shovel Test 5NW3. The piece of FCR is in the lower colluvial sequence and is likely in secondary context. No paleosols are present in the lower part of the colluvial sequence, indicating more rapid deposition with limited subaerial exposure.

Table 7. Lithology and soil determined for samples from Shovel Test 5NW3. Heavy line separates deposit types and bold text indicates intervals where artifacts were found.

Deposit (Soil Horizon)	Top (cm)	Base (cm)	Munsell	Texture	Sand Size	Sand %	Gravel Size	Gravel %	Leached?
Colluvium (C)	0	20	10YR 3/2-4/2	sandy loam	m	*	gr&p	1	no
Colluvium (C)	20	40	10YR 3/2	loamy sand	m-vc	*	gr&p	3	no
Colluvium (C)	40	60	10YR 3/2	sandy loam	m	*	gr&p	tr	no
Colluvium (C)	60	80	10YR 3/2	silt loam	vf&m	25	gr	tr	no
Colluvium (C)	80	100	10YR 3/1	silt loam	m	1	*	*	no
Organic (Ob)	100	110	10YR 2/1	muck	m	2	gr&p	tr	yes
Colluvium (Ab)	110	120	10YR 2/1-3/1	mucky silt loam	m	10	gr&p	1	yes
Colluvium (Ab)	**120**	**135**	**10YR 2/1**	**silt loam**	**m**	**30**	**gr&p**	**2**	**yes**
Colluvium (Ab)	135	145	10YR 2/1	silt loam	m	35	gr&p	tr	yes
Colluvium (ABb)	145	155	10YR 2/1-3/1	sandy clay loam	m	*	*	*	yes
Colluvium (ABb)	165	180	10YR 2/1-3/1	sandy clay loam	f-m	*	gr	tr	yes
Colluvium (C)	180	200	10YR 4/2	sandy clay loam	m	*	*	*	yes
Colluvium (C)	180	200	10YR 4/3	silt -silt loam	*	*	*	*	yes
Colluvium (C)	200	210	10YR 4/3&4/1	silt loam	*	*	*	*	yes
Colluvium (C)	210	220	10YR 4/3&4/1	silt loam	*	*	*	*	yes
Colluvium (C)	220	235	10YR 4/3&4/1	silty clay loam	*	*	*	*	yes
Colluvium (C)	**235**	**250**	**10YR 4/3-5/3**	**silty clay**	**vf**	**tr**	*	*	**yes**
Colluvium (C)	250	265	10YR 4/3-5/3	silty clay	vf	tr	*	*	yes
Colluvium (C)	265	285	10YR 4/3-5/3	silty clay	vf-f	2	gr&p	tr	yes
Colluvium (C)	285	295	10YR 4/3-5/3	clay-clay loam	f	30	gr&p	tr	yes
Colluvium (C)	**295**	**310**	**10YR 4/3-5/3**	**clay loam**	**f-m**	**35**	**gr&p**	**1**	**yes**
Colluvium (C)	**310**	**325**	**10YR 5/3**	**clay loam**	**f&m**	*	**gr&p**	**2**	**yes**
Colluvium (C)	**325**	**335**	**10YR 4/2**	**clay loam**	**f&m**	*	**gr&p**	**2**	**yes**
Colluvium (C)	335	350	10YR 4/2	clay loam	f&m	*	gr&p	2	yes

Geoarchaeology

The colluvium is poorly sorted gravelly deposits beneath foot slopes and an alluvial fan at the mouth of a small, steep valley. Just based on the transport mechanisms, artifacts could easily be entrained and be moved downslope as a part of the colluvial deposit. Primary occupations on the foot slope and alluvial fan could also be buried and preserved. Given the relatively homogeneous nature of the colluvial deposits and potential for subtle stratigraphic variation, a detailed examination of soils and stratigraphy using additional methods would be necessary to determine, with confidence, if archaeological deposits are in primary or secondary contexts. However, a good estimate of the artifact context was made using deposit type and master soil horizon designations. Artifacts in the colluvium can be transported to their recovered position as a part of the colluvial deposit, and are therefore in secondary contexts. Or their position may be the result of an occupation at the location of their recovery, and are therefore in primary context. If surface or buried A or AB horizons are present in the portion of the sequence where the artifacts occur, then it is more likely the artifacts are in primary contexts simply because the deposit were exposed at or near the landscape surface long enough for the A horizon to form. Artifacts in C horizons formed in colluvium are considered to be in secondary contexts because deposition was more rapid, minimizing time at the landscape surface.

Stratigraphically, the colluvium occurs at the surface, at the surface above organic deposits, and buried beneath organic deposits. Surface colluvium appears to have a cap of likely historic age colluvium characterized by weakly developed soils and/or unleached surface horizons often over a moderately developed buried A horizon. Soils formed below the historic cap consist of a thick cumulic Ab-ABb horizon sequence. These horizons form where there is slow accumulation of sediment and, in low landscape positions, likely organic-rich sediment. The sediment is constantly being incorporated into the upper soil by pedogenic processes. Artifacts could be in primary or secondary contexts that may be either dispersed (slow movement downslope and up and down the profile) or concentrated (stone lines beneath biomantles) by ongoing pedoturbation and/or may be buried.

Organic deposits accumulate in wetlands at seeps along the base of the slopes. The organic deposits mark a former landscape surface, and they overlie a buried soil formed in colluvium that marks an older landscape surface. The buried soil, like its surface counterparts has a thick cumulic A horizon. Archaeological deposits could be in primary or secondary contexts in the colluvium below the organic deposits. If the buried soil surface was occupied just before the formation of the wetland then those deposits may be well preserved.

The lacustrine deposits accumulated in lakes formed in the lower Minnesota River valley when it was dammed by outwash in the Mississippi River valley or in glaciolacustrine settings during ice retreat. These deposits were then eroded and exposed by catastrophic flooding in the late Pleistocene and early Holocene. An erosional surface cannot be detected in bag samples but it is assumed, given the lithologic change from one sample to the next, that an erosional surface is present between the lacustrine deposits and the colluvium. The subaqueous depositional environment and the lack of indicators of subaerial exposure (soils) in the lacustrine sequence indicates that contained artifacts are in secondary context.

Assemblages from occupations on foot slopes and active colluvium-dominated alluvial fans were likely in motion for part of their post-depositional history. The scale of the movement is variable from a few centimeters to tens of meters on a continuous or episodic temporal scale. Because of this, the integrity of the deposits is difficult to assess without large exposures in trenches or excavations.

References Cited

Collinson, J. D. and D. B. Thompson
1982 *Sedimentary Structures*. George Allen & Unwin, London.

Folk, Robert F
1974 *Petrology of Sedimentary Rocks*. Hemphill Publishing Company, Austin.

Meyer, Gary N. and Barbara Lusardi
2000 Surficial Geology of the St Paul 30 x 60 Minute Quadrangle, Minnesota. Minnesota Geological Survey Miscellaneous Map Series Map M-106.

Schoeneberger, P. J., D. A. Wysocki, E. C. Benham and W. D. Broderson
1998 Field Book for Describing and Sampling Soils Version 1.1. *National Soil Survey Center, Natural Resource Conservation Service, USDA, Lincoln, Nebraska*.

Soil Survey Staff
1975 Soil Taxonomy. *United States Department of Agriculture Handbook* 436.

APPENDIX B: OFFICE OF STATE ARCHAEOLOGIST LICENSE

APPLICATION FOR MINNESOTA
ANNUAL ARCHAEOLOGICAL RECONNAISSANCE SURVEY LICENSE

This license only applies to reconnaissance (Phase I) surveys conducted under Minnesota Statutes 138.31-.42 during calendar year 2014 . Separate licenses must be obtained for site evaluation (Phase II) surveys. for major site investigations (Phase III), for burial site authentications under Minnesota statutes 307.08, and for survey work that will continue into another calendar year. Only the below listed individual is licensed as a Principal Investigator, not the institution/agency/company or others who work for that entity. The licensed individual is required to comply with all the conditions attached to this license form. Permission to enter land for the purposes of archaeological investigation must be obtained from the landowner or land manager.

Name: Frank Florin

Institution/Agency/Company Affiliation: Florin Cultural Resource Services, LLC

Title/Position: Owner and Principal Investigator

Address: N12902 273rd Street, Boyceville, WI 54725

Work Phone: (715) 643-2918 E-Mail: florin@pressenter.com

Name of Advanced Degree Institution: U of MN, Minneapolis Year: 1996

Name of Department: Interdisciplinary Archaeological Studies Degree: _X_MA _ MS _ PhD

Purpose: (check all that may apply)
CRM X Academic Research ___ Institutional Field School ___

Type of Land: (check all that may apply)
State Owned _X_ County Owned _X_ Township/City Owned _X_
Other non-federal public ___ List: __________

MHS Repository Agreement # 650 Other Approved Curation Facility: __________

Previous License: Year 2013 Type: Annual Number: 13-44

Signed (applicant): Frank Florin Date: 4/5/14

Required Attachments: *Curriculum Vita* ___ and Documentation of Appropriate Experience ___ for previously unlicensed individuals.

Submit one copy of this form and attachments to:
Office of the State Archaeologist, Ft. Snelling History Center, St. Paul, MN 55111
612-725-2411 612-725-2729 FAX 612-725-2427 email: mnosa@state.mn.us

Minnesota Historical Society Approval: [signature] Date: 4-9-14
State Archaeologist Approval: [signature] Date: 4/8/14
License Number: 14-038

Form Date: 4/9/12

APPLICATION FOR MINNESOTA
EVALUATION/PHASE II SURVEY ARCHAEOLOGICAL LICENSE

This license only applies to evaluation investigations/Phase II surveys conducted under the provisions of Minnesota Statutes 138.31 - .42 at the specific site or locality listed on the application during calendar year 2014. Separate licenses must be obtained for reconnaissance (Phase I) surveys, for major investigation (Phase III) work, for burial site work under Minnesota statutes 307.08, for fieldwork that will continue into another calendar year, for fieldwork conducted at locations other than those listed below, and for fieldwork that significantly exceeds the Phase II specifications of the *SHPO Manual for Archaeological Projects in Minnesota*. Only the listed individual is licensed as a Principal Investigator, not the institution/agency/company or others who work for that entity. The licensed individual and the sponsoring entity are required to comply with all the conditions attached to the license.

Name: Frank Florin

Institution/Agency/Company Affiliation: Florin Cultural Resource Services, LLC

Title/Position: Owner and PI

Address: N12902 273rd Street Boycville, WI

Work Phone: (715) 643-2918 E-Mail: florin@pressenter.com

Name of Advanced Degree Institution: U of MN Year: 1996

Name of Department: IAS Degree: X MA __MS __PhD

Site Number: 281-1 Project: I35W Bridge Replacement

Type of Land: (check all that may apply)
State Owned __ County Owned X Township/City Owned __ Manager:______
Other non-federal public__ List: ______

Purpose: (check all that may apply)
CRM X Academic Research ___ Institutional Field School ___

Expected Period Components/Contexts: Precontact X Contact___ Post-Contact___

MHS Repository Agreement # 650 Other Approved Curation Facility:______

Signed (applicant): Frank Florin Date: 11/1/14

Required Attachments: 1) *Curriculum Vita* X 2) Documentation of Appropriate Experience X
3) Research Design X
Previous License: Year 2014 Type Phase I Number 14-038
Submit one copy of this form and attachments to:
Office of the State Archaeologist, Ft. Snelling History Center, St. Paul, MN 55111
612-725-2411 612-725-2729 FAX 612-725-2427 email: mnosa@state.mn.us

Minnesota Historical Society Approval: [signature] Date: 11-3-14
State Archaeologist Approval: [signature] Date: 11/3/14
License Number: 14-074

Form Date: 2/15/11

APPLICATION FOR MINNESOTA
EVALUATION/PHASE II SURVEY ARCHAEOLOGICAL LICENSE

This license only applies to evaluation investigations/Phase II surveys conducted under the provisions of Minnesota Statutes 138.31 - .42 at the specific site or locality listed on the application during calendar year 2014. Separate licenses must be obtained for reconnaissance (Phase I) surveys, for major investigation (Phase III) work, for burial site work under Minnesota statutes 307.08, for fieldwork that will continue into another calendar year, for fieldwork conducted at locations other than those listed below, and for fieldwork that significantly exceeds the Phase II specifications of the *SHPO Manual for Archaeological Projects in Minnesota.* Only the listed individual is licensed as a Principal Investigator, not the institution/agency/company or others who work for that entity. The licensed individual and the sponsoring entity are required to comply with all the conditions attached to the license.

Name: Frank Florin

Institution/Agency/Company Affiliation: Florin Cultural Resource Services, LLC

Title/Position: Owner and PI

Address: N12902 273rd Street Boycville, WI

Work Phone: (715) 643-2918 E-Mail: florin@pressenter.com

Name of Advanced Degree Institution: U of MN Year: 1996

Name of Department: IAS Degree: X MA __MS __PhD

Site Number: 281-2 Project: I35W Bridge Replacement

Type of Land: (check all that may apply)
State Owned __ County Owned X Township/City Owned __ Manager:________
Other non-federal public__ List: ________

Purpose: (check all that may apply)
CRM X Academic Research ___ Institutional Field School ___

Expected Period Components/Contexts: Precontact X Contact___ Post-Contact___

MHS Repository Agreement # 650 Other Approved Curation Facility:________

Signed (applicant): Frank Florin Date: 11/7/14

Required Attachments: 1) *Curriculum Vita* X 2) Documentation of Appropriate Experience X
3) Research Design X
Previous License: Year 2014 Type Phase I Number 14-038
Submit one copy of this form and attachments to:
Office of the State Archaeologist, Ft. Snelling History Center, St. Paul, MN 55111
612-725-2411 612-725-2729 FAX 612-725-2427 email: mnosa@state.mn.us

Minnesota Historical Society Approval: [signature] Date: 11-12-14
State Archaeologist Approval: [signature] Date: 11/12/14
License Number: 14-076

Form Date: 2/15/11

APPLICATION FOR MINNESOTA
ANNUAL ARCHAEOLOGICAL RECONNAISSANCE SURVEY LICENSE

This license only applies to reconnaissance (Phase I) surveys conducted under Minnesota Statutes 138.31-.42 during calendar year _**2016**_. Separate licenses must be obtained for site evaluation (Phase II) surveys, for major site investigations (Phase III), for burial site authentications under Minnesota statutes 307.08, and for survey work that will continue into another calendar year. Only the below listed individual is licensed as a Principal Investigator, not the institution/agency/company or others who work for that entity. The licensed individual is required to comply with all the conditions attached to this license form. Permission to enter land for the purposes of archaeological investigation must be obtained from the landowner or land manager.

Name: Frank Florin

Institution/Agency/Company Affiliation: Florin Cultural Resource Services, LLC

Title/Position: Owner and Principal Investigator

Address: N12902 273rd Street, Boyceville, WI 54725

Work Phone: (715) 643-2918 E-Mail: florin@pressenter.com

Name of Advanced Degree Institution: U of MN, Minneapolis Year: 1996

Name of Department: Interdisciplinary Archaeological Studies Degree: _X_MA __MS __PhD

Purpose: (check all that may apply)
CRM X Academic Research ___ Institutional Field School ___

Type of Land: (check all that may apply)
State Owned _X_ County Owned _X_ Township/City Owned _X_
Other non-federal public ___ List: ______________________

MHS Repository Agreement # __734______ Other Approved Curation Facility:____________

Previous License: Year 2015 Type: Annual Number: 15-009

Signed (applicant):_ Frank Florin _________ Date: __3/26/16_________

Required Attachments: *Curriculum Vita* and Documentation of Appropriate Experience ___ for previously unlicensed individuals.

Submit one copy of this form and attachments to:
Office of the State Archaeologist, Ft. Snelling History Center, St. Paul, MN 55111
612-725-2411 612-725-2729 FAX 612-725-2427 email: mnosa@state.mn.us

Minnesota Historical Society Approval: ____________ Date: 3-23-16
State Archaeologist Approval: Amanda [illegible] ____________ Date: 3/22/16
License Number: 16-035

Form Date: 4/9/12

APPLICATION FOR MINNESOTA
EVALUATION/PHASE II SURVEY ARCHAEOLOGICAL LICENSE

This license only applies to evaluation investigations/Phase II surveys conducted under the provisions of Minnesota Statutes 138.31 - .42 at the specific site or locality listed on the application during calendar year 2016. Separate licenses must be obtained for reconnaissance (Phase I) surveys, for major investigation (Phase III) work, for burial site work under Minnesota statutes 307.08, for fieldwork that will continue into another calendar year, for fieldwork conducted at locations other than those listed below, and for fieldwork that significantly exceeds the Phase II specifications of the *SHPO Manual for Archaeological Projects in Minnesota.* Only the listed individual is licensed as a Principal Investigator, not the institution/agency/company or others who work for that entity. The licensed individual and the sponsoring entity are required to comply with all the conditions attached to the license.

Name: Frank Florin

Institution/Agency/Company Affiliation: Florin Cultural Resource Services, LLC

Title/Position: Owner and PI

Address: N12902 273rd Street Boycville, WI

Work Phone: (715) 643-2918 E-Mail: florin@pressenter.com

Name of Advanced Degree Institution: U of MN Year: 1996

Name of Department: IAS Degree: X MA __MS __PhD

Site Number: 281-3&4 Project: I35W Bridge Replacement

Type of Land: (check all that may apply)
State Owned __ County Owned __ Township/City Owned X Manager:________
Other non-federal public__ List: ________

Purpose: (check all that may apply)
CRM X Academic Research ___ Institutional Field School ___

Expected Period Components/Contexts: Precontact X Contact___ Post-Contact___

MHS Repository Agreement # 734 Other Approved Curation Facility:________

Signed (applicant): Frank Florin Date: 7/27/16

Required Attachments: 1) *Curriculum Vita* X 2) Documentation of Appropriate Experience X
3) Research Design X
Previous License: Year 2016 Type Phase I Number 16-035

Submit one copy of this form and attachments to:
Office of the State Archaeologist, Ft. Snelling History Center, St. Paul, MN 55111
612-725-2411 612-725-2729 FAX 612-725-2427 email: mnosa@state.mn.us

Minnesota Historical Society Approval: [signature] Date: 7-25-16
State Archaeologist Approval: [signature] Date: 7/27/16
License Number: 16-065

Form Date: 2/15/11

APPENDIX C: ARTIFACT CATALOGS

21HE494 - Phase I Catalog

Prov #	Count	Location	F#	Depth	Depth Type	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
1.1	1	ST 5E		50-80	cmbs	Ceramic	body	grit temper	cord marked					2 (<1"-1/2")	2.1	smoothed over cordmarking; 3.9 mm	10/28/2014
1.2-5	4	ST 5E		50-80	cmbs	Ceramic	body	grit temper	cord marked					3 (<1/2"-1/4")	3.1	smoothed over cordmarking; 3.7, 3.5, 3.2, & 3.1 mm	10/28/2014
2.1	1	ST 5EA		40-60	cmbs	Ceramic	body	shell temper	smooth					3 (<1/2"-1/4")	0.7	1.9 mm	11/24/2014
3.1	1	ST 7W		0-30	cmbs	Faunal	mammalian, medium/large	longbone	fragment					2 (<1"-1/2")	12	partially mineralized	10/30/2014

21HE494 - Phase II Catalog

Prov #	Count	Location	F#	Depth	Depth Type	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
1.1	1	ST 5EAN5		0-10	cmbs	Lithic	debris	bifacial thinning			Cedar Valley Chert	>0-<50%	heat treated	2 (<1"-1/2")	1		11/24/2014
2.1	1	ST 5EN5		115-125	cmbs	Lithic	debris	broken flake			unidentified chert	0%		3 (<1/2"-1/4")	0.2		11/5/2014
3.1	1	ST 7WN5		0-20	cmbs	Faunal	mammalian, medium/large	unidentifiable	fragment	calcined				3 (<1/2"-1/4")	0.5		11/26/2014
4.1	1	ST 7WN5		35-55	cmbs	Faunal	mammalian, medium/large	unidentifiable	fragment	calcined & charred				3 (<1/2"-1/4")	0.5		11/25/2014
5.1-2	2	ST 7WW3		50-65	cmbs	Faunal	unidentified	unidentifiable	fragment	charred				4 (<1/4")	0.1		11/25/2014
6.1	1	XU 2		65-75	cmbd	Lithic	debris	nonbifacial			quartzite	0%	heat treated	3 (<1/2"-1/4")	1.1		11/24/2014
7.1	1	XU 2	1	91-100	cmbd	Botanical	wood charcoal							4 (<1/4")	0.2	Beta	11/24/2014
8.1	1	XU 2	1	97-97	cmbd	Ceramic	body	grit temper	cord marked					2 (<1"-1/2")	1.7	smoothed over cordmarking; 4.0 mm	11/25/2014
8.2	1	XU 2	1	97-97	cmbd	Ceramic	body	grit temper	undetermined					4 (<1/4")	0.1	2.8 mm	11/25/2014
9.1	1	XU 3		20-30	cmbd	Lithic	debris	nonbifacial			Prairie du Chien Chert (oolitic)	>0-<50%	heat treated	2 (<1"-1/2")	2.1	@17 fragments; similar to wild rice	11/26/2014
10.1	1	XU 2	1	91-102	cmbd	Botanical	starchy material							4 (<1/4")	0.2	@ 100 small fragments	11/25/2014
10.2	1	XU 2	1	91-102	cmbd	Botanical	Scirpus (bulrush)	seed						4 (<1/4")	0	@5 seeds	11/25/2014
10.3	1	XU 2	1	91-102	cmbd	Botanical	Poaceae (grasses)	seed						4 (<1/4")	0		11/25/2014
10.4	1	XU 2	1	91-102	cmbd	Botanical	Poaceae (grasses)	seed						4 (<1/4")	0	@3 fragments	11/25/2014

21HE494 - Phase II Catalog

Prov #	Count	Location	F#	Depth	Depth Type	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
10.5	1	XU 2	1	91-102	cmbd	Botanical	seed embryo							4 (<1/4")	0	from 2 different plants	11/25/2014
10.6	1	XU 2	1	91-102	cmbd	Botanical	sample							4 (<1/4")		unsorted light fraction sample containing rootlets, sediment; and charred material	11/25/2014

21HE495 - Phase I Catalog

Prov #	Count	Location	Depth (cmbs)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
1.1	1	ST 48W	0-15	Lithic	debris	bifacial thinning			Lake Superior Agate	0%		3 (<1/2"-1/4")	1.2		11/6/2014
2.1	1	ST 48W	25-40	Lithic	debris	broken flake			quartzite	0%		3 (<1/2"-1/4")	1		11/6/2014
3.1	1	ST 49W	20-40	Lithic	debris	decortication			Red River Chert	>0-<50%		2 (<1"-1/2")	2.3		11/6/2014
4.1	1	ST 62W	60-80	Lithic	debris	edge preparation			Prairie du Chien Chert (oolitic)	0%	probably heat treated	3 (<1/2"-1/4")	0.2		11/6/2014
5.1	1	ST 65W	0-20	Lithic	tool	unpatterned flake	utilized flake	broken	Red River Chert	0%		3 (<1/2"-1/4")	0.2	broken; distal fragment	11/6/2014
5.2	1	ST 65W	0-20	Lithic	debris	decortication			Prairie du Chien Chert (oolitic)	50-<100%	probably heat treated	2 (<1"-1/2")	6.6		11/6/2014
5.3	1	ST 65W	0-20	Lithic	debris	decortication			Swan River Chert	100%		3 (<1/2"-1/4")	0.6		11/6/2014
5.4	1	ST 65W	0-20	Lithic	debris	bifacial shaping			unidentified chert	0%		3 (<1/2"-1/4")	0.4		11/6/2014
6.1	1	ST 65W	60-80	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.3		11/6/2014
7.1	1	ST 70W	20-40	Lithic	debris	bifacial thinning			fusilinid chert	0%	probably heat treated	3 (<1/2"-1/4")	1.5		11/6/2014
8.1	1	ST 72W	30-40	Lithic	debris	nonbifacial			Red River Chert	0%		3 (<1/2"-1/4")	1.6		11/7/2014
8	1	ST 72W	30-40	Historic	metal	iron	wire fragment					3 (<1/2"-1/4")	4.6		11/7/2014
9.1	1	ST 75W	0-40	Lithic	debris	decortication			Red River Chert	50-<100%		2 (<1"-1/2")	2		11/7/2014
9.2	1	ST 75W	0-40	Lithic	debris	bifacial thinning			Prairie du Chien Chert (oolitic)	0%	heat treated	3 (<1/2"-1/4")	0.5		11/7/2014

21HE495 - Phase I Catalog

Prov #	Count	Location	Depth (cmbs)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
9.3	1	ST 75W	0-40	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.4		11/7/2014
9	1	ST 75W	0-40	Historic	metal	iron	washer					2 (<1"-1/2")	4.1		11/7/2014
10.1	1	ST 81W	20-40	Lithic	debris	bifacial thinning			unidentified chert	0%		3 (<1/2"-1/4")	0.3		11/7/2014
11.1	1	ST 83W	10-40	Lithic	debris	nonbifacial			Prairie du Chien Chert (oolitic)	0%		2 (<1"-1/2")	5.1		11/7/2014
11.2	1	ST 83W	10-40	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	1.3		11/7/2014
11.3	1	ST 83W	10-40	Lithic	debris	other G4 flake			Prairie du Chien Chert (oolitic)	0%	heat treated	4 (<1/4")	0.2		11/7/2014
12.1	1	ST 84W	10-20	Lithic	debris	decortication			Prairie du Chien Chert (oolitic)	50-<100%		2 (<1"-1/2")	3.2		11/7/2014
12	1	ST 84W	10-20	Historic	glass	clear	bottle fragment					2 (<1"-1/2")	7		11/7/2014
13.1	1	ST 87W	0-30	Lithic	tool	unpatterned flake	side and end scraper	broken	Grand Meadow Chert	0%		3 (<1/2"-1/4")	0.4	broken; distal fragment	11/7/2014
14.1	1	ST 90W	30-45	Lithic	debris	bifacial thinning			Knife Lake Siltstone	0%		3 (<1/2"-1/4")	1		11/7/2014
15.1	1	ST 91W	20-45	Lithic	debris	decortication			unidentified chert	50-<100%	probably heat treated	2 (<1"-1/2")	4.3		11/7/2014
15.2	1	ST 91W	20-45	Lithic	debris	shatter			Prairie du Chien Chert (oolitic)	50-<100%		3 (<1/2"-1/4")	2.4		11/7/2014

21HE495 - Phase II Catalog

Prov #	Count	Location	Depth (cmbs)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
1.1	1	ST 48WS5	70-80	Lithic	debris	shatter			Swan River Chert	0%	heat treated	3 (<1/2"-1/4")	1.8		11/6/2014
2.1	1	ST 48WN5	35-40	Lithic	debris	broken flake			Grand Meadow Chert	0%		3 (<1/2"-1/4")	0.2		11/6/2014
2	1	ST 48WN5	35-40	Historic	other	coal, clinker	clinker fragment					3 (<1/2"-1/4")	1.1		11/6/2014
3.1	1	ST 48WN5	55-60	Lithic	debris	nonbifacial			Swan River Chert	>0-<50%	heat treated	2 (<1"-1/2")	2.6		11/6/2014
3	1	ST 48WN5	55-60	Historic	metal	iron	nail, wire					3 (<1/2"-1/4")	5		11/6/2014
4.1	1	ST 49WN5	0-30	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.6		11/7/2014
900	1	ST 49WN5	30-40	Historic	metal	iron	nail, wire					3 (<1/2"-1/4")	2.4		11/7/2014
5.1	1	ST 49WS5	20-40	Lithic	debris	other G4 flake			unidentified chert	0%		4 (<1/4")	0.1		11/7/2014
6.1	1	ST 62WS5	0-30	Lithic	debris	shatter			Jasper Taconite	>0-<50%		3 (<1/2"-1/4")	2.1		11/6/2014
6.2	1	ST 62WS5	0-30	Lithic	debris	shatter			Swan River Chert	0%	heat treated	3 (<1/2"-1/4")	1.6		11/6/2014
6.3-5	3	ST 62WS5	0-30	Faunal	mammalian, medium/large	unidentifiable	fragment	calcined				3 (<1/2"-1/4")	1.9	Beta	11/6/2014
7.1	1	ST 62WN5	20-35	Lithic	debris	bipolar flake			quartz	>0-<50%		2 (<1"-1/2")	6.5		11/7/2014
7.2	1	ST 62WN5	20-35	Lithic	debris	bifacial shaping			Swan River Chert	0%	heat treated	4 (<1/4")	0.1		11/7/2014
8.1	1	ST 64WS5	20-40	Lithic	debris	decortication			quartz	100%		1 (<2"-1")	22.6		11/7/2014
9.1	1	ST 64WS5	40-60	Lithic	debris	nonbifacial			Prairie du Chien Chert (oolitic)	>0-<50%		3 (<1/2"-1/4")	1.6		11/7/2014
10.1	1	ST 65WN5	30-40	Lithic	debris	bipolar flake			Swan River Chert	>0-<50%	heat treated	2 (<1"-1/2")	9.7		11/7/2014
11.1	1	ST 65WN5	50-60	Lithic	debris	broken flake			Lake Superior Agate	0%		3 (<1/2"-1/4")	0.3		11/7/2014
12.1	1	ST 65WS5	0-20	Lithic	debris	decortication			Prairie du Chien Chert (oolitic)	50-<100%		3 (<1/2"-1/4")	0.7		11/7/2014

21HE495 - Phase II Catalog

Prov #	Count	Location	Depth (cmbs)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
12.2	1	ST 65WS5	0-20	Lithic	debris	nonbifacial			quartzite	>0-<50%		3 (<1/2"-1/4")	0.7		11/7/2014
12.3	1	ST 65WS5	0-20	Lithic	debris	shatter			Red River Chert	>0-<50%		2 (<1"-1/2")	4.9		11/7/2014
13.1	1	ST 66WN5	0-20	Lithic	core	freehand nonbifacial	patterned	unprepared	Prairie du Chien Chert (oolitic)	>0-<50%		1 (<2"-1")	27.4		11/7/2014
13.2	1	ST 66WN5	0-20	Lithic	debris	bifacial shaping			Prairie du Chien Chert (oolitic)	0%	heat treated	3 (<1/2"-1/4")	0.2		11/7/2014
14.1	1	XU 1	30-40	Lithic	tool	unpatterned flake	utilized flake	broken	Red River Chert	0%		3 (<1/2"-1/4")	0.4	finished; whole	12/3/2014
14.2	1	XU 1	30-40	Lithic	debris	broken flake			Grand Meadow Chert	0%		3 (<1/2"-1/4")	0.6		12/3/2014
14.3-4	2	XU 1	30-40	Faunal	mammalian, medium/large	unidentifiable	fragment	calcined & charred				3 (<1/2"-1/4")	1.4	possible ochre staining on end of bone	12/3/2014
901	1	XU 1	40-50	Historic	metal	iron	nail, square					3 (<1/2"-1/4")	3.9		12/3/2014
15.1	1	XU 1	50-60	Lithic	debris	decortication			Prairie du Chien Chert (oolitic)	50-<100%	heat treated	3 (<1/2"-1/4")	0.9		12/3/2014
15.2	1	XU 1	50-60	Lithic	debris	nonbifacial			Prairie du Chien Chert (oolitic)	>0-<50%		3 (<1/2"-1/4")	0.9		12/3/2014
15	1	XU 1	50-60	Historic	ceramic	earthenware	fragment					2 (<1"-1/2")	5.6		12/3/2014
16.1	1	XU 2	20-30	Lithic	tool	unpatterned flake	utilized flake & side scraper	nonbifacial	Grand Meadow Chert	>0-<50%		3 (<1/2"-1/4")	0.8	finished; whole	12/3/2014
16.2	1	XU 2	20-30	Lithic	debris	bifacial thinning			Grand Meadow Chert	0%		3 (<1/2"-1/4")	0.2		12/3/2014
16	2	XU 2	20-30	Historic	composite	unidentifiable	fragment					3 (<1/2"-1/4")	1.6		12/3/2014
17.1	1	XU 3	0-10	Lithic	debris	nonbifacial			quartzite	0%		2 (<1"-1/2")	3.4		12/4/2014

21HE495 - Phase II Catalog

Prov #	Count	Location	Depth (cmbs)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
18.1	1	XU 3	10-20	Lithic	tool	unpatterned flake	utilized flake	bifacial thinning	jasper	0%	probably heat treated	2 (<1"-1/2")	3.3	finished; whole	12/4/2014
18.2	1	XU 3	10-20	Lithic	tool	unpatterned flake	utilized flake	nonbifacial	Grand Meadow Chert	>0-<50%		3 (<1/2"-1/4")	0.8		12/4/2014
18.3	1	XU 3	10-20	Lithic	debris	decortication			Prairie du Chien Chert (oolitic)	50-<100%		3 (<1/2"-1/4")	1.4		12/4/2014
18.4	1	XU 3	10-20	Lithic	debris	nonbifacial			quartzite	>0-<50%		3 (<1/2"-1/4")	0.9		12/4/2014
18.5	1	XU 3	10-20	Lithic	debris	bifacial thinning			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	1		12/4/2014
18.6	1	XU 3	10-20	Lithic	debris	bifacial thinning			Prairie du Chien Chert (oolitic)	0%	heat treated	3 (<1/2"-1/4")	0.3		12/4/2014
18.7	1	XU 3	10-20	Lithic	debris	bifacial thinning			Galena Chert	0%	heat treated	3 (<1/2"-1/4")	0.2		12/4/2014
18.8	1	XU 3	10-20	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.7		12/4/2014
18.9	1	XU 3	10-20	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	>0-<50%	heat treated	3 (<1/2"-1/4")	0.4		12/4/2014
18.1	1	XU 3	10-20	Lithic	debris	other G4 flake			Swan River Chert	0%	heat treated	4 (<1/4")	0.2		12/4/2014
18.11-12	2	XU 3	10-20	Lithic	debris	other G4 flake			Swan River Chert	0%		4 (<1/4")	0.3		12/4/2014
18.13	1	XU 3	10-20	Lithic	debris	shatter			Swan River Chert	50-<100%		1 (<2"-1")	37.2		12/4/2014
19.1	1	XU 3	20-30	Lithic	debris	decortication			Prairie du Chien Chert (oolitic)	100%	probably heat treated	2 (<1"-1/2")	3		12/4/2014
19	1	XU 3	20-30	Historic	metal	brass	shotgun shell					3 (<1/2"-1/4")	1.9	"CLUB" on base	12/4/2014
19	1	XU 3	20-30	Historic	metal	iron	fence post staple					3 (<1/2"-1/4")	5.1		12/4/2014
20.1	1	XU 3	30-40	Lithic	debris	nonbifacial			Prairie du Chien Chert (oolitic)	50-<100%		3 (<1/2"-1/4")	0.7		12/4/2014

21HE495 - Phase II Catalog

Prov #	Count	Location	Depth (cmbs)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
20.2	1	XU 3	30-40	Lithic	debris	bifacial thinning			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.4		12/4/2014
21.1	1	XU 4	0-10	Lithic	tool	patterned bifacial	unfinished biface, stage 4		Prairie du Chien Chert (oolitic)	0%	probably heat treated	2 (<1"-1/2")	7.1		12/4/2014
21	1	XU 4	0-10	Historic	glass	clear	unidentified					3 (<1/2"-1/4")	1.2		12/4/2014
22.1	1	XU 4	10-20	Lithic	debris	nonbifacial			Prairie du Chien Chert (oolitic)	>0-<50%		2 (<1"-1/2")	20.4		12/4/2014
22.2	1	XU 4	10-20	Lithic	debris	decortication			unidentified material	100%	probably heat treated	2 (<1"-1/2")	3.1		12/4/2014
22.3	1	XU 4	10-20	Lithic	debris	decortication			Prairie du Chien Chert (oolitic)	50-<100%	heat treated	3 (<1/2"-1/4")	1.8		12/4/2014
22.4-5	2	XU 4	10-20	Lithic	debris	decortication			Prairie du Chien Chert (oolitic)	50-<100%	probably heat treated	3 (<1/2"-1/4")	2.9		12/4/2014
22.6	1	XU 4	10-20	Lithic	debris	bifacial thinning			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	1.1		12/4/2014
22.7-8	2	XU 4	10-20	Lithic	debris	bifacial shaping			Prairie du Chien Chert (oolitic)	0%	probably heat treated	4 (<1/4")	0.2		12/4/2014
22.9	1	XU 4	10-20	Lithic	debris	broken flake			quartz	0%		3 (<1/2"-1/4")	0.2		12/4/2014
22.10-12	3	XU 4	10-20	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	0%	heat treated	3 (<1/2"-1/4")	2.2		12/4/2014
22.13-14	2	XU 4	10-20	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	0%	probably heat treated	3 (<1/2"-1/4")	2.8		12/4/2014
22.15-17	3	XU 4	10-20	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	2		12/4/2014
22.18-19	2	XU 4	10-20	Lithic	debris	other G4 flake			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.4		12/4/2014

21HE495 - Phase II Catalog

Prov #	Count	Location	Depth (cmbs)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
23.1	1	XU 4	20-30	Lithic	debris	decortication			Prairie du Chien Chert (oolitic)	50-<100%	probably heat treated	3 (<1/2"-1/4")	1		12/4/2014
23.2	1	XU 4	20-30	Lithic	debris	bifacial thinning			Prairie du Chien Chert (oolitic)	0%	probably heat treated	3 (<1/2"-1/4")	1.5		12/4/2014
23.3	1	XU 4	20-30	Lithic	debris	edge preparation			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.2		12/4/2014
23.4	1	XU 4	20-30	Lithic	debris	broken flake			quartz	0%		3 (<1/2"-1/4")	0.8		12/4/2014
23.5-6	2	XU 4	20-30	Lithic	debris	other G4 flake			quartz	0%		4 (<1/4")	0.6		12/4/2014
23.7-8	2	XU 4	20-30	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	50-<100%		3 (<1/2"-1/4")	0.6		12/4/2014
23.9	1	XU 4	20-30	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	0%	probably heat treated	3 (<1/2"-1/4")	0.2		12/4/2014
24.1	1	XU 4	30-40	Lithic	debris	bifacial shaping			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.1		12/4/2014
24.2	1	XU 4	30-40	Lithic	debris	other G4 flake			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.2		12/4/2014
25.1	1	XU 5	10-20	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.3		12/5/2014
26.1	1	XU 5	20-30	Lithic	tool	unpatterned flake	utilized flake	bifacial thinning	Knife River Flint	0%		3 (<1/2"-1/4")	0.2	broken	12/5/2014
26.2	1	XU 5	20-30	Lithic	debris	bipolar flake			Prairie du Chien Chert (oolitic)	50-<100%	probably heat treated	2 (<1"-1/2")	10		12/5/2014
26.3	1	XU 5	20-30	Lithic	debris	nonbifacial			Lake of the Woods Rhyolite	>0-<50%		2 (<1"-1/2")	4.2		12/5/2014
26.4	1	XU 5	20-30	Lithic	debris	nonbifacial			Swan River Chert	0%	heat treated	3 (<1/2"-1/4")	0.5		12/5/2014
26.5	1	XU 5	20-30	Lithic	debris	bifacial thinning			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.3		12/5/2014

21HE495 - Phase II Catalog

Prov #	Count	Location	Depth (cmbs)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
26.6	1	XU 5	20-30	Lithic	debris	bifacial shaping			Swan River Chert	0%	heat treated	4 (<1/4")	0.1		12/5/2014
26.7	1	XU 5	20-30	Lithic	debris	other G4 flake			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.4		12/5/2014
26.8	1	XU 5	20-30	Lithic	debris	broken flake			unidentified chert	0%	probably heat treated	3 (<1/2"-1/4")	0.5		12/5/2014
27.1	1	XU 5	30-40	Lithic	debris	bipolar flake			quartz	0%		3 (<1/2"-1/4")	2.3		12/5/2014
27.2	1	XU 5	30-40	Lithic	debris	bipolar flake			Prairie du Chien Chert (oolitic)	50-<100%	heat treated	2 (<1"-1/2")	10.9		12/5/2014
27.3	1	XU 5	30-40	Lithic	debris	broken flake			quartz	0%		3 (<1/2"-1/4")	0.6		12/5/2014
27.4	1	XU 5	30-40	Lithic	debris	other G4 flake			unidentified chert	0%		4 (<1/4")	0.1		12/5/2014
28.1	1	XU 6	10-20	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	0%	probably heat treated	3 (<1/2"-1/4")	0.3		12/5/2014
29.1	1	XU 6	20-30	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	0%	heat treated	3 (<1/2"-1/4")	0.6		12/5/2014
30.1	1	XU 6	30-40	Lithic	debris	decortication			Swan River Chert	50-<100%	heat treated	1 (<2"-1")	0		12/5/2014
30.2	1	XU 6	30-40	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	>0-<50%	heat treated	3 (<1/2"-1/4")	0.5		12/5/2014
30.3-4	2	XU 6	30-40	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.7		12/5/2014
31.1	1	XU 6	40-50	Lithic	debris	shatter			quartz	0%		3 (<1/2"-1/4")	0.4		12/5/2014
31	1	XU 6	40-50	Historic	glass	clear	window fragment					3 (<1/2"-1/4")	1.2		12/5/2014
902	1	XU 6	50-60	Historic	metal	iron	nail, wire					3 (<1/2"-1/4")	1.9		12/5/2014
41.1	1	XU 7	20-30	Lithic	debris	nonbifacial			Red River Chert	>0-<50%		3 (<1/2"-1/4")	1.8		12/8/2014

21HE495 - Phase II Catalog

Prov #	Count	Location	Depth (cmbs)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
41.2	1	XU 7	20-30	Lithic	debris	nonbifacial			Prairie du Chien Chert (oolitic)	>0-<50%		3 (<1/2"-1/4")	1.1		12/8/2014
41.3	1	XU 7	20-30	Lithic	debris	nonbifacial			Prairie du Chien Chert (oolitic)	0%	heat treated	3 (<1/2"-1/4")	2.6		12/8/2014
41.4	1	XU 7	20-30	Lithic	tool	unpatterned flake	utilized flake	broken	Grand Meadow Chert	0%		3 (<1/2"-1/4")	0.2	finished, whole	12/8/2014
41.5-9	5	XU 7	20-30	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	1.1		12/8/2014
41.1	1	XU 7	20-30	Lithic	debris	other G4 flake			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.1		12/8/2014
41.11	1	XU 7	20-30	Lithic	debris	shatter			silicified wood	50-<100%	burned	2 (<1"-1/2")	4.4		12/8/2014
32.1	1	XU 7	30-40	Lithic	debris	nonbifacial			Prairie du Chien Chert (oolitic)	>0-<50%		2 (<1"-1/2")	2.5		12/8/2014
32.2	1	XU 7	30-40	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	>0-<50%		3 (<1/2"-1/4")	0.6		12/8/2014
32.3	1	XU 7	30-40	Lithic	debris	shatter			Prairie du Chien Chert (oolitic)	>0-<50%		3 (<1/2"-1/4")	1.5		12/8/2014
33.1	1	XU 8	10-20	Lithic	tool	unpatterned flake	utilized flake	nonbifacial	Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	2.1	broken	12/8/2014
33.2	1	XU 8	10-20	Lithic	debris	decortication			quartzite	100%		2 (<1"-1/2")	2.5		12/8/2014
33.3	1	XU 8	10-20	Lithic	debris	decortication			Prairie du Chien Chert (oolitic)	100%		3 (<1/2"-1/4")	1.6		12/8/2014
33.4	1	XU 8	10-20	Lithic	debris	nonbifacial			Prairie du Chien Chert (oolitic)	0%	heat treated	3 (<1/2"-1/4")	1.5		12/8/2014
33.5-6	2	XU 8	10-20	Lithic	debris	nonbifacial			Prairie du Chien Chert (oolitic)	>0-<50%		3 (<1/2"-1/4")	3.2		12/8/2014
33.7	1	XU 8	10-20	Lithic	debris	bifacial shaping			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.3		12/8/2014
33.8-9	2	XU 8	10-20	Lithic	debris	bifacial shaping			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.1		12/8/2014
33.1	1	XU 8	10-20	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	0%	heat treated	3 (<1/2"-1/4")	0.3		12/8/2014

21HE495 - Phase II Catalog

Prov #	Count	Location	Depth (cmbs)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
33.11	1	XU 8	10-20	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.3		12/8/2014
33	1	XU 8	10-20	Historic	glass	clear	bottle fragment					2 (<1"-1/2")	5		12/8/2014
34.1	1	XU 8	20-30	Lithic	debris	decortication			Prairie du Chien Chert (oolitic)	100%		3 (<1/2"-1/4")	1.5		12/8/2014
34.2	1	XU 8	20-30	Lithic	debris	nonbifacial			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	1.7		12/8/2014
34.3	1	XU 8	20-30	Lithic	debris	nonbifacial			Prairie du Chien Chert (oolitic)	>0-<50%		3 (<1/2"-1/4")	2		12/8/2014
34.4-7	4	XU 8	20-30	Lithic	debris	bifacial thinning			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	1.7		12/8/2014
34.8	1	XU 8	20-30	Lithic	debris	bifacial shaping			unidentified chert	0%		3 (<1/2"-1/4")	0.2		12/8/2014
34.9-10	2	XU 8	20-30	Lithic	debris	edge preparation			Grand Meadow Chert	0%		3 (<1/2"-1/4")	0.4		12/8/2014
34.11	1	XU 8	20-30	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.7		12/8/2014
34.12	1	XU 8	20-30	Lithic	fire-cracked rock	angular			granitic			1 (<2"-1")	22.6		12/8/2014
35.1	1	XU 8	30-40	Lithic	debris	nonbifacial			Red River Chert	>0-<50%		3 (<1/2"-1/4")	1.4		12/8/2014
35.2	1	XU 8	30-40	Lithic	debris	nonbifacial			Prairie du Chien Chert (oolitic)	>0-<50%		2 (<1"-1/2")	1.9		12/8/2014
35.3	1	XU 8	30-40	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.4		12/8/2014
35.4	1	XU 8	30-40	Lithic	debris	shatter			Prairie du Chien Chert (oolitic)	>0-<50%		2 (<1"-1/2")	4.2		12/8/2014
36.1	1	XU 9	10-20	Lithic	tool	patterned flake	side and end scraper	nonbifacial	Prairie du Chien Chert (oolitic)	>0-<50%		3 (<1/2"-1/4")	2.3		12/9/2014
36.2	1	XU 9	10-20	Lithic	debris	decortication			Jasper Taconite	50-<100%		2 (<1"-1/2")	6.5		12/9/2014
36.3	1	XU 9	10-20	Lithic	debris	nonbifacial			Prairie du Chien Chert (oolitic)	>0-<50%		3 (<1/2"-1/4")	0.6		12/9/2014

21HE495 - Phase II Catalog

Prov #	Count	Location	Depth (cmbs)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
36.4	1	XU 9	10-20	Lithic	debris	bifacial thinning			Knife River Flint	0%		3 (<1/2"-1/4")	0.2		12/9/2014
36.5-8	4	XU 9	10-20	Lithic	debris	bifacial thinning			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	1.9		12/9/2014
36.9	1	XU 9	10-20	Lithic	debris	bifacial thinning			Swan River Chert	0%	heat treated	3 (<1/2"-1/4")	0.5		12/9/2014
36.10-11	2	XU 9	10-20	Lithic	debris	bifacial shaping			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.1		12/9/2014
36.12	1	XU 9	10-20	Lithic	debris	bifacial thinning			Prairie du Chien Chert (oolitic)	0%	heat treated	3 (<1/2"-1/4")	0.2		12/9/2014
36.13	1	XU 9	10-20	Lithic	debris	edge preparation			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.2		12/9/2014
36.14	1	XU 9	10-20	Lithic	debris	broken flake			Gunflint Silica	0%		3 (<1/2"-1/4")	0.1		12/9/2014
36.15	1	XU 9	10-20	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.7		12/9/2014
36.16	1	XU 9	10-20	Lithic	debris	other G4 flake			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.1		12/9/2014
36.17	1	XU 9	10-20	Lithic	debris	other G4 flake			quartz	0%		4 (<1/4")	0.1		12/9/2014
36.18	1	XU 9	10-20	Lithic	debris	shatter			Red River Chert	50-<100%	heat treated	2 (<1"-1/2")	6.3		12/9/2014
37.1	1	XU 9	20-30	Lithic	debris	decortication			basaltic	100%		3 (<1/2"-1/4")	1.6		12/9/2014
37.2	1	XU 9	20-30	Lithic	debris	nonbifacial			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.9		12/9/2014
37.3	1	XU 9	20-30	Lithic	debris	bifacial shaping			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.2		12/9/2014
37.4	1	XU 9	20-30	Lithic	debris	bifacial thinning			Prairie du Chien Chert	0%		3 (<1/2"-1/4")	0.5		12/9/2014
37.5	1	XU 9	20-30	Lithic	debris	bifacial thinning			Prairie du Chien Chert (oolitic)	0%		2 (<1"-1/2")	0.9		12/9/2014
37.6	1	XU 9	20-30	Lithic	debris	broken flake			Grand Meadow Chert	>0-<50%		3 (<1/2"-1/4")	0.3		12/9/2014

21HE495 - Phase II Catalog

Prov #	Count	Location	Depth (cmbs)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
37.7	1	XU 9	20-30	Lithic	debris	other G4 flake			Red River Chert	0%		4 (<1/4")	0.2		12/9/2014
37.8	1	XU 9	20-30	Lithic	debris	other G4 flake			quartz	0%		4 (<1/4")	0.3		12/9/2014
37.9	1	XU 9	20-30	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	0%	heat treated	3 (<1/2"-1/4")	0.3		12/9/2014
37.1	1	XU 9	20-30	Lithic	debris	other G4 flake			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.1		12/9/2014
37.11	1	XU 9	20-30	Lithic	debris	shatter			Prairie du Chien Chert	50-<100%		2 (<1"-1/2")	4.6		12/9/2014
37.12-13	2	XU 9	20-30	Lithic	debris	shatter			Prairie du Chien Chert	50-<100%		3 (<1/2"-1/4")	3.3		12/9/2014
38.1	1	XU 9	30-40	Lithic	debris	decortication			Red River Chert	50-<100%		2 (<1"-1/2")	2.3		12/9/2014
38.2	1	XU 9	30-40	Lithic	debris	decortication			Prairie du Chien Chert (oolitic)	100%	heat treated	3 (<1/2"-1/4")	0.8		12/9/2014
38.3	1	XU 9	30-40	Lithic	tool	unpatterned flake	utilized flake	nonbifacial	Prairie du Chien Chert (oolitic)	>0-<50%	heat treated	2 (<1"-1/2")	5.2	finished, whole	12/9/2014
39.1	1	XU 10	10-20	Lithic	debris	decortication			Prairie du Chien Chert (oolitic)	50-<100%		2 (<1"-1/2")	3.5		12/9/2014
39.2	1	XU 10	10-20	Lithic	debris	edge preparation			unidentified chert	0%	probably heat treated	3 (<1/2"-1/4")	0.3		12/9/2014
40.1	1	XU 10	20-30	Lithic	core	bipolar (not rotated)			quartz	0%		2 (<1"-1/2")	5.8		12/9/2014
40.2	1	XU 10	20-30	Lithic	debris	bipolar flake			quartz	0%		3 (<1/2"-1/4")	1.1		12/9/2014
40	1	XU 10	20-30	Historic	metal	iron	nail, square					3 (<1/2"-1/4")	9.3		12/9/2014

21HE496 - Phase I Catalog

Phase	Prov#	Count	Location	Depth (cmbs)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
I	1.1	1	ST 16	190-200	Faunal	turtle	carapace	fragment	calcined				2 (<1"-1/2")	0.4	Beta	4/21/2016
I	2.1	1	ST 7SW5	260-290	Lithic	debris	decortication			Red River Chert	50-<100%		2 (<1"-1/2")	8.6		7/19/2016
I	3.1	1	ST 9W5	200-210	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.3		7/22/2016
I	4.1	1	ST 9N5	315-335	Lithic	debris	other G4 flake			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.1		7/20/2016
I	5.1	1	ST 16SW5	160-180	Lithic	debris	bifacial thinning			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.1		7/20/2016
I	5.2	1	ST 16SW5	160-180	Lithic	debris	other G4 flake			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.1		7/20/2016
I	6.1	1	ST 16SW5	315-330	Lithic	debris	nonbifacial			Gunflint Silica	100%		3 (<1/2"-1/4")	0.7		7/20/2016
I	7.1	1	ST 16SW5	330-340	Lithic	tool	unpatterned flake	utilized flake	broken	Swan River Chert	0%	heat treated	2 (<1"-1/2")	1.6	broken, distal	7/20/2016
I	900.0	1	ST 5	320-330	Lithic	fire-cracked rock	spall			granitic			1 (<2"-1")	23.5		4/20/2016
I	901.0	1	ST 13	255-265	Lithic	fire-cracked rock	angular			unidentified material			2 (<1"-1/2")	3.1		4/21/2016
I	902.0	1	ST 17	160-170	Lithic	fire-cracked rock	spall			granitic			2 (<1"-1/2")	7.9		4/20/2016
I	903.0	1	ST 16SW5	300-315	Lithic	fire-cracked rock	spall			basaltic			1 (<2"-1")	62.3		7/20/2016

21HE496 - Phase II Catalog

Phase	Prov#	Count	Location	Depth (cmbs)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
II	1.1	1	ST 5NW3	120-130	Lithic	debris	nonbifacial			basaltic	>0-<50%		2 (<1"-1/2")	2.8		8/15/2016
II	2.1	1	ST 5NW3	235-250	Lithic	debris	other G4 flake			unidentified chert	>0-<50%	burned	4 (<1/4")	0.2		8/15/2016
II	3.1	1	ST 5NW3	295-310	Lithic	debris	nonbifacial			basaltic	0%		1 (<2"-1")	47.1		8/15/2016
II	3.2	1	ST 5NW3	295-310	Lithic	debris	shatter			basaltic	0%		2 (<1"-1/2")	3.6		8/15/2016
II	4.1	1	ST 9NW7	140-150	Lithic	debris	other G4 flake			Prairie du Chien Chert (oolitic)	100%		4 (<1/4")	0		8/15/2016
II	5.1	1	ST 9NW7	190-200	Lithic	debris	nonbifacial			Swan River Chert	>0-<50%	heat treated	3 (<1/2"-1/4")	1.2		8/15/2016
II	6.1	1	ST 9NW7	205-220	Lithic	fire-cracked rock	spall			igneous			3 (<1/2"-1/4")	2.6		8/9/2016
II	7.1	1	ST 12S5	240-250	Lithic	debris	broken flake			basaltic	0%		3 (<1/2"-1/4")	0.2		8/9/2016
II	8.1	1	ST 16S3	80-90	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	>0-<50%		3 (<1/2"-1/4")	0.2		8/9/2016
II	9.1	1	ST 16S3	315-325	Lithic	debris	other G4 flake			Prairie du Chien Chert (oolitic)	50-<100%		4 (<1/4")	0.1		8/15/2016

21HE497 - Phase I Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
1	1	ST 21		20-30	Historic	organic	coal, clinker						2 (<1"-1/2")	4.1		4/21/2016
1.1	1	ST 21		20-30	Lithic	tool	patterned flake	side and end scraper	decortication	Prairie du Chien Chert	100%		2 (<1"-1/2")	4.3	finished, whole	4/21/2016
1.2-3	2	ST 21		20-30	Faunal	mammalian, medium/large	unidentifiable	fragment					3 (<1/2"-1/4")	1.5	refit	4/21/2016
2	1	ST 30		30-50	Historic	metal	aluminum	wire fragment					3 (<1/2"-1/4")	0.7		4/21/2016
2.1	1	ST 30		30-50	Lithic	debris	bifacial shaping			Grand Meadow Chert	0%		3 (<1/2"-1/4")	0.2		4/21/2016
3	1	ST 30		50-70	Lithic	fire-cracked rock	angular			quartzite			1 (<2"-1")	96		4/21/2016
3.1	1	ST 30		50-70	Lithic	debris	decortication			Grand Meadow Chert	0%		3 (<1/2"-1/4")	0.7		4/21/2016
4	1	ST 30		70-90	Lithic	fire-cracked rock	angular			unidentified material			2 (<1"-1/2")	22.3		4/21/2016
4	1	ST 30		70-90	Faunal	bivalve	unidentifiable	fragment					4 (<1/4")	0		4/21/2016
4.1	1	ST 30		70-90	Lithic	debris	bifacial shaping			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.1		4/21/2016
5.1	1	ST 30E5		60-70	Lithic	debris	bipolar flake			quartz	0%		3 (<1/2"-1/4")	1.4		4/22/2016
5.2	1	ST 30E5		60-70	Lithic	debris	bipolar flake			quartz	100%		2 (<1"-1/2")	2.7		4/22/2016
5.3	1	ST 30E5		60-70	Lithic	debris	nonbifacial			Swan River Chert	50-<100%	heat treated	3 (<1/2"-1/4")	1.2		4/22/2016
5.4	1	ST 30E5		60-70	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	>0-<50%		3 (<1/2"-1/4")	0.2		4/22/2016
6.1-2	2	ST 30E5		70-80	Lithic	debris	bipolar flake			Swan River Chert	0%	heat treated	3 (<1/2"-1/4")	2.2		4/22/2016
7.1	1	ST 30S5		80-90	Lithic	debris	nonbifacial			Prairie du Chien Chert	>0-<50%		3 (<1/2"-1/4")	0.2		4/22/2016
8.1	1	ST 30S5		95-105	Lithic	debris	broken flake			Grand Meadow Chert	0%	burned	3 (<1/2"-1/4")	0.1		4/22/2016

21HE497 - Phase I Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
9.1	1	ST 30S5		100-110	Lithic	debris	other G4 flake			quartz	0%		4 (<1/4")	0.1		4/22/2016
10.1	1	ST 30NE7		30-50	Lithic	tool	unpatterned flake	utilized flake	bifacial thinning	Swan River Chert	0%	heat treated	3 (<1/2"-1/4")	1.4	finished, whole	7/21/2016
10.2	1	ST 30NE7		30-50	Faunal	Odocoileus virginianus (white-tailed deer)	metacarpal, right	proximal fragment					2 (<1"-1/2")	4.6	Beta; refit	7/21/2016
10.3	1	ST 30NE7		30-50	Faunal	mammalian, large	longbone	shaft, fragment					3 (<1/2"-1/4")	2.4	Beta; refit	7/21/2016
10.4-8	5	ST 30NE7		30-50	Faunal	mammalian	unidentifiable	fragment	burned				3 (<1/2"-1/4")	1	Beta	7/21/2016
10.9	1	ST 30NE7		30-50	Faunal	Vertebrata	unidentifiable	fragment					4 (<1/4")	0.1	Beta	7/21/2016
11.1	1	ST 30NE7		50-80	Lithic	debris	nonbifacial			unidentified chert	>0-<50%	heat treated	2 (<1"-1/2")	6.4		7/21/2016
12.1	1	ST 31S5		120-130	Lithic	debris	broken flake			Galena Chert	0%		3 (<1/2"-1/4")	0.3		7/21/2016
13.1	1	ST 32E5		90-100	Lithic	debris	bifacial thinning			Swan River Chert	0%	heat treated	3 (<1/2"-1/4")	0.6		4/22/2016
14.1	1	ST 32S5		0-20	Lithic	debris	bifacial thinning			Prairie du Chien Chert (oolitic)	>0-<50%	heat treated	3 (<1/2"-1/4")	1.3		4/22/2016
15	1	ST 32S5		20-40	Lithic	fire-cracked rock	angular			granitic			1 (<2"-1")	41		4/22/2016
15	1	ST 32S5		20-40	Lithic	fire-cracked rock	angular			basaltic			2 (<1"-1/2")	14.2		4/22/2016
15.1	1	ST 32S5		20-40	Lithic	debris	bipolar flake			quartz	100%		3 (<1/2"-1/4")	2.1		4/22/2016
15.2	1	ST 32S5		20-40	Lithic	debris	bipolar flake			quartz	100%		4 (<1/4")	0.3		4/22/2016
15.3	1	ST 32S5		20-40	Lithic	debris	bipolar flake			metamorphic	100%		2 (<1"-1/2")	9.3		4/22/2016
15.4	1	ST 32S5		20-40	Lithic	debris	decortication			Red River Chert	100%		2 (<1"-1/2")	2.2		4/22/2016

21HE497 - Phase I Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
15.5	1	ST 32S5		20-40	Lithic	debris	other G4 flake			quartz	50-<100%		4 (<1/4")	0.3		4/22/2016
15.6	1	ST 32S5		20-40	Lithic	debris	broken flake			quartz	0%		3 (<1/2"-1/4")	0.4		4/22/2016
16.1	1	ST 34		40-50	Lithic	tool	patterned flake	side and end scraper	nonbifacial	Prairie du Chien Chert (oolitic)	>0-<50%		2 (<1"-1/2")	2.2	finished, whole	4/22/2016
901	1	ST 34W5		50-60	Lithic	fire-cracked rock	angular			granitic			1 (<2"-1")	213		7/21/2016
902	1	ST 34NW5		60-70	Lithic	fire-cracked rock	angular			quartzite			2 (<1"-1/2")	14.9		7/21/2016
902	1	ST 34NW5		60-70	Historic	organic	shell	button					3 (<1/2"-1/4")	0.6	with eye clasp	7/21/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
1.1	1	XU 1		40-50	Lithic	debris	broken flake			Prairie du Chien Chert	0%		3 (<1/2"-1/4")	0.8		8/10/2016
2.1	1	XU 1		50-60	Ceramic	body	grit temper	cord marked					3 (<1/2"-1/4")	0.6	3.5 mm	8/10/2016
2.2	1	XU 1		50-60	Faunal	Ondatra zibethicus	mandible, right	anterior, fragment					3 (<1/2"-1/4")	0.2		8/10/2016
2.3	1	XU 1		50-60	Lithic	debris	bifacial shaping			quartz	0%		3 (<1/2"-1/4")	0.2		8/10/2016
2.4-5	2	XU 1		50-60	Lithic	debris	bifacial shaping			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.3		8/10/2016
2.6	1	XU 1		50-60	Lithic	debris	other G4 flake			Grand Meadow Chert	0%		4 (<1/4")	0		8/10/2016
3	1	XU 1		60-70	Lithic	fire-cracked rock	spall			quartzite			1 (<2"-1")	12.2		8/11/2016
3.1	1	XU 1		60-70	Lithic	tool	unpatterned flake	utilized flake	decortication	basaltic	50-<100%		1 (<2"-1")	101	finished, whole	8/11/2016
3.2	1	XU 1		60-70	Lithic	debris	nonbifacial			quartz	100%		4 (<1/4")	0.1		8/11/2016
3.3	1	XU 1		60-70	Lithic	debris	bifacial shaping			unidentified chert	0%	probably heat treated	4 (<1/4")	0		8/11/2016
3.4	1	XU 1		60-70	Lithic	debris	other G4 flake			Prairie du Chien Chert	>0-<50%		3 (<1/2"-1/4")	0.3		8/11/2016
3.5	1	XU 1		60-70	Lithic	debris	shatter			quartz	100%		3 (<1/2"-1/4")	2		8/11/2016
3.6-7	2	XU 1		60-70	Faunal	Ondatra zibethicus	tooth, incisor	left fragment					4 (<1/4")	0.3	maxillary	8/11/2016
3.8	1	XU 1		60-70	Faunal	Ondatra zibethicus	femur, left	proximal fragment					4 (<1/4")	0.3		8/11/2016
3.9	1	XU 1		60-70	Faunal	Geomys bursarius (plains pocket gopher)	tooth, incisor	fragment					4 (<1/4")	0.2	maxillary	8/11/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
3.1	1	XU 1		60-70	Faunal	Geomys bursarius (plains pocket gopher)	tooth, cheek	fragment					4 (<1/4")	0.1		8/11/2016
3.11	1	XU 1		60-70	Faunal	mammalian, small	femur, right	shaft, fragment					4 (<1/4")	0.2		8/11/2016
3.12	1	XU 1		60-70	Faunal	Rodentia	tooth, incisor	fragment					4 (<1/4")	0.1		8/11/2016
3.13-19	7	XU 1		60-70	Faunal	Vertebrata	unidentifiable	fragment					4 (<1/4")	0.2		8/11/2016
4	1	XU 1		70-80	Faunal	molluscan	shell	fragment					3 (<1/2"-1/4")	29.6	@ 21 fragments	8/11/2016
4	1	XU 1		70-80	Faunal	molluscan	shell	fragment					4 (<1/4")	23.5	@390 small fragments	8/11/2016
4	1	XU 1		70-80	Lithic	fire-cracked rock	spall			unidentified material			2 (<1"-1/2")	10.2		8/11/2016
4	1	XU 1		70-80	Lithic	fire-cracked rock	spall			igneous			3 (<1/2"-1/4")	1.4		8/11/2016
4	1	XU 1		70-80	Lithic	fire-cracked rock	crumb			basaltic			3 (<1/2"-1/4")	0.2		8/11/2016
4	1	XU 1		70-80	Lithic	fire-cracked rock	angular			igneous			1 (<2"-1")	53		8/11/2016
4.1	1	XU 1		70-80	Ceramic	body	grit temper	cord marked		interior absent			3 (<1/2"-1/4")	0.8		8/11/2016
4.2-3	2	XU 1		70-80	Lithic	debris	decortication			quartz	100%		2 (<1"-1/2")	10.4		8/11/2016
4.4	1	XU 1		70-80	Lithic	debris	decortication			quartz	100%		3 (<1/2"-1/4")	1.8		8/11/2016
4.5	1	XU 1		70-80	Lithic	debris	decortication			Prairie du Chien Chert (oolitic)	50-<100%		2 (<1"-1/2")	4.5		8/11/2016
4.6	1	XU 1		70-80	Lithic	debris	nonbifacial			Prairie du Chien Chert (oolitic)	50-<100%		3 (<1/2"-1/4")	0.7		8/11/2016
4.7-8	2	XU 1		70-80	Lithic	debris	nonbifacial			quartz	50-<100%		3 (<1/2"-1/4")	2.9		8/11/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
4.9	1	XU 1		70-80	Lithic	debris	bifacial shaping			Knife River Flint	0%		3 (<1/2"-1/4")	0.1		8/11/2016
4.1	1	XU 1		70-80	Lithic	debris	bifacial shaping			Prairie du Chien Chert	0%		4 (<1/4")	0.1		8/11/2016
4.11	1	XU 1		70-80	Lithic	debris	bifacial thinning			Prairie du Chien Chert (oolitic)	0%	heat treated	3 (<1/2"-1/4")	0.9		8/11/2016
4.12	1	XU 1		70-80	Lithic	debris	bifacial thinning			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.4		8/11/2016
4.13-14	2	XU 1		70-80	Lithic	debris	broken flake			quartz	100%		3 (<1/2"-1/4")	0.4		8/11/2016
4.15-17	3	XU 1		70-80	Lithic	debris	broken flake			quartz	0%		3 (<1/2"-1/4")	1		8/11/2016
4.18	1	XU 1		70-80	Lithic	debris	other G4 flake			quartz	0%		4 (<1/4")	0.2		8/11/2016
4.19	1	XU 1		70-80	Lithic	debris	other G4 flake			Prairie du Chien Chert	0%		4 (<1/4")	0.1		8/11/2016
4.2	1	XU 1		70-80	Lithic	debris	other G4 flake			unidentified chert	0%		4 (<1/4")	0		8/11/2016
4.21	1	XU 1		70-80	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	100%		3 (<1/2"-1/4")	0.1		8/11/2016
4.22-23	2	XU 1		70-80	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.5		8/11/2016
4.24-25	2	XU 1		70-80	Lithic	debris	other G4 flake			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.1		8/11/2016
4.26	1	XU 1		70-80	Lithic	debris	shatter			quartz	>0-<50%		2 (<1"-1/2")	2.4		8/11/2016
4.27-28	2	XU 1		70-80	Faunal	Vertebrata	unidentifiable	fragment	calcined				4 (<1/4")	0.2		8/11/2016
5	1	XU 1		80-90	Faunal	molluscan	valve, left	fragment					3 (<1/2"-1/4")	23.5		8/12/2016
5	1	XU 1		80-90	Faunal	molluscan	shell	fragment					4 (<1/4")	17.2	@ 470 fragments	8/12/2016
5	1	XU 1		80-90	Faunal	molluscan	shell	fragment					3 (<1/2"-1/4")	0.2		8/12/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
5	1	XU 1		80-90	Lithic	fire-cracked rock	spall			basaltic			2 (<1"-1/2")	5.9		8/12/2016
5.1	1	XU 1		80-90	Lithic	tool	cobble	manuport		metamorphic	50-<100%		1 (<2"-1")	610	unknown function; possibly modified by flaking	8/12/2016
5.2	1	XU 1		80-90	Ceramic	body	grit temper	cord marked					2 (<1"-1/2")	4	6.3 mm	8/12/2016
5.3	1	XU 1		80-90	Ceramic	body	grit temper	cord marked					3 (<1/2"-1/4")	1.4	6.4 mm	8/12/2016
5.4	1	XU 1		80-90	Lithic	tool	unpatterned flake	utilized flake	broken	Red River Chert	0%		4 (<1/4")	0.2	finished, whole	8/12/2016
5.5	1	XU 1		80-90	Lithic	tool	unpatterned flake	utilized flake	bifacial thinning	Prairie du Chien Chert (oolitic)	>0-<50%		3 (<1/2"-1/4")	0.4	broken, distal	8/12/2016
5.6	1	XU 1		80-90	Lithic	debris	decortication			unidentified material	100%		3 (<1/2"-1/4")	1.8		8/12/2016
5.7	1	XU 1		80-90	Lithic	debris	nonbifacial			Prairie du Chien Chert (oolitic)	>0-<50%		3 (<1/2"-1/4")	0.3		8/12/2016
5.8	1	XU 1		80-90	Lithic	debris	bifacial thinning			Prairie du Chien Chert (oolitic)	0%	heat treated	3 (<1/2"-1/4")	0.3		8/12/2016
5.9-10	2	XU 1		80-90	Lithic	debris	bifacial thinning			unidentified chert	0%	probably heat treated	3 (<1/2"-1/4")	0.3		8/12/2016
5.11-12	2	XU 1		80-90	Lithic	debris	bifacial shaping			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.2		8/12/2016
5.13-14	2	XU 1		80-90	Lithic	debris	bifacial shaping			quartz	0%		4 (<1/4")	0.2		8/12/2016
5.15	1	XU 1		80-90	Lithic	debris	potlid flake			unidentified chert	100%	burned	3 (<1/2"-1/4")	1.3		8/12/2016
5.16	1	XU 1		80-90	Lithic	debris	other G4 flake			unidentified material	>0-<50%		4 (<1/4")	0.4		8/12/2016
5.17	1	XU 1		80-90	Lithic	debris	other G4 flake			unidentified material	0%		4 (<1/4")	0.2		8/12/2016

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
6	1	XU 1		90-100	Lithic	fire-cracked rock	cobble (friable)			granitic			1 (<2"-1")	102		8/12/2016
6	2	XU 1		90-100	Lithic	fire-cracked rock	crumb			granitic			3 (<1/2"-1/4")	2.4		8/12/2016
6	1	XU 1		90-100	Lithic	fire-cracked rock	spall			basaltic			1 (<2"-1")	21.6		8/12/2016
6	1	XU 1		90-100	Lithic	fire-cracked rock	angular			igneous			2 (<1"-1/2")	24		8/12/2016
6.1	1	XU 1		90-100	Lithic	debris	decortication			quartz	100%		2 (<1"-1/2")	7.8		8/12/2016
6.2	1	XU 1		90-100	Lithic	debris	bifacial shaping			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.1		8/12/2016
6.3	1	XU 1		90-100	Lithic	debris	bifacial shaping			Prairie du Chien Chert	0%		3 (<1/2"-1/4")	0.2		8/12/2016
6.4	1	XU 1		90-100	Lithic	debris	bifacial thinning			Grand Meadow Chert	>0-<50%		3 (<1/2"-1/4")	0.2		8/12/2016
6.5	1	XU 1		90-100	Lithic	debris	bifacial thinning			unidentified chert	0%		4 (<1/4")	0.1		8/12/2016
6.6	1	XU 1		90-100	Lithic	debris	bifacial thinning			Prairie du Chien Chert (oolitic)	0%	heat treated	3 (<1/2"-1/4")	0.4		8/12/2016
6.7-8	2	XU 1		90-100	Lithic	debris	bifacial thinning			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.4		8/12/2016
6.9	1	XU 1		90-100	Lithic	debris	bifacial thinning			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.1		8/12/2016
6.1	1	XU 1		90-100	Lithic	debris	edge preparation			Prairie du Chien Chert (oolitic)	0%	heat treated	4 (<1/4")	0.1		8/12/2016
6.11	1	XU 1		90-100	Lithic	debris	edge preparation			Swan River Chert	0%	heat treated	3 (<1/2"-1/4")	0.2		8/12/2016
6.12	1	XU 1		90-100	Lithic	debris	other G4 flake			Swan River Chert	0%	heat treated	4 (<1/4")	0.1		8/12/2016
6.13-15	3	XU 1		90-100	Lithic	debris	other G4 flake			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.1		8/12/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
6.16-17	2	XU 1		90-100	Lithic	debris	other G4 flake			Prairie du Chien Chert (oolitic)	100%		4 (<1/4")	0.2		8/12/2016
6.18	1	XU 1		90-100	Lithic	debris	shatter			quartz	50-<100%		2 (<1"-1/2")	4.6		8/12/2016
7.1	1	XU 1		100-110	Ceramic	body	grit temper	cord marked					2 (<1"-1/2")	6.4	7.3 mm	8/12/2016
8	2	XU 1		100-110	Lithic	fire-cracked rock	spall			basaltic			2 (<1"-1/2")	27.4		8/12/2016
8	1	XU 1		100-110	Lithic	fire-cracked rock	spall			basaltic			3 (<1/2"-1/4")	5.5		8/12/2016
8	1	XU 1		100-110	Lithic	fire-cracked rock	spall			granitic			1 (<2"-1")	56		8/12/2016
8.1	1	XU 1		100-110	Lithic	debris	edge preparation			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.2		8/12/2016
8.2	1	XU 1		100-110	Lithic	debris	edge preparation			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.1		8/12/2016
9.1	1	XU 1		110-120	Lithic	debris	bifacial thinning			Grand Meadow Chert	>0-<50%		3 (<1/2"-1/4")	0.3		8/17/2016
10.1	1	XU 2		40-50	Faunal	mammalian, medium/large	longbone	shaft, fragment					3 (<1/2"-1/4")	0.2		8/10/2016
11.1	1	XU 2		50-60	Ceramic	body	grit temper	cord marked					3 (<1/2"-1/4")	0.3	2.6 mm	8/11/2016
11.2	1	XU 2		50-60	Lithic	debris	bifacial thinning			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.9		8/11/2016
11.3	1	XU 2		50-60	Lithic	debris	bifacial shaping			unidentified chert	0%		4 (<1/4")	0.1		8/11/2016
11.4	1	XU 2		50-60	Lithic	debris	other G4 flake			quartzite	>0-<50%		3 (<1/2"-1/4")	0.2		8/11/2016
12	1	XU 2		60-70	Lithic	fire-cracked rock	spall			metamorphic			2 (<1"-1/2")	3.6		8/11/2016
12	1	XU 2		60-70	Lithic	fire-cracked rock	angular			granitic			2 (<1"-1/2")	22.4		8/11/2016

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
12.1-3	3	XU 2		60-70	Ceramic	body	grit temper	cord marked					3 (<1/2"-1/4")	12.5	some sherds woven fabric impressed; 4.9, 4.2 & 4.3 mm	8/11/2016
12.4-8	5	XU 2		60-70	Ceramic	body	grit temper	cord marked					4 (<1/4")	2.2	some sherds woven fabric impressed; 3.7, 2.9, 3.5, 3.1, & 3.0 mm	8/11/2016
12.9	1	XU 2		60-70	Lithic	tool	unpatterned flake (unifacial retouch)	retouched flake	decortication	Prairie du Chien Chert (oolitic)	50-<100%		2 (<1"-1/2")	3.9	finished, whole	8/11/2016
12.1	1	XU 2		60-70	Lithic	debris	bipolar flake			quartz	50-<100%		3 (<1/2"-1/4")	0.7		8/11/2016
12.11	1	XU 2		60-70	Lithic	debris	bipolar flake			quartz	50-<100%		4 (<1/4")	0.3		8/11/2016
12.12-13	2	XU 2		60-70	Lithic	debris	bipolar flake			quartz	0%		3 (<1/2"-1/4")	3.3		8/11/2016
12.14	1	XU 2		60-70	Lithic	debris	bipolar flake			Gunflint Silica	>0-<50%		3 (<1/2"-1/4")	1.3		8/11/2016
12.15	1	XU 2		60-70	Lithic	debris	nonbifacial			quartzite	>0-<50%		3 (<1/2"-1/4")	1.9		8/11/2016
12.16	1	XU 2		60-70	Lithic	debris	nonbifacial			quartz	50-<100%		3 (<1/2"-1/4")	0.4		8/11/2016
12.17-18	2	XU 2		60-70	Lithic	debris	nonbifacial			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	2.1		8/11/2016
12.19-23	5	XU 2		60-70	Lithic	debris	bifacial shaping			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.4		8/11/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
12.24-25	2	XU 2		60-70	Lithic	debris	bifacial shaping			unidentified chert	0%		4 (<1/4")	0.2		8/11/2016
12.26	1	XU 2		60-70	Lithic	debris	unidentified			Swan River Chert	0%	heat treated	3 (<1/2"-1/4")	0.8		8/11/2016
12.27	1	XU 2		60-70	Lithic	debris	broken flake			Swan River Chert	50-<100%	heat treated	3 (<1/2"-1/4")	1.7		8/11/2016
12.28	1	XU 2		60-70	Lithic	debris	broken flake			quartz	0%		3 (<1/2"-1/4")	1.6		8/11/2016
12.29	1	XU 2		60-70	Lithic	debris	other G4 flake			unidentified chert	0%		4 (<1/4")	0.1		8/11/2016
13	1	XU 2		70-80	Lithic	fire-cracked rock	spall			quartzite			2 (<1"-1/2")	1.7		8/12/2016
13.1	1	XU 2		70-80	Ceramic	body	grit temper	cord marked					2 (<1"-1/2")	1.1	3.5 mm	8/12/2016
13.2-3	2	XU 2		70-80	Ceramic	body	grit temper	cord marked					3 (<1/2"-1/4")	0.6	3.4 & 3.3 mm	8/12/2016
13.4	1	XU 2		70-80	Lithic	tool	patterned flake	end scraper	nonbifacial	Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	4.4	broken by bipolar percussion	8/12/2016
13.5	1	XU 2		70-80	Lithic	debris	decortication			quartz	100%		2 (<1"-1/2")	14.1		8/12/2016
13.6	1	XU 2		70-80	Lithic	debris	nonbifacial			unidentified chert	0%	burned	2 (<1"-1/2")	3		8/12/2016
13.7	1	XU 2		70-80	Lithic	debris	bifacial thinning			Red River Chert	0%		3 (<1/2"-1/4")	0.7		8/12/2016
13.8	1	XU 2		70-80	Lithic	debris	bifacial thinning			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.4		8/12/2016
13.9	1	XU 2		70-80	Lithic	debris	bifacial thinning			Grand Meadow Chert	>0-<50%		3 (<1/2"-1/4")	0.5		8/12/2016
13.1	1	XU 2		70-80	Lithic	debris	edge preparation			Prairie du Chien Chert (oolitic)	>0-<50%		3 (<1/2"-1/4")	0.2		8/12/2016
13.11	1	XU 2		70-80	Lithic	debris	edge preparation			Prairie du Chien Chert (oolitic)	>0-<50%		4 (<1/4")	0.1		8/12/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
13.12	1	XU 2		70-80	Lithic	debris	other G4 flake			Swan River Chert	0%		4 (<1/4")	0.1		8/12/2016
13.13	1	XU 2		70-80	Lithic	debris	broken flake			quartz	0%		3 (<1/2"-1/4")	0.3		8/12/2016
13.14	1	XU 2		70-80	Lithic	debris	broken flake			Prairie du Chien Chert	0%		3 (<1/2"-1/4")	0.7		8/12/2016
13.15	1	XU 2		70-80	Lithic	debris	other G4 flake			unidentified chert	0%	burned	3 (<1/2"-1/4")	0.3		8/12/2016
14	2	XU 2		80-90	Lithic	fire-cracked rock	spall			basaltic			2 (<1"-1/2")	5.1		8/12/2016
14	1	XU 2		80-90	Lithic	fire-cracked rock	spall			granitic			2 (<1"-1/2")	13.7		8/12/2016
14	1	XU 2		80-90	Lithic	fire-cracked rock	angular			basaltic			2 (<1"-1/2")	11.8		8/12/2016
14.1	1	XU 2		80-90	Lithic	debris	bipolar flake			quartz	0%		3 (<1/2"-1/4")	0.5		8/12/2016
14.2	1	XU 2		80-90	Lithic	debris	bifacial thinning			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	1.2		8/12/2016
14.3	1	XU 2		80-90	Lithic	debris	bifacial shaping			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.2		8/12/2016
14.4-5	2	XU 2		80-90	Lithic	debris	other G4 flake			Prairie du Chien Chert	0%		4 (<1/4")	0.2		8/12/2016
14.6	1	XU 2		80-90	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.4		8/12/2016
14.7	1	XU 2		80-90	Lithic	debris	other G4 flake			quartzite	100%		4 (<1/4")	0.2		8/12/2016
14.8	1	XU 2		80-90	Lithic	debris	shatter			quartz	>0-<50%		3 (<1/2"-1/4")	0.7		8/12/2016
15.1	1	XU 2		90-100	Lithic	debris	bifacial thinning			Grand Meadow Chert	>0-<50%	heat treated	3 (<1/2"-1/4")	1.2		8/12/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
16.1	1	XU 3		40-50	Ceramic	neck	grit temper	cord marked	punctate			Madison	2 (<1"-1/2")	2	rows of triangular punctate; Madison punctate; 5.8 mm	8/6/2016
16.2-5	4	XU 3		40-50	Ceramic	body	grit temper	cord marked					3 (<1/2"-1/4")	3.6	woven fabric impressions; 4.1, 3.9, 3.8, & 3.8 mm	8/6/2016
16.6	1	XU 3		40-50	Ceramic	body	grit temper	cord marked		interior absent			3 (<1/2"-1/4")	0.3		8/6/2016
16.7	1	XU 3		40-50	Ceramic	body	grit temper	cord marked					2 (<1"-1/2")	2.8	interior has cordmarked surafce; exterior has smoothed over cordmarked surface; 5.8 mm	8/6/2016
16.8	1	XU 3		40-50	Lithic	debris	bipolar flake			Gunflint Silica	0%		3 (<1/2"-1/4")	2.1		8/6/2016
16.9	1	XU 3		40-50	Lithic	debris	bifacial thinning			Swan River Chert	0%	probably heat treated	3 (<1/2"-1/4")	0.3		8/6/2016
16.1	1	XU 3		40-50	Lithic	debris	bifacial thinning			Grand Meadow Chert	>0-<50%		3 (<1/2"-1/4")	0.7		8/6/2016
16.11	1	XU 3		40-50	Lithic	debris	other G4 flake			Grand Meadow Chert	0%		4 (<1/4")	0.1		8/6/2016
17	1	XU 3		50-60	Lithic	fire-cracked rock	angular			quartzite			3 (<1/2"-1/4")	4.4		8/11/2016

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
17	1	XU 3		50-60	Lithic	fire-cracked rock	angular			granitic			2 (<1"-1/2")	9.1		8/11/2016
17	1	XU 3		50-60	Lithic	fire-cracked rock	angular			unidentified material			2 (<1"-1/2")	3.6		8/11/2016
17	1	XU 3		50-60	Lithic	fire-cracked rock	spall			granitic			1 (<2"-1")	130		8/11/2016
17	2	XU 3		50-60	Lithic	fire-cracked rock	spall			igneous			2 (<1"-1/2")	10.3		8/11/2016
17	2	XU 3		50-60	Lithic	fire-cracked rock	spall			igneous			3 (<1/2"-1/4")	3.5		8/11/2016
17	1	XU 3		50-60	Lithic	fire-cracked rock	spall			basaltic			1 (<2"-1")	109		8/11/2016
17	1	XU 3		50-60	Lithic	fire-cracked rock	angular/spall			basaltic			2 (<1"-1/2")	9.8		8/11/2016
17	2	XU 3		50-60	Lithic	fire-cracked rock	angular/spall			basaltic			3 (<1/2"-1/4")	3.5		8/11/2016
17	2	XU 3		50-60	Lithic	fire-cracked rock	angular			igneous			1 (<2"-1")	53.4		8/11/2016
17.1-2	2	XU 3		50-60	Faunal	turtle	carapace/plastron	fragment	calcined				4 (<1/4")	0.1		8/11/2016
17.3	1	XU 3		50-60	Lithic	debris	other G4 flake			unidentified chert	0%		4 (<1/4")	0.1		8/11/2016
17.4	1	XU 3		50-60	Ceramic	body	grit temper	cord marked					2 (<1"-1/2")	3.9	interior has cordmarked surafce; exterior has smoothed over cordmarked surface; 5.7 mm	8/11/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
17.5	1	XU 3		50-60	Ceramic	neck	grit temper	cord marked	punctate			Madison	2 (<1"-1/2")	2.1	triangular punctate; Madison punctate; 5.0 mm	8/11/2016
17.6	1	XU 3		50-60	Ceramic	neck	grit temper	cord marked				Madison	3 (<1/2"-1/4")	1.6	triangular punctate; Madison punctate; 4.9 mm	8/11/2016
17.7-12	6	XU 3		50-60	Ceramic	body	grit temper	cord marked		interior absent			3 (<1/2"-1/4")	3.3	most have woven fabric impressions	8/11/2016
17.13	1	XU 3		50-60	Ceramic	body	grit temper	undetermined		exterior absent			2 (<1"-1/2")	1.1		8/11/2016
17.14-17	4	XU 3		50-60	Ceramic	body	grit temper	undetermined		exterior absent			3 (<1/2"-1/4")	3		8/11/2016
17.18	1	XU 3		50-60	Ceramic	body	grit temper	undetermined		exterior absent			4 (<1/4")	0.1		8/11/2016
17.19-25	7	XU 3		50-60	Ceramic	body	grit temper	cord marked					2 (<1"-1/2")	19.4	most have woven fabric impressions; 5.1, 5.0, 4.3, 3.5, 4.5, 3.8, & 3.6 mm	8/11/2016

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
17.26-41	16	XU 3		50-60	Ceramic	body	grit temper	cord marked					3 (<1/2"-1/4")	15.1	most have woven fabric impressions; 3.4, 3.5, 3.3, 3.1, 3.7, 3.9, 3.9, 3.8, 3.5, 3.7, 3.5, 3.8, 3.8, 3.5, 3.2, & 3.8 mm	8/11/2016
17.42	1	XU 3		50-60	Lithic	debris	decortication			Prairie du Chien Chert (oolitic)	100%	heat treated	2 (<1"-1/2")	4.2		8/11/2016
17.43	1	XU 3		50-60	Lithic	debris	bifacial thinning			Grand Meadow Chert	0%		3 (<1/2"-1/4")	0.7		8/11/2016
17.44	1	XU 3		50-60	Lithic	debris	bifacial thinning			unidentified chert	0%		3 (<1/2"-1/4")	0.4		8/11/2016
17.45-46	2	XU 3		50-60	Lithic	debris	other G4 flake			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.2		8/11/2016
17.47	1	XU 3		50-60	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	>0-<50%		3 (<1/2"-1/4")	1		8/11/2016
17.48	1	XU 3		50-60	Lithic	debris	other G4 flake			quartz	0%		4 (<1/4")	0.1		8/11/2016
17.49	1	XU 3		50-60	Faunal	mammalian, medium/large	longbone	shaft, fragment					3 (<1/2"-1/4")	0.8	Beta	8/11/2016
17.5	1	XU 3		50-60	Ceramic	neck	grit temper	cord marked	punctate			Madison	2 (<1"-1/2")	4.2	semi-circular punctates on exterior; Madsion Punctate; 5.1 mm	8/11/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
17.51	1	XU 3		50-60	Ceramic	rim	grit temper	cord marked	punctate			Madison	2 (<1"-1/2")	6.5	exterior has smoothed over cordmarking & interior is cordmarked; semi-circular punctates on interior; Madsion Punctate; 5.8 mm	8/11/2016
17.52	1	XU 3		50-60	Ceramic	neck	grit temper	cord marked	punctate			Madison	2 (<1"-1/2")	5.4	rows or triangular punctate; Madison Punctate; 5.3 mm	8/11/2016
18	1	XU 3		60-70	Lithic	fire-cracked rock	angular			unidentified material			2 (<1"-1/2")	6.6		8/11/2016
18.1	1	XU 3		60-70	Ceramic	body	grit temper	cord marked			residue present		3 (<1/2"-1/4")	1.1	4.0 mm	8/11/2016
18.2	1	XU 3		60-70	Ceramic	body	grit temper	cord marked					2 (<1"-1/2")	2.2	5.7 mm	8/11/2016
18.3-4	2	XU 3		60-70	Ceramic	body	grit temper	cord marked					3 (<1/2"-1/4")	1.6	5.6 & 3.9 mm	8/11/2016
18.5-6	2	XU 3		60-70	Lithic	tool	unpatterned flake	utilized flake	bifacial thinning	Grand Meadow Chert	>0-<50%		2 (<1"-1/2")	4.6	finished, whole	8/11/2016
18.7	1	XU 3		60-70	Lithic	debris	decortication			quartz	100%		2 (<1"-1/2")	13.2		8/11/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
18.8	1	XU 3		60-70	Lithic	debris	nonbifacial			quartz	>0-<50%		3 (<1/2"-1/4")	0.4		8/11/2016
18.9	1	XU 3		60-70	Lithic	debris	nonbifacial			quartzite	50-<100%		3 (<1/2"-1/4")	0.3		8/11/2016
18.1	1	XU 3		60-70	Lithic	debris	broken flake			Red River Chert	>0-<50%		3 (<1/2"-1/4")	0.4		8/11/2016
18.11	1	XU 3		60-70	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	50-<100%		3 (<1/2"-1/4")	0.2		8/11/2016
18.12	1	XU 3		60-70	Lithic	debris	broken flake			quartz	0%		3 (<1/2"-1/4")	0.4		8/11/2016
18.13-14	2	XU 3		60-70	Lithic	debris	other G4 flake			quartz	0%		4 (<1/4")	0.2		8/11/2016
19	1	XU 3		70-80	Faunal	molluscan	shell	fragment					3 (<1/2"-1/4")	2.2		8/11/2016
19.1	1	XU 3		70-80	Lithic	debris	bifacial shaping			Prairie du Chien Chert	0%		3 (<1/2"-1/4")	0.1		8/11/2016
20.1	1	XU 4		30-40	Lithic	debris	broken flake			quartz	>0-<50%		2 (<1"-1/2")	2.4		8/10/2016
20.2	1	XU 4		30-40	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.6		8/10/2016
20.3	1	XU 4		30-40	Ceramic	body	grit temper	cord marked					3 (<1/2"-1/4")	1	woven fabric impressions; 4.4 mm	8/10/2016
21	1	XU 4		40-50	Lithic	fire-cracked rock	spall			basaltic			3 (<1/2"-1/4")	0.9		8/10/2016
21	1	XU 4		40-50	Lithic	fire-cracked rock	angular			basaltic			2 (<1"-1/2")	6.5		8/10/2016
21.1	1	XU 4		40-50	Lithic	tool	unpatterned cobble	hammerstone		granitic	100%		1 (<2"-1")	383	finished, whole	8/10/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
21.2-3	2	XU 4		40-50	Lithic	tool	unmodified	nonutilitarian		basaltic	100%		1 (<2"-1")	73.6	whole; 2 nearly identical round stones; function uncertain, perhaps symbolic	8/10/2016
21.4	1	XU 4		40-50	Lithic	tool	unpatterned flake	utilized flake	bifacial thinning	Grand Meadow Chert	>0-<50%		3 (<1/2"-1/4")	1.5	finished, whole	8/10/2016
21.5	1	XU 4		40-50	Lithic	debris	bifacial thinning			Grand Meadow Chert	>0-<50%		2 (<1"-1/2")	2.7		8/10/2016
21.6	1	XU 4		40-50	Lithic	debris	other G4 flake			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.2		8/10/2016
21.7	1	XU 4		40-50	Lithic	debris	other G4 flake			Lake of the Woods Rhyolite	0%		4 (<1/4")	0.1		8/10/2016
21.8-9	2	XU 4		40-50	Ceramic	body	grit temper	cord marked		interior absent			3 (<1/2"-1/4")	0.4		8/10/2016
21.1	1	XU 4		40-50	Faunal	mammalian	unidentifiable	fragment					3 (<1/2"-1/4")	0.2		8/10/2016
21.11	1	XU 4		40-50	Lithic	tool	patterned flake (bifacial retouch)	projectile point	unidentified	Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.6	small side-notched type; finished, whole	8/10/2016
22	3	XU 4		50-60	Lithic	fire-cracked rock	angular/spall			igneous			2 (<1"-1/2")	16.2		8/11/2016
22	1	XU 4		50-60	Lithic	fire-cracked rock	angular/spall			granitic			3 (<1/2"-1/4")	3.3		8/11/2016
22	1	XU 4		50-60	Lithic	fire-cracked rock	spall			granitic			1 (<2"-1")	145		8/11/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
22.1	1	XU 4		50-60	Lithic	debris	other G4 flake			unidentified chert	>0-<50%	burned	4 (<1/4")	0.3		8/11/2016
22.2	1	XU 4		50-60	Lithic	tool	patterned bifacial	projectile point		Burlington Chert	0%	probably heat treated	2 (<1"-1/2")	1.7	broken; blade fragment	8/11/2016
22.3	1	XU 4		50-60	Lithic	debris	decortication			quartzite	100%		3 (<1/2"-1/4")	1.2		8/11/2016
22.4	1	XU 4		50-60	Lithic	debris	unidentified			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.6		8/11/2016
22.5	1	XU 4		50-60	Faunal	mammalian, medium/large	unidentifiable	fragment	calcined				3 (<1/2"-1/4")	0.3	Beta	8/11/2016
22.6	1	XU 4		50-60	Lithic	tool	patterned bifacial	projectile point		Swan River Chert	0%	heat treated	2 (<1"-1/2")	5	stemmed point; tip and stem broken; probable Waubesa type	8/11/2016
22.7	1	XU 4		50-60	Lithic	tool	patterned flake (bifacial retouch)	projectile point	unidentified	unidentified chert	0%	probably heat treated	3 (<1/2"-1/4")	0.9	small side-notched type; finished, whole	8/11/2016
23.1	1	XU 4		60-70	Lithic	debris	shatter			Grand Meadow Chert	0%		2 (<1"-1/2")	1.7		8/11/2016
23.2	1	XU 4		60-70	Lithic	debris	broken flake			quartz	0%		2 (<1"-1/2")	1		8/11/2016
24	1	XU 5		0-10	Historic	metal	iron	nail, wire					4 (<1/4")	1.4		8/16/2016
24	1	XU 5		0-10	Historic	metal	iron	unidentified					3 (<1/2"-1/4")	1.1		8/16/2016
24	1	XU 5		0-10	Historic	composite		unidentified					3 (<1/2"-1/4")	0.7		8/16/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
24.1	1	XU 5		0-10	Lithic	debris	bipolar flake			Red River Chert	50-<100%		3 (<1/2"-1/4")	2.5		8/16/2016
24.2	1	XU 5		0-10	Lithic	debris	nonbifacial			Prairie du Chien Chert (oolitic)	>0-<50%		2 (<1"-1/2")	8.4		8/16/2016
24.3	1	XU 5		0-10	Lithic	debris	bifacial thinning			Grand Meadow Chert	>0-<50%		2 (<1"-1/2")	3.9		8/16/2016
24.4	1	XU 5		0-10	Lithic	debris	broken flake			Swan River Chert	0%	heat treated	3 (<1/2"-1/4")	0.7		8/16/2016
25	1	XU 5		10-20	Faunal	molluscan	shell	fragment					3 (<1/2"-1/4")	3.1		8/16/2016
25	1	XU 5		10-20	Historic	glass	clear	window fragment					3 (<1/2"-1/4")	1.4		8/16/2016
25	1	XU 5		10-20	Historic	metal	iron	nail, wire					3 (<1/2"-1/4")	5		8/16/2016
25	2	XU 5		10-20	Lithic	fire-cracked rock	angular			granitic			1 (<2"-1")	47.8		8/16/2016
25	1	XU 5		10-20	Lithic	fire-cracked rock	angular			granitic			2 (<1"-1/2")	13.8		8/16/2016
25	1	XU 5		10-20	Lithic	fire-cracked rock	angular			unidentified material			1 (<2"-1")	53.2		8/16/2016
25	1	XU 5		10-20	Lithic	fire-cracked rock	spall			metamorphic			1 (<2"-1")	20.6		8/16/2016
25	1	XU 5		10-20	Lithic	fire-cracked rock	spall			metamorphic			3 (<1/2"-1/4")	3.3		8/16/2016
25	1	XU 5		10-20	Lithic	fire-cracked rock	spall			granitic			2 (<1"-1/2")	8.7		8/16/2016
25	1	XU 5		10-20	Lithic	fire-cracked rock	spall			basaltic			2 (<1"-1/2")	13.3		8/16/2016
25.1	1	XU 5		10-20	Lithic	debris	potlid flake			unidentified chert	100%	burned	3 (<1/2"-1/4")	0.4		8/16/2016
25.2	1	XU 5		10-20	Lithic	debris	shatter			quartz	>0-<50%		2 (<1"-1/2")	6.5		8/16/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
26	1	XU 6		0-10	Lithic	fire-cracked rock	spall			metamorphic			3 (<1/2"-1/4")	1.8		8/16/2016
26	1	XU 6		0-10	Lithic	fire-cracked rock	spall			granitic			2 (<1"-1/2")	25.9		8/16/2016
26	1	XU 6		0-10	Lithic	fire-cracked rock	angular			granitic			2 (<1"-1/2")	10		8/16/2016
26.1	1	XU 6		0-10	Lithic	debris	broken flake			quartzite	0%		2 (<1"-1/2")	1.9		8/16/2016
27	1	XU 6		10-20	Lithic	fire-cracked rock	angular			granitic			1 (<2"-1")	273		8/16/2016
27	3	XU 6		10-20	Lithic	fire-cracked rock	spall			unidentified material			3 (<1/2"-1/4")	2.9		8/16/2016
27	1	XU 6		10-20	Lithic	fire-cracked rock	spall			basaltic			2 (<1"-1/2")	6.1		8/16/2016
27	2	XU 6		10-20	Lithic	fire-cracked rock	spall			granitic			2 (<1"-1/2")	24.7		8/16/2016
27	1	XU 6		10-20	Lithic	fire-cracked rock	spall			quartzite			3 (<1/2"-1/4")	1.8		8/16/2016
27	1	XU 6		10-20	Lithic	fire-cracked rock	angular/spall			granitic			1 (<2"-1")	74		8/16/2016
27	1	XU 6		10-20	Lithic	fire-cracked rock	cobble with spall			granitic			1 (<2"-1")	234		8/16/2016
27	1	XU 6		10-20	Lithic	fire-cracked rock	cobble with spall			basaltic			1 (<2"-1")	199		8/16/2016
27.1	1	XU 6		10-20	Lithic	debris	nonbifacial			Grand Meadow Chert	50-<100%		2 (<1"-1/2")	2.3		8/16/2016
27.2	1	XU 6		10-20	Lithic	debris	bifacial thinning			Prairie du Chien Chert (oolitic)	0%	heat treated	3 (<1/2"-1/4")	1		8/16/2016
27.3	1	XU 6		10-20	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	0%	heat treated	3 (<1/2"-1/4")	0.2		8/16/2016
27.4	1	XU 6		10-20	Lithic	debris	other G4 flake			Cedar Valley Chert	0%		4 (<1/4")	0.1		8/16/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
28	2	XU 7		40-50	Lithic	fire-cracked rock	spall			granitic			2 (<1"-1/2")	20.4		8/16/2016
28	1	XU 7		40-50	Lithic	fire-cracked rock	friable rounded piece			granitic			2 (<1"-1/2")	12		8/16/2016
28.1	1	XU 7		40-50	Lithic	debris	other G4 flake			Prairie du Chien Chert	0%		4 (<1/4")	0.1		8/16/2016
28.2	1	XU 7		40-50	Lithic	debris	broken flake			unidentified chert	0%		3 (<1/2"-1/4")	0.2		8/16/2016
29	1	XU 7		50-60	Lithic	fire-cracked rock	spall			granitic			2 (<1"-1/2")	4.1		8/16/2016
29.1	1	XU 7		50-60	Lithic	debris	broken flake			Swan River Chert	0%	heat treated	3 (<1/2"-1/4")	0.4		8/16/2016
30.1	1	XU 7		60-70	Lithic	debris	bipolar flake			quartz	100%		3 (<1/2"-1/4")	0.9		8/16/2016
31	3	XU 8		30-40	Lithic	fire-cracked rock	spall			unidentified material			2 (<1"-1/2")	19.6		8/16/2016
31.1	1	XU 8		30-40	Lithic	debris	broken flake			quartz	0%		3 (<1/2"-1/4")	2.1		8/16/2016
32.1	1	XU 9		40-50	Lithic	debris	other G4 flake			Red River Chert	>0-<50%		4 (<1/4")	0.1		8/17/2016
32.2	1	XU 9		40-50	Ceramic	body	grit temper	cord marked					3 (<1/2"-1/4")	1.1	woven fabric impressions; 3.5 mm	8/17/2016
32.3-5	3	XU 9		40-50	Ceramic	body	grit temper	undetermined		exterior absent			4 (<1/4")	0.3		8/17/2016
33.1	1	XU 9		50-60	Lithic	debris	nonbifacial			unidentified chert	>0-<50%		3 (<1/2"-1/4")	2	material #2	8/17/2016
33.2	1	XU 9		50-60	Lithic	debris	bipolar flake			quartz	100%		3 (<1/2"-1/4")	0.4		8/17/2016
33.3	1	XU 9		50-60	Lithic	debris	nonbifacial			Knife Lake Siltstone	>0-<50%		2 (<1"-1/2")	2.1		8/17/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
33.4	1	XU 9		50-60	Lithic	debris	decortication			quartz	100%		3 (<1/2"-1/4")	1.1		8/17/2016
33.5	1	XU 9		50-60	Lithic	debris	bifacial shaping			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.1		8/17/2016
33.6	1	XU 9		50-60	Lithic	debris	bifacial thinning			fusilinid chert	0%	heat treated	3 (<1/2"-1/4")	0.2		8/17/2016
33.7	1	XU 9		50-60	Lithic	debris	other G4 flake			Swan River Chert	0%	heat treated	4 (<1/4")	0.1		8/17/2016
33.8	1	XU 9		50-60	Ceramic	neck	grit temper	cord marked	punctate			Madison	2 (<1"-1/2")	2.9	semi-circular punctate; Madison punctate; 6.0 mm	8/17/2016
33.9-15	7	XU 9		50-60	Ceramic	body	grit temper	cord marked					2 (<1"-1/2")	16.3	most are woven fabric impressions; 2.7, 4.6, 3.8, 4.4, 4.8, 4.4, & 4.6 mm	8/17/2016
33.16-25	10	XU 9		50-60	Ceramic	body	grit temper	cord marked					3 (<1/2"-1/4")	8.1	most are woven fabric impressions; 4.1, 3.8, 3.6, 3.6, 3.2, 3.6, 2.6, 3.3, 2.9, & 5.4 mm	8/17/2016
33.26-32	7	XU 9		50-60	Ceramic	body	grit temper	cord marked		interior absent			3 (<1/2"-1/4")	3.3		8/17/2016
33.33-35	3	XU 9		50-60	Ceramic	body	grit temper	cord marked		interior absent			4 (<1/4")	0.4		8/17/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
33.36-42	7	XU 9		50-60	Ceramic	body	grit temper	undetermined		exterior absent			3 (<1/2"-1/4")	3.1		8/17/2016
33.43	1	XU 9		50-60	Ceramic	body	grit temper	undetermined		exterior absent			4 (<1/4")	0.2		8/17/2016
34	1	XU 9		60-70	Lithic	fire-cracked rock	spall			metamorphic			2 (<1"-1/2")	3.7		8/18/2016
34	5	XU 9		60-70	Lithic	fire-cracked rock	crumb			granitic			3 (<1/2"-1/4")	4.2		8/18/2016
34	3	XU 9		60-70	Lithic	fire-cracked rock	crumb			basaltic			3 (<1/2"-1/4")	2.2		8/18/2016
34	1	XU 9		60-70	Lithic	fire-cracked rock	split cobble			basaltic			1 (<2"-1")	150		8/18/2016
34.1	1	XU 9		60-70	Lithic	debris	bipolar flake			quartz	0%		4 (<1/4")	0.4		8/18/2016
34.2	1	XU 9		60-70	Lithic	debris	bipolar flake			quartz	>0-<50%		4 (<1/4")	0.6		8/18/2016
34.3	1	XU 9		60-70	Lithic	debris	bipolar flake			quartz	100%		2 (<1"-1/2")	10		8/18/2016
34.4	1	XU 9		60-70	Lithic	debris	nonbifacial			Swan River Chert	>0-<50%	heat treated	2 (<1"-1/2")	3		8/18/2016
34.5	1	XU 9		60-70	Lithic	debris	nonbifacial			Prairie du Chien Chert	>0-<50%	heat treated	3 (<1/2"-1/4")	0.8		8/18/2016
34.6	1	XU 9		60-70	Lithic	debris	nonbifacial			unidentified chert	>0-<50%		2 (<1"-1/2")	2.4	material #2	8/18/2016
34.7	1	XU 9		60-70	Lithic	debris	nonbifacial			unidentified chert	50-<100%		3 (<1/2"-1/4")	1.4	material #2	8/18/2016
34.8	1	XU 9		60-70	Lithic	debris	bifacial thinning			Prairie du Chien Chert	0%		3 (<1/2"-1/4")	0.3		8/18/2016
34.9-10	2	XU 9		60-70	Lithic	debris	bifacial shaping			Jasper Taconite	0%		4 (<1/4")	0.1		8/18/2016
34.11	1	XU 9		60-70	Lithic	debris	bifacial shaping			Prairie du Chien Chert (oolitic)	0%	heat treated	4 (<1/4")	0.1		8/18/2016
34.12	1	XU 9		60-70	Lithic	debris	bifacial shaping			Swan River Chert	0%	heat treated	3 (<1/2"-1/4")	0.1		8/18/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
34.13	1	XU 9		60-70	Lithic	debris	shatter			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	2.4		8/18/2016
34.14	1	XU 9		60-70	Lithic	debris	broken flake			Western River Group	0%		3 (<1/2"-1/4")	0.3		8/18/2016
34.15	1	XU 9		60-70	Lithic	debris	other G4 flake			Swan River Chert	0%	heat treated	4 (<1/4")	0.1		8/18/2016
34.16	1	XU 9		60-70	Lithic	debris	broken flake			Grand Meadow Chert	>0-<50%		3 (<1/2"-1/4")	1.1		8/18/2016
34.17	1	XU 9		60-70	Lithic	debris	broken flake			quartz	0%		3 (<1/2"-1/4")	0.4		8/18/2016
34.18	1	XU 9		60-70	Lithic	debris	other G4 flake			unidentified chert	0%	burned	4 (<1/4")	0.1		8/18/2016
34.19	1	XU 9		60-70	Ceramic	neck	grit temper	cord marked	punctate			Madison	2 (<1"-1/2")	2.1	semi-circular punctate; Madison punctate; 4.6 mm	8/18/2016
34.20-21	2	XU 9		60-70	Ceramic	neck	grit temper	cord marked	punctate			Madison	3 (<1/2"-1/4")	1.4	semi-circular punctate; Madison punctate; 4.4 & 4.5 mm	8/18/2016
34.22-36	15	XU 9		60-70	Ceramic	body	grit temper	undetermined		exterior absent			3 (<1/2"-1/4")	4.4		8/18/2016
34.37	1	XU 9		60-70	Ceramic	body	grit temper	undetermined		exterior absent			4 (<1/4")	0.1		8/18/2016
34.38-52	15	XU 9		60-70	Ceramic	body	grit temper	cord marked		interior absent			3 (<1/2"-1/4")	4.8	some have woven fabric impressions	8/18/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
34.53-68	16	XU 9		60-70	Ceramic	body	grit temper	cord marked					2 (<1"-1/2")	33.9	most have woven fabric impresions; sample measurements are 3.5, 3.3, 3.6, 3.4, 3.9, 5.0, 4.4, 4.7, 4.0, 3.5, 3.7, 4.1 mm	8/18/2016
34.69-129	61	XU 9		60-70	Ceramic	body	grit temper	cord marked					3 (<1/2"-1/4")	47.9	most have woven fabric impresions; sample measurements are 3.5, 3.3, 3.6, 3.4, 3.9, 5.0, 4.4, 4.7, 4.0, 3.5, 3.7, 4.1 mm	8/18/2016
34.130-131	2	XU 9		60-70	Faunal	turtle	carapace/plastron	fragment	calcined				4 (<1/4")	0.1		8/18/2016
34.132-134	3	XU 9		60-70	Faunal	Vertebrata	unidentifiable	fragment	calcined				4 (<1/4")	0.2		8/18/2016
34.135	1	XU 9		60-70	Ceramic	neck	grit temper	cord marked	punctate				2 (<1"-1/2")	5	semi-circular punctates; cormarking on interior; 5.0 mm	8/18/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
34.136	1	XU 9		60-70	Ceramic	rim	grit temper	cord marked	punctate			Madison	3 (<1/2"-1/4")	1.2	lip has "u" shaped notches' punctates are semi-circular; Madison Punctate; 3.1 mm at lip & 4.6 mm below lip	8/18/2016
35	1	XU 9		70-80	Lithic	fire-cracked rock	spall			granitic			2 (<1"-1/2")	27.9		8/18/2016
35	1	XU 9		70-80	Lithic	fire-cracked rock	friable rounded piece			granitic			1 (<2"-1")	38.1		8/18/2016
35.1	1	XU 9		70-80	Lithic	tool	unpatterned flake	utilized flake	broken	Burlington Chert	0%	heat treated	3 (<1/2"-1/4")	0.9	finished, whole	8/18/2016
35.2	1	XU 9		70-80	Lithic	tool	unpatterned flake	utilized flake	bifacial thinning	Prairie du Chien Chert (oolitic)	0%		2 (<1"-1/2")	2.5	finished, whole	8/18/2016
35.3	1	XU 9		70-80	Lithic	tool	unpatterned flake	utilized flake	bifacial thinning	Grand Meadow Chert	>0-<50%		2 (<1"-1/2")	3	finished, whole	8/18/2016
35.4	1	XU 9		70-80	Lithic	debris	bipolar flake			quartz	>0-<50%		3 (<1/2"-1/4")	1.2		8/18/2016
35.5	1	XU 9		70-80	Lithic	debris	decortication			quartz	50-<100%		2 (<1"-1/2")	5.4		8/18/2016
35.6	1	XU 9		70-80	Lithic	debris	bifacial thinning			Tongue River Silica	0%		3 (<1/2"-1/4")	0.4		8/18/2016
35.7-8	2	XU 9		70-80	Lithic	debris	bifacial shaping			Burlington Chert	>0-<50%	heat treated	4 (<1/4")	0.2		8/18/2016
35.9	1	XU 9		70-80	Lithic	debris	bifacial shaping			Prairie du Chien Chert	0%		4 (<1/4")	0.1		8/18/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
35.1	1	XU 9		70-80	Lithic	debris	broken flake			quartz	0%		3 (<1/2"-1/4")	0.2		8/18/2016
35.11-13	3	XU 9		70-80	Ceramic	body	grit temper	cord marked					2 (<1"-1/2")	8.2	some have woven fabric impressions; 4.7, 3.7, & 5.2 mm	8/18/2016
35.14-21	8	XU 9		70-80	Ceramic	body	grit temper	cord marked					3 (<1/2"-1/4")	5.7	some have woven fabric impressions; 3.2, 3.4, 3.8, 3.8, 3.9, 3.4, 4.6, & 3.6 mm	8/18/2016
35.22-23	2	XU 9		70-80	Ceramic	body	grit temper	undetermined		exterior absent			4 (<1/4")	0.3		8/18/2016
36	1	XU 9		80-90	Lithic	fire-cracked rock	angular			metamorphic			1 (<2"-1")	33.4		8/18/2016
36	1	XU 9		80-90	Lithic	fire-cracked rock	angular			granitic			1 (<2"-1")	35.3		8/18/2016
36	1	XU 9		80-90	Lithic	fire-cracked rock	spall			granitic			2 (<1"-1/2")	3.9		8/18/2016
36.1	1	XU 9		80-90	Lithic	debris	broken flake			Grand Meadow Chert	50-<100%		3 (<1/2"-1/4")	1.3		8/18/2016
36.2	1	XU 9		80-90	Lithic	debris	other G4 flake			quartz	0%		4 (<1/4")	0.1		8/18/2016
37	5	XU 9		90-100	Lithic	fire-cracked rock	spall			unidentified material			2 (<1"-1/2")	38.7		8/18/2016
37	1	XU 9		90-100	Lithic	fire-cracked rock	spall			unidentified material			3 (<1/2"-1/4")	1.1		8/18/2016
37.1	1	XU 9		90-100	Lithic	core	bipolar (not rotated)			quartz	>0-<50%		3 (<1/2"-1/4")	3.3		8/18/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
38.1	1	XU 10		40-50	Lithic	debris	shatter			quartz	50-<100%		3 (<1/2"-1/4")	0.7		8/17/2016
38.2	1	XU 10		40-50	Lithic	debris	other G4 flake			quartz	0%		4 (<1/4")	0.1		8/17/2016
38.3	1	XU 10		40-50	Ceramic	body	grit temper	cord marked					2 (<1"-1/2")	2.4	6.6 mm	8/17/2016
38.4-5	2	XU 10		40-50	Ceramic	body	grit temper	cord marked					3 (<1/2"-1/4")	1.1	3.6 & 3.7 mm	8/17/2016
39	1	XU 10		50-60	Lithic	fire-cracked rock	angular/spall			granitic			2 (<1"-1/2")	3.5		8/17/2016
39	1	XU 10		50-60	Lithic	fire-cracked rock	angular			metamorphic			2 (<1"-1/2")	3.2		8/17/2016
39	2	XU 10		50-60	Lithic	fire-cracked rock	spall			igneous			2 (<1"-1/2")	17.8		8/17/2016
39	1	XU 10		50-60	Lithic	fire-cracked rock	cobble (friable)			granitic			1 (<2"-1")	38.7		8/17/2016
39.1	1	XU 10		50-60	Lithic	tool	patterned bifacial	unfinished biface, stage 4		Prairie du Chien Chert (oolitic)	0%	heat treated	2 (<1"-1/2")	9.5	broken, distal	8/17/2016
39.2	1	XU 10		50-60	Lithic	debris	other G4 flake			quartz	0%		4 (<1/4")	0.1		8/17/2016
39.3	1	XU 10		50-60	Faunal	Vertebrata	unidentifiable	fragment	calcined				4 (<1/4")	0.1		8/17/2016
39.4	1	XU 10		50-60	Ceramic	body	grit temper	undetermined		exterior absent			3 (<1/2"-1/4")	0.3		8/17/2016
39.5-6	2	XU 10		50-60	Ceramic	body	grit temper	undetermined		exterior absent			4 (<1/4")	0.2		8/17/2016
39.7-9	3	XU 10		50-60	Ceramic	body	grit temper	cord marked		interior absent			3 (<1/2"-1/4")	0.8		8/17/2016
39.10-11	2	XU 10		50-60	Ceramic	body	grit temper	cord marked					2 (<1"-1/2")	3.2	some have woven fabric impressions; 3.7 & 3.3 mm	8/17/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
39.12-19	8	XU 10		50-60	Ceramic	body	grit temper	cord marked					3 (<1/2"-1/4")	7.7	some have woven fabric impressions; 4.3, 3.6, 5.3, 4.1, 4.2, 4.6, 3.5, & 3.2 mm	8/17/2016
39.2	1	XU 10		50-60	Ceramic	neck	grit temper	cord marked	punctate			Madison	2 (<1"-1/2")	3.4	rows of triangular punctates; Madison Punctate; 6.2 mm	8/17/2016
40	2	XU 10		60-70	Lithic	fire-cracked rock	angular			basaltic			2 (<1"-1/2")	9.6		8/17/2016
40	1	XU 10		60-70	Lithic	fire-cracked rock	spall			granitic			2 (<1"-1/2")	9.7		8/17/2016
40	1	XU 10		60-70	Lithic	fire-cracked rock	split cobble			granitic			1 (<2"-1")	90		8/17/2016
40	1	XU 10		60-70	Lithic	fire-cracked rock	spall			basaltic			1 (<2"-1")	23.7		8/17/2016
40.1	1	XU 10		60-70	Lithic	tool	patterned bifacial	projectile point		Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.5	broken, distal; probable point tip fragment	8/17/2016
40.2	1	XU 10		60-70	Lithic	debris	decortication			Western River Group	100%		3 (<1/2"-1/4")	0.9		8/17/2016
40.3	1	XU 10		60-70	Lithic	debris	nonbifacial			unidentified chert	>0-<50%		3 (<1/2"-1/4")	0.8		8/17/2016
40.4	1	XU 10		60-70	Lithic	debris	bifacial thinning			Burlington Chert	0%	heat treated	3 (<1/2"-1/4")	0.3		8/17/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
40.5	1	XU 10		60-70	Lithic	debris	shatter			Red River Chert	>0-<50%		2 (<1"-1/2")	2.8		8/17/2016
40.6-7	2	XU 10		60-70	Faunal	turtle	peripheral	fragment	calcined & charred				3 (<1/2"-1/4")	0.2		8/17/2016
40.8	1	XU 10		60-70	Ceramic	body	grit temper	cord marked		interior absent			3 (<1/2"-1/4")	0.9		8/17/2016
40.9-10	2	XU 10		60-70	Ceramic	body	grit temper	cord marked		interior absent			4 (<1/4")	0.3		8/17/2016
40.11-12	2	XU 10		60-70	Ceramic	body	grit temper	cord marked					2 (<1"-1/2")	3.2	most sherds have woven fabric impressions; 4.4 & 3.8 mm	8/17/2016
40.13-19	7	XU 10		60-70	Ceramic	body	grit temper	cord marked					3 (<1/2"-1/4")	6.9	most sherds have woven fabric impressions; 3.8, 4.9, 3.6, 3.5, 3.6, 4.4, & 4.0 mm	8/17/2016
41.1	1	XU 10		70-80	Lithic	debris	bifacial thinning			Knife River Flint	0%		3 (<1/2"-1/4")	0.2		8/18/2016
41.2	1	XU 10		70-80	Ceramic	body	grit temper	undetermined		exterior absent			3 (<1/2"-1/4")	0.3		8/18/2016
41.3-14	12	XU 10		70-80	Ceramic	body	grit temper	cord marked					3 (<1/2"-1/4")	9.4	some sherds have woven fabric impressions; 4.2, 4.6, 3.4, 4.6, 4.5, 3.4, 4.2, 3.6, 4.6, 4.5, 2.7, & 4.9 mm	8/18/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
42	1	XU 11		36-40	Lithic	fire-cracked rock	spall			granitic			2 (<1"-1/2")	4.6		8/17/2016
42.1	1	XU 11		36-40	Lithic	core	bipolar (not rotated)			quartz	50-<100%		2 (<1"-1/2")	13.4		8/17/2016
42.2	1	XU 11		36-40	Ceramic	body	grit temper	cord marked					3 (<1/2"-1/4")	1.3	3.4 mm	8/17/2016
43.1	1	XU 11		40-50	Lithic	tool	unpatterned flake	retouched flake	nonbifacial	Swan River Chert	0%		2 (<1"-1/2")	4.1	finished, whole	8/17/2016
43.2	1	XU 11		40-50	Lithic	core	freehand nonbifacial	unpatterned (multi-directional)	unprepared	Prairie du Chien Chert (oolitic)	50-<100%		2 (<1"-1/2")	5.4	small pebble core	8/17/2016
43.3	1	XU 11		40-50	Lithic	debris	unidentified			Red River Chert	>0-<50%		3 (<1/2"-1/4")	0.6		8/17/2016
43.4	1	XU 11		40-50	Lithic	debris	shatter			quartz	50-<100%		2 (<1"-1/2")	3.2		8/17/2016
43.5	1	XU 11		40-50	Lithic	debris	other G4 flake			Western River Group	>0-<50%		4 (<1/4")	0.2		8/17/2016
43.6	1	XU 11		40-50	Lithic	debris	other G4 flake			Prairie du Chien Chert (oolitic)	0%	probably heat treated	4 (<1/4")	0.2		8/17/2016
43.7-8	2	XU 11		40-50	Lithic	debris	other G4 flake			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.1		8/17/2016
43.9-12	4	XU 11		40-50	Ceramic	body	grit temper	cord marked					2 (<1"-1/2")	7.7	3.7, 4.2, 5.2, & 4.0 mm	8/17/2016
43.13-16	4	XU 11		40-50	Ceramic	body	grit temper	cord marked					3 (<1/2"-1/4")	3.6	3.7, 4.2, 3.7, & 3.2 mm	8/17/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
43.17	1	XU 11		40-50	Ceramic	rim	grit temper	cord marked	cord wrapped stick				2 (<1"-1/2")	2.8	cord-wrapped stick impressions on lip & horizontally below lip; Madison-Nininger Cord-Wrapped Stick Ware; 4.2 mm at lip & 5.5 mm below lip	8/17/2016
44.1	1	XU 11		50-60	Lithic	core	bipolar (not rotated)			quartz	0%		2 (<1"-1/2")	3.6		8/17/2016
44.2	1	XU 11		50-60	Lithic	debris	decortication			quartz	100%		3 (<1/2"-1/4")	0.6		8/17/2016
44.3	1	XU 11		50-60	Lithic	debris	bifacial thinning			Red River Chert	>0-<50%		2 (<1"-1/2")	3.8		8/17/2016
44.4	1	XU 11		50-60	Lithic	debris	bifacial thinning			Red River Chert	0%		3 (<1/2"-1/4")	0.5		8/17/2016
44.5-10	6	XU 11		50-60	Ceramic	body	grit temper	cord marked					3 (<1/2"-1/4")	3.5	some have woven fabric impressions; 3.3, 3.9, 4.4, 3.3, 3.5, & 2.7 mm	8/17/2016
44.11	1	XU 11		50-60	Ceramic	body	grit temper	cord marked		interior absent			3 (<1/2"-1/4")	0.6		8/17/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
45	1	XU 11		60-70	Lithic	fire-cracked rock	spall			basaltic			2 (<1"-1/2")	4.2		8/17/2016
45	1	XU 11		60-70	Lithic	fire-cracked rock	spall			igneous			1 (<2"-1")	10		8/17/2016
45	2	XU 11		60-70	Lithic	fire-cracked rock	spall			basaltic			2 (<1"-1/2")	43		8/17/2016
45	1	XU 11		60-70	Lithic	fire-cracked rock	angular/spall			quartzite			1 (<2"-1")	54.4		8/17/2016
45	1	XU 11		60-70	Lithic	fire-cracked rock	split cobble			granitic			1 (<2"-1")	87.4		8/17/2016
45.1	1	XU 11		60-70	Lithic	tool	unpatterned flake	utilized flake	bifacial thinning	Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	1	finished, whole	8/17/2016
45.2	1	XU 11		60-70	Lithic	debris	bipolar flake			quartz	0%		3 (<1/2"-1/4")	0.7		8/17/2016
45.3	1	XU 11		60-70	Lithic	debris	bipolar flake			quartz	100%		2 (<1"-1/2")	6.7		8/17/2016
45.4	1	XU 11		60-70	Lithic	debris	decortication			quartz	100%		3 (<1/2"-1/4")	2		8/17/2016
45.5	1	XU 11		60-70	Lithic	debris	bifacial thinning			Prairie du Chien Chert	0%		3 (<1/2"-1/4")	0.6		8/17/2016
45.6	1	XU 11		60-70	Lithic	debris	broken flake			quartz	>0-<50%		3 (<1/2"-1/4")	0.6		8/17/2016
45.7	1	XU 11		60-70	Lithic	debris	shatter			quartz	>0-<50%		3 (<1/2"-1/4")	1.5		8/17/2016
46	3	XU 11		70-80	Lithic	fire-cracked rock	angular			igneous			2 (<1"-1/2")	53.7		8/18/2016
46	2	XU 11		70-80	Lithic	fire-cracked rock	spall			igneous			2 (<1"-1/2")	8.7		8/18/2016
46	2	XU 11		70-80	Lithic	fire-cracked rock	split cobble			metamorphic			1 (<2"-1")	147.1		8/18/2016
46	1	XU 11		70-80	Lithic	fire-cracked rock	spall			basaltic			2 (<1"-1/2")	3.6		8/18/2016

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
46.1	1	XU 11		70-80	Lithic	debris	bifacial thinning			Swan River Chert	0%	heat treated	2 (<1"-1/2")	1.2		8/18/2016
46.2	1	XU 11		70-80	Lithic	debris	potlid flake			Prairie du Chien Chert (oolitic)	0%	burned	3 (<1/2"-1/4")	0.6		8/18/2016
47.1	1	XU 12		40-50	Lithic	debris	bipolar flake			quartz	0%		2 (<1"-1/2")	2.6		8/17/2016
47.2	1	XU 12		40-50	Lithic	debris	bipolar flake			quartz	50-<100%		2 (<1"-1/2")	1.6		8/17/2016
47.3	1	XU 12		40-50	Lithic	debris	unidentified			Prairie du Chien Chert	>0-<50%		3 (<1/2"-1/4")	0.4		8/17/2016
47.4-5	2	XU 12		40-50	Lithic	debris	other G4 flake			quartz	0%		4 (<1/4")	0.2		8/17/2016
47.6	1	XU 12		40-50	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	0%	heat treated	3 (<1/2"-1/4")	1		8/17/2016
47.7-8	2	XU 12		40-50	Ceramic	body	grit temper	cord marked					2 (<1"-1/2")	3.7	4.3 & 3.9 mm	8/17/2016
47.9-10	2	XU 12		40-50	Ceramic	body	grit temper	cord marked					3 (<1/2"-1/4")	1.8	2.8 & 3.0 mm	8/17/2016
47.11-12	2	XU 12		40-50	Ceramic	body	grit temper	cord marked		interior absent			3 (<1/2"-1/4")	0.9		8/17/2016
48	1	XU 12		50-60	Lithic	fire-cracked rock	split cobble			granitic			1 (<2"-1")	95		8/17/2016
48	1	XU 12		50-60	Lithic	fire-cracked rock	angular			granitic			1 (<2"-1")	22.4		8/17/2016
48	1	XU 12		50-60	Lithic	fire-cracked rock	spall			basaltic			2 (<1"-1/2")	6.6		8/17/2016
48	1	XU 12		50-60	Lithic	fire-cracked rock	cobble (non-friable)			sandstone			1 (<2"-1")	75.1		8/17/2016
48.1	1	XU 12		50-60	Ceramic	body	grit temper	cord marked					2 (<1"-1/2")	3.1	4.5 mm	8/17/2016
48.2	1	XU 12		50-60	Ceramic	body	grit temper	cord marked		interior absent			3 (<1/2"-1/4")	0.6		8/17/2016
49	1	XU 12		60-70	Lithic	fire-cracked rock	angular			metamorphic			2 (<1"-1/2")	8.4		8/17/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
49.1	1	XU 12		60-70	Lithic	tool	unpatterned flake	utilized flake & side/ end scraper	nonbifacial	unidentified chert	50-<100%		3 (<1/2"-1/4")	0.3	broken, distal	8/17/2016
49.2	1	XU 12		60-70	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	>0-<50%		3 (<1/2"-1/4")	0.8		8/17/2016
49.3	1	XU 12		60-70	Lithic	debris	other G4 flake			unidentified chert	0%		4 (<1/4")	0		8/17/2016
50.1	1	XU 12		70-80	Lithic	debris	nonbifacial			Tongue River Silica	>0-<50%		3 (<1/2"-1/4")	1.5		8/18/2016
50.2	1	XU 12		70-80	Lithic	debris	nonbifacial			unidentified chert	>0-<50%	probably heat treated	3 (<1/2"-1/4")	0.8		8/18/2016
50.3	1	XU 12		70-80	Lithic	debris	other G4 flake			unidentified chert	0%		4 (<1/4")	0.1		8/18/2016
51.1	1	XU 12		80-90	Lithic	debris	bipolar flake			quartz	0%		3 (<1/2"-1/4")	1.3		8/18/2016
51.2	1	XU 12		80-90	Lithic	debris	decortication			Red River Chert	100%		2 (<1"-1/2")	8.2		8/18/2016
51.3	1	XU 12		80-90	Lithic	debris	bifacial thinning			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.2		8/18/2016
51.4	1	XU 12		80-90	Lithic	debris	other G4 flake			Swan River Chert	0%	heat treated	4 (<1/4")	0.2		8/18/2016
51.5	1	XU 12		80-90	Lithic	debris	other G4 flake			Red River Chert	100%		4 (<1/4")	0.1		8/18/2016
52	1	XU 13		23-30	Lithic	fire-cracked rock	spall			granitic			1 (<2"-1")	16.3		8/18/2016
52.1	1	XU 13		23-30	Lithic	debris	bifacial shaping			Prairie du Chien Chert	0%		4 (<1/4")	0.1		8/18/2016
52.2	1	XU 13		23-30	Lithic	debris	broken flake			quartzite	>0-<50%		3 (<1/2"-1/4")	0.8		8/18/2016
52.3	1	XU 13		23-30	Lithic	debris	other G4 flake			Prairie du Chien Chert	0%		4 (<1/4")	0.1		8/18/2016

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
52.4	1	XU 13		23-30	Lithic	tool	patterned bifacial	unfinished biface, stage 4		Prairie du Chien Chert (oolitic)	>0-<50%		2 (<1"-1/2")	23.8	unfinished, whole	8/18/2016
53	1	XU 13		30-40	Faunal	molluscan	shell	fragment					4 (<1/4")	0.1		8/19/2016
53.1	1	XU 13		30-40	Lithic	debris	nonbifacial			quartz	0%		3 (<1/2"-1/4")	1		8/19/2016
53.2	1	XU 13		30-40	Lithic	debris	bifacial thinning			unidentified chert	0%		3 (<1/2"-1/4")	0.2		8/19/2016
53.3	1	XU 13		30-40	Ceramic	body	grit temper	cord marked			residue present		2 (<1"-1/2")	2.9	3.0 mm	8/19/2016
53.4-5	2	XU 13		30-40	Ceramic	body	grit temper	cord marked			residue present		3 (<1/2"-1/4")	1.8	3.6 & 3.7 mm	8/19/2016
54	1	XU 13		40-50	Faunal	molluscan	valve, left	fragment					3 (<1/2"-1/4")	1.2		8/19/2016
54	1	XU 13		40-50	Faunal	molluscan	shell	fragment					3 (<1/2"-1/4")	3.8	@ 14 fragments	8/19/2016
54.1	1	XU 13		40-50	Lithic	debris	broken flake			Grand Meadow Chert	0%	probably heat treated	3 (<1/2"-1/4")	1		8/19/2016
54.2-3	2	XU 13		40-50	Lithic	debris	nonbifacial			Grand Meadow Chert	100%	burned	3 (<1/2"-1/4")	0.8		8/19/2016
54.4	1	XU 13		40-50	Lithic	debris	nonbifacial			Grand Meadow Chert	100%	burned	4 (<1/4")	0.2		8/19/2016
54.5-7	3	XU 13		40-50	Ceramic	body	grit temper	cord marked					3 (<1/2"-1/4")	2	woven fabric impressions; 3.3, 3.1, & 3.2 mm	8/19/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
54.8-11	4	XU 13		40-50	Ceramic	body	grit temper	cord marked			residue present		2 (<1"-1/2")	7.9	some have woven fabric impressions; 3.3, 2.9, 3.0, & 2.9 mm	8/19/2016
54.12	1	XU 13		40-50	Ceramic	body	grit temper	cord marked			residue present		3 (<1/2"-1/4")	1	some have woven fabric impressions; 3.1 mm	8/19/2016
55	1	XU 13		50-60	Faunal	molluscan	shell	fragment					3 (<1/2"-1/4")	20.1	@ 6 fragments	8/19/2016
55	1	XU 13		50-60	Lithic	fire-cracked rock	spall			basaltic			1 (<2"-1")	16		8/19/2016
55	1	XU 13		50-60	Faunal	molluscan	shell	fragment					3 (<1/2"-1/4")	6.1	@ 39 fragments	8/19/2016
55.1	1	XU 13		50-60	Faunal	Lampsilis sp. (freshwater mussel)	valve, right	fragment					3 (<1/2"-1/4")	2.3		8/19/2016
55.2	1	XU 13		50-60	Lithic	debris	bifacial thinning			Prairie du Chien Chert	0%		3 (<1/2"-1/4")	0.8		8/19/2016
55.3	1	XU 13		50-60	Lithic	debris	decortication			Red River Chert	100%		3 (<1/2"-1/4")	1		8/19/2016
55.4-5	2	XU 13		50-60	Ceramic	body	grit temper	cord marked					2 (<1"-1/2")	4.3	some have woven fabric impressions; 2.9 & 3.4 mm	8/19/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
55.6-10	5	XU 13		50-60	Ceramic	body	grit temper	cord marked					3 (<1/2"-1/4")	3	some have woven fabric impressions; 3.8, 3.0, 2.7, 3.4, & 3.3 mm	8/19/2016
55.11	1	XU 13		50-60	Ceramic	body	grit temper	undetermined		interior/ exterior absent			4 (<1/4")	0.1		8/19/2016
55.12	1	XU 13		50-60	Ceramic	body	grit temper	cord marked			residue present		1 (<2"-1")	15.8	some have woven fabric impressions; 4.1 mm	8/19/2016
55.13-16	4	XU 13		50-60	Ceramic	body	grit temper	cord marked			residue present		2 (<1"-1/2")	7.7	some have woven fabric impressions; 4.5, 2.9, 4.5, & 3.5 mm	8/19/2016
55.17-21	5	XU 13		50-60	Ceramic	body	grit temper	cord marked			residue present		3 (<1/2"-1/4")	4.2	some have woven fabric impressions; 3.5, 3.4, 3.5, 3.6, & 3.2 mm	8/19/2016
55.22-23	2	XU 13		50-60	Ceramic	body	grit temper	cord marked			residue present		2 (<1"-1/2")	8.1	woven fabric impressions; 4.5 & 3.2 mm	8/19/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
55.24-26	3	XU 13		50-60	Ceramic	body	grit temper	cord marked			residue present		3 (<1/2"-1/4")	3.2	woven fabric impressions; 3.3, 3.2, & 3.0 mm	8/19/2016
55.27	1	XU 13		50-60	Ceramic	rim	grit temper	cord marked	punctate			Madison	1 (<2"-1")	11.7	lip has "u" shape notches; rim has semi-circular punctates with vertical cord-marking; Madison Punctate; 3.0 mm at lip & 5.0 mm below lip	8/19/2016
55.28-30	3	XU 13		50-60	Ceramic	body	grit temper	cord marked			residue present		2 (<1"-1/2")	12.5	Beta; residue removed for dating; woven fabric impressions; 3.7, 3.0, 3.3 mm	8/19/2016
56	1	XU 13		60-70	Faunal	molluscan	shell	fragment					3 (<1/2"-1/4")	1.2	@ 4 fragments	8/19/2016
56	1	XU 13		60-70	Lithic	fire-cracked rock	spall			basaltic			2 (<1"-1/2")	8.1		8/19/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
56.1	1	XU 13		60-70	Lithic	debris	bifacial thinning			Grand Meadow Chert	0%		2 (<1"-1/2")	1.6		8/19/2016
56.2	1	XU 13		60-70	Lithic	debris	bifacial shaping			unidentified chert	0%		4 (<1/4")	0		8/19/2016
56.3	1	XU 13		60-70	Lithic	debris	broken flake			Grand Meadow Chert	0%		3 (<1/2"-1/4")	0.3		8/19/2016
56.4	1	XU 13		60-70	Lithic	debris	other G4 flake			Grand Meadow Chert	0%		4 (<1/4")	0.1		8/19/2016
56.5	1	XU 13		60-70	Lithic	debris	other G4 flake			Grand Meadow Chert	>0-<50%		4 (<1/4")	0.2		8/19/2016
56.6	1	XU 13		60-70	Lithic	debris	broken flake			unidentified chert	0%		3 (<1/2"-1/4")	0.1		8/19/2016
56.7	1	XU 13		60-70	Lithic	debris	broken flake			Swan River Chert	0%	heat treated	3 (<1/2"-1/4")	0.3		8/19/2016
56.8	1	XU 13		60-70	Ceramic	body	grit temper	undetermined					3 (<1/2"-1/4")	0.6	3.9 mm	8/19/2016
57	1	XU 13		70-80	Faunal	molluscan	shell	fragment					3 (<1/2"-1/4")	0.4	@2 fragments	8/19/2016
57.1-3	3	XU 13		70-80	Lithic	debris	bifacial thinning			Grand Meadow Chert	>0-<50%		3 (<1/2"-1/4")	2.5		8/19/2016
57.4	1	XU 13		70-80	Lithic	debris	broken flake			Swan River Chert	0%	heat treated	3 (<1/2"-1/4")	0.1		8/19/2016
57.5	1	XU 13		70-80	Lithic	debris	bifacial thinning			Knife River Flint	0%		3 (<1/2"-1/4")	0.4		8/19/2016
57.6	1	XU 13		70-80	Lithic	debris	other G4 flake			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.1		8/19/2016
58	1	XU 13		80-90	Lithic	fire-cracked rock	spall			basaltic			2 (<1"-1/2")	3.9		8/19/2016
58.1	1	XU 13		80-90	Lithic	debris	decortication			unidentified chert	100%	heat treated	3 (<1/2"-1/4")	1.1		8/19/2016
58.2	1	XU 13		80-90	Lithic	debris	bifacial shaping			Prairie du Chien Chert	0%		4 (<1/4")	0.1		8/19/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
58.3	1	XU 13		80-90	Lithic	debris	bifacial thinning			Prairie du Chien Chert (oolitic)	0%	probably heat treated	3 (<1/2"-1/4")	0.2		8/19/2016
58.4	1	XU 13		80-90	Lithic	debris	bifacial thinning			Prairie du Chien Chert	0%		3 (<1/2"-1/4")	0.2		8/19/2016
58.5	1	XU 13		80-90	Lithic	debris	broken flake			Grand Meadow Chert	0%		3 (<1/2"-1/4")	0.4		8/19/2016
58.6	1	XU 13		80-90	Lithic	debris	other G4 flake			quartz	0%		4 (<1/4")	0.1		8/19/2016
59	1	XU 13		90-100	Lithic	fire-cracked rock	spall			basaltic			1 (<2"-1")	56.6		8/19/2016
59	1	XU 13		90-100	Lithic	fire-cracked rock	spall			unidentified material			1 (<2"-1")	176		8/19/2016
59.1	1	XU 13		90-100	Lithic	debris	bifacial shaping			Grand Meadow Chert	>0-<50%		4 (<1/4")	0.1		8/19/2016
59.2-3	2	XU 13		90-100	Lithic	debris	bifacial shaping			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.2		8/19/2016
59.4	1	XU 13		90-100	Lithic	debris	bifacial thinning			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.3		8/19/2016
59.5-6	2	XU 13		90-100	Lithic	debris	bifacial thinning			Prairie du Chien Chert	0%		3 (<1/2"-1/4")	0.3	refit	8/19/2016
59.7-8	2	XU 13		90-100	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.4	refit	8/19/2016
59.9	1	XU 13		90-100	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.1		8/19/2016
59.1	1	XU 13		90-100	Lithic	debris	shatter			unidentified material	0%		1 (<2"-1")	19.1		8/19/2016
60	1	XU 13		100-110	Lithic	fire-cracked rock	angular			granitic			2 (<1"-1/2")	14.4		8/19/2016
60	1	XU 13		100-110	Lithic	fire-cracked rock	spall			granitic			1 (<2"-1")	79.8		8/19/2016
60	1	XU 13		100-110	Lithic	fire-cracked rock	spall			basaltic			3 (<1/2"-1/4")	2.4		8/19/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
60	1	XU 13		100-110	Lithic	fire-cracked rock	cobble (non-friable)			granitic			1 (<2"-1")	124		8/19/2016
60	1	XU 13		100-110	Lithic	fire-cracked rock	cobble (friable)			granitic			1 (<2"-1")	96		8/19/2016
60	1	XU 13		100-110	Lithic	fire-cracked rock	friable rounded piece			granitic			1 (<2"-1")	31.6		8/19/2016
60.1	1	XU 13		100-110	Lithic	debris	decortication			quartz	100%		3 (<1/2"-1/4")	0.8		8/19/2016
60.2	1	XU 13		100-110	Lithic	debris	nonbifacial			Grand Meadow Chert	50-<100%		2 (<1"-1/2")	1.3		8/19/2016
60.3	1	XU 13		100-110	Lithic	debris	nonbifacial			Prairie du Chien Chert (oolitic)	50-<100%		3 (<1/2"-1/4")	0.4		8/19/2016
60.4	1	XU 13		100-110	Lithic	debris	bifacial thinning			Grand Meadow Chert	0%		3 (<1/2"-1/4")	0.2		8/19/2016
60.5-10	6	XU 13		100-110	Lithic	debris	bifacial thinning			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	3.1		8/19/2016
60.11	1	XU 13		100-110	Lithic	debris	broken flake			Grand Meadow Chert	50-<100%		3 (<1/2"-1/4")	0.3		8/19/2016
60.12	1	XU 13		100-110	Lithic	debris	broken flake			Grand Meadow Chert	0%		3 (<1/2"-1/4")	0.1		8/19/2016
60.13-14	2	XU 13		100-110	Lithic	debris	broken flake			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.6		8/19/2016
60.14-15	2	XU 13		100-110	Lithic	debris	other G4 flake			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.1		8/19/2016
60.16	1	XU 13		100-110	Lithic	debris	broken flake			unidentified chert	0%	probably heat treated	3 (<1/2"-1/4")	0.2		8/19/2016
60.17-18	2	XU 13		100-110	Ceramic	body	grit temper	undetermined					3 (<1/2"-1/4")	2	6.8 & 5.3 mm	8/19/2016
60.19	1	XU 13		100-110	Ceramic	body	grit temper	undetermined		exterior absent			3 (<1/2"-1/4")	0.9		8/19/2016
61	1	XU 13		110-120	Lithic	fire-cracked rock	cobble with spall			basaltic			1 (<2"-1")	258		8/19/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
61	1	XU 13		110-120	Lithic	fire-cracked rock	spall			basaltic			3 (<1/2"-1/4")	2		8/19/2016
61	1	XU 13		110-120	Lithic	fire-cracked rock	spall			quartzite			2 (<1"-1/2")	16.1		8/19/2016
61.1	1	XU 13		110-120	Lithic	debris	decortication			Grand Meadow Chert	100%		2 (<1"-1/2")	2.4		8/19/2016
61.2	1	XU 13		110-120	Lithic	debris	bifacial thinning			Grand Meadow Chert	0%		2 (<1"-1/2")	1.6		8/19/2016
61.3-4	2	XU 13		110-120	Lithic	debris	bifacial thinning			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	0.8		8/19/2016
61.5	1	XU 13		110-120	Lithic	debris	bifacial thinning			Prairie du Chien Chert (oolitic)	>0-<50%		2 (<1"-1/2")	2		8/19/2016
61.6	1	XU 13		110-120	Ceramic	body	grit temper	cord marked					2 (<1"-1/2")	2.3	5.9 mm	8/19/2016
61.7	1	XU 13		110-120	Ceramic	body	grit temper	cord marked					3 (<1/2"-1/4")	1	5.4 mm	8/19/2016
61.8-9	2	XU 13		110-120	Ceramic	body	grit temper	undetermined		exterior absent			3 (<1/2"-1/4")	1.5		8/19/2016
62.1	1		1 S1/2	60-76	Lithic	debris	bifacial shaping			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0	heavy fraction	8/11/2016
62.2-3	2		1 S1/2	60-76	Faunal	Vertebrata	unidentifiable	fragment	burned				4 (<1/4")	0.1	heavy fraction	8/11/2016
63.1-2	2		1 S1/2	80-93	Faunal	Vertebrata	unidentifiable	fragment					4 (<1/4")	0.1	heavy fraction	8/12/2016
64.1-2	2	XU 10	5	72-72	Faunal	turtle	peripheral	fragment	burned				3 (<1/2"-1/4")	0.2		8/17/2016
65.1-2	2	XU 10	5 E1/2	70-79	Ceramic	body	grit temper	cord marked					3 (<1/2"-1/4")	0.7	heavy fraction; 3.0 & 3.1 mm	8/17/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
65.3	1	XU 10	5 E1/2	70-79	Faunal	Emydidae (pond turtle)	neural	fragment	burned				3 (<1/2"-1/4")	0.1	heavy fraction; Beta	8/17/2016
65.4	1	XU 10	5 E1/2	70-79	Faunal	Emydidae (pond turtle)	carapace	fragment	burned				3 (<1/2"-1/4")	0.1	heavy fraction; Beta	8/17/2016
65.5-6	2	XU 10	5 E1/2	70-79	Faunal	turtle	carapace/plastron	fragment	burned				4 (<1/4")	0.1	heavy fraction	8/17/2016
65.7-10	4	XU 10	5 E1/2	70-79	Faunal	Vertebrata	unidentifiable	fragment					4 (<1/4")	0.1	heavy fraction; Beta	8/17/2016
65.11	1	XU 10	5 E1/2	70-79	Botanical	wood charcoal							4 (<1/4")	1.6	heavy fraction	8/17/2016
66.1	1	XU 10	5 W1/2	70-79	Faunal	Ameiurus sp. (bullhead catfish)	pectoral spine, right	fragment					4 (<1/4")	0.2	heavy fraction	8/17/2016
66.2	1	XU 10	5 W1/2	70-79	Faunal	turtle	ilium, left	fragment					4 (<1/4")	0.1	heavy fraction	8/17/2016
66.3-7	5	XU 10	5 W1/2	70-79	Faunal	turtle	carapace/plastron	fragment	burned				4 (<1/4")	0.3	heavy fraction; Beta	8/17/2016
66.8-11	4	XU 10	5 W1/2	70-79	Faunal	turtle	carapace/plastron	fragment					3 (<1/2"-1/4")	0.4	heavy fraction	8/17/2016
66.12	1	XU 10	5 W1/2	70-79	Faunal	Chrysemys picta (painted turtle)	entoplastron	fragment	burned				4 (<1/4")	0.1	heavy fraction	8/17/2016
66.13-40	28	XU 10	5 W1/2	70-79	Faunal	Vertebrata	unidentifiable	fragment	burned				4 (<1/4")	0.4	heavy fraction; Beta	8/17/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
66.41-58	18	XU 10	5 W1/2	70-79	Faunal	Vertebrata	unidentifiable	fragment					4 (<1/4")	0.3	heavy fraction	8/17/2016
67	1	XU 10	5	79-79	Lithic	fire-cracked rock	cobble with spall			unidentified material			1 (<2"-1")	48		8/17/2016
67.1	1	XU 10	5	79-79	Ceramic	body	grit temper	cord marked					2 (<1"-1/2")	2.3	4.7 mm	8/17/2016
68	1		6 W1/2	80-85	Faunal	molluscan	shell	fragment					3 (<1/2"-1/4")	16.7	@29 fragments	8/19/2016
68	1		6 W1/2	80-85	Faunal	molluscan	valve, right	fragment					2 (<1"-1/2")	5.3		8/19/2016
68	1		6 W1/2	80-85	Faunal	molluscan	shell	fragment					3 (<1/2"-1/4")	43	@ 160 fragments	8/19/2016
68	1		6 W1/2	80-85	Faunal	molluscan	shell	fragment					1 (<2"-1")	19	1 fragment	8/19/2016
68.1	1		6 W1/2	80-85	Faunal	Fusconaia flava (wabash pigtoe)	valve, right	fragment					2 (<1"-1/2")	5.8		8/19/2016
68.2	1		6 W1/2	80-85	Faunal	Leptodea fragilis (fragile papershell)	valve, right	fragment					3 (<1/2"-1/4")	1.3		8/19/2016
68.3-4	2		6 W1/2	80-85	Faunal	Leptodea fragilis (fragile papershell)	valve, left	fragment					2 (<1"-1/2")	4.3		8/19/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
68.5	1		6 W1/2	80-85	Faunal	Lasmigona sp. (freshwater mussel)	valve, left	fragment					1 (<2"-1")	6.7		8/19/2016
68.6	1		6 W1/2	80-85	Faunal	Lampsilis cardium (plain pocketbook)	valve, left	fragment					1 (<2"-1")	36.1		8/19/2016
68.7	1		6 W1/2	80-85	Faunal	Leptodea fragilis (fragile papershell)	valve, right	fragment					1 (<2"-1")	5.6		8/19/2016
68.8	1		6 W1/2	80-85	Faunal	Lampsilis teres (yellow sandshell)	valve, left	fragment					1 (<2"-1")	7		8/19/2016
68.9	1		6 W1/2	80-85	Faunal	Leptodea fragilis (fragile papershell)	valve, left	fragment					2 (<1"-1/2")	3.4		8/19/2016
68.1	1		6 W1/2	80-85	Faunal	Amblema plicata (threeridge)	valve, left	fragment					1 (<2"-1")	26.8		8/19/2016
68.11	1		6 W1/2	80-85	Faunal	Obliquaria reflexa (threehorn wartyback)	valve, left	fragment					1 (<2"-1")	11.4		8/19/2016
68.12	1		6 W1/2	80-85	Faunal	Amblema plicata (threeridge)	valve, right	fragment					1 (<2"-1")	36.7		8/19/2016
68.13	1		6 W1/2	80-85	Faunal	Lampsilis siliquoidea (fatmucket clam)	valve, right	fragment					1 (<2"-1")	15.1		8/19/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
68.14	1		6 W1/2	80-85	Faunal	Lampsilis siliquoidea (fatmucket clam)	valve, left	fragment					1 (<2"-1")	51.2		8/19/2016
68.15	1		6 W1/2	80-85	Faunal	Amblema plicata (threeridge)	valve, left	fragment					1 (<2"-1")	29.1		8/19/2016
68.16	1		6 W1/2	80-85	Faunal	Lampsilis cardium (plain pocketbook)	valve, right	fragment					2 (<1"-1/2")	8.8		8/19/2016
68.17	1		6 W1/2	80-85	Faunal	Amblema plicata (threeridge)	valve, left	complete					1 (<2"-1")	55.7		8/19/2016
68.18	1		6 W1/2	80-85	Faunal	Lampsilis siliquoidea (fatmucket clam)	valve, right	fragment					1 (<2"-1")	57.3		8/19/2016
68.19	1		6 W1/2	80-85	Faunal	Amblema plicata (threeridge)	valve, left	complete					1 (<2"-1")	56		8/19/2016
69	1		6 W1/2	90-115	Faunal	molluscan	shell	fragment					3 (<1/2"-1/4")	0.2	heavy fraction; 1 fragment	8/19/2016
69.1	1		6 W1/2	90-115	Ceramic	body	grit temper	cord marked					3 (<1/2"-1/4")	1.3	heavy fraction; 6.3 mm	8/19/2016
69.2	1		6 W1/2	90-115	Ceramic	body	grit temper	cord marked		interior absent			4 (<1/4")	0.1	heavy fraction	8/19/2016
69.3-4	2		6 W1/2	90-115	Ceramic	body	grit temper	undetermined		exterior absent			4 (<1/4")	0.3	heavy fraction	8/19/2016

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
69.5-8	4		6 W1/2	90-115	Lithic	debris	other G4 flake			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.2	heavy fraction	8/19/2016
69.9	1		6 W1/2	90-115	Lithic	debris	bifacial thinning			Prairie du Chien Chert (oolitic)	0%		3 (<1/2"-1/4")	1	heavy fraction	8/19/2016
69.1	1		6 W1/2	90-115	Lithic	debris	shatter			quartz	0%		3 (<1/2"-1/4")	0.5	heavy fraction	8/19/2016
69.11	1		6 W1/2	90-115	Botanical	wood charcoal							4 (<1/4")	0.6	heavy fraction	8/19/2016
69.12	1		6 W1/2	90-115	Faunal	Rodentia	tooth, incisor	fragment					4 (<1/4")	0.1	heavy fraction	8/19/2016
69.13-19	7		6 W1/2	90-115	Faunal	Vertebrata	unidentifiable	fragment	burned				3 (<1/2"-1/4")	0.2	heavy fraction	8/19/2016
70	1		6 E1/2	80-85	Faunal	molluscan	valve, left	fragment					2 (<1"-1/2")	3.5	1 fragment	8/19/2016
70	1		6 E1/2	80-85	Faunal	molluscan	valve, left	fragment					1 (<2"-1")	15.5	1 fragment	8/19/2016
70	1		6 E1/2	80-85	Faunal	molluscan	valve, left	fragment					1 (<2"-1")	19.9	1 fragment	8/19/2016
70	1		6 E1/2	80-85	Faunal	molluscan	shell	fragment					3 (<1/2"-1/4")	36.8	@ 150 fragments	8/19/2016
70	1		6 E1/2	80-85	Faunal	molluscan	valve, right	fragment					3 (<1/2"-1/4")	7.1		8/19/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
70	1		6 E1/2	80-85	Faunal	molluscan	shell	fragment					3 (<1/2"-1/4")	34.5	@ 34 fragments	8/19/2016
70	1		6 E1/2	80-85	Faunal	molluscan	shell	fragment					3 (<1/2"-1/4")	15.6	@ 110 fragments	8/19/2016
70.1	1		6 E1/2	80-85	Faunal	Fusconaia flava (wabash pigtoe)	valve, left	complete					1 (<2"-1")	34		8/19/2016
70.2	1		6 E1/2	80-85	Faunal	Actinonaias ligamentina (mucket mussel)	valve, right	fragment					1 (<2"-1")	38.1		8/19/2016
70.3	1		6 E1/2	80-85	Faunal	Actinonaias ligamentina (mucket mussel)	valve, right	fragment					1 (<2"-1")	33.8		8/19/2016
70.4	1		6 E1/2	80-85	Faunal	Actinonaias ligamentina (mucket mussel)	valve, left	fragment					1 (<2"-1")	31.2		8/19/2016
70.5	1		6 E1/2	80-85	Faunal	Lampsilis sp. (freshwater mussel)	valve, right	fragment					1 (<2"-1")	6.4		8/19/2016
70.6	1		6 E1/2	80-85	Faunal	Actinonaias ligamentina (mucket mussel)	valve, right	fragment					1 (<2"-1")	23.2		8/19/2016
70.7	1		6 E1/2	80-85	Faunal	Amblema plicata (threeridge)	valve, left	fragment					1 (<2"-1")	22.9		8/19/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
70.8	1		6 E1/2	80-85	Faunal	Amblema plicata (threeridge)	shell	fragment					2 (<1"-1/2")	6.1		8/19/2016
70.9	1		6 E1/2	80-85	Faunal	Amblema plicata (threeridge)	valve, left	fragment					1 (<2"-1")	33.5		8/19/2016
70.1	1		6 E1/2	80-85	Faunal	Amblema plicata (threeridge)	valve, left	fragment					2 (<1"-1/2")	9.3		8/19/2016
70.11-12	2		6 E1/2	80-85	Faunal	Leptodea fragilis (fragile papershell)	valve, right	fragment					2 (<1"-1/2")	6.7		8/19/2016
70.13	1		6 E1/2	80-85	Faunal	Lasmigona sp. (freshwater mussel)	valve, right	fragment					1 (<2"-1")	12.6		8/19/2016
71	1		6 E1/2	80-119	Lithic	fire-cracked rock	spall			basaltic			3 (<1/2"-1/4")	0.6	heavy fraction	8/19/2016
71	1		6 E1/2	80-119	Lithic	fire-cracked rock	crumb			granitic			3 (<1/2"-1/4")	1.5	heavy fraction	8/19/2016
71	1		6 E1/2	80-119	Lithic	fire-cracked rock	spall			unidentified material			3 (<1/2"-1/4")	0.8	heavy fraction	8/19/2016
71	1		6 E1/2	80-119	Faunal	molluscan	shell	fragment					3 (<1/2"-1/4")	32.2	heavy fraction; 117 fragments	8/19/2016
71.1-2	2		6 E1/2	80-119	Lithic	debris	bifacial shaping			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.2	heavy fraction	8/19/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
71.3-4	2		6 E1/2	80-119	Lithic	debris	broken flake			quartz	0%		3 (<1/2"-1/4")	0.4	heavy fraction	8/19/2016
71.5-7	3		6 E1/2	80-119	Lithic	debris	other G4 flake			quartz	0%		4 (<1/4")	0.1	heavy fraction	8/19/2016
71.8-13	6		6 E1/2	80-119	Lithic	debris	other G4 flake			Prairie du Chien Chert (oolitic)	0%		4 (<1/4")	0.1	heavy fraction	8/19/2016
71.14	1		6 E1/2	80-119	Ceramic	body	grit temper	cord marked		interior absent			4 (<1/4")	0.1	heavy fraction	8/19/2016
71.15-16	2		6 E1/2	80-119	Ceramic	body	grit temper	cord marked		interior absent			3 (<1/2"-1/4")	0.3	heavy fraction	8/19/2016
71.17-20	4		6 E1/2	80-119	Ceramic	body	grit temper	undetermined		exterior absent			3 (<1/2"-1/4")	1.9	heavy fraction	8/19/2016
71.21-24	4		6 E1/2	80-119	Ceramic	body	grit temper	cord marked		exterior absent			3 (<1/2"-1/4")	1	heavy fraction	8/19/2016
71.25-36	12		6 E1/2	80-119	Ceramic	body	grit temper	cord marked		exterior absent			4 (<1/4")	1.4	heavy fraction	8/19/2016
71.37	1		6 E1/2	80-119	Ceramic	body	grit temper	undetermined		interior/ exterior absent			3 (<1/2"-1/4")	0.2	heavy fraction	8/19/2016
71.38-39	2		6 E1/2	80-119	Ceramic	body	grit temper	cord marked					2 (<1"-1/2")	6.7	heavy fraction; 6.2 & 6.1 mm	8/19/2016
71.40-41	2		6 E1/2	80-119	Ceramic	body	grit temper	cord marked					3 (<1/2"-1/4")	1.3	heavy fraction; 5.8 & 5.5 mm	8/19/2016

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
71.42-49	8		6 E1/2	80-119	Faunal	Vertebrata	unidentifiable	fragment	burned				4 (<1/4")	0.1	heavy fraction	8/19/2016
71.5	1		6 E1/2	80-119	Faunal	Vertebrata	unidentifiable	fragment					4 (<1/4")	0	heavy fraction	8/19/2016
71.51-53	3		6 E1/2	80-119	Ceramic	body	grit temper	smooth	stamped	interior absent		St. Croix	3 (<1/2"-1/4")	2.6	St. Croix Stamped; thickness measured without interior surface; 6.6, 5.8, & 6.2 mm	8/19/2016
71.54	1		6 E1/2	80-119	Botanical	wood charcoal							4 (<1/4")	0.6	heavy fraction	8/19/2016
72.1	1	XU 9	7 N1/2	88-102	Lithic	debris	other G4 flake			quartz	0%		4 (<1/4")	0	heavy fraction	8/19/2016
72.2	12	XU 9	7 N1/2	88-102	Botanical	wood charcoal							4 (<1/4")	0.2	heavy fraction; Beta-destroyed	8/19/2016
73	2	XU 9	7 S1/2	88-102	Botanical	wood charcoal							4 (<1/4")	0	heavy fraction; Beta-destroyed	8/19/2016
73.1	1	XU 9	7 S1/2	88-102	Lithic	debris	bipolar flake			quartz	100%		3 (<1/2"-1/4")	1.7	heavy fraction	8/19/2016

21HE497 - Phase II Catalog

Prov #	Count	Loc.	F#	Depth (cmbd)	Class	Desc1	Desc2	Desc3	Desc4	Desc5	Desc6	Desc7	Size Grade	Weight (g)	Artifact Notes	Date
73.2-3	2	XU 9	7 S1/2	88-102	Faunal	Vertebrata	unidentifiable	fragment					4 (<1/4")	0.1	heavy fraction	8/19/2016
74.1	1		7	102-102	Lithic	tool	patterned bifacial	projectile point		Tongue River Silica	0%	heat treated	2 (<1"-1/2")	4.7	Waubesa type; tip broken	8/19/2016
900	1	XU 5		20-30	Lithic	fire-cracked rock	spall			granitic			1 (<2"-1")	22.4		8/16/2016
901	1	XU 5		30-40	Lithic	fire-cracked rock	angular			basaltic			1 (<2"-1")	64		8/16/2016
901	1	XU 5		30-40	Lithic	fire-cracked rock	angular/spall			granitic			3 (<1/2"-1/4")	3.2		8/16/2016
902	1	XU 11		80-90	Lithic	fire-cracked rock	spall			metamorphic			3 (<1/2"-1/4")	1		8/18/2016
902	1	XU 11		80-90	Lithic	fire-cracked rock	spall			igneous			2 (<1"-1/2")	5.7		8/18/2016
903	1		6 W1/2	80-117	Faunal	molluscan	shell	fragment					3 (<1/2"-1/4")	13.8	heavy fraction; @ 55 fragments	8/19/2016
903	1		6 W1/2	80-117	Lithic	fire-cracked rock	spall			unidentified material			2 (<1"-1/2")	2.1	heavy fraction	8/19/2016

APPENDIX D: RADIOCARBON DATING REPORTS FROM BETA ANALYTIC INC.

BETA
Consistent accuracy
delivered on time

Beta Analytic Inc.
4985 S.W. 74 Court
Miami, Florida 33155 USA
PH: 305-667-5167
FAX: 305-663-0964
beta@radiocarbon.com
www.radiocarbon.com

Darden Hood
President

Ronald Hatfield
Christopher Patrick
Deputy Directors

January 17, 2017

Mr. Frank Florin
Florin Cultural Resource Services
N12902 273rd Street
Boyceville, WI 54725
USA

RE: Radiocarbon Dating Results.

Dear Mr. Florin:

Enclosed is the radiocarbon dating result for one sample recently sent to us. As usual, specifics of the analysis are listed on the report with the result and calibration data is provided where applicable. The Conventional Radiocarbon Age has been corrected for total fractionation effects and where applicable, calibration was performed using 2013 calibration databases (cited on the graph pages).

The web directory containing the table of results and PDF download also contains pictures, a cvs spreadsheet download option and a quality assurance report containing expected vs. measured values for 3-5 working standards analyzed simultaneously with your samples.

The reported result is accredited to ISO/IEC 17025:2005 Testing Accreditation PJLA #59423 standards and all pretreatments and chemistry were performed here in our laboratories and counted in our own accelerators here in Miami. Since Beta is not a teaching laboratory, only graduates trained to strict protocols of the ISO/IEC 17025:2005 Testing Accreditation PJLA #59423 program participated in the analysis.

As always Conventional Radiocarbon Ages and sigmas are rounded to the nearest 10 years per the conventions of the 1977 International Radiocarbon Conference. When counting statistics produce sigmas lower than +/- 30 years, a conservative +/- 30 BP is cited for the result. The reported d13C was measured separately in an IRMS (isotope ratio mass spectrometer). It is NOT the AMS d13C which would include fractionation effects from natural, chemistry and AMS induced sources.

When interpreting the result, please consider any communications you may have had with us regarding the sample. As always, your inquiries are most welcome. If you have any questions or would like further details of the analysis, please do not hesitate to contact us.

The cost of the analysis was charged to the American Express card provided. Thank you. As always, if you have any questions or would like to discuss the results, don't hesitate to contact me.

Sincerely ,

Darden Hood
Digital signature on file

BETA Beta Analytic Inc.
DR. M.A. TAMERS and MR. D.G. HOOD
4985 S.W. 74 COURT
MIAMI, FLORIDA, USA 33155
PH: 305-667-5167 FAX: 305-663-0964
beta@radiocarbon.com

REPORT OF RADIOCARBON DATING ANALYSES

Mr. Frank Florin — Report Date: 1/17/2017

Florin Cultural Resource Services — Material Received: 1/3/2017

Sample Data	Measured Radiocarbon Age	Isotopes Results o/oo	Conventional Radiocarbon Age
Beta - 454888	1060 +/- 30 BP	d13C= -28.8	1000 +/- 30 BP

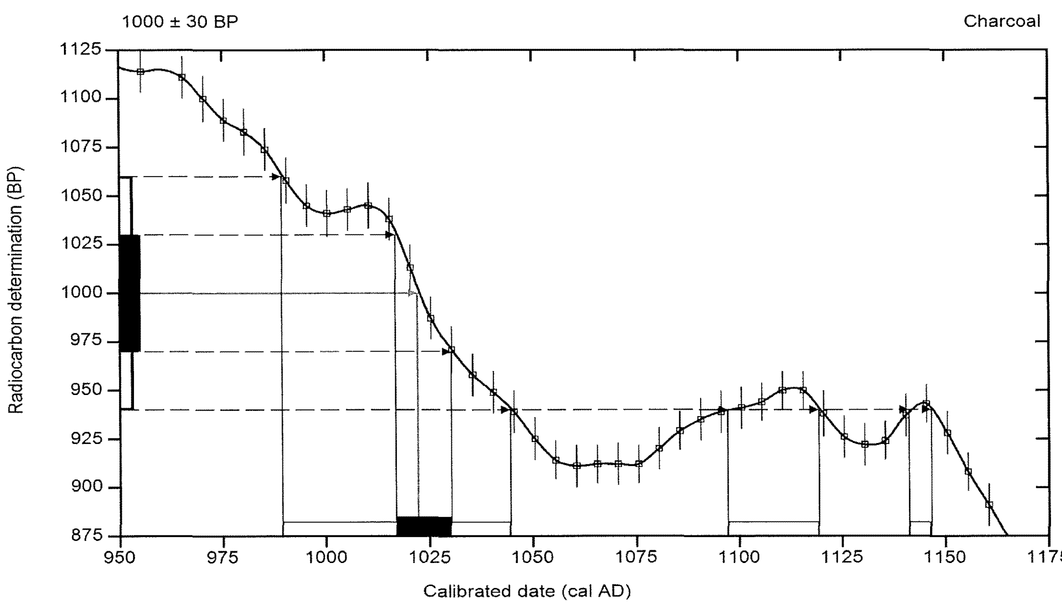
SAMPLE: 281-1 F1 91-100
ANALYSIS: RadiometricPLUS-Standard delivery
MATERIAL/PRETREATMENT: (charred material): acid/alkali/acid
2 SIGMA CALIBRATION : cal AD 990 - 1045 (cal BP 960 - 905) and cal AD 1095 - 1120 (cal BP 855 - 830)
cal AD 1095 - 1120 (cal BP 855 - 830) and cal AD 1140 - 1145 (cal BP 810 - 805)
cal AD 1140 - 1145 (cal BP 810 - 805)

Results are ISO/IEC-17025:2005 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" is corrected for isotopic fraction and was used for calendar calibration where applicable. The Age was calculated using the Libby half-life (5568 years), is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted error is 1 sigma of counting error on the combined measurements of sample, background and modern reference. Calculated sigmas less than 30 years are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C) and are reported in per mil relative to VPDB-1. Applicable calendar calibrated results were calculated using INTCAL13, MARINE13 or SHCAL13 as appropriate (see calibration graph report for references). Applicable d15N values are relative to VPDB-1 and applicable d18O and dD values are relative to VSMOW. Applicable water results are reported without correction for isotopic fractionation.

Calibration of Radiocarbon Age to Calendar Years

(Variables: d13C = -28.80 o/oo)

Laboratory number	**Beta-454888 281-1 F1 91-100**	
Conventional radiocarbon age	**1000 ± 30 BP**	
2 Sigma calibrated result 95% probability	**cal AD 990 - 1045**	**(cal BP 960 - 905)**
	cal AD 1095 - 1120	**(cal BP 855 - 830)**
	cal AD 1140 - 1145	**(cal BP 810 - 805)**
Intercept of radiocarbon age with calibration curve	cal AD 1020 (cal BP 930)	
1 Sigma calibrated results 68% probability	**cal AD 1015 - 1030**	**(cal BP 935 - 920)**



Database used

INTCAL13

References

References to Intercept Method

A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2) : 317-322

References to Database INTCAL13

Reimer, et.al., 2013, Radiocarbon55(4).

BETA
Consistent accuracy delivered on time

Beta Analytic Inc.
4985 S.W. 74 Court
Miami, Florida 33155 USA
PH: 305-667-5167
FAX: 305-663-0964
beta@radiocarbon.com
www.radiocarbon.com

Darden Hood
President

Ronald Hatfield
Christopher Patrick
Deputy Directors

January 10, 2017

Mr. Frank Florin
Florin Cultural Resource Services
N12902 273rd Street
Boyceville, WI 54725
USA

RE: Radiocarbon Dating Results.

Dear Mr. Florin:

Enclosed is the radiocarbon dating result for one sample recently sent to us. As usual, the method of analysis is listed on the report with the results and calibration data is provided where applicable. The Conventional Radiocarbon Ages have all been corrected for total fractionation effects and where applicable, calibration was performed using 2013 calibration databases (cited on the graph pages).

The web directory containing the table of results and PDF download also contains pictures, a cvs spreadsheet download option and a quality assurance report containing expected vs. measured values for 3-5 working standards analyzed simultaneously with your samples.

Reported results are accredited to ISO/IEC 17025:2005 Testing Accreditation PJLA #59423 standards and all chemistry was performed here in our laboratory and counted in our own accelerators here. Since Beta is not a teaching laboratory, only graduates trained to strict protocols of the ISO/IEC 17025:2005 Testing Accreditation PJLA #59423 program participated in the analyses.

As always Conventional Radiocarbon Ages and sigmas are rounded to the nearest 10 years per the conventions of the 1977 International Radiocarbon Conference. When counting statistics produce sigmas lower than +/- 30 years, a conservative +/- 30 BP is cited for the result. The reported d13C values were measured separately in an IRMS (isotope ratio mass spectrometer). They are NOT the AMS d13C which would include fractionation effects from natural, chemistry and AMS induced sources.

When interpreting the results, please consider any communications you may have had with us regarding the samples. As always, your inquiries are most welcome. If you have any questions or would like further details of the analyses, please do not hesitate to contact us.

The cost of the analysis was charged to the American Express card provided. Thank you. As always, if you have any questions or would like to discuss the results, don't hesitate to contact me.

Sincerely ,

Darden Hood
Digital signature on file

BETA Beta Analytic Inc.
DR. M.A. TAMERS and MR. D.G. HOOD

4985 S.W. 74 COURT
MIAMI, FLORIDA, USA 33155
PH: 305-667-5167 FAX: 305-663-0964
beta@radiocarbon.com

REPORT OF RADIOCARBON DATING ANALYSES

Mr. Frank Florin — Report Date: 1/10/2017

Florin Cultural Resource Services — Material Received: 1/3/2017

Sample Data	Measured Radiocarbon Age	Isotopes Results o/oo	Conventional Radiocarbon Age
Beta - 454887 SAMPLE: 281-2 ST62W S5 ANALYSIS: AMS-Standard delivery	4580 +/- 30 BP	d13C= -18.6 d18O= -17.2	4690 +/- 30 BP

MATERIAL/PRETREATMENT: (cremated bone carbonate): bone carbonate extraction (acid wash prior to acidification)

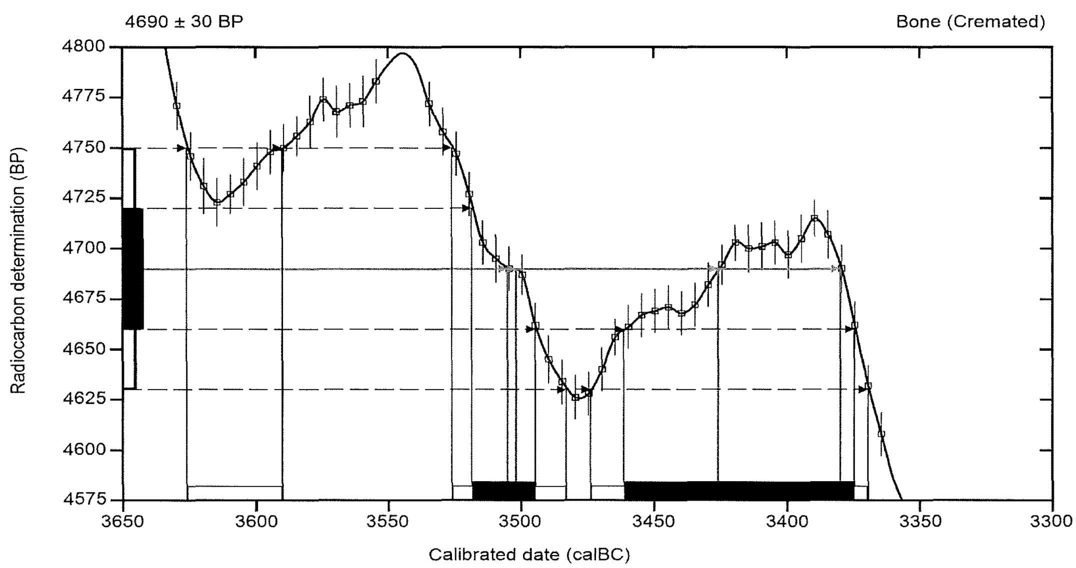
2 SIGMA CALIBRATION : cal BC 3625 - 3590 (cal BP 5575 - 5540) and cal BC 3525 - 3485 (cal BP 5475 - 5435)
cal BC 3525 - 3485 (cal BP 5475 - 5435) and cal BC 3475 - 3370 (cal BP 5425 - 5320)
cal BC 3475 - 3370 (cal BP 5425 - 5320)

Results are ISO/IEC-17025:2005 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" is corrected for isotopic fraction and was used for calendar calibration where applicable. The Age was calculated using the Libby half-life (5568 years), is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted error is 1 sigma of counting error on the combined measurements of sample, background and modern reference. Calculated sigmas less than 30 years are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C) and are reported in per mil relative to VPDB-1. Applicable calendar calibrated results were calculated using INTCAL13, MARINE13 or SHCAL13 as appropriate (see calibration graph report for references). Applicable d15N values are relative to VPDB-1 and applicable d18O and dD values are relative to VSMOW. Applicable water results are reported without correction for isotopic fractionation.

Calibration of Radiocarbon Age to Calendar Years

(Variables: d13C = -18.60 o/oo)

Laboratory number	**Beta-454887 281-2 ST62W S5**	
Conventional radiocarbon age	**4690 ± 30 BP**	
2 Sigma calibrated result	**cal BC 3625 - 3590**	**(cal BP 5575 - 5540)**
95% probability	**cal BC 3525 - 3485**	**(cal BP 5475 - 5435)**
	cal BC 3475 - 3370	**(cal BP 5425 - 5320)**
Intercept of radiocarbon age with calibration curve	cal BC 3505 (cal BP 5455)	
	cal BC 3500 (cal BP 5450)	
	cal BC 3425 (cal BP 5375)	
	cal BC 3380 (cal BP 5330)	
1 Sigma calibrated results	**cal BC 3520 - 3495**	**(cal BP 5470 - 5445)**
68% probability	**cal BC 3460 - 3375**	**(cal BP 5410 - 5325)**



Database used

INTCAL13

References

References to Intercept Method

A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2) : 317-322

References to Database INTCAL13

Reimer, et.al., 2013, Radiocarbon55(4).

Beta Analytic Radiocarbon Dating Laboratory

4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • Email: beta@radiocarbon.com

BETA
Consistent accuracy delivered on time

Beta Analytic Inc.
4985 S.W. 74 Court
Miami, Florida 33155 USA
PH: 305-667-5167
FAX: 305-663-0964
beta@radiocarbon.com
www.radiocarbon.com

Darden Hood
President

Ronald Hatfield
Christopher Patrick
Deputy Directors

August 25, 2016

Mr. Frank Florin
Florin Cultural Resource Services
N12902 273rd Street
Boyceville, WI 54725
USA

RE: Radiocarbon Dating Results.

Dear Mr. Florin:

Enclosed is the radiocarbon dating result for one sample recently sent to us. As usual, specifics of the analysis are listed on the report with the result and calibration data is provided where applicable. The Conventional Radiocarbon Age has been corrected for total fractionation effects and where applicable, calibration was performed using 2013 calibration databases (cited on the graph pages).

The web directory containing the table of results and PDF download also contains pictures, a cvs spreadsheet download option and a quality assurance report containing expected vs. measured values for 3-5 working standards analyzed simultaneously with your samples.

The reported result is accredited to ISO/IEC 17025:2005 Testing Accreditation PJLA #59423 standards and all pretreatments and chemistry were performed here in our laboratories and counted in our own accelerators here in Miami. Since Beta is not a teaching laboratory, only graduates trained to strict protocols of the ISO/IEC 17025:2005 Testing Accreditation PJLA #59423 program participated in the analysis.

As always Conventional Radiocarbon Ages and sigmas are rounded to the nearest 10 years per the conventions of the 1977 International Radiocarbon Conference. When counting statistics produce sigmas lower than +/- 30 years, a conservative +/- 30 BP is cited for the result. The reported d13C was measured separately in an IRMS (isotope ratio mass spectrometer). It is NOT the AMS d13C which would include fractionation effects from natural, chemistry and AMS induced sources.

When interpreting the result, please consider any communications you may have had with us regarding the sample. As always, your inquiries are most welcome. If you have any questions or would like further details of the analysis, please do not hesitate to contact us.

The cost of the analysis was charged to the American Express card provided. Thank you. As always, if you have any questions or would like to discuss the results, don't hesitate to contact me.

Sincerely ,

Darden Hood
Digital signature on file

BETA Beta Analytic Inc.
DR. M.A. TAMERS and MR. D.G. HOOD

4985 S.W. 74 COURT
MIAMI, FLORIDA, USA 33155
PH: 305-667-5167 FAX: 305-663-0964
beta@radiocarbon.com

REPORT OF RADIOCARBON DATING ANALYSES

Mr. Frank Florin — Report Date: 8/25/2016

Florin Cultural Resource Services — Material Received: 8/15/2016

Sample Data	Measured Radiocarbon Age	Isotopes Results o/oo	Conventional Radiocarbon Age(*)
Beta - 443706	1980 +/- 30 BP	d13C= -26.4	1960 +/- 30 BP
SAMPLE: 281-3 ST16 190-200		d18O= -20.7	

ANALYSIS: AMS-Standard delivery
MATERIAL/PRETREATMENT: (cremated bone carbonate): bone carbonate extraction
2 SIGMA CALIBRATION : Cal BC 40 to AD 85 (Cal BP 1990 to 1865)

Results are ISO-17025 accredited. AMS measurements were made on one of 4 in-house NEC SSAMS accelerator mass spectrometers.The reported age is the "Conventional Radiocarbon Age", corrected for isotopic fraction using the d13C. Age is reported as RCYBP (radiocarbon years before present, abbreviated as BP, "present" = AD 1950). By international convention, the modern reference standard was 95% the 14C signature of NBS SRM-4990C (oxalic acid) and calculated using the Libby 14C half life (5568 years). Quoted error on the BP date is 1 sigma (1 relative standard deviation with 68% probability) of counting error (only) on the combined measurements of sample, background and modern reference standards. Total error at Beta (counting + laboratory) is known to be well within +/- 2 sigma. d13C values are reported in parts per thousand (per mil) relative to PDB-1 measured on a Thermo Delta Plus IRMS. Typical d13C error is +/- 0.3 o/oo. Percent modern carbon (pMC) and Delta 14C (D14C) are not absolute. They equate to the Conventional Radiocarbon Age. Calendar calibrated results were calculated the material appropriate 2013 database (INTCAL13, MARINE13 or SHCAL13). See graph report for references.

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -26.4 o/oo : lab. mult = 1)

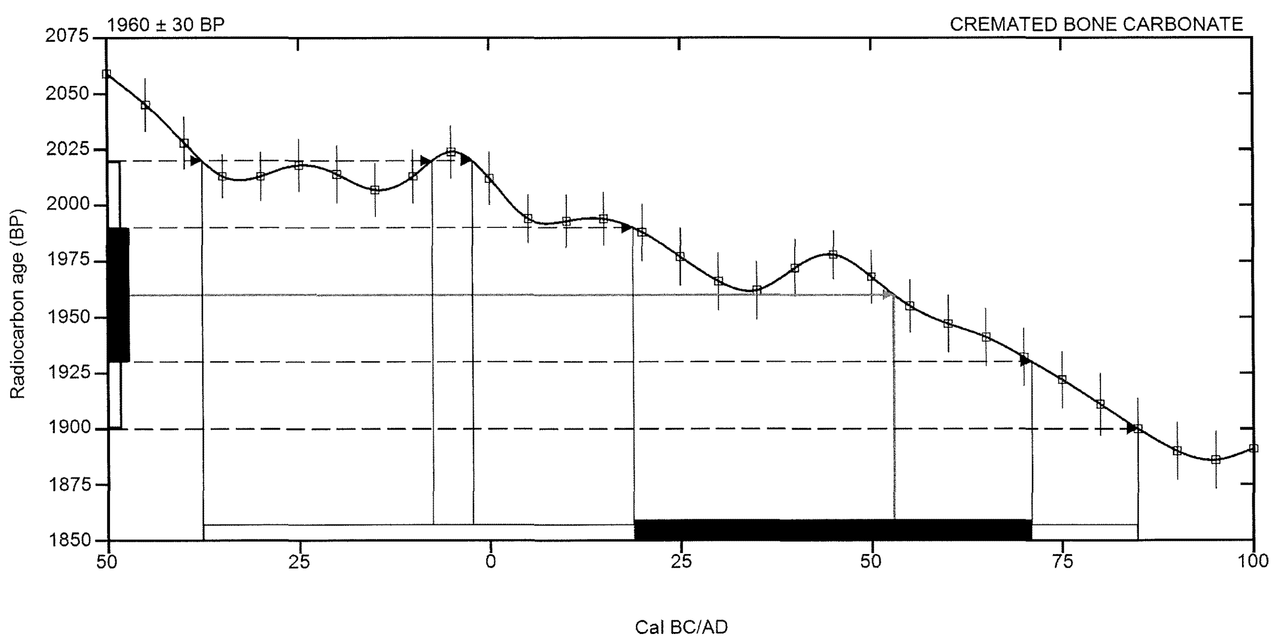
Laboratory number **Beta-443706 : 281-3 ST16 190-200**

Conventional radiocarbon age **1960 ± 30 BP**

Calibrated Result (95% Probability) **Cal BC 40 to AD 85 (Cal BP 1990 to 1865)**

Intercept of radiocarbon age with calibration curve Cal AD 55 (Cal BP 1895)

Calibrated Result (68% Probability) Cal AD 20 to 70 (Cal BP 1930 to 1880)



Database used

INTCAL13

References

Mathematics used for calibration scenario

A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322

References to INTCAL13 database

Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55(4):1869–1887., 2013.

Beta Analytic Radiocarbon Dating Laboratory

4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • Email: beta@radiocarbon.com

BETA
Consistent accuracy
delivered on time

Beta Analytic Inc.
4985 S.W. 74 Court
Miami, Florida 33155 USA
PH: 305-667-5167
FAX: 305-663-0964
beta@radiocarbon.com
www.radiocarbon.com

Darden Hood
President

Ronald Hatfield
Christopher Patrick
Deputy Directors

January 17, 2017

Mr. Frank Florin
Florin Cultural Resource Services
N12902 273rd Street
Boyceville, WI 54725
USA

RE: Radiocarbon Dating Results.

Dear Mr. Florin:

Enclosed is the radiocarbon dating result for one sample recently sent to us. As usual, specifics of the analysis are listed on the report with the result and calibration data is provided where applicable. The Conventional Radiocarbon Age has been corrected for total fractionation effects and where applicable, calibration was performed using 2013 calibration databases (cited on the graph pages).

The web directory containing the table of results and PDF download also contains pictures, a cvs spreadsheet download option and a quality assurance report containing expected vs. measured values for 3-5 working standards analyzed simultaneously with your samples.

The reported result is accredited to ISO/IEC 17025:2005 Testing Accreditation PJLA #59423 standards and all pretreatments and chemistry were performed here in our laboratories and counted in our own accelerators here in Miami. Since Beta is not a teaching laboratory, only graduates trained to strict protocols of the ISO/IEC 17025:2005 Testing Accreditation PJLA #59423 program participated in the analysis.

As always Conventional Radiocarbon Ages and sigmas are rounded to the nearest 10 years per the conventions of the 1977 International Radiocarbon Conference. When counting statistics produce sigmas lower than +/- 30 years, a conservative +/- 30 BP is cited for the result. The reported d13C was measured separately in an IRMS (isotope ratio mass spectrometer). It is NOT the AMS d13C which would include fractionation effects from natural, chemistry and AMS induced sources.

When interpreting the result, please consider any communications you may have had with us regarding the sample. As always, your inquiries are most welcome. If you have any questions or would like further details of the analysis, please do not hesitate to contact us.

The cost of the analysis was charged to the American Express card provided. Thank you. As always, if you have any questions or would like to discuss the results, don't hesitate to contact me.

Sincerely ,

Darden Hood
Digital signature on file

BETA Beta Analytic Inc.
DR. M.A. TAMERS and MR. D.G. HOOD

4985 S.W. 74 COURT
MIAMI, FLORIDA, USA 33155
PH: 305-667-5167 FAX: 305-663-0964
beta@radiocarbon.com

REPORT OF RADIOCARBON DATING ANALYSES

Mr. Frank Florin — Report Date: 1/17/2017

Florin Cultural Resource Services — Material Received: 1/9/2017

Sample Data	Measured Radiocarbon Age	Isotopes Results o/oo	Conventional Radiocarbon Age
Beta - 455235	1290 +/- 30 BP	d13C= -25.7	1280 +/- 30 BP

SAMPLE: 281-4 XU13 50-60
ANALYSIS: AMS-Standard delivery
MATERIAL/PRETREATMENT: (potsherd residue): acid/alkali/acid
2 SIGMA CALIBRATION : cal AD 665 - 775 (cal BP 1285 - 1175)

Results are ISO/IEC-17025:2005 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" is corrected for isotopic fraction and was used for calendar calibration where applicable. The Age was calculated using the Libby half-life (5568 years), is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted error is 1 sigma of counting error on the combined measurements of sample, background and modern reference. Calculated sigmas less than 30 years are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C) and are reported in per mil relative to VPDB-1. Applicable calendar calibrated results were calculated using INTCAL13, MARINE13 or SHCAL13 as appropriate (see calibration graph report for references). Applicable d15N values are relative to VPDB-1 and applicable d18O and dD values are relative to VSMOW. Applicable water results are reported without correction for isotopic fractionation.

Calibration of Radiocarbon Age to Calendar Years

(Variables: d13C = -25.70 o/oo)

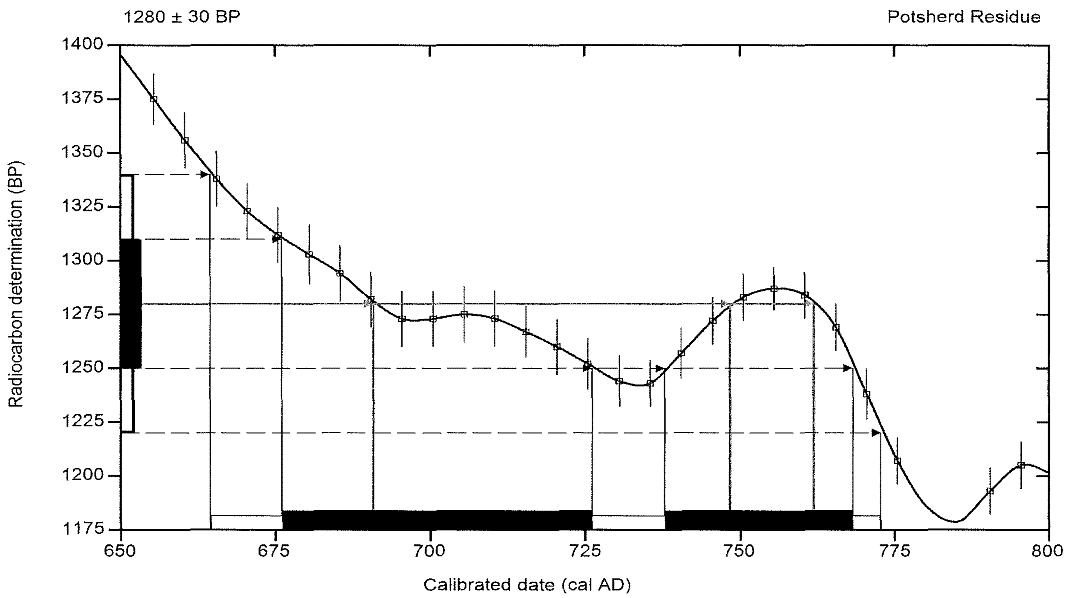
Laboratory number **Beta-455235 281-4 XU13 50-60**

Conventional radiocarbon age **1280 ± 30 BP**

2 Sigma calibrated result **cal AD 665 - 775** **(cal BP 1285 - 1175)**
95% probability

Intercept of radiocarbon age with calibration curve
cal AD 690 (cal BP 1260)
cal AD 750 (cal BP 1200)
cal AD 760 (cal BP 1190)

1 Sigma calibrated results
68% probability
cal AD 675 - 725 **(cal BP 1275 - 1225)**
cal AD 740 - 770 **(cal BP 1210 - 1180)**



Database used
INTCAL13

References
References to Intercept Method
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2) : 317-322
References to Database INTCAL13
Reimer, et.al., 2013, Radiocarbon55(4).

Beta Analytic Radiocarbon Dating Laboratory
4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • Email: beta@radiocarbon.com

Beta Analytic Inc.
4985 S.W. 74 Court
Miami, Florida 33155 USA
PH: 305-667-5167
FAX: 305-663-0964
beta@radiocarbon.com
www.radiocarbon.com

Consistent accuracy delivered on time

Darden Hood
President

Ronald Hatfield
Christopher Patrick
Deputy Directors

February 10, 2017

Mr. Frank Florin
Florin Cultural Resource Services
N12902 273rd Street
Boyceville, WI 54725
USA

RE: Radiocarbon Dating Results.

Dear Mr. Florin:

Enclosed are the radiocarbon dating results for three samples recently sent to us. As usual, the method of analysis is listed on the report with the results and calibration data is provided where applicable. The Conventional Radiocarbon Ages have all been corrected for total fractionation effects and where applicable, calibration was performed using 2013 calibration databases (cited on the graph pages).

You will notice that Beta-457226 is reported with the units "pMC" rather than BP. "pMC" stands for "percent modern carbon". Results are reported in the pMC format when the analyzed material had more 14C than did the modern (AD 1950) reference standard. The source of this "extra" 14C in the atmosphere is thermo-nuclear bomb testing which on-set in the 1950s. Its presence generally indicates the material analyzed was part of a system that was respiring carbon after the on-set of the testing (AD 1950s). On occasion, the two sigma lower limit will extend into the time region before this "bomb-carbon" onset (i.e. less than 100 pMC). In those cases, there is some probability for 18th, 19th, or 20th century antiquity.

Reported results are accredited to ISO/IEC 17025:2005 Testing Accreditation PJLA #59423 standards and all chemistry was performed here in our laboratory and counted in our own accelerators here. Since Beta is not a teaching laboratory, only graduates trained to strict protocols of the ISO/IEC 17025:2005 Testing Accreditation PJLA #59423 program participated in the analyses.

As always Conventional Radiocarbon Ages and sigmas are rounded to the nearest 10 years per the conventions of the 1977 International Radiocarbon Conference. When counting statistics produce sigmas lower than +/- 30 years, a conservative +/- 30 BP is cited for the result. The reported d13C values were measured separately in an IRMS (isotope ratio mass spectrometer). They are NOT the AMS d13C which would include fractionation effects from natural, chemistry and AMS induced sources.

When interpreting the results, please consider any communications you may have had with us regarding the samples. As always, your inquiries are most welcome. If you have any questions or would like further details of the analyses, please do not hesitate to contact us.

The cost of the analysis was charged to the American Express card provided. Thank you. As always, if you have any questions or would like to discuss the results, don't hesitate to contact me.

Sincerely ,

Darden Hood
Digital signature on file

BETA
Beta Analytic Inc.
DR. M.A. TAMERS and MR. D.G. HOOD
4985 S.W. 74 COURT
MIAMI, FLORIDA, USA 33155
PH: 305-667-5167 FAX: 305-663-0964
beta@radiocarbon.com

REPORT OF RADIOCARBON DATING ANALYSES

Mr. Frank Florin — Report Date: 2/10/2017

Florin Cultural Resource Services — Material Received: 2/1/2017

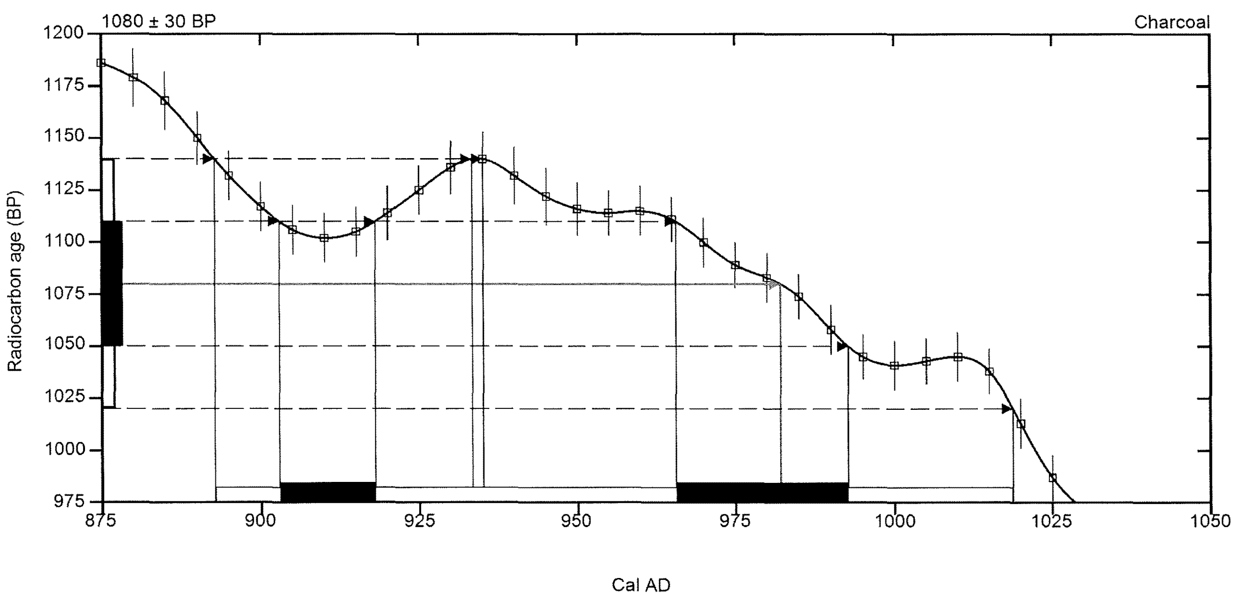
Sample Data	Measured Radiocarbon Age	Isotopes Results o/oo	Conventional Radiocarbon Age
Beta - 457225 281-4 F5E 70-79 AMS-Standard delivery MATERIAL/PRETREATMENT: (charred material): acid/alkali/acid 2 SIGMA CALIBRATION : Cal AD 895 to 1020 (Cal BP 1055 to 930)	1090 +/- 30 BP	d13C= -25.5	1080 +/- 30 BP
Beta - 457226 281-4 F6W 90-115 AMS-Standard delivery MATERIAL/PRETREATMENT: (charred material): acid/alkali/acid COMMENTS: The reported result indicates an age of post 0 BP and has been reported as a % of the modern reference standard, indicating the material was living about the last 60 years or so ("pMC" = percent modern carbon).	128.9 +/- 0.5 pMC	d13C= -26.8	129.4 +/- 0.5 pMC
Beta - 457227 281-4 F6E 80-119 AMS-Standard delivery MATERIAL/PRETREATMENT: (charred material): acid/alkali/acid 2 SIGMA CALIBRATION : Cal AD 670 to 775 (Cal BP 1280 to 1175)	1290 +/- 30 BP	d13C= -26.1	1270 +/- 30 BP

Results are ISO/IEC-17025:2005 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" is corrected for isotopic fraction and was used for calendar calibration where applicable. The Age was calculated using the Libby half-life (5568 years), is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted error is 1 sigma of counting error on the combined measurements of sample, background and modern reference. Calculated sigmas less than 30 years are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C) and are reported in per mil relative to VPDB-1. Applicable calendar calibrated results were calculated using INTCAL13, MARINE13 or SHCAL13 as appropriate (see calibration graph report for references). Applicable d15N values are relative to VPDB-1 and applicable d18O and dD values are relative to VSMOW. Applicable water results are reported without correction for isotopic fractionation.

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -25.5 o/oo : lab. mult = 1)

Laboratory number	**Beta-457225 : 281-4 F5E 70-79**
Conventional radiocarbon age	**1080 ± 30 BP**
Calibrated Result (95% Probability)	**Cal AD 895 to 1020 (Cal BP 1055 to 930)**
Intercept of radiocarbon age with calibration curve	Cal AD 980 (Cal BP 970)
Calibrated Result (68% Probability)	Cal AD 905 to 920 (Cal BP 1045 to 1030) Cal AD 965 to 995 (Cal BP 985 to 955)



Database used
INTCAL13

References

Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322

References to INTCAL13 database
Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55(4):1869–1887., 2013.

Beta Analytic Radiocarbon Dating Laboratory
4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • Email: beta@radiocarbon.com

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -26.1 o/oo : lab. mult = 1)

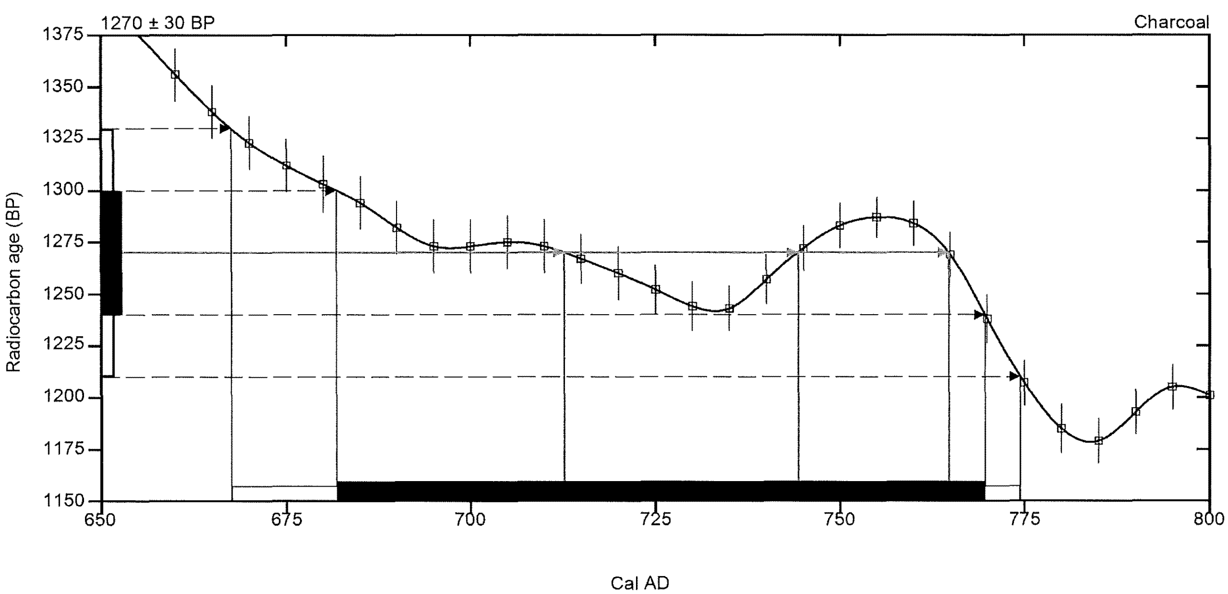
Laboratory number **Beta-457227 : 281-4 F6E 80-119**

Conventional radiocarbon age **1270 ± 30 BP**

Calibrated Result (95% Probability) **Cal AD 670 to 775 (Cal BP 1280 to 1175)**

Intercept of radiocarbon age with calibration curve
Cal AD 715 (Cal BP 1235)
Cal AD 745 (Cal BP 1205)
Cal AD 765 (Cal BP 1185)

Calibrated Result (68% Probability) Cal AD 680 to 770 (Cal BP 1270 to 1180)



Database used
INTCAL13

References
Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322
References to INTCAL13 database
Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55(4):1869–1887., 2013.

Beta Analytic Radiocarbon Dating Laboratory
4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • Email: beta@radiocarbon.com

Beta Analytic Inc.
4985 S.W. 74 Court
Miami, Florida 33155 USA
PH: 305-667-5167
FAX: 305-663-0964
beta@radiocarbon.com
www.radiocarbon.com

Consistent accuracy delivered on time

Darden Hood
President

Ronald Hatfield
Christopher Patrick
Deputy Directors

February 27, 2017

Mr. Frank Florin
Florin Cultural Resource Services
N12902 273rd Street
Boyceville, WI 54725
USA

RE: Radiocarbon Dating Results.

Dear Mr. Florin:

Enclosed are the radiocarbon dating results for two samples recently sent to us. As usual, the method of analysis is listed on the report with the results and calibration data is provided where applicable. The Conventional Radiocarbon Ages have all been corrected for total fractionation effects and where applicable, calibration was performed using 2013 calibration databases (cited on the graph pages).

The web directory containing the table of results and PDF download also contains pictures, a cvs spreadsheet download option and a quality assurance report containing expected vs. measured values for 3-5 working standards analyzed simultaneously with your samples.

Reported results are accredited to ISO/IEC 17025:2005 Testing Accreditation PJLA #59423 standards and all chemistry was performed here in our laboratory and counted in our own accelerators here. Since Beta is not a teaching laboratory, only graduates trained to strict protocols of the ISO/IEC 17025:2005 Testing Accreditation PJLA #59423 program participated in the analyses.

As always Conventional Radiocarbon Ages and sigmas are rounded to the nearest 10 years per the conventions of the 1977 International Radiocarbon Conference. When counting statistics produce sigmas lower than +/- 30 years, a conservative +/- 30 BP is cited for the result. The reported d13C values were measured separately in an IRMS (isotope ratio mass spectrometer). They are NOT the AMS d13C which would include fractionation effects from natural, chemistry and AMS induced sources.

When interpreting the results, please consider any communications you may have had with us regarding the samples. As always, your inquiries are most welcome. If you have any questions or would like further details of the analyses, please do not hesitate to contact us.

The cost of the analysis was charged to the American Express card provided. Thank you. As always, if you have any questions or would like to discuss the results, don't hesitate to contact me.

Sincerely ,

Darden Hood
Digital signature on file

BETA Beta Analytic Inc.
DR. M.A. TAMERS and MR. D.G. HOOD
4985 S.W. 74 COURT
MIAMI, FLORIDA, USA 33155
PH: 305-667-5167 FAX: 305-663-0964
beta@radiocarbon.com

REPORT OF RADIOCARBON DATING ANALYSES

Mr. Frank Florin — Report Date: 2/27/2017

Florin Cultural Resource Services — Material Received: 2/6/2017

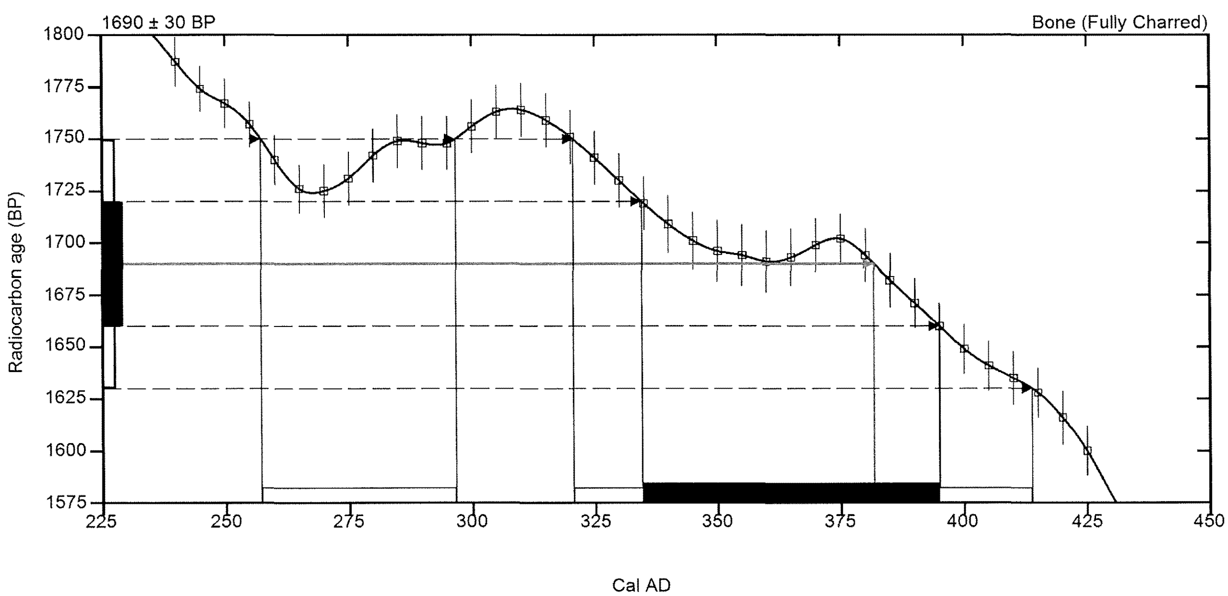
Sample Data	Measured Radiocarbon Age	Isotopes Results o/oo	Conventional Radiocarbon Age
Beta - 457514 281-4 F7 88-102 AMS-Standard delivery	1710 +/- 30 BP	d13C= -26.2	1690 +/- 30 BP
MATERIAL/PRETREATMENT: (charred material): acid/alkali/acid 2 SIGMA CALIBRATION : Cal AD 255 to 295 (Cal BP 1695 to 1655) and Cal AD 320 to 415 (Cal BP 1630 to 1535)			
Beta - 457515 281-4 XU3 50-60 AMS-Standard delivery	810 +/- 30 BP	d13C= -21.1 d15N= +3.9	870 +/- 30 BP
MATERIAL/PRETREATMENT: (bone collagen): collagen extration: with alkali 2 SIGMA CALIBRATION : Cal AD 1050 to 1085 (Cal BP 900 to 865) and Cal AD 1125 to 1140 (Cal BP 825 to 810) Cal AD 1150 to 1225 (Cal BP 800 to 725)			

Results are ISO/IEC-17025:2005 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" is corrected for isotopic fraction and was used for calendar calibration where applicable. The Age was calculated using the Libby half-life (5568 years), is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted error is 1 sigma of counting error on the combined measurements of sample, background and modern reference. Calculated sigmas less than 30 years are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C) and are reported in per mil relative to VPDB-1. Applicable calendar calibrated results were calculated using INTCAL13, MARINE13 or SHCAL13 as appropriate (see calibration graph report for references). Applicable d15N values are relative to VPDB-1 and applicable d18O and dD values are relative to VSMOW. Applicable water results are reported without correction for isotopic fractionation.

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -26.2 o/oo : lab. mult = 1)

Laboratory number	**Beta-457514 : 281-4 F7 88-102**
Conventional radiocarbon age	**1690 ± 30 BP**
Calibrated Result (95% Probability)	**Cal AD 255 to 295 (Cal BP 1695 to 1655)** **Cal AD 320 to 415 (Cal BP 1630 to 1535)**
Intercept of radiocarbon age with calibration curve	Cal AD 380 (Cal BP 1570)
Calibrated Result (68% Probability)	Cal AD 335 to 395 (Cal BP 1615 to 1555)



Database used
INTCAL13

References

Mathematics used for calibration scenario
A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322

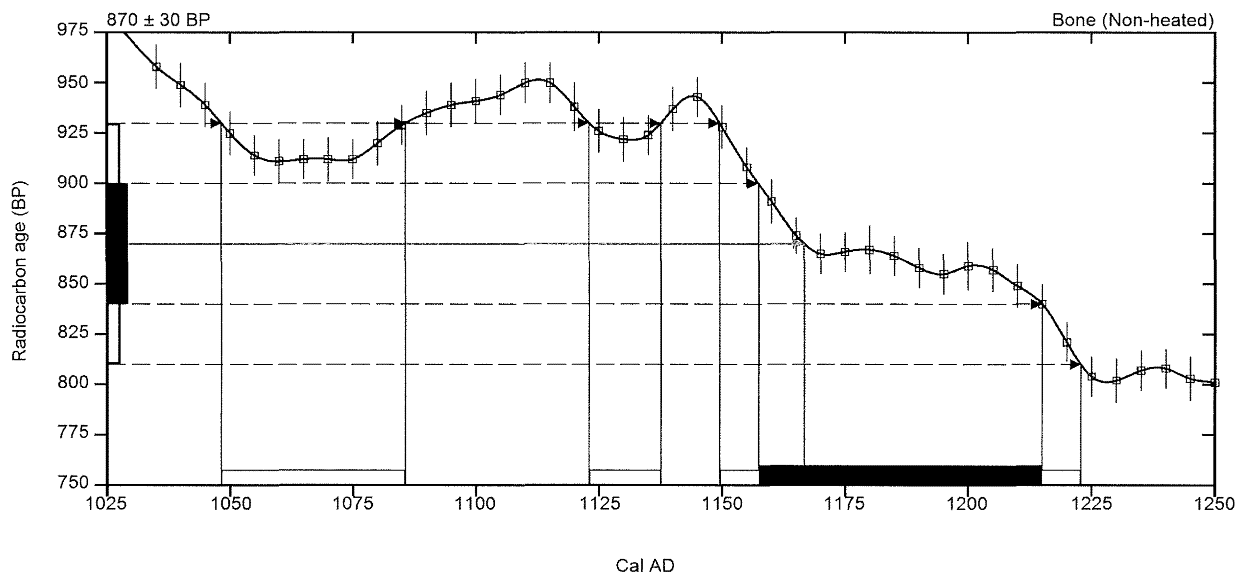
References to INTCAL13 database
Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55(4):1869–1887., 2013.

Beta Analytic Radiocarbon Dating Laboratory
4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • Email: beta@radiocarbon.com

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -21.1 o/oo : lab. mult = 1)

Laboratory number	**Beta-457515 : 281-4 XU3 50-60**
Conventional radiocarbon age	**870 ± 30 BP**
Calibrated Result (95% Probability)	**Cal AD 1050 to 1085 (Cal BP 900 to 865)** **Cal AD 1125 to 1140 (Cal BP 825 to 810)** **Cal AD 1150 to 1225 (Cal BP 800 to 725)**
Intercept of radiocarbon age with calibration curve	Cal AD 1165 (Cal BP 785)
Calibrated Result (68% Probability)	Cal AD 1155 to 1215 (Cal BP 795 to 735)



Database used

INTCAL13

References

Mathematics used for calibration scenario

A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322

References to INTCAL13 database

Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55(4):1869–1887., 2013.

Beta Analytic Radiocarbon Dating Laboratory

4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • Email: beta@radiocarbon.com

BETA
Consistent accuracy delivered on time

Beta Analytic Inc.
4985 S.W. 74 Court
Miami, Florida 33155 USA
PH: 305-667-5167
FAX: 305-663-0964
beta@radiocarbon.com
www.radiocarbon.com

Darden Hood
President

Ronald Hatfield
Christopher Patrick
Deputy Directors

February 23, 2017

Mr. Frank Florin
Florin Cultural Resource Services
N12902 273rd Street
Boyceville, WI 54725
USA

RE: Radiocarbon Dating Results.

Dear Mr. Florin:

Enclosed is the radiocarbon dating result for one sample recently sent to us. As usual, specifics of the analysis are listed on the report with the result and calibration data is provided where applicable. The Conventional Radiocarbon Age has been corrected for total fractionation effects and where applicable, calibration was performed using 2013 calibration databases (cited on the graph pages).

The web directory containing the table of results and PDF download also contains pictures, a cvs spreadsheet download option and a quality assurance report containing expected vs. measured values for 3-5 working standards analyzed simultaneously with your samples.

The reported result is accredited to ISO/IEC 17025:2005 Testing Accreditation PJLA #59423 standards and all pretreatments and chemistry were performed here in our laboratories and counted in our own accelerators here in Miami. Since Beta is not a teaching laboratory, only graduates trained to strict protocols of the ISO/IEC 17025:2005 Testing Accreditation PJLA #59423 program participated in the analysis.

As always Conventional Radiocarbon Ages and sigmas are rounded to the nearest 10 years per the conventions of the 1977 International Radiocarbon Conference. When counting statistics produce sigmas lower than +/- 30 years, a conservative +/- 30 BP is cited for the result. The reported d13C was measured separately in an IRMS (isotope ratio mass spectrometer). It is NOT the AMS d13C which would include fractionation effects from natural, chemistry and AMS induced sources.

When interpreting the result, please consider any communications you may have had with us regarding the sample. As always, your inquiries are most welcome. If you have any questions or would like further details of the analysis, please do not hesitate to contact us.

The cost of the analysis was charged to the American Express card provided. Thank you. As always, if you have any questions or would like to discuss the results, don't hesitate to contact me.

Sincerely ,

Darden Hood
Digital signature on file

BETA Beta Analytic Inc.
DR. M.A. TAMERS and MR. D.G. HOOD

4985 S.W. 74 COURT
MIAMI, FLORIDA, USA 33155
PH: 305-667-5167 FAX: 305-663-0964
beta@radiocarbon.com

REPORT OF RADIOCARBON DATING ANALYSES

Mr. Frank Florin

Report Date: 2/23/2017

Florin Cultural Resource Services

Material Received: 2/13/2017

Sample Data	Measured Radiocarbon Age	Isotopes Results o/oo	Conventional Radiocarbon Age
Beta - 458050 281-4 ST30 NE7 30-50 AMS-Standard delivery	1060 +/- 30 BP	d13C= -19.7 d15N= +3.9	1150 +/- 30 BP

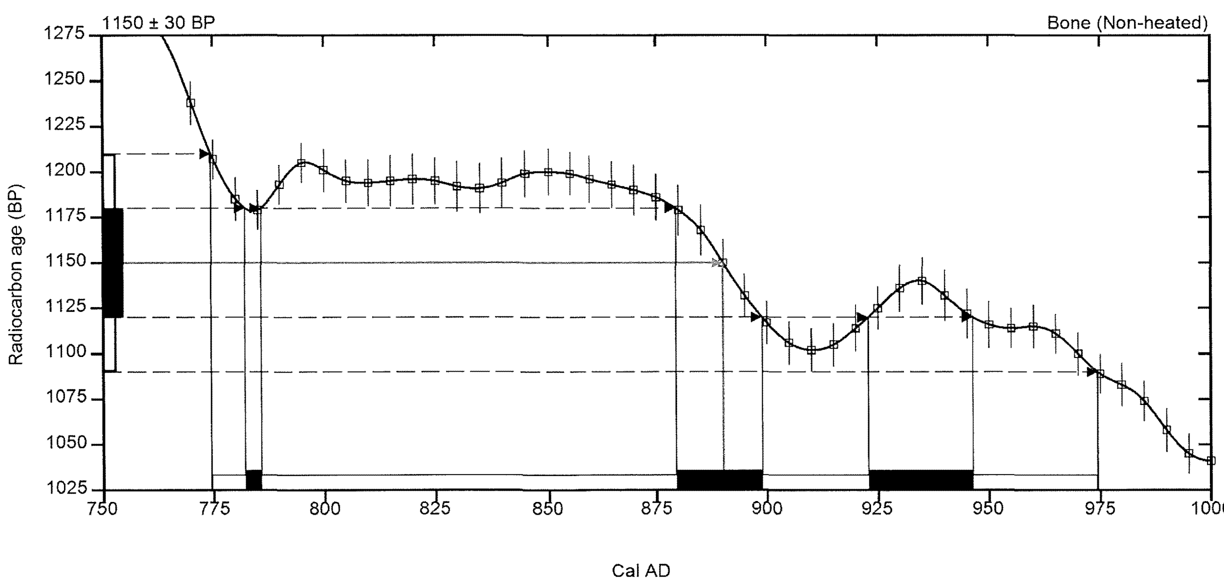
MATERIAL/PRETREATMENT: (bone collagen): collagen extration: with alkali
2 SIGMA CALIBRATION : Cal AD 775 to 975 (Cal BP 1175 to 975)

Results are ISO/IEC-17025:2005 accredited. No sub-contracting or student labor was used in the analyses. All work was done at Beta in 4 in-house NEC accelerator mass spectrometers and 4 Thermo IRMSs. The "Conventional Radiocarbon Age" is corrected for isotopic fraction and was used for calendar calibration where applicable. The Age was calculated using the Libby half-life (5568 years), is rounded to the nearest 10 years and is reported as radiocarbon years before present (BP), "present" = AD 1950. Results greater than the modern reference are reported as percent modern carbon (pMC). The modern reference standard was 95% the 14C signature of NIST SRM-4990C (oxalic acid). Quoted error is 1 sigma of counting error on the combined measurements of sample, background and modern reference. Calculated sigmas less than 30 years are conservatively rounded up to 30. d13C values are on the material itself (not the AMS d13C) and are reported in per mil relative to VPDB-1. Applicable calendar calibrated results were calculated using INTCAL13, MARINE13 or SHCAL13 as appropriate (see calibration graph report for references). Applicable d15N values are relative to VPDB-1 and applicable d18O and dD values are relative to VSMOW. Applicable water results are reported without correction for isotopic fractionation.

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12 = -19.7 o/oo : lab. mult = 1)

Laboratory number	**Beta-458050 : 281-4 ST30 NE7 30-50**
Conventional radiocarbon age	**1150 ± 30 BP**
Calibrated Result (95% Probability)	**Cal AD 775 to 975 (Cal BP 1175 to 975)**
Intercept of radiocarbon age with calibration curve	Cal AD 890 (Cal BP 1060)
Calibrated Result (68% Probability)	Cal AD 780 to 785 (Cal BP 1170 to 1165) Cal AD 880 to 900 (Cal BP 1070 to 1050) Cal AD 925 to 945 (Cal BP 1025 to 1005)



Database used

INTCAL13

References

Mathematics used for calibration scenario

A Simplified Approach to Calibrating C14 Dates, Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2):317-322

References to INTCAL13 database

Reimer PJ et al. IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. Radiocarbon 55(4):1869–1887., 2013.

Beta Analytic Radiocarbon Dating Laboratory

4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • Email: beta@radiocarbon.com