Archeological Inventory, Testing, and Data Recovery at the James Staples House (HS 9), Herbert Hoover National Historic Site, West Branch, Iowa

by
Dawn Bringelson,
Amanda Davey,
and
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with contributions by
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Technical Report No. 107

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This report has been reviewed against the criteria contained in 43CFR Part 7, Subpart A, Section 7.18 (a) (1) and, upon recommendation of the Midwest Regional Office and the Midwest Archeological Center, has been classified as

Available

Making the report available meets the criteria of 43CFR Part 7, Subpart A, Section 7.18 (a) (1).

ABSTRACT

Staff of the Midwest Archeological Center investigated archeology associated with the James Staples House (HS-09) at Herbert Hoover National Historic Site during fall 2005 and spring 2006. These investigations ensued as a part of a rehabilitation project to upgrade staff housing, to restore the home's historic character, and to improve conditions for its long-term preservation. Geophysical and shovel test inventories, as well as evaluative testing and data recovery excavations all provided information on the nature and distribution of archeological deposits across the house lot. Deposits vary, with a shallow kitchen midden dominating the southwest quadrant and extending south into the adjacent house lot. This dense yet relatively fragmented assemblage includes a wide variety of personal and domestic artifacts, as well as heating and construction debris (noted within the near-surface sediments everywhere). The northwest lot contains one or more potentially significant deposits located beneath a sizeable layer of re-deposited and/or churned fill. A buried trash feature contains a concentration of largely intact construction, domestic, and personal materials. Both eastern quadrants also showed a significant amount of redeposited sub-soil capping original grade and potentially significant artifact deposits, including early landscaping features and historic remodeling debris. Analyses suggest basement excavation spoil was distributed across the front and north sides during basement excavation and remodeling near the turn of the 20th Century. The artifact assemblage provides a useful source of information regarding house occupants throughout the late 19th into the mid-20th century. This assemblage might be used in comparison with others from the West Branch neighborhood to address questions regarding social and economic dynamics during that time.

Archeological deposits are capped by 30 or more centimeters of tilled and/or moved sediments in all but the southwest quadrant, where significant deposits are located at or near the surface. Archeological consultation early in the process of planning for any future undertakings involving groundwork at this lot is recommended. This is especially emphasized for the southwest area of this lot, as well as portions of the adjoining Wright House lot.

Materials and data associated with this project are stored at the Midwest Archeological Center under MWAC Accessions 1104, 1105 and 1119 (HEHO Accessions 126, 127, and 129, respectively).

ACKNOWLEDGEMENTS

The Staples House project's successful completion is due to the efforts of many individuals from multiple organizations. Park staff were instrumental in initiating and facilitating field efforts. Former Superintendent Bruce McKeeman first brought the project to our attention and supported efforts to complete the work. Chief Ranger Neil Korsmo, Historian Cary Wiesner, then-Facilities Manager Dennis Steele, Maintenance Mechanic Daris Honemann, and other HEHO staff worked with us over multiple field trips to keep things moving. They provided access, vegetation control, information, backhoe, and other assistance every time it was needed.

The staff of the Iowa State Historic Preservation Office, especially Archaeologist Doug Jones, has been helpful throughout this project with answers and suggestions to smooth the path of partnered compliance. Several Iowa Archaeological Society volunteers provided enthusiastic field help during October of 2005. Thank you, Bob Brandon, Steve Hanken, Gary Dalecky, Fred Gee and Charlotte Wright.

The team at the Midwest Archeological Center has made this work a pleasure. Former Park Program Manager Tom Thiessen set this project off on solid footing, giving key editorial and programmatic advice early on. Steven De Vore's geophysical survey and reporting sets the standard for professionalism and efficiency; it is a privilege to work with him. Archeologist Ken Cannon, and Archeological Technicians Mike Hammons, John Gapp, and Amanda Davey provided expert field assistance. I was very fortunate to have their help. Amanda Davey and Jonathan Weiland worked with materials in the lab, contributing substantially to all phases of processing and analysis. Thanks to Ken Cannon for his detailed and enlightening faunal analysis. The publications team has put this project over the last hump: Program Managers Jeffrey Richner and Ralph Hartley screened it and advised final reworking, and Allan Weber and Jeff Larson formatted the report for publishing. Especially heartfelt appreciation is given to Jeffrey Richner, who led field efforts in my absence during March of 2006. I cannot thank him enough.

While all these individuals were indispensible in the completion of this report, all errors and omissions are my own.

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1. INTRODUCTION

The Herbert Hoover National Historic Site (HEHO) was designated in 1965 to preserve the historically significant resources associated with the life of the nation's 31st president. The 186-acre unit of the National Park Service is located in the town of West Branch in Cedar County, Iowa (Figure 1). The park's historic resources include Hoover's birthplace, the site of his boyhood home, and the gravesite of Herbert and his wife, Lou Henry Hoover. HEHO also houses a blacksmith shop and Quaker meeting house representing buildings present during his childhood years in West Branch, and a portion of the residential neighborhood from that period.

In the Fall of 2005, HEHO was preparing to rehabilitate one of this neighborhood's historic properties. The James Staples House (HS-9), located within the historic core area of HEHO, was constructed between 1869 and 1872 (Wagner 1982), and was thus a part of town during the time that Hoover was a resident of West Branch. This structure underwent extensive additions over the years, resulting in an appearance inconsistent with the historic character sought by the park for the historic core. In addition, some wood elements of the current structure were in direct contact with the ground, and drainage was poor on this lot. This project was also needed to produce the first Americans with Disabilities Act-compliant staff housing at the park. Therefore, extensive reworking was necessary to improve and stabilize the condition of the house.

Rehabilitation efforts planned included actions with potential impacts to archeological deposits, such as minor grading across the lot, excavation around the perimeter of the house to the bottom of the basement foundation, removal and replacement of certain later structural elements, and excavation of sediments below some floors. In accordance with Section 106 of the National Historic Preservation Act and 36CFR Part 800, archeological inventory was planned to help the park take into account the effects of these undertakings on the historic Staples property. Prior to this project, no archeological fieldwork had been conducted on the Staples lot itself (Finney 2005), but work near other structures in the HEHO historic core (Hunt 1996; Richner 1997; Sudderth 1992) had shown significant archeological deposits exist elsewhere within the park. Because of the extensive nature of the intended work, inventory was planned across the Staples lot, with the proviso that testing and data recovery would be undertaken if inventory results indicated the need (which was indeed the case). This report summarizes methods and results of all work completed to fulfill the requirements of Section 106, including inventory, testing, and data recovery.

2. ENVIRONMENTAL AND GEOMORPHOLOGICAL CONTEXT

The James Staples House lot is located on the corner of Wetherell and Poplar streets, within HEHO and the town of West Branch, Cedar County, Iowa. HEHO is located within the Southern Iowa Drift Plain, a landform region with topography including "steeply rolling hills, level upland divides, stepped erosion surfaces, and dendritic drainage networks" (Finney 2005:4). Cedar County is underlain by Devonian and Silurian bedrock mantled by loess of Wisconsinan age (Finney 2005). The soils of West Branch are identified as Tama Silt Loam, 5-9 percent slopes. The upper component (approximately one foot thick) is very dark brown silt loam or silty clay loam, underlain by a friable silty clay loam some 30 inches in thickness. This subsoil grades in color from dark brown to yellowish brown, from top to bottom. (*Soil Survey of Cedar County, Iowa*, USDA-SCS, ISU, DSC-Iowa 1979, pp 21-22).

The Staples lot is located on a slope, approximately 150 meters north of a branch of Wapsinonoc Creek that runs through the park. This house lot was terraced, with the highest point occurring in the northwest corner, adjacent to Wetherell Road, and the lowest point in the front yard, adjacent to Poplar Trace. Observations of profiles exposed in backhoe trenches across the lot (detailed in a following section), indicated a gradation from the A-horizon to the B and C horizons, with loess for parent material. All trenches were one meter or deeper, and no paleosols were exposed.

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3. CULTURAL CONTEXT

The Human Record for Eastern Iowa

Fred Finney (2005) provides a comprehensive cultural context for HEHO. Information on previous archeological investigations, recorded sites, and culture history relevant to the Staples investigations are abstracted here from that document.

The record of human occupation of Iowa extends back some 13,000 years. Earliest known occupants of the New World are identified as Paleoindian. Paleoindian sites are distinguished by the presence of fluted lanceolate points; relatively little other material culture is reliably tied to these early occupations, spanning from approximately 11000 to about 8000 B.C. Later Paleoindian points exhibited greater variety in form, including some that were unfluted.

Even though pointed stone bifaces comprise the great majority of the Paleoindian tool kit, faunal material found in context with such artifacts tells much about the Paleoindian lifeway. Early Paleoindian hunting appears to have focused on communal hunts of large mammals, as evidenced from points have been found in context with large mammal remains. Late Paleonindian adaptations appear to have broadened in spectrum, incorporating hunting, fishing, and gathering for subsistence.

This subsistence pattern continues into the following stage, identified as Archaic. The Archaic period in Iowa spans roughly 8000 to 500 BC, and is characterized by a great diversification in point styles as well as tool types, the latter including the emergence of plant-processing tools. Broadening of diet is also indicated by increased diversity in animal species represented in faunal assemblages.

The Woodland Stage follows the Archaic, spanning roughly 500 BC to AD 1000 in the project area, and is divided for analytical and descriptive purposes into Early, Middle and Late substages. In large part a continuation of subsistence and settlement patterns exhibited in the Archaic, the Woodland is marked (in Iowa at least) by three new traits: ceramic vessel use, earthwork creation, and plant cultivation. All three traits have precursors in the Archaic Stage, but develop more fully during the Woodland.

The Early Woodland looks much like the Archaic, with the addition of pottery (ie., low-fired ceramics). Thick-walled, sand-tempered paste is characteristic of early Woodland pottery. The Middle Woodland is marked by the fluorescence of larger-scale social networks, as evidenced by the appearance of exotic trade goods in the archeological record, and pottery traits shared across great distance. Eastern Iowa Middle Woodland is generally identified with the Havana Tradition, a Hopewell trait distributed around the lower Illinois Valley. Later trends during the Woodland involved decentralization, and a continued increase in plant horticulture through time.

The period after the Woodland, termed the late Prehistoric in the study area, includes a broad range of material cultures across Iowa. All exhibit a similarly diverse subsistence pattern, incorporating hunting and agricultural practices. Specific differences between cultures in Iowa are outlined by Alex (2000). The late Prehistoric Oneota culture, seen in eastern Iowa, continued into Protohistoric times. Material culture associated with the Oneota complex also sometimes includes early European trade items such as metal utensils and glass beads.

The only known Native American material that has been found in the park is reported by Richner (1997), who mentions a small number of beads with possible ties to an Indian school of the later 19th century in West Branch. Three non-diagnostic chipped stone artifacts were recovered from shovel tests in different parts of the current project area (Table 1). Given their sparse distribution, it is unknown whether they are in original cultural context, or if they represent collection and discard by Staple House occupants.

As the prehistoric record of the area encompassing eastern Iowa is summarized by Finney (2005) and detailed by Alex (2000), the reader is directed to these sources for more information.

History of West Branch

The town of West Branch, Springdale Township, Iowa was first platted in 1869, but settlement of this community began during the 1850s, and was dominantly Quaker. In fact, this settlement was called the "West Branch of the Red Cedar Meeting at Springdale" (Finney 2005:15). Historic maps show a town of Springdale near the current location of West Branch in 1855, and the Red Cedar River is shown to have the Wapsinonoc (west branch of which runs through the town of West Branch) as a tributary in a less detailed 1868 map. A railroad map of Iowa, published in 1881, shows the town of West Branch as a stop on the "B.C.R.&N. Ry" (Figure 2), suggesting it's establishment as an enduring settlement by that time. An Atlas of Cedar County, published in 1872, indicates that this town was in existence at least ten years earlier. It shows the West Branch plat, including a prominent lot for the Friends Meeting House, a cemetery, and a large lot belonging to Joseph Steer, on the block just north of the current project site. Steer is listed in the business directory as "lumber dealer, and dealer in real estate" (Wagner 1982b:53), and figures in the history of the Staples House lot (discussed below).

Herbert Hoover National Historic Site has 17 previously recorded archeological sites, all of which have Euroamerican components. Deposits associated with the Jesse Hoover Blacksmith shop, recorded as 13CD18, were extensively excavated in the early 1970s (Anderson 1973; Husted 1970). Ten site numbers have been assigned to house lots in the historic core of the park, all resulting from investigations tied to various maintenance-related activities. Hunt has conducted excavations around the Hoover Birthplace Cottage, determining that archeological deposits associated with its original configuration are intact (Hunt 1996). Other work in the historic core (Richner 1997; Suddereth 1992) has explored deposits associated with other houses. Significant features reported include cisterns, wells, evidence of previous structures (e.g., porch footings), and extensive middens (see Richner1997 for details).

Staples House history

The first recorded owner of the land on which the Staples House sits was Aaron Baker, who in January of 1852 acquired the land with a warrant issued him for serving in the Mexican War. He had 160 acres, which he soon sold to Samuel King, who subdivided the land and sold an 80-acre tract including the relevant parcel to Joseph Steer in 1853.

Steer subdivided and sold a five-acre tract to J.M. Wetherell, who in 1871 subdivided this tract into town lots (Bearrs 1970:84-85). Wetherell's widow sold several lots with improvements to Eliza Staples in 1876. Eliza died before her husband, Dr. James Staples, who continued to reside in the house until his death in 1891 (Bearrs 1970:86). Table 2 outlines the history of ownership and occupancy of the Staples House, from its construction around 1870 to its acquisition by the National Park Service nearly 100 years later.

Over the years, this property had many owners and occupants. A few stand out from an archeological perspective, in terms of modifications to the house and grounds. While the house bears the name of Dr. James and Eliza Staples, they were involved for a relatively short period. It was likely John Wetherell who built the house and sold it to Staples, although the Staples probably added a kitchen addition to the west soon after taking ownership. A subsequent owner made the largest and most lasting architectural impact. The O.C. Pennock family made major modifications to the footprint and façade sometime soon after acquiring the property in 1912. This family added a large two-story wing to the north side of the house, as well as a covered porch on its east face, spanning the new and original sections. Owners after the Pennocks also made changes. The Rummells family screened in the east, or front, porch and added a side light to the north yard. Subsequent owners, the Endsley family enclosed the porch and added storm windows during their ownership in the mid-century. This is the way the house appeared in the late 1960s when the National Park Service acquired the home.

For the most part, the Staples House served as a dwelling for middle- and working-class families. Earlier occupants were older; both the Staples and the Randalls were retired or couples with grown children upon moving in. Twentieth-century occupants included younger families with longer tenure on the property.

4. PROJECT BACKGROUND AND GOALS

As discussed in the Introduction, a rehabilitation project planned by HEHO necessitated archeological investigation of the Staples lot. Work was designed in stages, as per Section 106 requirements. Inventory results fed testing and data recovery plans. Inventory project goals included determining the existence, extent and nature of archeological deposits on the lot of the James Staples House. Several stages of investigation were conducted, starting with a geophysical inventory of the Staples and adjacent Wright House lots.

De Vore (see Appendix A) provides excellent detail of the geophysical theory, methods, and techniques used for this project. He also details the results of this work, which are only summarized here. The survey was tied into the UTM grid using GPS technology. Multiple instruments provided complementary information to the near-surface sensing data bank. An electrical resistance meter, electrical conductivity meter, magnetic gradient meter, and ground-penetrating radar instruments were all used to collect data at 50-centimeter intervals. Collectively, survey results provided information on concentrations of organic matter, ferrous and non-ferrous metals, and changes in subsurface density. These data were combined to develop expectations regarding locations of potential features and subsequent work.

A shovel-test inventory across the lot was used to gather information regarding relative density and distribution of archeological materials, in order to develop an understanding of activity and discard here. Test unit and back hoe excavations were then used to test expectations based upon geophysical, shovel test, and historic data regarding structure and feature locations in areas away from the house.

Data recovery excavations immediately south and west of the back porch provided further information regarding the nature of the midden deposit identified in earlier phases of fieldwork, and collected for analysis a significant sample of the deposit to be impacted by rehabilitation-related activities.

Fieldwork for this project was conducted over the course of three episodes. During the week of October 3-7, 2005, MWAC archeologists Steven De Vore and Dawn Bringelson collected geophysical data for the Staples and adjacent Wright House lots (Bringelson 2005; Appendix A; project records archived as MWAC Accession 1105). During the week of October 16, 2005, another MWAC team traveled to HEHO to conduct shovel test inventory and test excavation across the Staples House lot. This team included Archeological Technicians Amanda Davey, Michael Hammons, John Gapp and Archeologists Ken Cannon and Dawn Bringelson. The MWAC crew was assisted over the course of the week by HEHO staff members Cary Wiesner and Daris Honemann, and Iowa Archeological Society (IAS) volunteers Bob Brandon, Steve Hanken, Fred Gee, Gary Dalecky, and Charlotte Wright. Project artifacts and archives are included in MWAC Accession 1104.

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A third MWAC team worked during the week of March 6-10, 2006 to complete archeological inventory in previously unavailable locations of the project area, and to conduct data recovery. MWAC Archeologist Jeffery Richner led this effort, assisted by MWAC Archeological Technicians Amanda Davey, John Gapp and Michael Hammons. HEHO historian Cary Wiesner and Student Conservation Association volunteer Amy Skrabacz also participated in this work. Artifacts and archives associated with this portion of the project are included in MWAC Accession 1119.

5. FIELD METHODS

Geophysical Inventory

Geophysical inventory of the Staples and Wright lots incorporated multiple instruments, including a fluxgate gradiometer (Geoscan Research), a ground conductivity meter (Geonics EM38), a resistance meter (Geoscan Research RM15), and a ground-penetrating radar meter (Geophysical Survey Systems, Inc. Terra SIRch SIR System-3000 ground penetrating radar cart system). All data were collected on north-south gridlines at 50-centimeter intervals in order to allow resolution sufficient to distinguish historic features of interest, including cisterns and privies. The data collection grid was set up using a survey-grade compass and tape, installing wooden stakes at 20-meter intervals. The 0 North/0 East point for this grid is in its southwest corner, located in the west edge of the parking pad west of the Wright House (Figure 3). Further methodological and technical details are provided by De Vore in Appendix A.

Shovel-test inventory

Shovel-test inventory data collection utilized the grid set for collection of geophysical data. The 20-meter grid corners provided base points for the smaller, five-meter grid intervals used for the second survey. Crew members pulled measuring tapes between the 2-x-2 inch wood stakes, placing pin flags at five-meter intervals across the lot. These intervals were altered in a small area near the Wright House to the south. Park utility maps and the conductivity data (see Appendix A, Figures 12 and 18) indicate several utility lines running along the 15 North grid line from about 25 East to the east edge of the project area. For this reason, three shovel tests in the front yard between the Staples and Wright houses were moved north slightly, to the 17 North grid line.

Each shovel test measured approximately 30-cm wide and was excavated to the natural B-horizon, or until artifacts were no longer encountered. Soil corers (1-inch and 4-inch) were applied to the base of shovel tests in holes where native soil was not apparent. Shovel test depth varied across the Staples lot from approximately 40 cm below surface to more than 80 cm below surface.

Most of the shovel tests were excavated during the second field trip, including all within the 5-meter interval grid around the exterior of the Staples House. Several additional shovel tests were excavated in March of 2006, including four in the sediments under the west porch, and one within an interior closet adjacent to a well. Floorboards in both of these areas had been removed by HEHO staff in anticipation of March investigations. Figure 3 shows the distribution of shovel tests across the study area.

The 38 grid-oriented shovel tests documented a scatter of materials across the lot, most commonly represented by coal and cinder, but also largely construction debris. Rarer items included bottle glass and historic ceramic fragments, while personal items occurred less frequently. Artifact concentrations were indicated in a few areas, however. Shovel tests in the 15 North line, in the southwest portion of the Staples House yard, contained larger numbers of items, including relatively high proportions of domestic and personal items. Higher quantities of cultural materials were noted in shovel tests along the 40 North line, especially at 10 and 15 East. Shovel tests in the front yard, off the northeast corner of the house uncovered a very compact layer of clay associated with deposits of lathe-plaster at around 30 cm below surface, and a shovel test at 30 North/35 East, revealed parts of three bricks, laid end-to-end, below this layer. Shovel tests in the other end of the front yard showed natural soils lying under thick (up to 75 cm) deposits of mottled clay and loam.

The four additional shovel tests excavated under the west porch indicated a very limited scatter of historic materials, as did a single shovel test within the west interior closet.

Test Unit excavation

Test excavation addressed questions raised by the geophysical and shovel-test inventories. In all, six 1-x-1 meter test units were excavated.

Test Unit ’05-1: 15-16 North/4-5 East.

Geophysical data, collected during the week of October 3 (Bringelson 2005; Appendix A), suggested a shallow midden-type feature off the southwest corner of the Staples House (see Appendix A, Figures 17-19). Shovel tests in this area were consistent with this, indicating an artifact concentration in the first 40 cm below surface. A 1-x-1 meter test unit was placed to expand on this information, with the goal of gaining more information on artifact content, deposit structure, and integrity.

Results of this excavation are consistent with the interpretation of a shallow midden deposit. Field notes indicate that artifact density is high near the surface, and decreases dramatically below 40 cm below surface. The unit profile shows a depositional unit associated with the heaviest concentration of artifacts lying between 20 and 40 cm below surface (Figure 4). The top twenty cm also contained a high concentration of materials, but may represent disturbed sediments.

This deposit consists of relatively small artifact fragments, especially near the surface (though analyses are pending). It also contains a broad range of artifacts, including personal items (e.g., porcelain toy fragment, ring, pocket knife part), domestic items (e.g., glass and ceramic fragments), faunal debris (including fish vertebrae), as well as construction and heating debris (brick, coal and cinder fragments). The upper 20 cm have been impacted by disturbance of some form, perhaps associated with landscaping or gardening, or tied to the construction of the nearby parking pad some 20 years ago. In any case, the cultural deposit is dense here, and is likely to be part of a laterally extensive midden, as suggested by multiple geophysical data sets (see the cluster of anomalies extending from the back porch through the southwest yard, apparent in the magnetic gradient and resistance data (see Appendix A).

Test Unit ’05-2: 39-40 North/10-11 East.

An historic photograph, dating to the early 20th Century, depicts two structures north of the Staples House (Figure 5.c). These are difficult to interpret in the photo, as the distance from the camera and the sizes of the structures are unknown. The geophysical data were consulted in order to identify isolated anomalies that may be associated with either of these structures. A strong, spatially defined contrast at approximately 39 North/11 East corresponds with a possible structural location (Figure 5.d shows Ken Cannon standing in the location of the anomaly and possibly in the location of the northernmost structure shown in Figure 5.c). The possibility that this structure was a privy was considered. A 1-x-1 meter test unit was initiated in order to test this interpretation.

Artifacts in this test unit occur from near the ground surface to a depth of at least 100 cm, but the greatest density of material is between 50 and 100 cm below surface (Figure 6). This unit contained ashy lenses, suggesting dumping of household heating debris, or trash-burning. These kinds of deposits occur throughout the depth of the unit, but materials found in the lower half are markedly intact, including construction debris (e.g., a ferrous metal paint-type can, large limestone blocks and large brick fragments), domestic debris (e.g., fruit jars, faunal material, ceramic fragments) and personal items (clay tobacco pipe and shoe fragments were found in the lower levels). This deposit, extending south from this test unit, may represent a trash pit associated with one or more early construction episodes and has potential to contribute to information about the nineteenth century history of this lot. While the interpretation of this as the location of a privy could not be ruled out by the evidence recovered, neither the dimensions nor the contents clearly supported it. Although it is possible that this deposit represents the remains of an early privy, it is termed a trash disposal pit for the purposes of this report.

Test Unit ’05-3: 35-35 North/35-36 East.

Shovel tests in the northeast yard revealed a highly compacted clay layer associated with quantities of plaster and brick fragments. A 1-x-1 meter test unit was placed to further investigate the nature of the deposits between the corner of the front porch, a mature spruce tree in the front yard, and the property line to the north.

Excavation of this test unit revealed a highly compact clay layer between 15 and 30 cm below surface, and a dense mortar and plaster deposit at around 25 cm, on top of the clay at that location (Figure 7). Very few artifacts were found below the clay layer, and a one-inch soil probe from 40 to 115 cm below surface indicates a natural soil profile.

Test Unit ’05-4: 30-31 North/34-35 East (Feature 2).

A shovel test near the front porch exposed three bricks, laid end-to-end. This row of bricks lay about 40 cm below ground surface, beneath a plaster deposit and a layer of highly compacted clay similar to that seen to the north. This brick alignment (labeled Feature 2 in Figure 3) may correspond with a strong anomaly in the magnetic gradient data and a minor anomaly in the ground penetrating radar data (Appendix A). These data, however, do not provide information on the extent and layout of the bricks, so a 1-x-1 test unit was placed over the feature.

Artifacts in this test unit are relatively diffuse and largely contained within the sediments above the clay layer. This and Test Unit ’05-3 differ from others in that soil compaction increases dramatically to a compacted clay layer at about 30 cm below surface (Figure 8). A layer of plaster fragments (as if removed from lath context) lies on the clay surface. An east-west line of bricks, lying end-to-end below this clay layer, extends into the east and west walls of the test unit. Artifact density drops off dramatically below this feature. It appears that the brick feature was associated with the earliest configuration of the Staples House, sometime prior to the north ell addition in 1919. The function of this brick feature is uncertain but might relate to front yard landscaping.

Compacted clay and plaster deposits in this part of the front yard appear to stem from the same events that created those seen in Test Unit 3. A series of soil cores were placed across this area to further investigate the continuity and horizontal extent of this compacted clay layer. These data indicate that the clay is indeed continuous between the two test units but does not extend much further to the east. It appears that this front, or northeast, corner of the house lot contains spoil from the basement of the north ell addition, which lies directly beneath plaster fragments and other debris from wall demolition necessary for connecting the addition to the house core. This area served as a work or temporary trash location during construction. Artifact deposits just below the clay layer are likely to be associated with the early history of the Staples House.

Test Unit ’05-5: 35-36 North/11-12 East (Feature 1).

Initial excavation of backhoe Trench 1 (see discussion below) uncovered a single row of bricks aligned end-to-end just below the sod at its east end. In response to this, the backhoe restarted its line a meter to the north, and the brick alignment was cleaned up and recorded as Feature 1. In order to explore any subsurface deposits associated with this brick alignment, a 1-x-1 meter unit (Figure 9) was placed over the south portion of this feature

This feature, oval in shape, appears to be associated with garden landscaping (Figure 10). It encircled an extant rose bush. This, and the observation by a maintenance staff member that the bricks had been visible on the surface in the recent past, suggests it was associated with later (mid-late twentieth century) occupations of the Staples House.

Materials near the surface of this test unit were fragmented within a soft (perhaps tilled) matrix, and included a similar variety of items as other test units (construction and domestic debris). Artifact density is greatest in the upper levels, decreasing dramatically by 45 cm below surface.

Test Unit ‘06-1: southeast corner of east porch area

A final 1-x-1 meter test unit was excavated in March of 2006, after removal of above-ground structural elements of the front (east) porch by HEHO staff. This test unit was placed to encounter any architectural elements remaining from the original front stoop, as shown in early photographs (Figure 5.a and 5.b). Thus, it was placed relative to the front corner of the house and not according to the data collection grid.

Excavation exposed the remains of a square wooden (probably cedar) post and a post mold (designated Feature ’06-1), located approximately “five feet east of the limestone foundation of the original core of the house” (Richner 2006). Post remnants first appeared between 40 and 50 cm below surface, and the post mold penetrated intact prairie soil, and continued into the floor of the unit when excavation ceased at 84 cm below surface.

This unit was excavated in 10 centimeter levels, with fill screened through ¼” hardware mesh, down to 60 cm BS. No artifacts were encountered between 50 and 60 centimeters, so excavation continued without further screening, with the goal of exposing intact prairie soil. Stratigraphy revealed in this test unit indicates a significant amount of fill on top of prairie soil. The top 60 to 70 cm consist of yellow clay mottled with dark brown silty loam, suggesting multiple episodes of basement excavation and distribution of spoil piles. Figure 11 shows stratigraphic details and the post mold at 84 cm below surface. This test unit and post feature are designated together in Figure 3 as “TU/Feat 06-1.”

Backhoe trench excavation

In order to expose stratigraphic profiles around the Staples House and search for subsurface features, backhoe trenches were placed in several areas across the lot during the second episode of fieldwork. HEHO supplied the equipment (a backhoe with a 50-cm wide toothed bucket) and operator necessary to do this. Specific trench locations were determined by shovel test results, geophysical data, and the location of obstacles such as existing shrubs. Based on results of shovel tests across the lot, cultural deposits and modifications were generally expected to occur within the top meter of the soil profile. It was agreed that all trenches would be excavated to a depth of approximately one meter and not, for safety reasons, to exceed four feet (1.2 meters).

Trench 1 was excavated along the 37 North line, extending from 1.45 East to 9.45 East in order to explore an area where a stable is depicted on historic Sanborn fire insurance maps. Shovel tests in this area contained some limestone and mortar, as well as a few nails, thus offering an assemblage consistent with such past use of this area.

No clear evidence of a stable or other structure was evident in the Trench 1 wall profile (Figure 13.a). A possible pit was identified at its east end, but no artifacts were found associated with it. Its location near the surface suggests it is of relatively recent origin, and it was not designated as a feature. The upper 40 to 60 cm of this trench was identified as an A horizon, with a coarse, granular soil structure and loose consistence, grading in color from very dark grey (10YR 3/1) near the surface to olive brown (2.5Y 4/3) at its base. The content of the possible pit is very similar to the rest of the upper stratum, with color identified as very dark greyish brown (10YR 3/2). Below this horizon, a B horizon is identified, light olive brown (2.5Y 5/6) in color. The B extends to the base of the trench, at approximately one meter below surface.

Trench 2 was placed with its north wall at 26.7 North, from 10.8 to 16 East, to investigate a large, high-contrast, rectangular anomaly in the conductivity data off the back of the house (see Appendix A, Figure 18). This anomaly did not appear in any of the other geophysical data sets, and no interpretation was evident. It was hoped that trench stratigraphy would help identify the source of the anomaly. Unfortunately, there were no observed differences in soil or sediment characteristics near the 15 East line, where they might be expected based on the conductivity data plot (Figure 13.b). The A horizon, occupying approximately the upper 75 cm of the profile is described as very dark grey (10YR 3/1) silt loam (as in Trench 1), and grades into the light olive brown B horizon (2.5Y 5/6 silt loam), which extends to the floor of the trench.

Trench 3 extended along the 37 North line, from 13.65 to approximately 25 East. This trench, in the north-central portion of the Staples lot, was placed to explore stratigraphy along the lower terrace, as well as to look for evidence associated with potential structures or other features associated with an anomaly in the ground penetrating radar data (see Appendix A, Figure 21). This anomaly presented one other potential location for one of the structures visible in the early 20th century image (Figure 5.c).

No evidence for a structure was observed in this trench. Mortar fragments and a drain tile line were found at opposite ends of the trench, but the area intersecting the GPR anomaly, between approximately 17 and 20 East, was not distinguished from the adjacent areas (Figure 13.c). This profile also had an intact appearance, with a very dark grey (10YR 3/1 silt loam) A horizon grading to a light olive brown (2.5Y 5/6 silt loam) B horizon approximately 60 cm below surface. The location of the drain tile presents an exception to this. Where it sits, the A/B juncture is about 80 cm below surface here, representing the pipe trench excavation. The drain tile pipe is associated with an abandoned line from the house running north, and the mortar fragments, very near the surface at the opposite end of the trench, may be associated in some way with Feature 1 and landscaping in the relatively recent past.

Trench 4 was placed in the Staples House front (southeast) yard. Shovel testing had indicated sediments similar to topsoil located below a clay layer across the southeast yard, suggesting that this area holds a significant amount of fill. The conductivity data (Appendix

A, Figure 19) and park utility maps indicated that, while several active lines run between the Staples House, the neighboring Wright House, and Poplar Trace, part of the front yard should be clear of utilities and safe for backhoe excavation. The backhoe excavated a trench extending along the 24 North line, between 34 and 42.5 East. This was designed to come as close as possible to the front patio of the house and to cross-section the front yard terrace.

This profile contrasts with those of the other trenches in that cultural stratigraphy is clearly apparent (Figure 13.d). The top stratum, termed Horizon 1, has coarse granular soil structure with slightly hard consistence (10 YR 3/1 silt loam), and grades into Horizon 2 between 20 and 65 cm below surface. Horizon 2 has massive soil structure and very hard consistence, and is dark grayish brown mottled with yellow (10YR 4/2, 2.5Y 7/6). An abrupt boundary at 60 to 100 cm below surface separates Horizon 2 from Horizon 3, which is fine-grained with granular soil structure and soft consistence. This is likely the original ground surface, or natural A Horizon.

Trench 4 is consistent with the interpretation, based on shovel tests, that the southeast yard of the Staples lot contains large amounts of spoil from the cellar excavation. This pattern was also observed closer to the house foundation in Test Unit ‘06-1, discussed above. Both Horizons 1 and 2 are interpreted as cultural fill: if this does represent such spoil, Horizon 2 consists of sediments removed from the B and C horizons, near the bottom of the basement, with Horizon 1 containing topsoil, or A Horizon sediments. It is currently unknown whether this is associated with the original basement excavation, with an addition, or with multiple episodes of construction activity. Temporally sensitive artifacts (e.g., door hardware, medicine bottle) from shovel tests, this trench, and especially Test Unit ‘06-1 may be useful in exploring this further.

Data recovery: southwest midden

In accordance with discussions between HEHO, MWAC, and the Iowa SHPO (see Bringelson 2006), a shallow midden feature detected by earlier work, located off the back porch of the Staples House, was sampled during the March 2006 fieldwork. A block comprised of eight contiguous 1-x-1 meter excavation units was excavated during fieldwork conducted in March 2006 (Richner 2006). The goal of this effort was to collect a significant sample of the midden contents from the area to be impacted by rehabilitation activities. Figure 14 shows the location of these excavations, termed “Block 1” in relation to the midden and planned grading activities.

Excavation confirmed that this is a shallow deposit, with artifacts just below the sod and within the top 30 cm or so BS. Excavation sampled the densest strata, extending up to 40 cm BS. All fill was screened through ¼” hardware mesh. This block revealed a brick alignment similar to Feature 1, composed of soft orange bricks arranged in a rough circle (Richner 2006). Plan maps of test units ‘06-2 and ‘06-3, drawn at 20 cm BS, show part of this alignment (Figure 15).

Richner's field summary indicates a variety of architectural, domestic, and personal items, as well as a few objects indicative of equipment or vehicle repair derived from this block (Richner 2006). He also mentions that density of personal and domestic materials is concentrated toward the eastern end of the excavation block.

Recording the well in the west interior closet

A brick well, situated within the southwest closet of the west house addition, was recorded during field work in March, 2006. It is located approximately 20 centimeters from the west and south walls, and adjacent to the single shovel test placed within the closet, reported above. It is approximately one meter in diameter, constructed of soft orange brick, and capped with mortar around its exterior surface (Figure 12). The interior of the well was open at the time of field work, with no artifacts visible at the bottom. The MWAC team created a plan map showing the well's situation in relation to the closet walls and the shovel test, and took digital photographs. This feature was to be capped and preserved in place during rehabilitation.

6. SITE CONTEXT

Depositional context varies dramatically across the Staples House lot. Discussion here focuses on stratigraphic descriptions, geophysical data, and other pertinent data, by area of the lot, in order to address the history of deposition across the Staples lot.

Southwest quadrant: the kitchen midden

The southwest quarter of the Staples lot is largely covered by a concentration of historic debris. Shovel tests and backhoe Trench 2 indicate an unbroken, natural soil profile with an A-horizon of dark brown silty loam grading into a more yellow, clayey silt loam within 50 to 70 cm below surface. Geophysical data – especially electrical resistance and magnetic data – indicate a near-surface concentration of materials just west of the back porch and south of the back walkway. Examination of resistance, conductivity, and magnetic data suggests that the highest density of these materials is within the southwest quadrant of the Staples lot, with a continuation of the scatter south, well into the Wright House lot (see Figure 14 and Appendix A, Figures 19 and 20).

Shovel-test data indicates a relatively high density of personal, domestic and tools/ hardware items in this area of the lot as well. Domestic items such as dinnerware and bottle glass make up almost 40% of the shovel-test assemblage from the southwest portion of the project area. Mean number of domestic items per shovel test are highest in this area (Figure 16).

Controlled excavation in this area also indicates stratigraphic differences within this quadrant of the lot. Test Unit ’05-1, located near the western border of the study area (near the back alley and parking pad), shows a layer of mixed material in the upper 20 cm, underlain by another 20 cm of dense historic deposit (see Figure 4). On the other hand, data recovery excavations in Block 1 near the back porch of the house reveal a shallow, dense deposit. It is quite likely that grading associated with the parking pad and the back service road contributed to a redistribution of upper-layer sediments near the west end of the Staples lot.

In spite of these stratigraphic differences, flat glass samples from the two excavations are similar. Distributions of frequency by projected date (based on thickness, as calculated by Schoen [1990]) are multimodal for both Block 1 and Test Unit ‘05-1, with primary modes at 1850 in both areas, as well as smaller modes in the early and late 19th century (Figure 17). Even though the secondary modes project slightly different dates, it is plausible that they are overlapping, especially given the smaller sample size for TU ‘05-1.

This quadrant of the lot contains potentially sensitive materials very near the surface. The artifact concentration extending from the west porch across this quadrant of the lot (and extending onto the Wright lot to the south) likely represents casual discard of household and personal items over a period of time encompassing early occupation of the house.

Northwest quadrant: buried trash deposit

Investigations in the northwest area of the lot provide information on depositional context as well. The soil profile in Trench 1 shows a gradation from the surface to a B-horizon approximately one meter below surface, indicating no major sediment-moving events in the historic past. Geophysical data from this area shows one isolated, strong anomaly, suggesting a significant archeological feature at some depth. Magnetic gradient data show this and a light scatter of smaller isolated anomalies; conductivity and resistance also indicate a diffuse scatter of debris throughout the quadrant (Appendix A). Shovel test data (see Figure 16) indicate a medium-to-high density of domestic items (14 per shovel test).

Test units excavated in this quadrant show diversity in depositional context. Test Unit ‘05-2, on the northern border of the project area, was placed to test the strong isolated anomaly present in the geophysical data sets. Excavation encountered approximately 40 cm of mixed sediments with highly fragmented artifacts. Below this layer lies a feature comprised of largely intact domestic and architectural debris. This is interpreted as a trash pit created during one of the renovations of the Staples House. A clay pipe fragment found near the base of the unit suggests it is associated with one of the earlier renovations of the Staples House. Test Unit ‘05-5 was placed to test sediments associated with a soft orange-brick garden feature (“Feat.1” in Figure 3). This brick alignment, lying just below the sod layer, is probably the source of the possible structure suggested by magnetic gradient and conductivity data (see Appendix A, Figures 18 and 19). Sediments encountered in the upper 20 to 30 cm were soft and organic-rich, with highly fragmented artifact content. This supports the interpretation of the brick alignment as a garden feature; sediments show indications of tillage and perhaps artificial enrichment. Artifact content in this layer is varied, including domestic, architectural, and heating debris, suggesting a minor trash disposal function for this area, or redeposition from another area of the lot for soil enrichment in this garden area. The tillage appears to be limited to garden areas in the western – or back – half of this quad.

Flat glass analyses suggest that the area sampled by TU ‘05-5 contains redeposited or mixed fill (Figure 18). Mean thickness-derived flat glass date for the lowest level is later than that for the upper levels, suggesting inversion. In addition, a histogram of these data show three distinct modes, corresponding with the mid-19th, late-19th, and early-20th centuries. This diversity of values implies multiple sources for the window glass in this test unit. Combined with mean date by level, this suggests that fill was disturbed or redistributed in this area during or after the early 20th century.

Flat glass analysis of TU ‘05-2 corresponds with the intact, rapidly-filled pit interpreted from field data. The date histogram based on flat glass thickness values from this test unit shows a normal distribution, with the mode centered at about 1865 (Figure 19). Mean date by level indicates newer materials in the top levels, as would be expected for an intact feature (or feature fragment) overlain by more recent sediments. It appears that this pit was indeed associated with an early remodeling episode, if not the initial construction of the house.

Northeast quadrant: construction staging area and early landscaping

The northeast quadrant of the lot, or the front/side yard of the house nearest the intersection of Wetherell and Poplar roads (extending from 30 to 40 North and 25 to 45 East), has a different depositional context than that seen in the back yard. Utility maps and conductivity data (see Appendix A) indicate much disturbance in recent years due to installation of buried utility lines, and Backhoe Trench 3 revealed an abandoned drain tile line running from the house towards Wetherell (see Figure 13). Despite this, however, many older cultural deposits remain intact. Shovel tests encountered a layer of dense plaster and mortar fragments, mixed with coal and cinders at about 30 cm BS. A series of auger cores and two test unit excavations indicate that this layer is spread across the north portion of the front yard, extending from 30 to 35 North and 30 to 35 East. Analyses of the Test Unit ’05-4 assemblage indicate that this area of the yard hosted some construction or demolition-related activity prior to distribution of basement spoil. The top graph in Figure 20 (representing the two uppermost levels of Test Unit ’05-4) and the bottom graph (representing sediments located below the brick alignment) are very similar in terms of flat glass samples; both have modes around 1830 and 1880. Conversely, the sample derived from the dense plaster layer is unimodal, centered around 1865. This suggests that the upper- and lower-most layers are drawn from the same parent material (in this case, the side yard of the original house), and that the middle layer was exposed for a relatively short period during a construction/ demolition event.

The brick alignment encountered below this layer at 30 North/35 East resembles the brick garden feature encountered in the back yard of the house (see Figures 8 and 10). The fact that this feature lies beneath a significant amount of basement spoil indicates an early-occupation front-yard feature, and thus begs the question of timing for the other features. Brick recycling for the backyard features is one plausible explanation for their relatively recent use. Alternatively, the brick alignment within Block 1 may have also been early, and Feature 1 may have had continuous use from early house history.

Finally, shovel-test contents indicate a relatively low density of domestic debris in this part of the yard (see Figure 16) as well as artifacts in general. It is not surprising that discard of trash did not generally occur here, in front of the house. Overall, this area of the lot is overlain with basement spoil, which provides 30 to 40 cm of cover for early landscape features as well as debris associated with the addition of the north ell and east porch.

Southeast quadrant: the front yard

The southeast lot quadrant, extending from 15 to 25 North and 25 to 40 East, encompasses the area south of the front sidewalk and east of the lilac hedge running between the Staples and Wright houses. Soil profiles observed in shovel tests, Trench 4, and Test Unit '06-1 all show a great divergence from those seen in other parts of the lot. Evidence of a large amount of spoil overlying the original prairie soil was encountered throughout the southern portion of the front yard. Trench 4 revealed mottled clay and silt loam overlying the original A-horizon, and the Test Unit '06-1 profile provides greater detail. Excavators were able to distinguish four strata extending from about ten to 80 cm BS, representing three or four separate fill episodes.

Historic photos of the front of the Staples House may help tie these fill episodes to renovation events. The 1878 photo (see Figure 5.a) shows a woman standing and a man seated near the front steps of the house, prior to addition of the ell. These individuals may be Eliza and James Staples, or the Oliphant's, with James Staples seated and visible in the first-floor window. The top of the limestone foundation is visible, and appears to be near the height of the woman's waist (as is the porch floor). This implies that the ground surface was some three feet, or 90 cm below this point. Another photo, dated circa 1895 (see Figure 5.b), shows the porch and stairs in profile. The porch appears to have five steps leading to it and the level of the door sill. Given six- to eight-inch risers, the porch would have risen 30 to 40 inches, or 75 to 100 cm off the ground surface at that time. Photos taken after the ell addition show a reduction in the number of steps. An image from the early 20th Century shows four steps leading to the then-new east porch's central entrance (Figure 5.c), providing 24 to 32 inches (61 to 81 cm) of rise between the ground surface and the entrance. Modern photos show only three steps, providing 18 to 21 inches (45 to 53 cm) of rise. This reduction of 6 to 8 inches (15 to 20 cm) in rise is evident from the photographic record at two points: after the addition of the ell and east porch, and after the remodel of the east porch (to recent conditions).

According to the profile of Test Unit '06-1, one meter east of the original front door, original grade lies at about 70 cm BS (or 80 cm below datum, see Figure 11). The top of the first fill episode stratum lies between 42 and 58 cm (16-23 inches) below the current surface, depending on both the buried and exposed surface topography. The top of this stratum, and perhaps the "redeposited A-horizon" overlying it (at 35 cm or 14 inches below current surface), are interpreted as the ground surface at the time the late 19th Century images were taken, in which the porch had 5 steps. This is supported by excavation data; the wooden post remnant (Feature '06-1) found in Test Unit '06-1 was first noted between 40 and 50 cm below datum, and continued down through sediments interpreted as "fill episode 1." The associated post mold continued at least ten centimeters into original grade. The top of the "fill episode 2" stratum lies 18 to 25 cm (7 to 10 inches) below current surface, and was likely to be the ground surface after the addition of the ell and east porch. The top of "fill episode 3," lies five to 12 cm (or 2 to 5 inches) below modern grade. This stratum is noted to contain ferrous metal fragments, limestone and mortar, and is likely associated with the east porch remodel.

Given the depth of the fill overlying the front yard, it is not surprising that geophysical data reflects little more than buried utility lines. One exception is the likely location of a buried cistern in the side yard, at approximately 16 North/27 East. This is marked on the surface by a concrete footing with the remains of a wooden post set in it (see Figure 3), and in the geophysical data by significant anomalies detected by resistance and ground-penetrating radar surveys (Appendix A).

Density of artifacts in shovel tests in this quadrant far exceeds that seen in other areas of the lot, with 114 artifacts per shovel test versus 45 or less elsewhere. Almost 90% of those are comprised of heating by-products and architectural debris though. The mean of 13 domestic-type artifacts per shovel test is very close to that seen for this class of artifact in the back yard. Average weight of such artifacts per unit is highest here though (40g of domestic artifacts), indicating a lower rate of fragmentation in this part of the front yard. This may be due to the protective properties of the fill observed here, and may also be related to a different function of this area (i.e., no tilling).

The distribution of chronologically sensitive artifacts recovered from TU '06-1 also contributes to understanding the depositional history in the front yard. The uppermost level in this test unit contained a bottle dated to 1820-1890. The second level, extending from 10 to 20 cm BS contained a flat glass sample (n=16) with a modal date of 1860 and both cut and wire nails. The level below that contained cut nails only, and a flat glass sample dating to 1850 (n= 8). However, the lowest level screened (40 to 50 cm below surface) contained only wire nails, indicating redeposition. This is consistent with the interpretations made in the field, as shown on the profile in Figure 11. In general, this portion of the yard appears to have undergone extensive modification, at least through the early part of the 20th century.

7. LABORATORY METHODS

MWAC staff cleaned, sorted, identified and quantified artifacts. Information was recorded onto catalog cards for curation, and catalog records were created using Re: Discovery museum software. All records are on file at MWAC.

Specific processing varied according to artifact type. Fuel and heating by-products (such as coal, clinker, and charcoal fragments), and construction or architectural debris (plaster, mortar, limestone, and brick fragments) were sorted by sieve size (one-inch, half-inch, and quarter-inch) and weighed by provenience lot. Counts and weights (by provenience lot) were recorded for potentially diagnostic and less-numerous material classes, including flat and curved glass fragments, nails, ceramics, etc. Each unique set of material in each provenience, size grade, and material type was recorded in a single catalog record. For materials that were counted instead of size-graded, the entire set of that material class was grouped within each provenience unit for purposes of analysis and cataloging.

After quantification of a set of size-graded material from a given provenience was complete, a sample of the material was retained for future reference, and the remainder discarded. A table summarizing the material treated in this manner is included in the relevant accession. This procedure was followed for test units only. Quantities from shovel tests were never so great as to pose a curation dilemma, and so were retained and cataloged.

Artifact classes with potential to provide temporal information were treated in greater detail. Curved glass was sorted by color within each provenience, and bottle fragments with technological or chronologically relevant details intact were individually researched. Historic ceramic fragments with potentially diagnostic patterns were treated similarly. Flat glass was counted and weighed by lot. Data on thickness and color were collected on each fragment; specific details of data collection are included below, with the presentation of Architectural data. Similarly, faunal materials were individually described in terms of species, element and indications of cultural modification. Materials were analyzed and summarized for this report. Original data tables are available upon request.

JAMES STAPLES HOUSE ARCHEOLOGY

8. MATERIAL CULTURE

Artifacts are organized here according to interpreted function. Categories include: architecture (limestone, mortar, plaster, nails, flat glass); domestic (curved or vessel glass, ceramics, kitchen fauna, etc.); personal (clothing parts, toys, leisure items, etc.); tools and machine parts (e.g., nuts, bolts, horseshoe nails, etc.); heating by-products (coal, clinker, charcoal); and miscellaneous (items unidentified to function, modern materials, etc.).

Domestic items

The domestic items category includes artifacts related to sustenance. Any object related to the storage, serving, or consumption of food or drink is included here. Therefore, discussion here focuses on curved glass fragments and bottles, ceramics, fauna, and glassware. Because bottles and ceramics are of particular use for project goals (i.e., absolute and relative dating of deposits across the Staples lot), they are treated in greatest detail.

Curved Glass

Historic bottle dating can be derived from manufacturing methods including finishing techniques, as well as historical documentation. Bottle manufacturing methods evolved through time as the use of molds became increasingly popular leading to standardization and mechanization of the bottle making process. Bottle finishing techniques co-evolved with manufacturing methods, also creating standardization of finish sizes and styles through time. Analysis of mold seams, tooling marks, and embossing, which can be characteristic of certain manufacturing techniques, allows for a chronological interpretation of the approximate time frame during which a bottle was manufactured. Historical documentation provides further detailed information on the bottle manufacturer, bottle contents, place of manufacture, and can provide a narrower dating time frame. Most of the chronological interpretation below is based on technological information provided by the Bureau of Land Management Historic Glass Bottle Identification and Information Website (Lindsey 2006). Where maker’s marks or other distinguishing characteristics are present, historical data are used to aid in chronological interpretations.

Technological analysis: Bottle Finishes

According to Jones and Sullivan (1985) a bottle finish is defined as the “top part of the neck of a bottle or jar, made to suit the cap, cork, or other closure (BSI 1962 cited in Jones and Sullivan 1985). Bottle finish styles varied based on closure types as well as the bottle contents and manufacturing methods. Early bottle molds dating to the early 18th century only formed the bottle body; neck shapes and finishes were mouth-blown and hand-tooled after the bottle was removed from the mold. These molds were gradually replaced by full-sized molds beginning in the 1820’s which formed the bottle neck but left the finish to be hand-tooled. Finish techniques involved directly re-firing the end of the bottle neck where the blow pipe was removed and using a hand-tool to fold it into the bore or out on to the upper neck of the bottle. This is described as a hand-tooled finish and usually dates from or before the 1870's (Lindsey 2006). Another early technique involved applying additional molten glass to the top of the neck where the blow pipe was removed and using a hand-tool or finishing tool to shape the glass into the desired form. This is described as an applied hand-tooled finish and usually dates from 1820-1890 (Lindsey 2006). Horizontal tooling marks can be seen on the finish from the tooling done after the application of the glass.

As bottle molds increased in use, specific finishing or lipping tools were developed that matched the exact size of the bottle neck mold and created precise, symmetrical finish forms. This is described as a tooled finish since a specific finishing or lipping tool was used to create the finish and usually dates from the 1880's – 1920's (Lindsey 2006). Horizontal tooling marks can be seen on the finish itself as well as extending partially down the bottle neck usually erasing the mold seams. With the development of a bottle mold that pre-formed most of the finish shape circa 1900, only the top of the finish was still tooled. Horizontal tooling marks are present only on the top of the finish and the bottle mold seams extend into the finish. This is described as an improved tool finish and usually dates from 1900-1920 (Lindsey 2006). Completely machine made bottles usually date post 1905-1910 and can be identified by neck ring mold seams and mold seams that extend over the top of the finish (Lindsey 2006). Table 3 lists all diagnostic bottle finish fragments, including provenience, description, and chronological interpretation for each.

Historic Bottle Analysis

Several specimens from the Staples assemblage are sufficiently intact and distinctive to match to specific commercial products. Analyses here are aided by bottle collector and research literature, especially Fike (1987), Wilson and Wilson (1977), and Toulouse (1971).

An intact bottle embossed with "Dr. Pierce's Golden Medical Discovery" (catalog number 7680) was found in Test Unit 15N 5E, Level 3, 40-50 cm bd. This large, (7 15/16" x 1 ½" x 1 ½") aqua glass bottle, was manufactured using a two piece vertical body mold with a separate cup mold base part and a tooled ring or oil finish. It has a Blake-style base (rectangular with flat chamfers). Based on its finish style, this bottle was most likely manufactured from the 1880's to 1920's. The bottle has four incised panels with embossed lettering on both side panels "R. V. PIERCE MD." and "BUFFALO, N.Y." and on the back panel "DR. PIERCE'S GOLDEN MEDICAL DISCOVERY".

Dr. Pierce's Golden Medical discovery was first introduced circa 1870 and was first advertised in 1871 (Fike 1987). Dr. Ray Vaughn Pierce practiced medicine in Buffalo, New York. In 1873 he opened the World's Dispensary Medicine Company and distributed his products across the country as well as internationally. Dr. Pierce also wrote several very popular books which sold into the multi-millions by 1900 (Wilson and Wilson 1971). An 1880's chemical analysis of Dr. Pierce's Golden Medical Discovery by the Mass. State

Board of Health revealed extracts of opium. Following this report Pierce removed opium from the recipe ca. 1890's (Wilson and Wilson 1971). The business was owned and operated by the Pierce family until ca. 1960 and Golden Medical Discovery was still on the market in 1982 (Fike 1987).

A small, (5 13/16" x 1" x 1") aqua glass bottle (catalog number 7698, see Figure 21) was found in shovel test 20N 40E, 0-71 cm bs. This bottle was manufactured using a two piece vertical body mold with a separate cup mold base part and a tooled double ring finish, and a rounded rectangular. Based on the finish style, this bottle would most likely date from the 1880's to 1920's however, mold air venting marks located on the body and base of bottle indicate that the bottle was most likely manufactured between 1900 and 1920. Air venting marks used to create sharper, more distinct bottle embossing are not usually found on bottle bases prior to this time period (Lindsey 2006). The bottle has four incised panels with embossed lettering located on both side panels "DR. S. PITCHERS" and "CASTORIA" and on the base, "S3."

Castoria was patented by Dr. Samuel Pitcher of Barnstable Massachusetts on May 12, 1868. The patent was specifically for extracting senna with boiling water, using a small amount of baking soda (Wilson and Wilson 1971). Pitcher's formula also included taraxacum, essence of wintergreen, sugar, and water (Wilson and Wilson 1971). Pitcher established the Castoria Manufactory in Boston, Mass and began distribution in approximately 1869. Castoria was advertised as aid for infants' and childrens' constipation that contained no opium, morphine, or other narcotic substances (Wilson and Wilson 1971). In 1871, the patent was sold to Demas Barnes, and J.B. Rose, an established propriety medicine dealer, was given sole authority to sell the product. The product was then billed as Castoria and retained Pitcher's name (Fike 1987).

A fragment of an incised bottle panel was found in shovel test 17N 40E, 0-50 cm bs (catalog number 7690). This fragment contains the embossed lettering: "A DR. KIL", and is most likely from Dr. Kilmer's Swamp Root Kidney, Liver, and Bladder Cure, introduced in 1881 (Fike 1987:101). After the turn of the century, bottles were embossed with "Remedy" instead of "Cure" (Wilson and Wilson 1971). Thus this bottle was most likely manufactured after 1881 to ca. 1900.

Professor S. Andral Kilmer started a manufactory for prescription medicine production in the mid 1870's in Binghamton, New York, and was joined by his brother Jonas in 1878 (Wilson and Wilson 1971). The Swamp Root was the most well-known and popular of Dr. Kilmer's medicines. It was advertised as a cure for "Bright's disease, catarrh of the bladder, torpid liver" and claimed to dissolve gall-stones and gravel (Wilson and Wilson 1971). It was only distributed locally until 1888 when Jonas' son began to heavily advertise the product. By 1895, 18 different medicines as well as their own bottles and corks were being produced by the company (Fike 1987).

Several Mason jar fragments were found at the Staples House site, and are listed in Table 4. Analysis of Mason fruit jar manufacturing techniques, which differs slightly from bottles, can also provide dating information. The Mason shoulder-seal jar was patented by John Landis Mason of New York City on November 30th, 1858 (Toulouse 1969). A finish-forming bottle mold was used to emboss continuous external threads above the shoulder ending at the lip. Then the lip surface was ground to remove extra glass. This finish style was most commonly used on glass fruit jars between 1858 and 1915 (Toulouse 1971). A zinc lid was to be used to seal the jar. The “Mason” name eventually became a generic term used for fruit jars with embossed continuous externally threaded screw finishes (Jones and Sullivan 1985). After the patent had expired, other companies began making the jar embossed “Mason’s Patent Nov. 30th 1858” in four lines on the side. This copy was used until at least 1912. A different version came into use in 1900 with Mason’s or Mason Jar, and Mason (Toulouse 1971).

According to Toulouse (1969) this glass seal was for use with screw band top seals and featured a deep, circular, depression in center of glass seal to “center on top of beaded neck jar using Mason shoulder seal (Toulouse 1969).” Glass liners were developed in the United States before 1869 (Toulouse 1971). Boyd was the first to patent a glass liner in 1869 (Jones and Sullivan 1985).

Glassware

Several green Depression Glass fragments from a single saucer (Catalog number 7739) were found in the test unit at 35N 12E, Level 2 (20-30 cm below datum). The term “Depression Glass” refers to transparent, colored glassware made throughout a period starting sometime before 1929 and continuing past the end of the Second World War. Mold-etched patterns were popular between 1930 and 1934 (Krupey 2002). The intricate mold-etched patterns were used to hide imperfections in the poor quality glass used by the manufacturers. The cherry blossom pattern seen in the Staples House example was manufactured by Jeannette Glass Company between 1930 and 1938 (Klamkin 1973). The saucer’s center panel features cherries with leaves, surrounded by panels with cherry blossoms and foliage “divided by groups of double lines curving outward toward the edge of the plate (Klamkin 1973).”

Ceramics

Ceramics trail bottle and other curved glass in terms of frequency at Staples House excavations (Table 5). While 945 ceramic artifacts were recovered from these investigations, they were highly fragmented, compromising much of the diagnostic potential for this artifact class. As shown in Table 6, a variety of historic wares are represented in the assemblage, including porcelain, redware, yellowware, stoneware and whiteware. However, the collection is dominated by the latter two.

Whitewares comprise over half of the ceramic assemblage, and over half of these derive from excavations in the midden area (Block 1 and TU ’05-5). Whiteware ceramics were produced and popular throughout the 19th Century, though particular decorative techniques represented in a small proportion of the assemblage have potential for further chronological refinement.

Transfer printing, a technique in which ink is applied to a (metal) die, then to a sheet, then to the biscuit ware, then over-glazed and fired, originated in the mid-18th Century and continues today (Richardson n.d.). However, particular motifs and colors can be traced to the mid and later 19th Century. Flow Blue transfer printing (in which the colors were intentionally blurred), for example, peaked in popularity in the mid-1800s and again toward the turn of that century (Sudderth 1992:10-11; Richardson n.d.). Transfer-printed whiteware fragments were found in the midden area of the southwest yard, mainly derived from Test Unit ’05-5 at the western end of that quadrant. A few pieces of this decorative type were found in Test Unit ’05-4 in the northeastern portion of the lot and in ’05-5, in the northwest yard as well. Figure 22a shows examples of transfer printed artifacts from this assemblage. The mulberry transfer print specimen, found in Block 1 excavations in the midden area, was likely produced between 1850 and 1855 (Williams 1993).

Decal-decorated ceramics are also represented in the Staples House assemblage. According to Sudderth (1992), this technique originated around 1845 and was popular after 1860 (see also Derven 1980). Figure 22b shows examples, also illustrating the highly fragmented nature of the assemblage. Note that all three pieces have the same design and may well originate from the same piece. All were excavated from the midden area.

Hand-painted decoration is less-useful for chronological interpretation, although styles represented in this assemblage suggest a relatively broad span of time. Figure 22g shows small-scale floral designs.

Overall, decorated pieces form a small minority of the largely undecorated whiteware assemblage. This supports a late-19th century and later deposition timeframe for these materials, as popularity of the highly embellished printed table service was declining in favor of simpler molded and plain white-surfaced types in the later 1800s (Richner 1997:43).

Stoneware fragments account for 257 of the 945-piece ceramic assemblage; roughly 70 percent of these were found in the midden area, with most of the remainder deriving from features in the northwest yard. Figure 22 (c and f) shows examples of this utilitarian ware from this assemblage.

Porcelain, a finer ceramic ware, is represented in the Staples House assemblage by 73 fragments (Figure 22d). Most of these were found in the midden area as well.

Yellowware, a utilitarian ware, makes up the next most populous ceramic group, with a total of 55 pieces; it is not surprising that most of these also derive from the midden area excavations. This ceramic type was most popular between 1870 and 1900, though production did continue to about 1930. An example of this ware is shown in Figure 22e, and appears to represent part of a mochaware decoration (see Richardson n.d.).

Finally, redware, a coarse earthenware also used for utilitarian purposes, was identified for 18 ceramic fragments. This ware likely competed poorly against newer more durable stonewares, leading to a fall-off in production by the turn of the 20th Century (Sudderth 1992:12; see also McConnell 1988)

Kitchen Fauna

A modest faunal assemblage of 625 elements and fragments was recovered during the Staples House work. Four hundred twenty of these originated from midden area excavations, including Test Unit ’05-1, Block 1 test units, and south west yard shovel tests (Table 5). Cannon (Appendix B) concludes that, generally, the faunal assemblage reflects food refuse disposal. His analysis shows that it is largely composed of domestic species (cattle, hog, and chicken), and nearly a third of it has cut marks or other modification. That this feature is located just out the back door, near the kitchen during the early years of house occupation, is not surprising.

Architectural materials

Architectural materials are defined as all items related to construction of the house or other structures. This includes building hardware, limestone, mortar, plaster, window (flat) glass, and nails. Because flat glass and nails comprise the majority of systematically collected architectural artifacts in the Staples House assemblage, and because they have the greatest potential for use in assessments of deposit chronology, discussion of architectural materials focuses on these two artifact classes.

Flat Glass

Flat, or window pane, glass fragments have proven useful in the chronological ordering of historic architectural deposits. Technological changes through the 19th century, tied to efforts to create larger stable pane sizes, resulted in the gradual thickening of window pane glass up to approximately 1920 (Moir n.d.; Roenke 1978; Weiland 2007). Thickness of flat glass fragments is a valuable source of relative data in this project. Methodological considerations make absolute dating of the window glass assemblage unrealistic; we have little information on the manufacture, transport and installation of window glass of given thickness in the central plains. However, we can provide a general chronological context for architectural debris, and an ordering of artifact deposits across the project area.

Data collection began with distinction of flat from curved glass. Visual and tactile inspection of fragments was used to determine the presence of any curve not obvious upon first inspection. Through this process it was determined that the Staples House assemblage contains 822 pieces of flat glass from 97 proveniences. Fragments were measured, using digital calipers, to the hundredth of a millimeter, and information was entered into an Excel spread sheet. Schoen (1990) recommends three measurements to encompass variability in pane thickness resulting from the tendency for old glass (a liquid) panes to be thicker at the bottom than at the top. However, the highly fragmentary nature of the assemblage (the majority of the flat glass sherds were less than one inch in their longest diameter) led to the conclusion that multiple measurements would not contribute substantially to analytical goals for this project, and a single measurement was taken for each specimen. Raw data are available under MWAC accessions 1104 and 1119.

Preliminary screening of these data led to the removal of certain specimens from the flat glass data set. Fragments were removed from analysis for one of three reasons: A) they exceed a thickness of 3.2 millimeter and are therefore most likely not window glass (Moir n.d.:17); B) they were determined due to some characteristic not to be window glass; C) the sample fractured so that only one surface remained flat, therefore precluding measurement of pane thickness.

Mean thickness for the flat glass assemblage is 2.12 mm, with an interpreted mean date of 1868 (Figure 23). However, the distribution appears to be multimodal, as would be expected for an assemblage collected from deposits representing multiple events. The two largest modes equate with 1850 and 1865. Given the documented initial construction date of 1869-1872 for the Staples House, this suggests either that some of the window glass was reused from an older structure, or that there perhaps existed an unrecorded structure on this site prior to the construction of the main house. A third possibility is that, due to localized variables in transport and trade, glass available for construction in West Branch at the end of the 1860s was from an older source than those used to create the formula used to calculate dates here (see Schoen 1990; see also Moir n.d., Roenke 1978).

Regardless of absolute dates calculated, flat glass-derived dates have greatest utility for this project in their relative sense. Earlier and later modal dates may be used to relate deposits to each other, and contribute to overall interpretations regarding stratigraphy and significance of archeological deposits across the Staples lot. Analyses and interpretations specific to particular deposits are discussed above, in Site Context.

Nails

Nails can provide information useful for interpretation of stratigraphy and order of deposition at the Staples lot. The relevant time period for Staples House construction and remodeling overlaps with the time during which a technological transition was occurring in nail technology. Machine-cut nails were made from mill-rolled iron plates which were fed into a shear that cut them into tapered shanks. This technology rapidly replaced handwrought nails near the end of the 18th Century, and continued to dominate for the following century. Wire nails were being made in North America by the 1850s, but were not widely used in construction for several decades after that, and did not actually dominate until the 1890s (Nelson 1968). Nelson explains this delay with the fact that cut nails tended to hold better (had greater adhesion) than wire nails, so it was not until a variety of sizes were readily available and the cost was sufficiently low for the latter that the former nail type really phased out of use.

Because the period of interest for this project spans the 1860s through the early decades of the 20th Century, relative frequencies of cut versus wire nails may be of use in interpreting depositional sequence on the Staples lot. The Site Context section, above, uses cut versus wire nail frequency to interpret depositional sequence, so an assemblage-wide summary is given here.

Overall, the assemblage is split fairly evenly between the two nail types (Table 7). Cut nails account for 53% of the total, and wire nails 46%. The midden area excavations match this distribution, with the same relative frequencies for the Block 1 assemblage and roughly similar frequencies in TU ’05-1 (60% cut nails, 40% wire). In contrast, TU ’05-2 in the northwest corner of the lot contains 76% cut nails, supporting the interpretation of an older origin for the trash deposit tested there. Test Unit ’05-5 has a slightly higher proportion of wire nails (53%), suggesting a younger deposit there. This is not unexpected, given the shallow and churned nature of the cultural materials in this unit. Test Unit ’05-4, in the northeast corner of the lot also contained a higher percentage of wire nails, suggesting newer deposits here. It could also support the interpretation raised in Site Context, that this area was used for staging and construction activities during the addition of the north ell in the early decades of the 20th Century.

Personal Items

One-hundred thirty-six objects considered to be personal items were recovered from Staples House investigations (Table 8). These include ammunition, clothing parts, jewelry, ceramic pipes and pipe fragments, toys, and miscellaneous items.

Ammunition, including cartridge cases and shotgun shells, derived mainly from the midden area. Four were found there, and two in other areas of the lot.

Clothing parts make up 55% of all personal items, and includes clothing fasteners, shoe fragments, buckle fragments, garters, rivets, and snaps. Buttons comprise the majority of this group, with 41 buttons and button fragments in total (Figure 21c). Clothing-related items derived mainly from the kitchen midden area (58 items total from the block excavation, the west porch shovel tests, and Test Unit ’05-2), with the remaining found across the rest of the lot.

Ten jewelry items, including seven rings (see Figure 21f), a decorative pin (Figure 21e), and a fragment of a hair comb were found across the study area, although six of these items derive from the midden area.

Ceramic smoking pipe fragments were located in the midden area, the trash pit and in a single shovel test in the back yard. This assemblage contains one nearly complete pipe bowl and several stem fragments (Figure 21b). While clay tobacco pipes were originally manufactured in England nearly 500 years ago (Gaulton 1999), the style of the Staples lot white clay pipe bowl is consistent with Canadian manufacture. While a brief search for comparable specimens resulted in no conclusive identification, and the item is absent a maker's mark, it is similar to those reported at Old Munising in Michigan (Richner 1992). There, Richner identified 12 "Henderson/Montreal" specimens, with a late-19th century manufacturing date. In addition, clay tobacco pipes found elsewhere at HEHO, manufactured as distant as Holland and as close as Muscatine, Iowa, also were created during the last decades of the 19th century at latest (Richner 1997:49, 73).

A few toys occur within this category as well. Four doll parts representing at least two porcelain dolls were found in the midden and front porch areas, and six marbles (both fired clay and glass) were found in various areas across the lot (Figure 21i).

Artifacts placed in the "other" category include a variety of modern and historic items. Of interest here are writing utensils (five slate pencils or fragments thereof and a pen nib [Figure 21d]), an 1872 shield nickel from the front porch area, a bone tatting needle from the kitchen midden (Figure 21g), and an aluminum thimble from Trench 2 in the backyard (Figure 21h). This last item is emblazoned with the words "Hoover/Home/Happiness" in blue enamel lettering, and is identified as a campaign giveaway for the 1928 election.

Miscellaneous Items

Objects that were not identifiable in any of the above functional categories were placed under "Miscellaneous." This category consists of recent debris, unidentifiable object fragments, and a small number of prehistoric lithic objects. These last consist of one informal biface and three pieces of debitage collected from various areas of the lot, and are not considered to comprise a prehistoric site, though their presence is recorded here for future reference.

Unidentified objects make up 784 pieces (or 2947 grams), which comprises 7.5% by count and 8.8% by weight of the total assemblage collected during the Staples House project (Table 9). Most of these unidentified objects are of ferrous metal (667 pieces, 2704 grams), but 223 pieces (or 92 grams) of non-ferrous metal also add to the count. These two groups of material make up over 99% of the unidentified objects in this assemblage.

Thirty-nine percent (by weight) of unidentified fragments derive from the trash feature investigated in Test Unit '05-2, and some 28% were found in excavations related to the kitchen midden area. Note that this is an incomplete accounting, underestimating the quantity of such items from Test Unit ’05-2, as much of the unidentified ferrous metal fragments returned from the field were quantified then discarded in order to facilitate more efficient curation (a list of items that were recorded and discarded prior to cataloging and curation procedures is archived with MWAC Accession 1104). Note also that non-diagnostic materials such as these fragments were not collected at all during data recovery of the kitchen midden feature, so the contribution of this feature to this artifact class is likely also underestimated here. The remainder of unidentified items were scattered across the excavation area. It is possible, but unconfirmed, that many of the unidentified ferrous metal fragments are the remains of food cans.

9. CONCLUSIONS

Deposits across the Staples House lot

Front yard

Deep deposits resulting from the distribution of basement excavation sediments cap natural prairie soil, generally ranging from 40 to 75 cm in thickness, across the south end of the front yard. These same basement excavation deposits also cap a layer of construction debris in the north portion of the front yard.

Backyard

An upper layer of tilled and/or redeposited garden soil, approximately 40 cm in thickness, lies over at least one intact trash disposal feature. The feature excavated within Test Unit ’05-2 contained a variety of construction-related debris most likely associated with early house construction or remodeling. At least half of this feature remains in-place, and geophysical data suggest that other similar features exist in this part of the lot as well. The southern half of the backyard contains a shallow sheet-midden deposit, which extends from the southwest corner of the (now-removed) back porch to the alley and into the Wright yard to the south. Excavations in this deposit yielded numerous functionally diagnostic items dating to the early years of the Staples House. Although upper sediments near the back alley may be disturbed and/or redeposited, the midden feature in general is continuous and near the surface across this area.

Future Research

Archeological materials derived from this project have proven of use to questions regarding order of deposition across the Staples House lot, and types of activities likely associated with individual deposits and areas of the yard. Their greater value, however, lies in context with assemblages from other lots in the Hoover neighborhood, such as those resulting from testing and excavation at the Laban Miles and Hayhurt Houses, (Richner 1997), the Hoover cottage (Hunt 1996), and the Leech House (Peterson 2000).

One potential research avenue involves the role of patent medicine in the West Branch community, especially in view of the alcohol and narcotic content of many sold during the late 19th Century. Medicine bottles were recovered in the Staples House yard; Richner (1997) also reports on such finds. The Quaker religious doctrine, assumed to be prevalent in early West Branch, discourages the consumption of alcohol (Jones, n.d.). Bearrs (1970) reports that Huldah Randall, occupant of the Staples House at the turn the of the 20th Century, was active in the Epworth League, a Methodist Youth movement founded in 1890 by the Methodist Episcopal Church, and named after John Wesley’s home. The Wesleyan doctrine also dissuaded alcohol use (Vernon 2001). In both cases, the use of patent medicines may be construed as an acceptable form of an otherwise unacceptable habit. This is merely broad speculation at this point; it is more reasonable to interpret the presence of the bottles as indication of maladies. The Staples House sample is evocative, but cannot be used to draw reliable conclusions on this topic. Comparison of archeological assemblages across HEHO, as well as other communities of the late 19th Century, for the presence and distribution of patent medicine and alcoholic beverage bottles, may be of use in testing interpretations.

This is but one potential research avenue for future work. Others, as suggested by Finney (2005), that would also benefit from analysis of multiple of the smaller compliance-derived assemblages include examination of resistance to acculturation, and the role of large-scale transport systems in household economy.

Management Recommendations

Archeological deposits across much of the Staples lot are capped by relatively sterile (i.e., containing little in the way of artifacts) sediments. Thus, shallow (20 to 40 cm BS) earth disturbance activities are not likely to have significant impact on archeological resources. Future work within this shallow zone may require monitoring by an archeologist. Any work expected to extend below this zone should incorporate archeological consultation early in the process.

The southwest quadrant of the Staples lot, however, does contain sensitive archeological materials within the upper 20 to 30 cm below surface. Any earth-disturbing activities in this area are likely to impact significant resources. Any future work impacting sediments in this part of the lot, as well as in the adjacent area of the Wright lot, should include archeological consultation early in the planning process.

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Count

		FUNCTION						
		Architecture	**Domestic**	**Heating**	**Miscellaneous**	**Personal**	**Tools/Machinery**	**Total**
General Provenience	FP_surf	7	5	0	2	2	0	**16**
	'05-1	236	451	5	21	21	10	**744**
	'05-2	356	274	139	597	4	6	**1376**
	'05-3	34	38	15	3	1	1	**92**
	'05-4	275	147	200	66	4	20	**712**
	'05-5	402	505	61	50	8	17	**1043**
	05ST_NE	130	32	86	24*	1	2	**275**
	05ST_NW	219	164	271	10*	8	3	**675**
	05ST_SE	319	88	387	4	1	3	**802**
	05ST_SW	149	140	24	27*	8	12	**360**
	'06-1	106	72	0	0	3	2	**183**
	Block1TU	1025	1244	0	77	65	59	**2470**
	int_well	3	0	0	1	0	0	**4**
	Trench 1	1	19	0	0	0	0	**20**
	Trench 2	5	10	1	0	1	0	**17**
	Trench 3	1	17	1	1	1	0	**21**
	Trench 4	3	4	2	1	0	1	**11**
	wporchST	45	33	0	6	8	3	**95**
Total		**3316**	**3243**	**1192**	**890**	**136**	**139**	**8916**

* See note on page 54.

Table 2. Occupants of Staples House, from its construction to NPS acquisition. Information from Bearrs 1970.

Years	Name	Age(s)	O/R#	Occupation/Notes
1869-1876	John Wetherell		Own	built house sometime in 69-72; unknown if he occupied house or rented it out (was a developer?)
1876-1891	James and Eliza Staples	62, 55	Own	retired (Vermont natives)
1884-91?	Horace M and Chloe Oliphant		Board	lived with James Staples after Eliza's death; Horace was wheelwright, Chloe kept house
1891-1893	William Wren		Own	
1893-1900	Edward and Sarah Randall	75, 75	Own	blacksmith (Sarah was born in Ireland)
1893-1900	Huldah Randall	38	dau. Of owner	piano teacher, Epworth League; held big sale in May 1900 (another sister, Elma, married during this time)
1900-1910	Dr. J.I. Baily		Own	landlord only
1900-06?	Annie Bremner (and hus.)		Rent	grocers; tried to purchase house in 1906 but couldn't make payments
1910-1912	James Clemson		Rent	rented house until Pennock family moved in
1910-1929	O. C. Pennock and family		Own	occ'd after 1912; added north ell, expanded west annex; son Adlebert purchased Wright House in 1920
1929-1946	C.A. and Marjorie Rummells	young family	Own	added asphalt shingles, floodlight to north elevation
1946-1967	M.E. and Nellie M. Endsley		Own	enclosed front porch, added storm windows

O: Name indicates Staples House owner.
R: Name indicates renting occupent of Staples House.

* See note on page 54.

Table 3. Chronologically diagnostic bottle finishes from the Staples House site, 13CD153.

Catalog Number	Finish Style	Finish Technique	Chronology	Color	Provenience	Depth
7658	Patent or Flat	Hand-Tooled	Prior to 1870's	Amethyst	Trench 1	**Backfill**
7670	Double Ring	Applied Hand Tooled	1820-1890	Aqua	15N 5E	**0-30 cmbd**
7680	Ring or Oil	Tooled	1880-1920	Aqua	15N 5E	**40-50 cmbd**
7684	Patent or Flat	Tooled	1880-1920	Clear	15N 20E	**0-50 cmbs**
7689	Ring or Oil	Improved Tool	1900-1920	Aqua	17N 35E	**0-61 cmbs**
7698	Double Ring	Tooled	1880-1920	Aqua	20N 40E	**0-71 cmbs**
7723	Prescription	Tooled	1880-1920	Clear	30N 35E	**50-60 cmbs**
7734	Bead	Tooled	1880-1920	Clear	35N 12E	**0-20 cmbd**
7746	Bead	Tooled	1880-1920	Blue	35N 12E	**20-30 cmbd**

Table 3. Continued.

Catalog Number	Finish Style	Finish Technique	Chronology	Color	Provenience	Depth
7744	Crown	Machine	1910-present	Brown	35N 12E	**20-30 cmbd**
7749	Patent or Flat	Tooled	1880-1920	Clear	35N 12E	**20-30 cmbd**
7758	Prescription	Tooled	1880-1920	Clear	35N 12E	**40-50 cmbd**
7773	Prescription	Tooled	1880-1920	Clear	39N 11E	**10-20 cmbs**
7775	Patent or Flat	Tooled	1880-1920	Aqua	39N 11E	**20-30 cmbs**
7783	External Screw Thread	Ground	1858-1915	Aqua	39N 11E	**60-70 cmbs**
7785	Flare	Applied Hand Tooled	1820-1890	Aqua	39N 11E	**70-80 cmbs**
8304	Patent or Flat	Machine	1910-present	Clear	17N 15E	**0-10 cmbs, 0-14 cmbd**
8316 (Fig.20)	Rolled Over	Hand-Tooled	Prior to 1870's	Blue	17N 15E	**10-20 cmbs, 14-24 cmbd**
8379	Patent or Flat	Tooled	1880-1920	Clear	17N 16E	**10-20 cmbs**

Table 3. Concluded.

Catalog Number	Finish Style	Finish Technique	Chronology	Color	Provenience	Depth
8293	Prescription	Tooled	1880-1920	Clear	18N 15E	**10-20 cmbs, 16-26 cmbd**
8323	Patent or Flat	Improved Tool	1900-1920	Clear	19N 14E	**0-9 cmbd**
8272 (Fig.20)	Ring or Oil	Applied Hand Tooled	1820-1890	Green	1m N, 1m W of Southeast Corner of Staples House	**0-20 cmbd**

Table 4. Mason Jar fragments.

Catalog Number	Provenience	Item Count	Description
7659	Trench 2 Backfill	1 Fragment	Embossed lettering: V / 18
7678	15N 5E, 40-50 cmbd	2 Fragments	Embossed lettering: NOV 3 / 185, OV 3
7705	30N 5E, 0-50 cmbs	1 Fragment	Embossed lettering: PA / NO
7780	39N 11E, Level 5, 50-60 cmbs	1 Fragment	Embossed lettering: NOV / 1
7783	39N 11E Level 7 Ash layer	1 Fragment	-Fragment with embossed continuous externally threaded screw finishes and shoulder, roughly ground lip surface, and one piece mold manufacture -Fragment with embossed lettering: V 30TH / 858
7740	35N 12E, 20-30 cmbd	6 Fragments	Glass Fruit Jar Seal Embossed lettering: “ATLAS EDJ SEAL”

Table 5. Domestic objects by provenience.

Provenience		domestic objects				Total
	Bottle glass	Ceramics	Fauna	Glassware	Other	
FP_surf	1	1	1	0	2	**5**
‘05-1	226	95	121	6	3	**451**
‘05-2	118	99	54	1	2	**274**
‘05-3	11	20	5	2	0	**38**
‘05-4	75	41	28	2	1	**147**
‘05-5	309	120	53	15	8	**505**
05ST_NE	26	5	0	0	1	**32**
05ST_NW	110	30	19	1	4	**164**
05ST_SE	49	23	16	0	0	**88**
05ST_SW	76	32	24	4	4	**140**
‘06-1	49	5	14	4	0	**72**
Block1TU	464	454	275	37	14	**1244**
Trench 1	11	5	2	1	0	**19**
Trench 2	5	2	3	0	0	**10**
Trench 3	10	3	0	3	1	**17**
Trench 4	0	2	2	0	0	**4**
wporchST	11	8	8	1	5	**33**
Total	**1551**	**945**	**625**	**77**	**45**	**3243**

* See note on page 54.

Table 6. Ceramic type by provenience.

Count

		Ceramics					Total
Provenience		**Porcelain**	**Redware**	**Stoneware**	**Whiteware**	**Yellow ware**	
	FP_surf	0	0	1	0	0	**1**
	‘05-1	7	0	13	74	1	**95**
	‘05-2	6	0	36	48	9	**99**
	‘05-3	4	0	4	12	0	**20**
	‘05-4	4	1	8	21	7	**41**
	‘05-5	19	4	20	65	12	**120**
	05ST_NE	0	0	1	4	0	**5**
	05ST_NW	5	3	1	19	2	**30**
	05ST_SE	0	0	7	11	5	**23**
	05ST_SW	4	2	6	18	2	**32**
	‘06-1	0	0	0	4	1	**5**
	Block1TU	21	4	159	255	15	**454**
	Trench 1	1	0	1	2	1	**5**
	Trench 2	1	0	0	1	0	**2**
	Trench 3	0	0	0	3	0	**3**
	Trench 4	0	2	0	0	0	**2**
	wporchST	1	2	0	5	0	**8**
Total		**73**	**18**	**257**	**542**	**55**	**945**

* See note on page 54.

Table 7. Counts of identifiable nail types by provenience, including front porch area surface, test units, grid-oriented shovel tests (grouped by lot quadrant), Block 1, backhoe trenches, and interior shovel tests.

Count

		Object		
Provenience		**Cut nail**	**Wire nail**	**Total**
	FP_surf	0	6	**6**
	‘05-1	90	59	**149**
	‘05-2	48	15	**63**
	‘05-3	5	10	**15**
	‘05-4	41	48	**89**
	‘05-5	85	95	**180**
	05ST_NE	33	9	**42**
	05ST_NW	22	23	**45**
	05ST_SE	36	21	**57**
	05ST_SW	36	25	**61**
	‘06-1	15	50	**65**
	Block1TU	391	343	**734**
	int_well	1	1	**2**
	Trench 2	1	2	**3**
	Trench 4	1	0	**1**
	wporchST	4	6	**10**
Total		**809**	**713**	**1522**

* See note on page 54.

Table 8. Personal items by general provenience units, tabulated by number of objects.

Provenience	Personal items						Total
	Ammunition	Clothing	Jewelry	Other	Pipe	Toy	
FP_surf	0	0	0	0	0	2	**2**
‘05-1	1	14	3	2	0	1	**21**
‘05-2	0	2	0	0	2	0	**4**
‘05-3	0	0	1	0	0	0	**1**
‘05-4	0	0	1	2	0	1	**4**
‘05-5	1	4	0	2	0	1	**8**
05ST_NE	0	1	0	0	0	0	**1**
05ST_NW	0	3	0	3	1	1	**8**
05ST_SE	1	0	0	0	0	0	**1**
05ST_SW	0	5	1	1	0	1	**8**
‘06-1	0	1	0	2	0	0	**3**
Block1TU	3	38	3	13	3	5	**65**
Trench 2	0	0	0	1	0	0	**1**
Trench 3	0	1	0	0	0	0	**1**
wporchST	0	6	1	1	0	0	**8**
Total	**6**	**75**	**10**	**27**	**6**	**12**	**136**

* See note on page 54.

Table 9. Unidentified objects by provenience. Top: object count; bottom: weight in grams.

	Object Count					Total
Provenience	Ferrous Metal	Non-Ferrous Metal	Plastic	Synthetic	Unidentified	
Front porch surface	2	0	0	0	0	**2**
‘05-1	16	1	0	0	0	**17**
‘05-2	517	72	0	0	1	**590**
‘05-3	0	0	1	0	0	**1**
‘05-4	14	10	1	0	0	**25**
‘05-5	33	0	8	0	1	**42**
05ST_NE	4	0	0	0	0	**4**
05ST_NW	8	0	1	0	0	**9**
05ST_SE	1	1	1	0	0	**3**
05ST_SW	8	1	6	0	0	**15**
Block1TU	57	7	0	3	0	**67**
well	1	0	0	0	0	**1**
Trench 3	1	0	0	0	0	**1**
Trench 4	1	0	0	0	0	**1**
wporchST	6	0	0	0	0	**6**
Total	**669**	**92**	**18**	**3**	**2**	**784**

	Weight in Grams					Total
Provenience	Ferrous Metal	Non-Ferrous Metal	Plastic	Synthetic	Unidentified	
Front porch surface	571	0	0	0	0	**571**
‘05-1	153	1	0	0	0	**154**
‘05-2	996	160	0	0	6	**1162**
‘05-3	0	0	1	0	0	**1**
‘05-4	64	11	0	0	0	**75**
‘05-5	171	0	2	0	1	**174**
05ST_NE	13	0	0	0	0	**13**
05ST_NW	22	0	0	0	0	**22**
05ST_SE	0	6	0	0	0	**6**
05ST_SW	55	3	3	0	0	**61**
Block1TU	570	42	0	5	0	**617**
well	12	0	0	0	0	**12**
Trench 3	9	0	0	0	0	**9**
Trench 4	9	0	0	0	0	**9**
wporchST	61	0	0	0	0	**61**
Total	**2706**	**223**	**6**	**5**	**7**	**2947**

* See note on page 54.

Note: in tables 1,5,6,7,8 and 9 artifacts are grouped by general horizontal provenience unit. Data are shown for the front porch surface ("FP_surf"), each 2005 test unit ("'05-x"), shovel tests grouped by lot quadrant ("05ST_xx"), 2006 test units ("'06-1": east porch area unit; "Block1TU": multi-unit block near the west porch), well within interior closet ("well"), backhoe trench materials ("Trench x"), and shovel tests under the west porch ("wporchST").

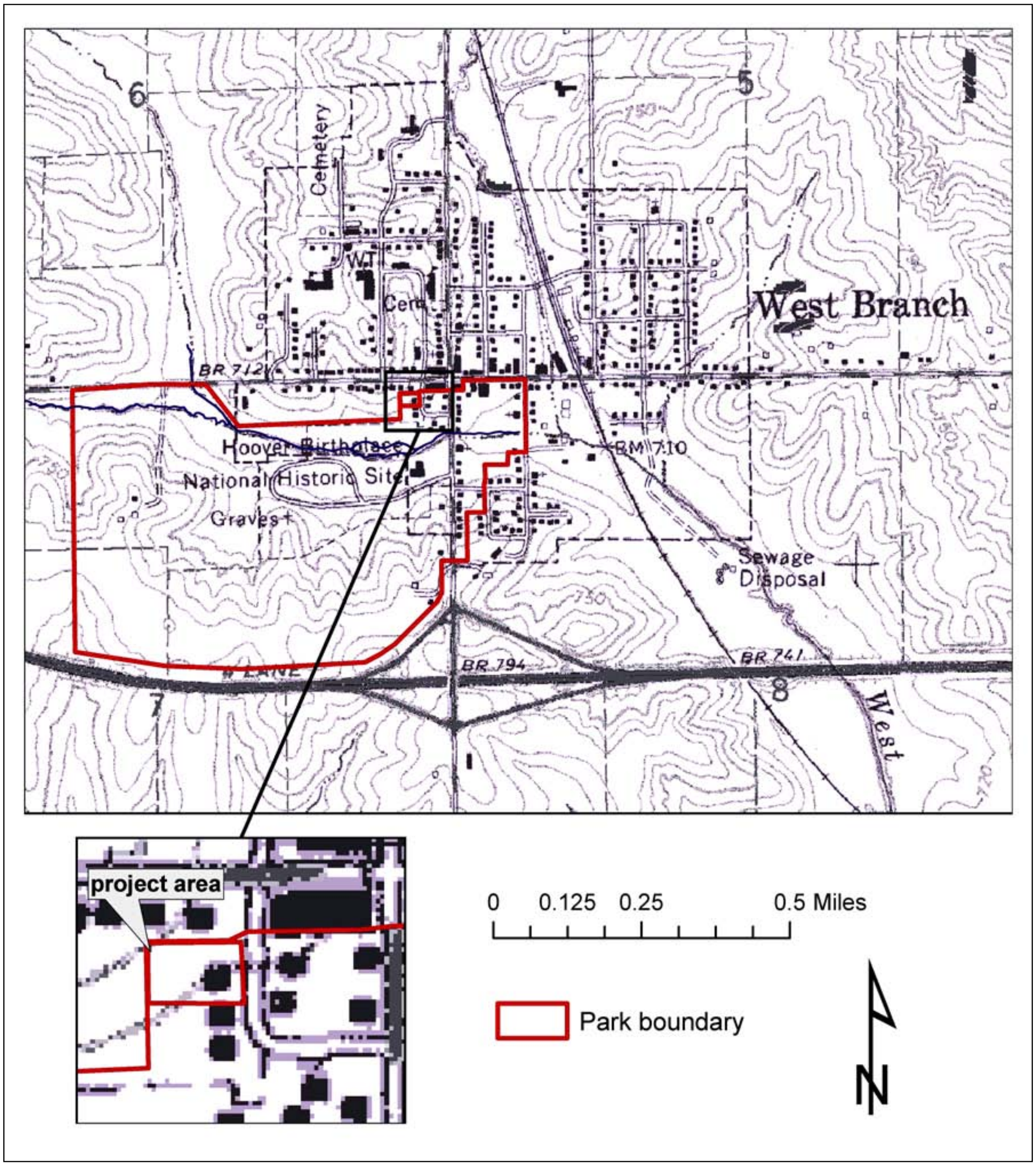


Figure 1. Staples House project area, Herbert Hoover National Historic Site, West Branch, Iowa. West Branch 7.5' USGS quadrangle, Section 7 of Township 79 North, Range 4 West.

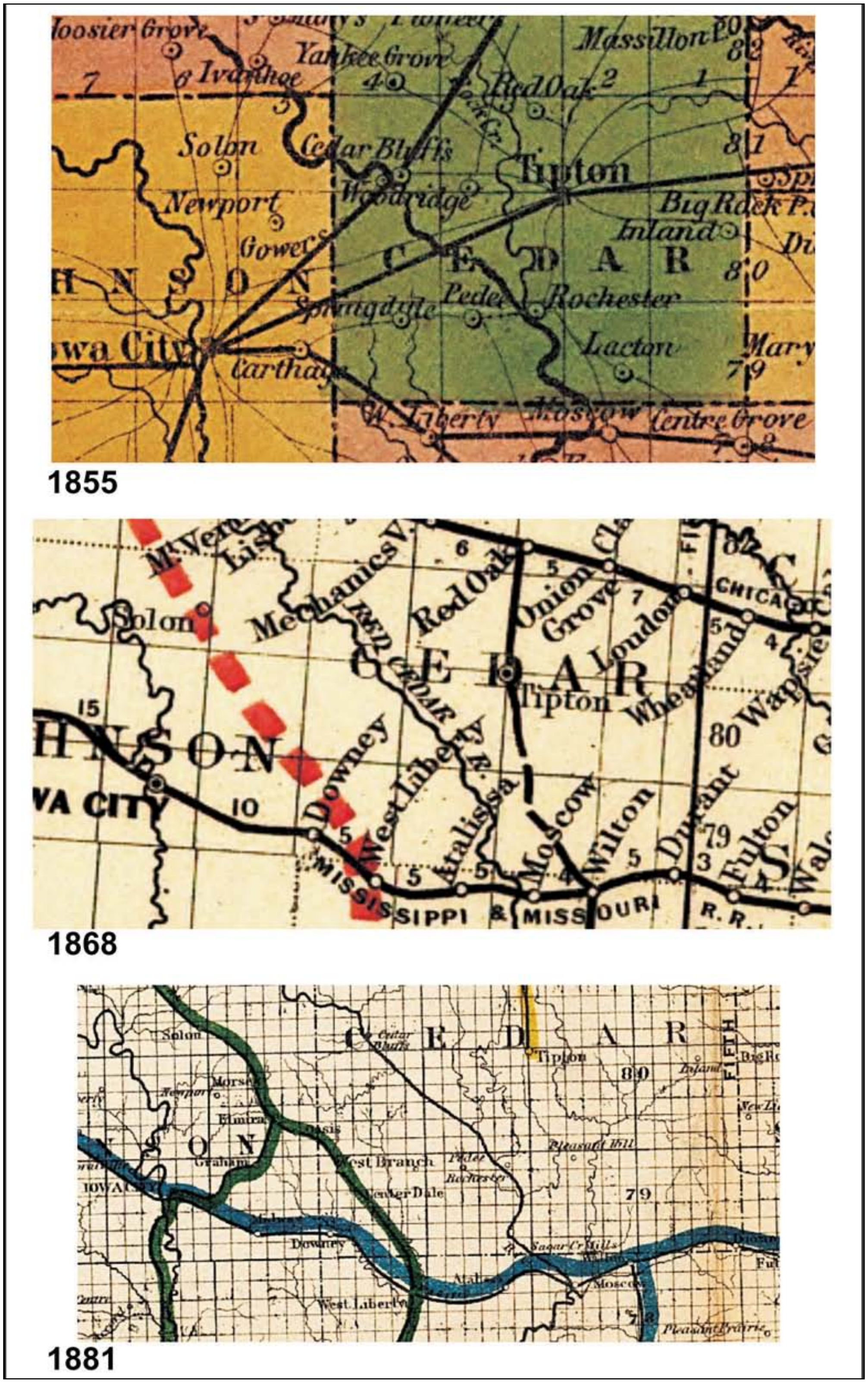


Figure 2. Portions of historic maps, showing the area surrounding West Branch (Mendenhall 1855; Colton & Co. 1868; Iowa Railroad Commissioners 1881). Note that the name of "West Branch" appears only in the 1881 version.

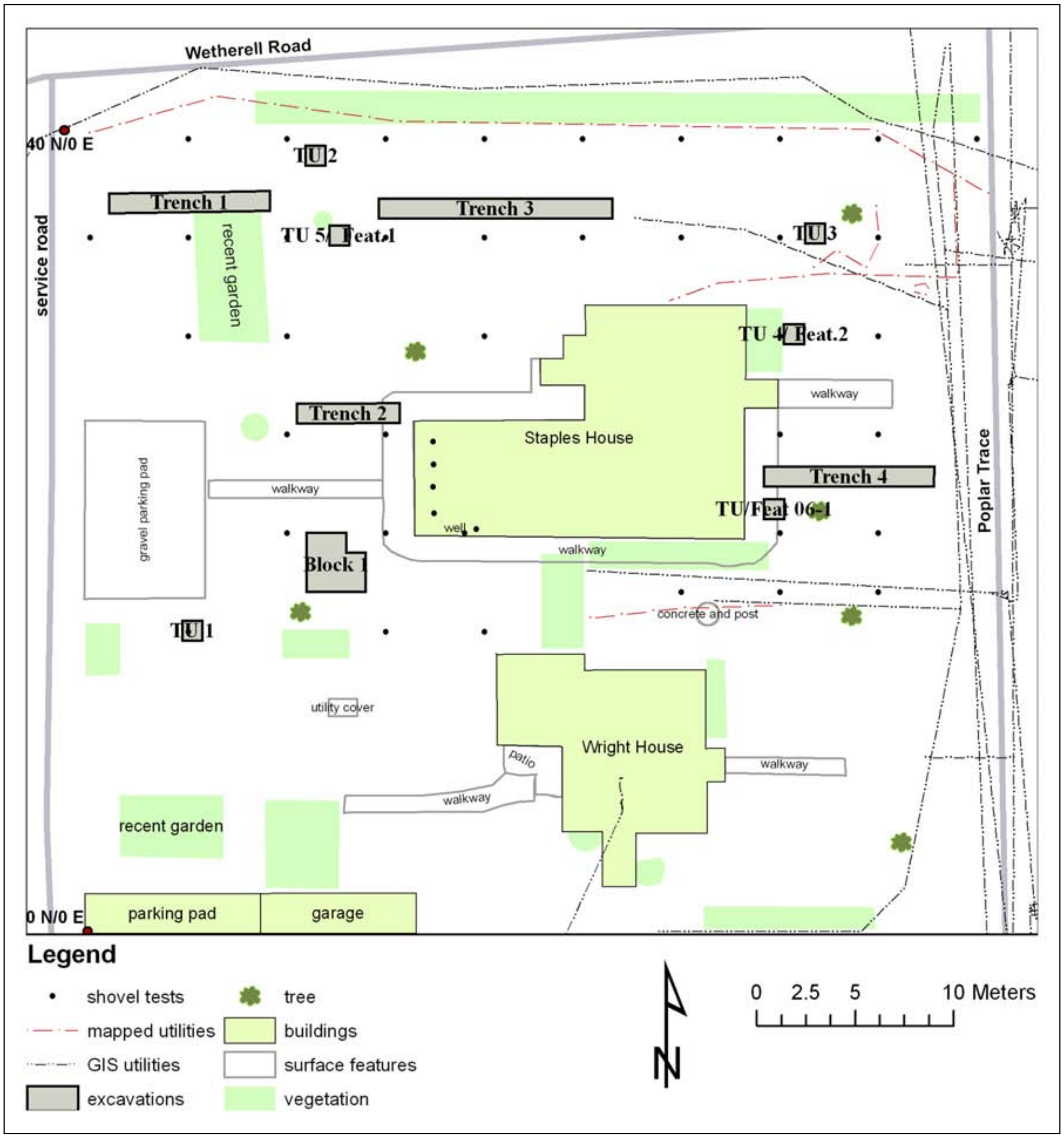


Figure 3. Staples House project area and locations of subsurface investigations, October 2005-March 2006. See also Appendix A.

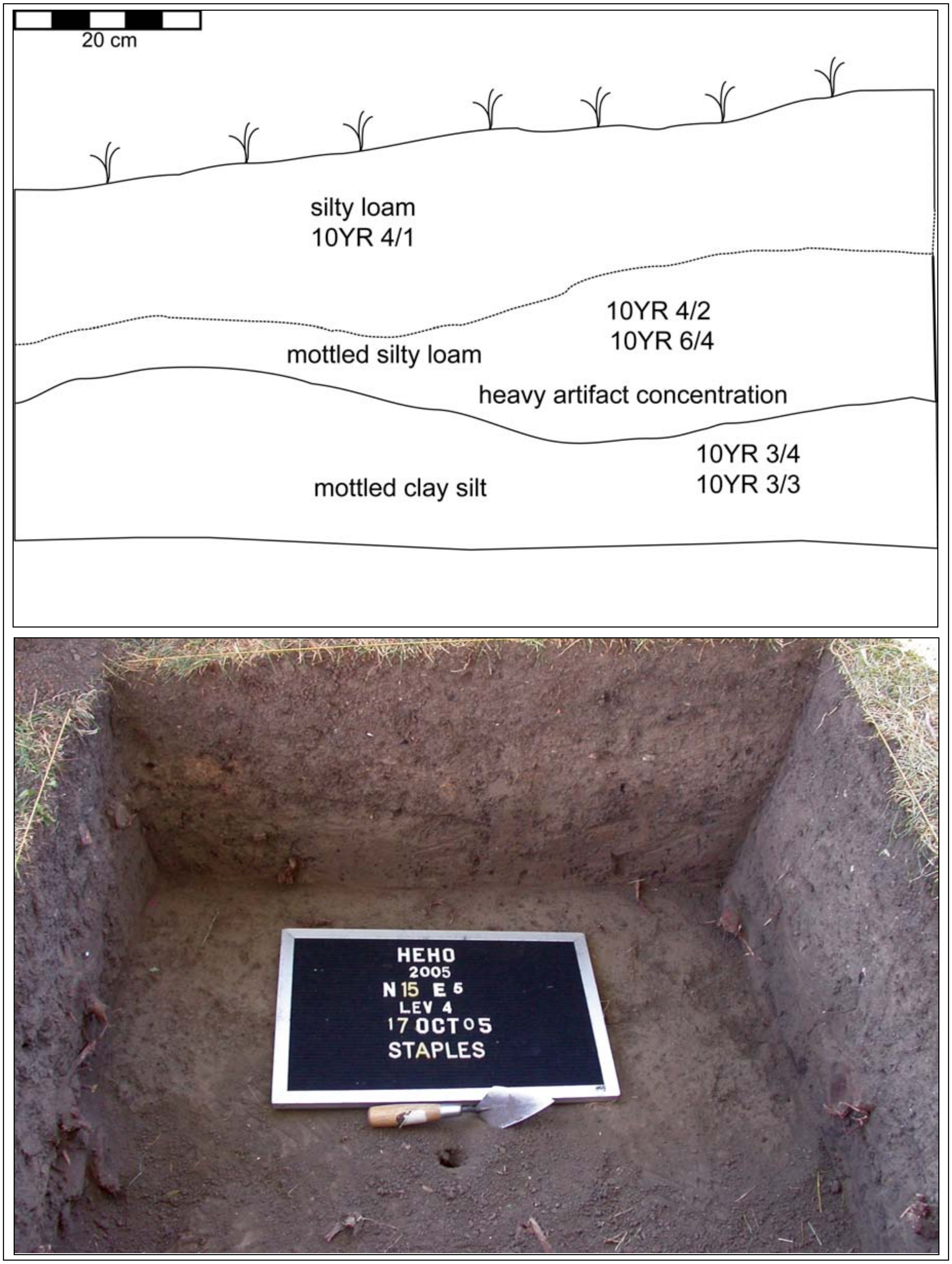


Figure 4. Test Unit ’05-1 (15-16 North, 5-6 East), west wall profile.

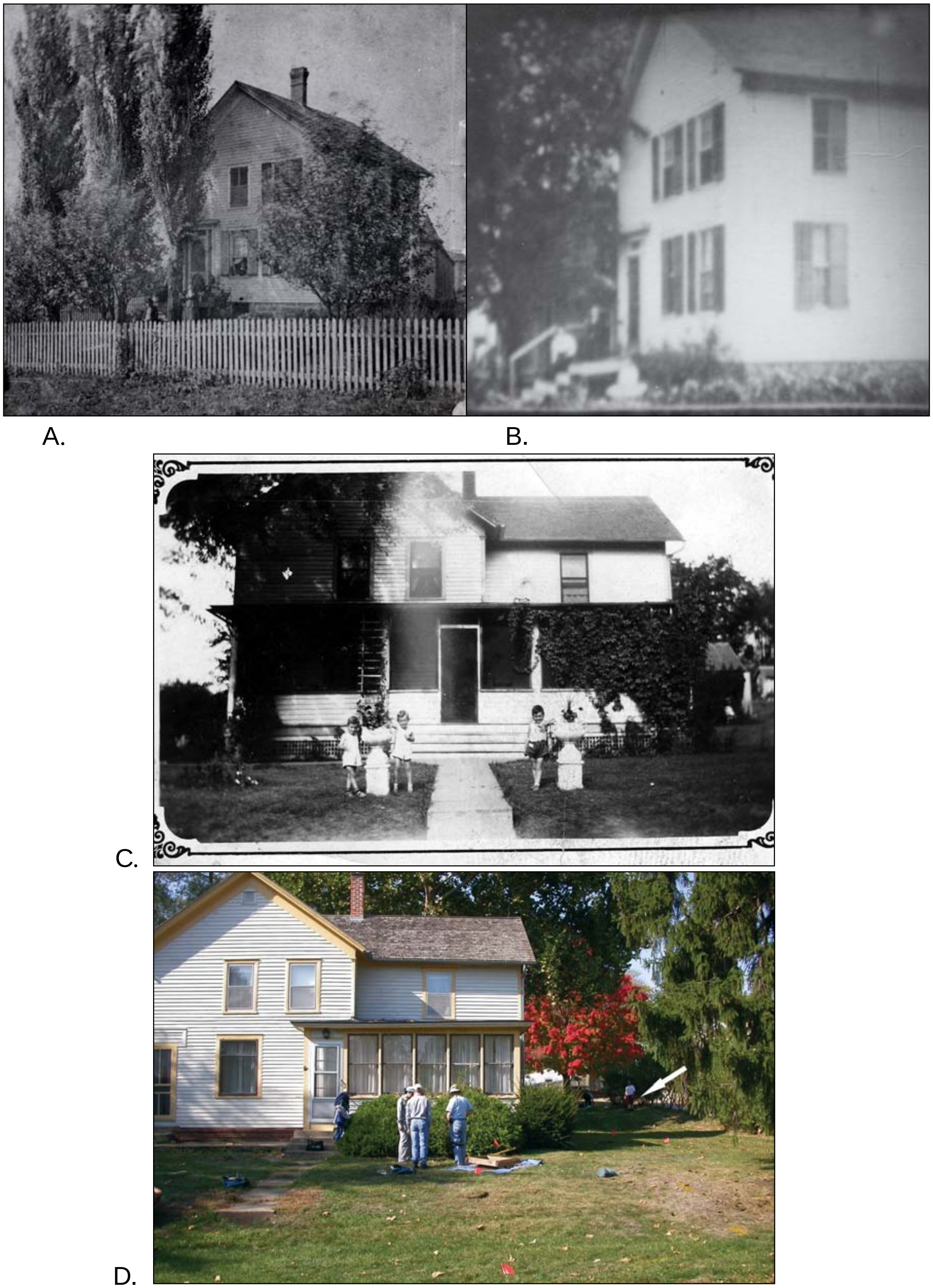


Figure 5. The Staples House in (a) 1878, (b) ca. 1895, (c) early 20th century, (d) October 2006. Arrow in Figure d. shows location of Test Unit ’05-2, and approximate location of structure shown in Figure c.

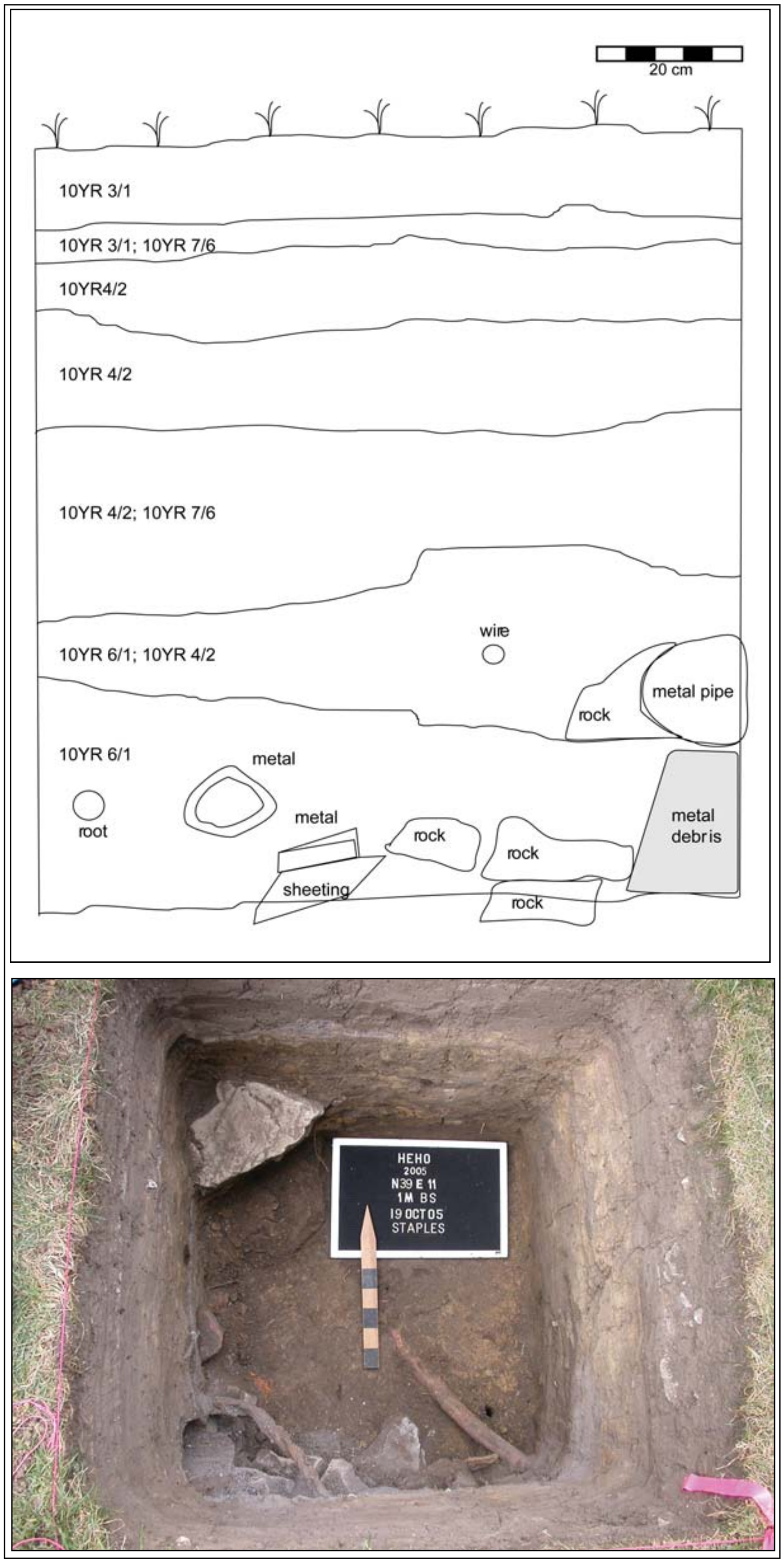


Figure 6. Test Unit '05-2 (35-40 North, 11-12 East). South wall profile, and plan view photo at one meter below surface (north to top).

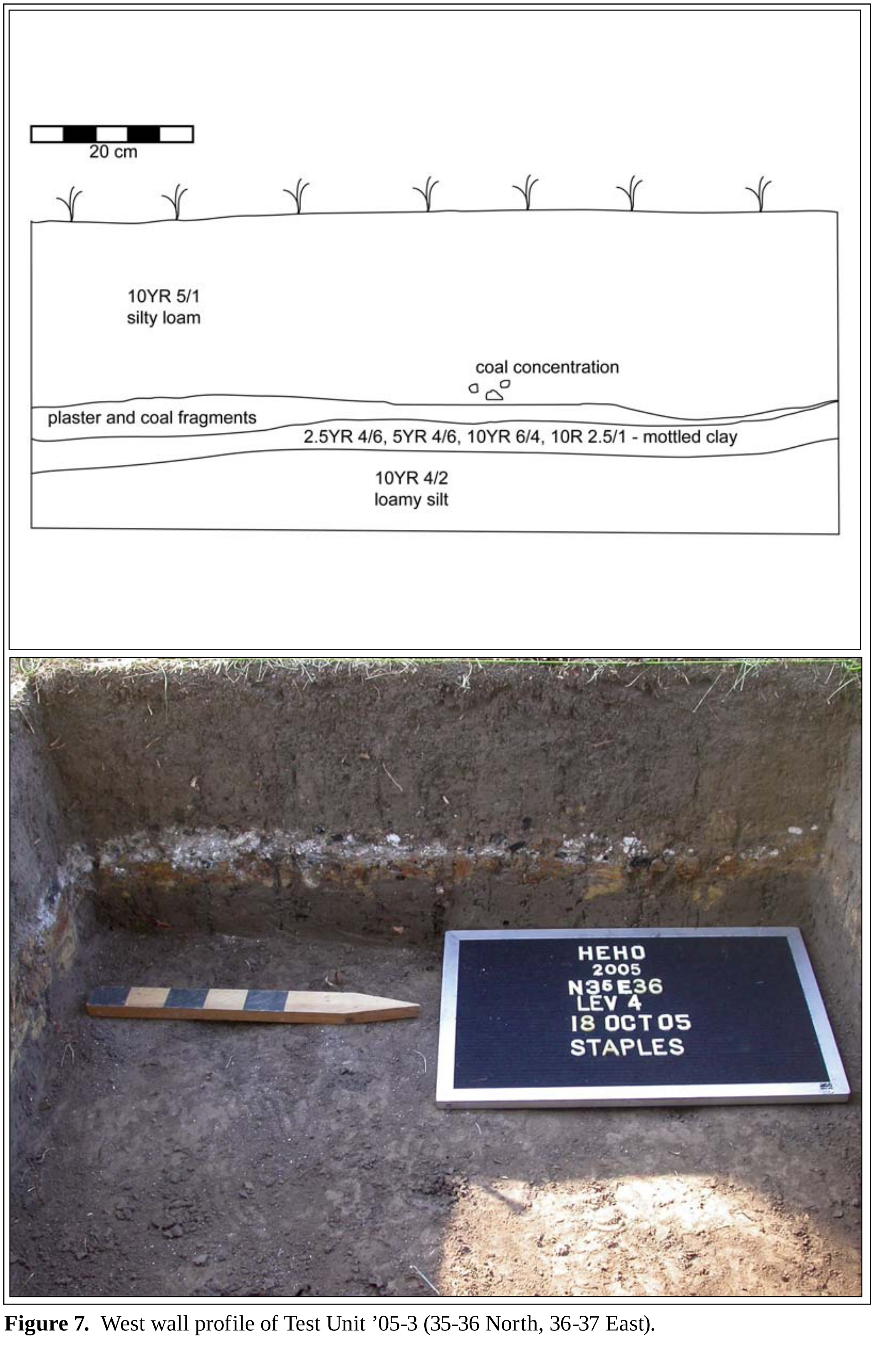


Figure 7. West wall profile of Test Unit ’05-3 (35-36 North, 36-37 East).

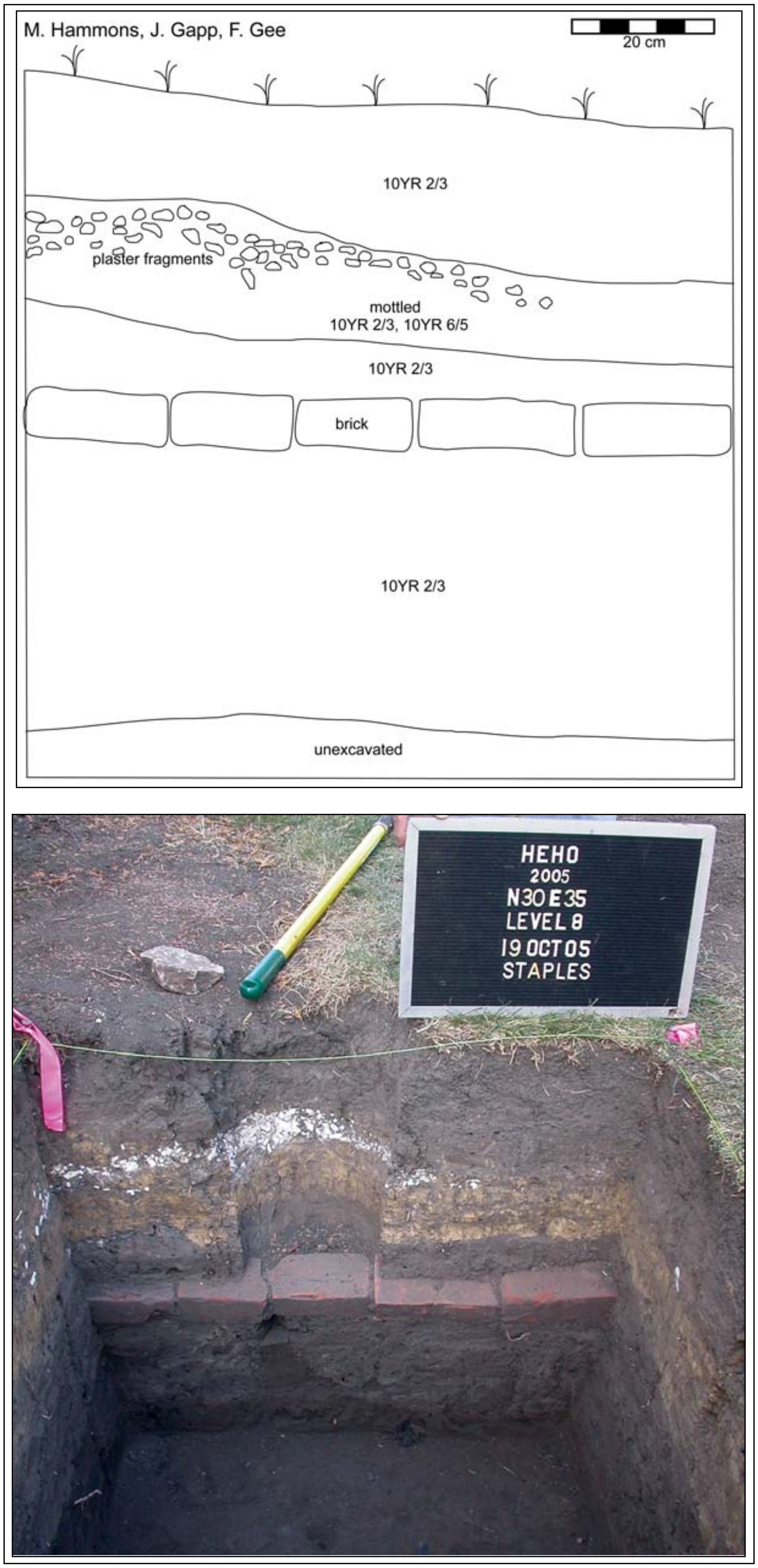


Figure 8. North wall profile of Test Unit ’05-4 (30-31 North, 35-36 East).

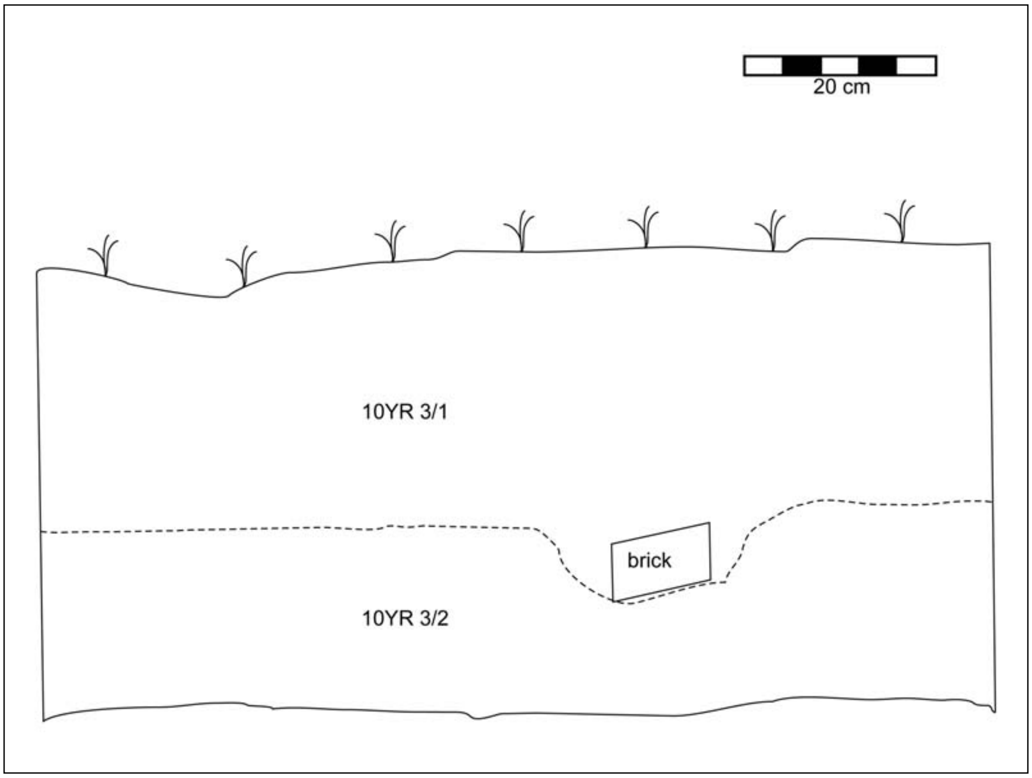


Figure 9. South wall profile of Test Unit ’05-5 (35-36 North, 12-13 East).

Figure 10. Feature 1 overview at surface. Location of Test Unit ’05-5.

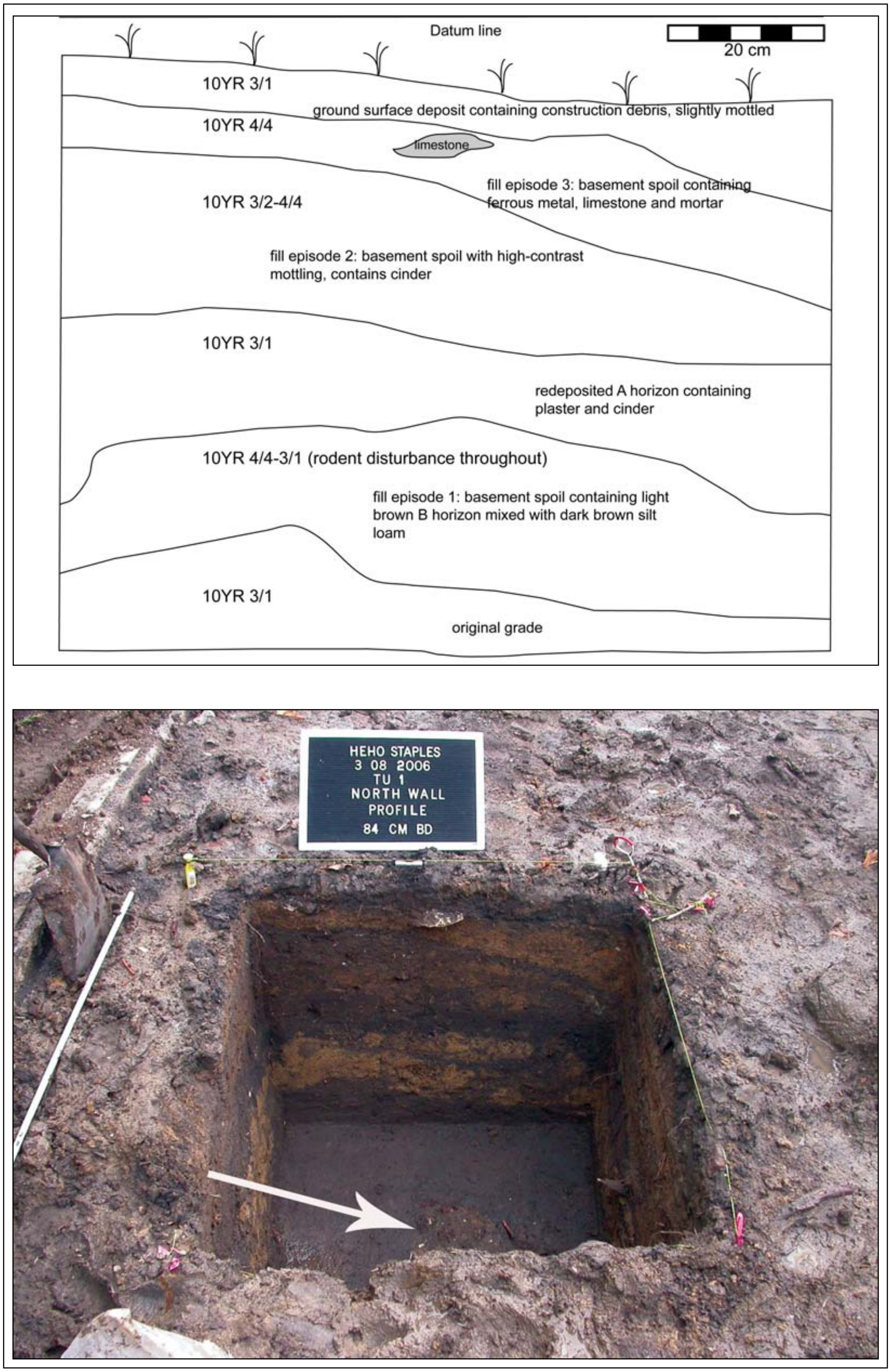


Figure 11. Test Unit ’06-1 north wall profile, southeast corner of east porch area. Arrow indicates post mold (Feature ‘06-1) in floor at 84 cm below datum.

Figure 12. Brick well exposed below floor joists of southwest closet (see Figure 3).

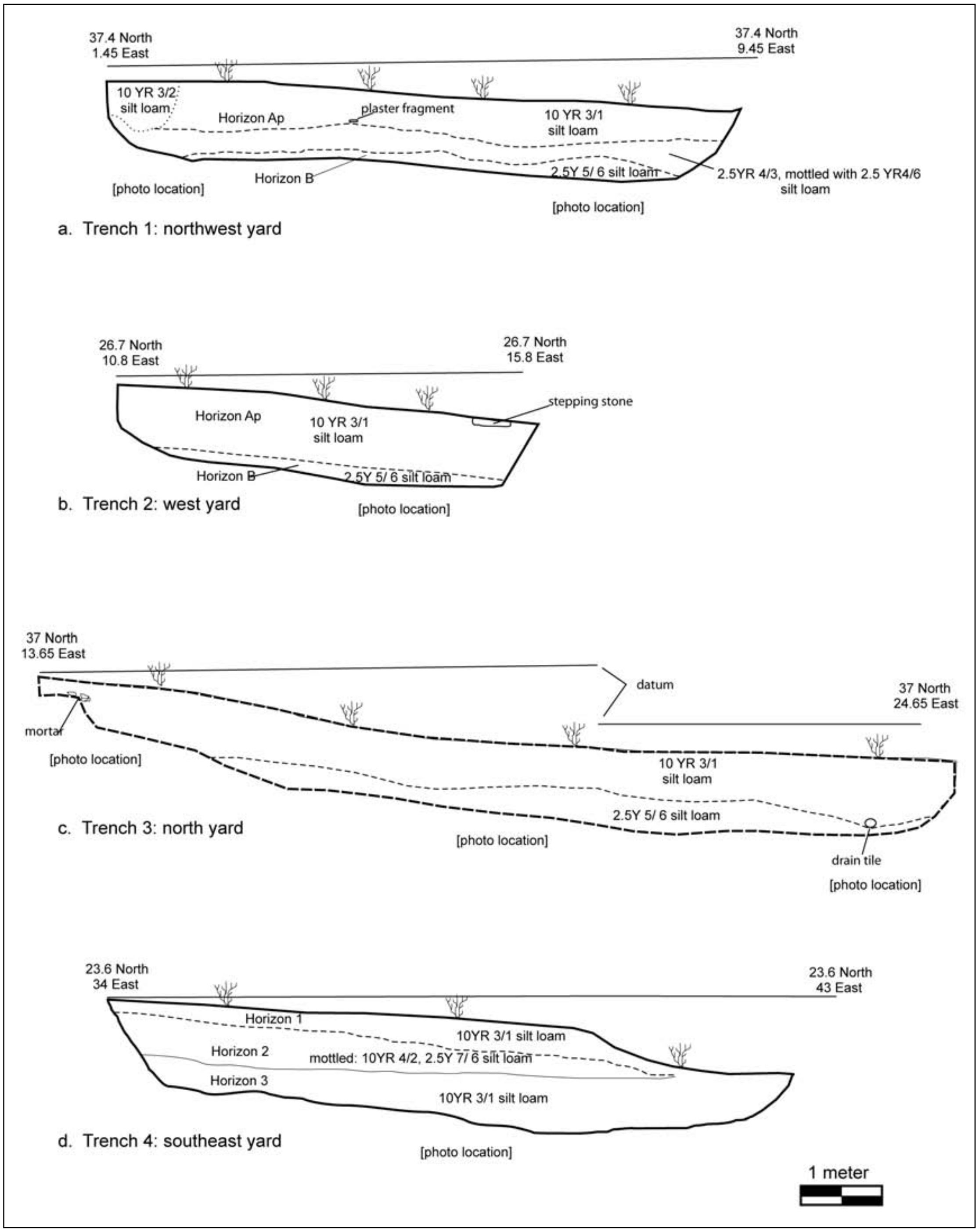


Figure 13. Backhoe Trenches 1, 2, 3, and 4 north wall profiles.

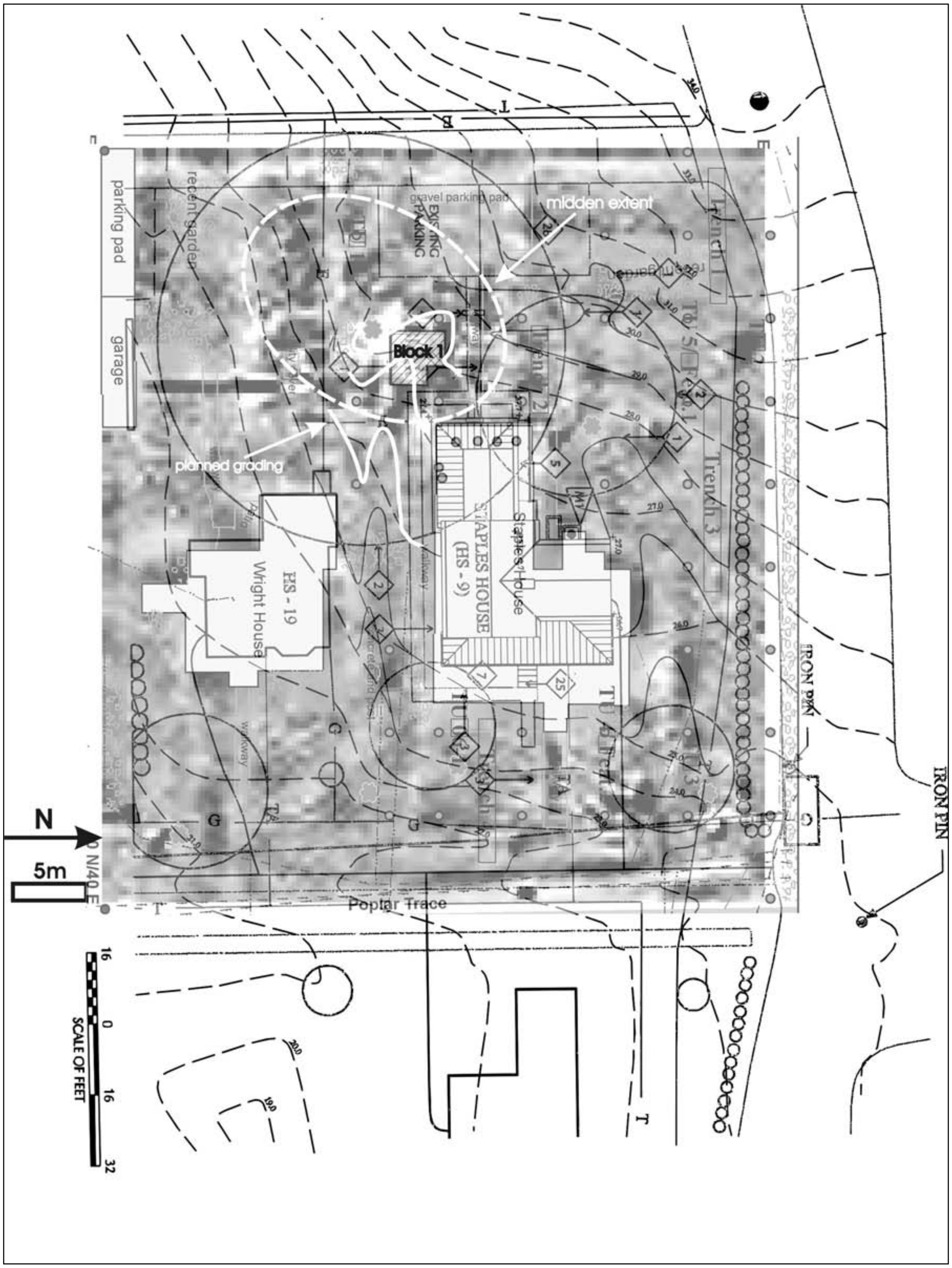


Figure 14. Architectural/engineering plan for Staples lot modifications, modified to highlight impact to midden area (as shown by overlay of electrical resistance data; see also Appendix A for details), and location of data recovery performed to mitigate this impact (Block 1).

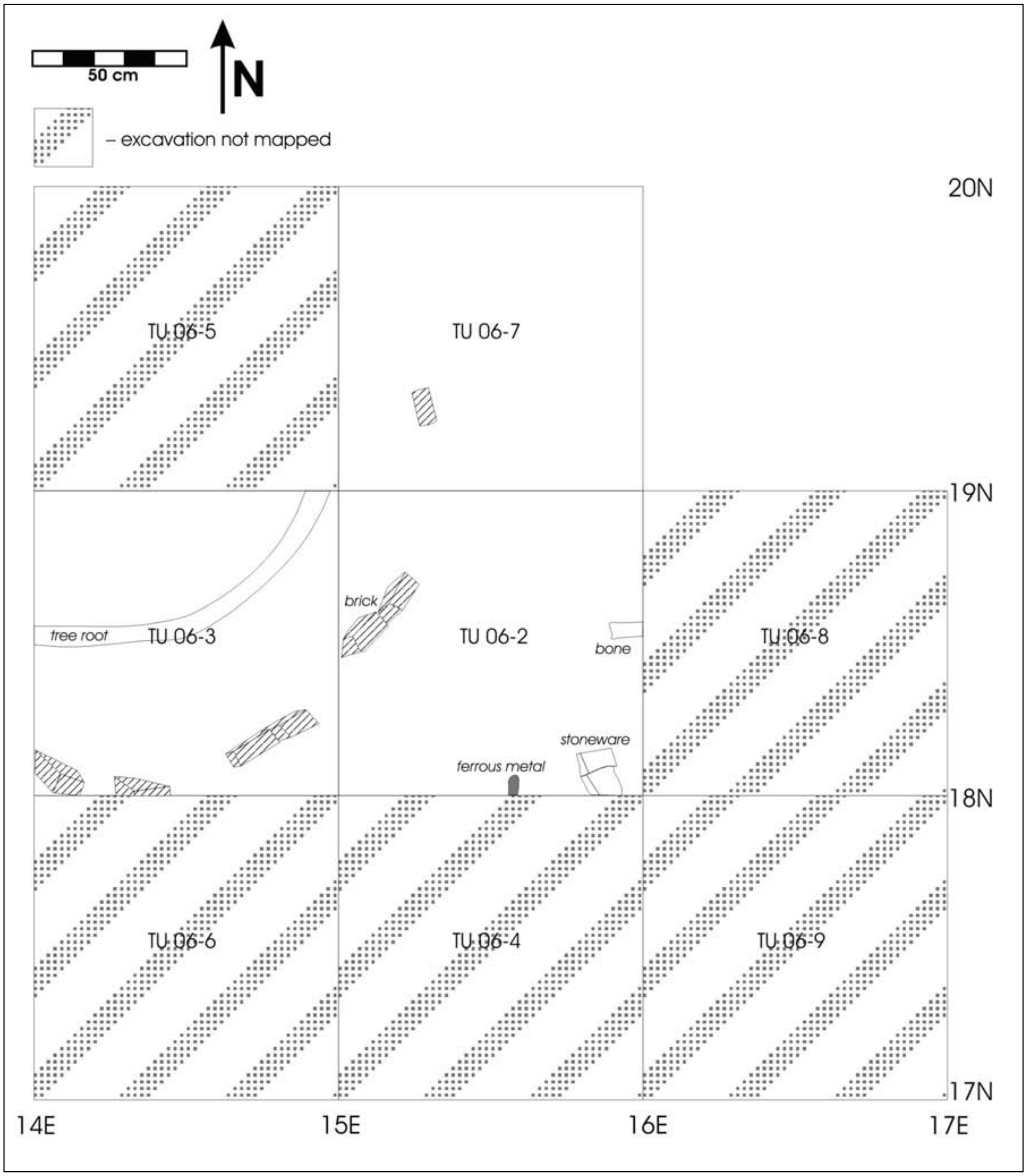


Figure 15. Detail of Block 1 excavations.

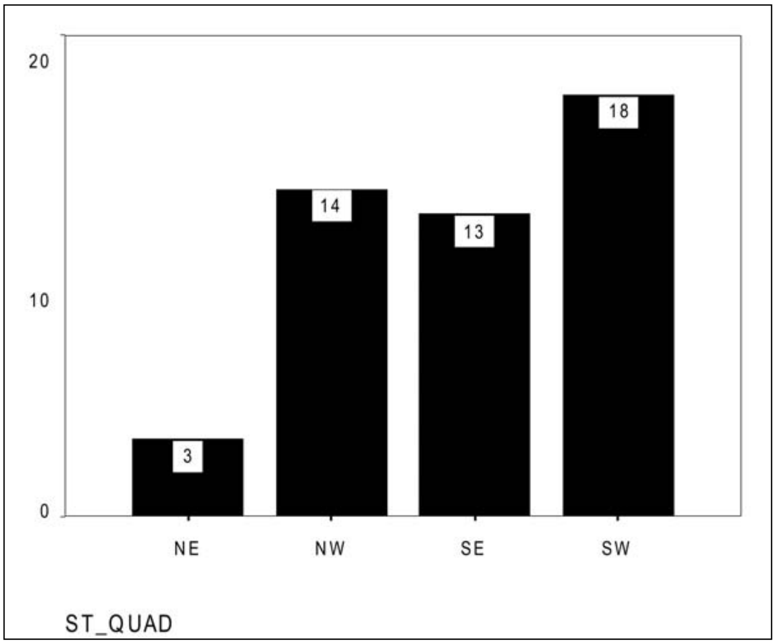
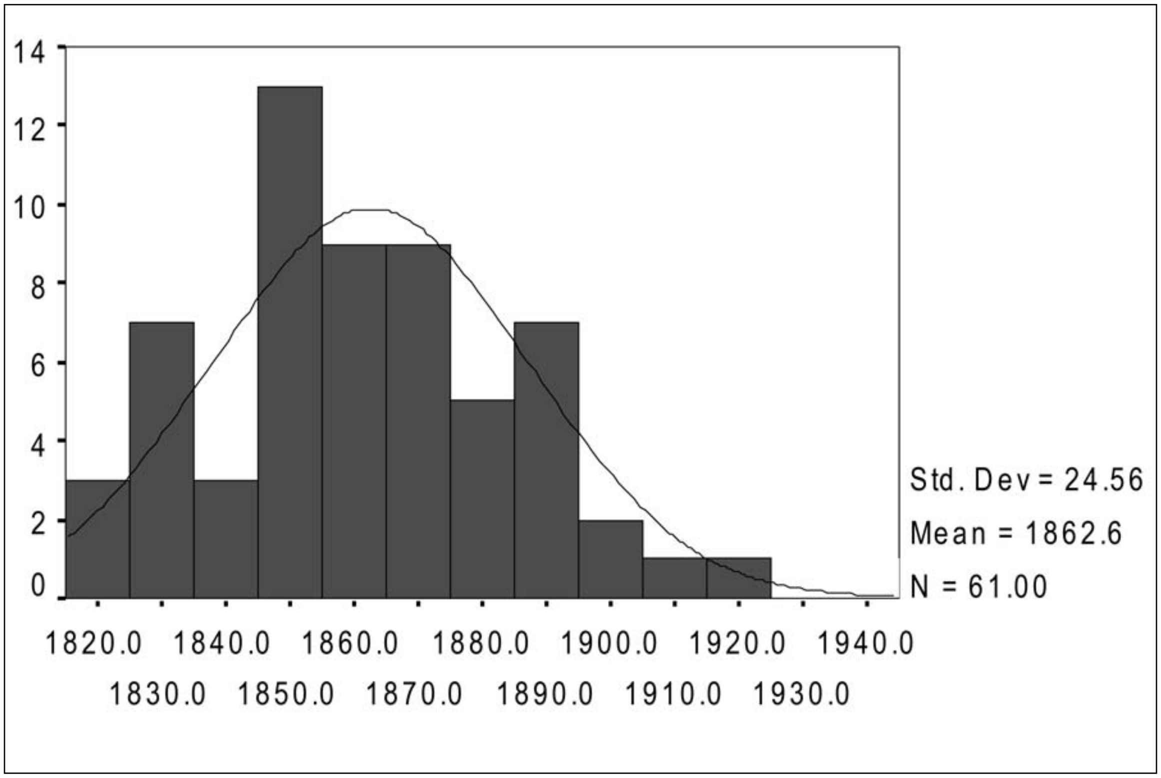


Figure 16. Mean number of domestic type artifacts per shovel test, by lot quadrant.



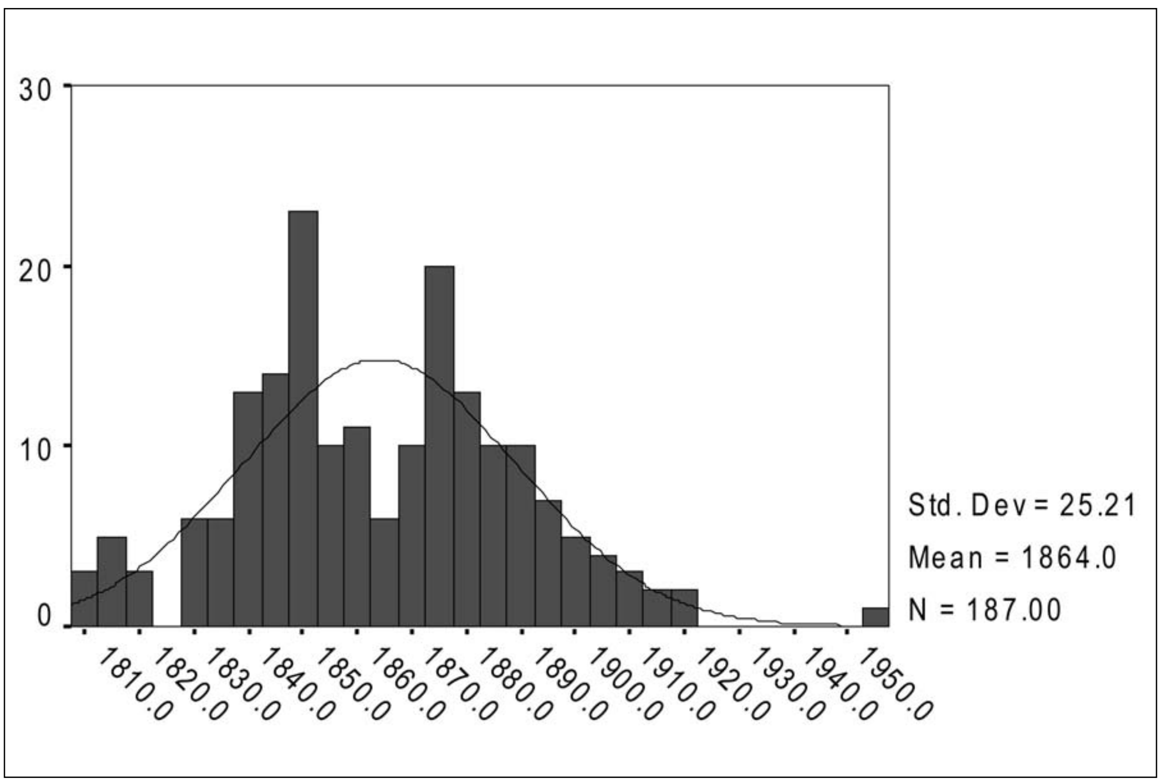


Figure 17. Flat glass-estimated dates for midden-area excavations, Test Unit ‘05-1 (top) and Block 1 (bottom). These and following window glass calculations area based on Schoen 1990:68. Y=1725.664 + 1713.008(X), where X is thickness of each flat glass fragment, and Y is the estimated date of window installation (i.e., construction or remodeling episode).

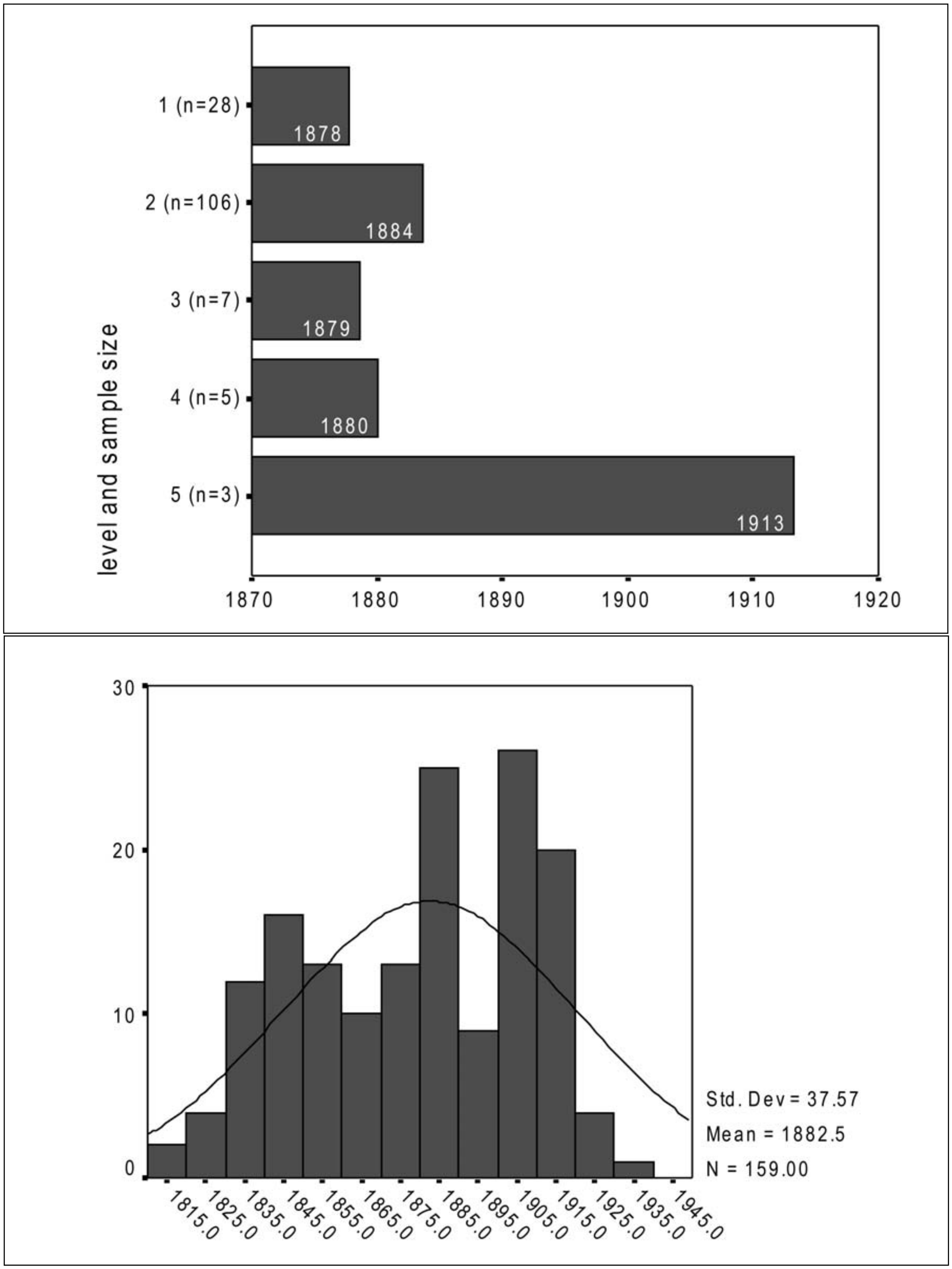


Figure 18. Flat glass data for Test Unit '05-5, supporting a long-term depositional history and post-depositional movement of sediments. The top graph is consistent with field observations, suggesting the mixing of sediments. Lower graph shows a multimodal distribution of thickness-based date estimates, suggesting that materials were deposited in this area at various points in the Staples House history.

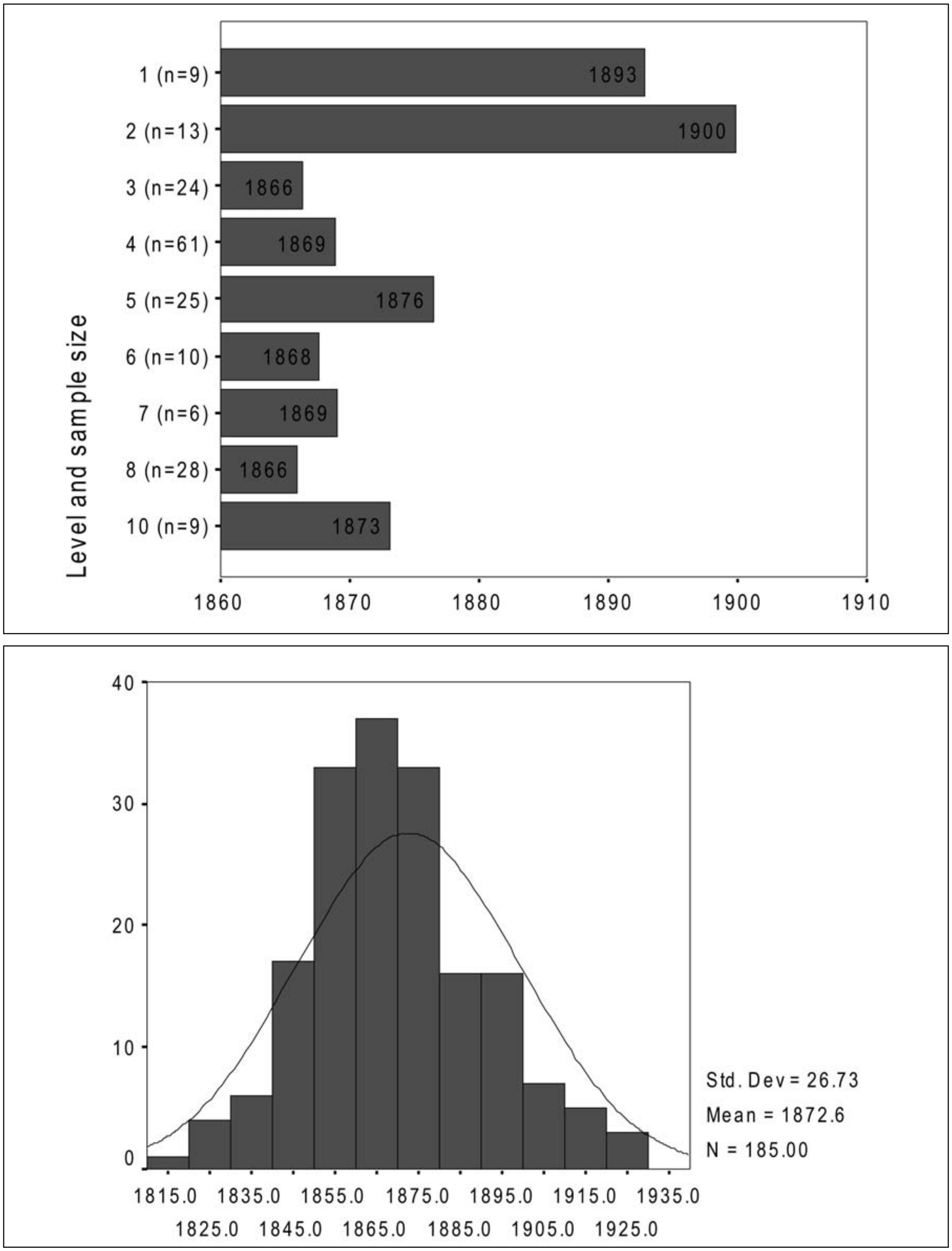


Figure 19. Flat glass data for Test Unit '05-2, supporting a single-event or short-term discard feature dating to Staples House construction or early renovation. Top graph shows that mean date estimates for each 10-cm level excavated within the visible portion of the feature (below 20cm BS) are essentially the same. The unimodal distribution of thickness (i.e., estimated date) for all window glass fragments (bottom graph) suggests a single event or short period of deposition time.

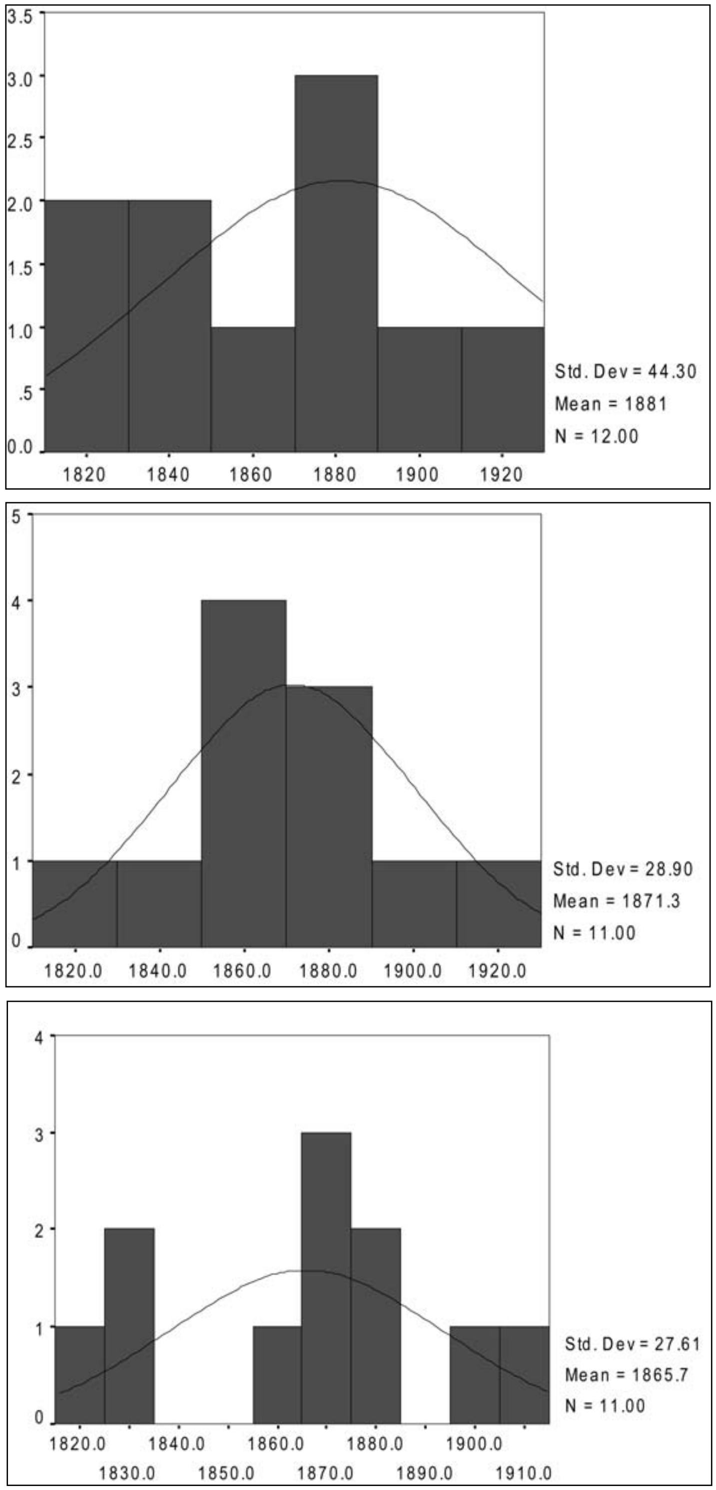


Figure 20. Flat glass thickness-derived date estimates for the southeast yard, based on data from Test Unit ’05-4. Top graph represents fill above dense plaster/coal/cinder layer (levels 1 and 2); middle graph represents materials from layer with dense plaster fragments and mottled fill above brick alignment (levels 3 and 4); bottom graph represents all lower levels.

Figure 21. Selected artifacts from the Staples House assemblage; a: curved glass; b-j: personal items (b: tobacco pipe fragments; c: buttons; d: pen nib; e: decorative pin; f: rings; g: tatting needle; h: Hoover campaign thimble; i: marbles; j: porcelain doll parts).

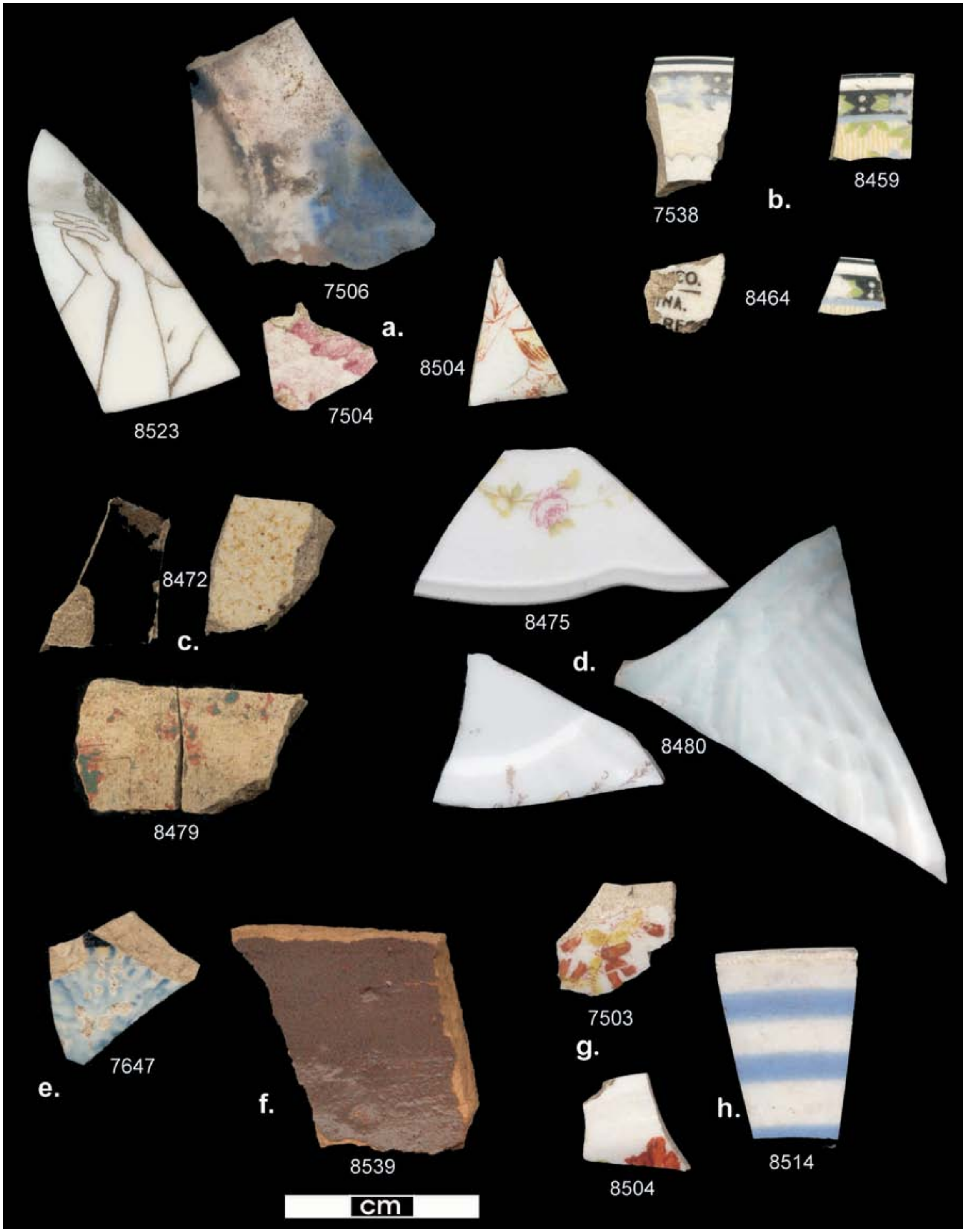


Figure 22. Selected ceramic specimens from the Staples House; a: transfer-printed whiteware, b: decal-decorated whiteware (including portion of maker's mark on reverse); c: stoneware; d: porcelain; e: yellowware; f: Albany-slipped stoneware; g: hand-painted whiteware; h: annular-decorated whiteware.

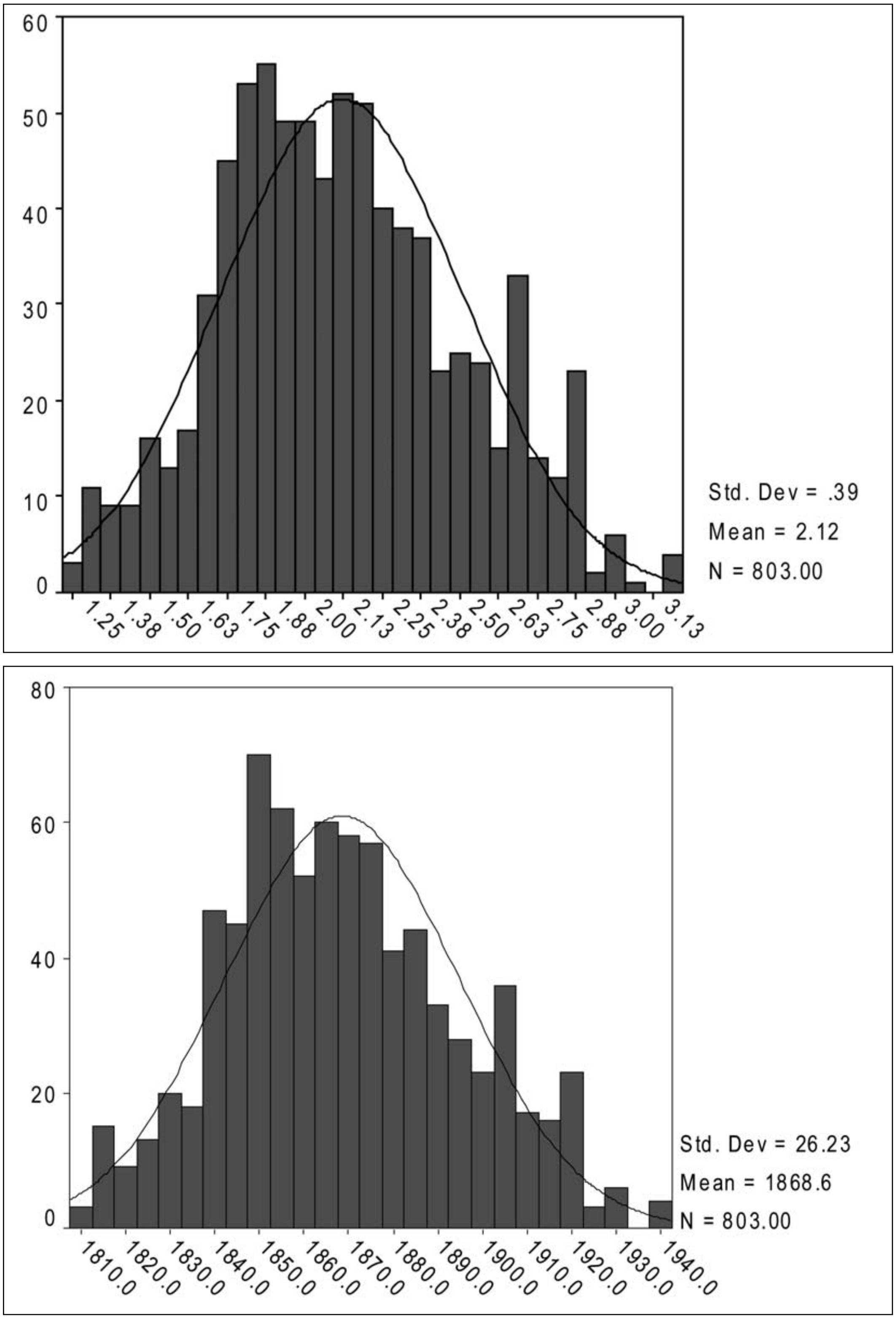


Figure 23. Thickness values and dates derived for flat glass fragments, Staples House assemblage. Dates calculated based on Schoen (1990). Cases with thickness greater than 3.2 mm were removed from analysis.

APPENDIX A

Geophysical Investigations at Herbert Hoover National Historic Site

Steven L. De Vore

Introduction

Geophysical methods were used to survey the Staples House (HS-09) and the Wright House (HS-19) yards at Herbert Hoover National Historic Site during the week of October 3rd through October 7th, 2005 (Figure 1). The geophysical investigations were requested by the park staff as part of a restoration project ultimately planned for the two houses. The geophysical investigations were part of the archeological inventory and evaluation project of the two properties. The geophysical equipment used in the survey effort included a ground penetrating radar cart system with 400 mHz antenna, a resistance meter with twin probe array, a fluxgate gradiometer, a ground conductivity meter, and a resistivity meter with an offset Wenner probe array.

Established on August 12th, 1965, the Herbert Hoover National Historic Site commemorates the life of the 31st President of the United States. The Park contains the neighborhood where Herbert Hoover was born on August 19th, 1874, and grow up until the age of eleven when he left Iowa on an emigrant train to Oregon where he lived with his Uncle Henry John Minthorn's family (Wheeler 1993:25). The Park contains the cottage where President Hoover was born, a replica of his father's blacksmith shop, the relocated first one room schoolhouse in West Branch, and the relocated Quaker meeting house where the Hoovers worshiped. In addition to these buildings, the park also contains several other homes associated with the friends and neighbors of the Hoover family. Following his death in 1964, President Hoover was returned to his native Iowa and was buried on a hilltop overlooking his birthplace.

The present geophysical project is located in the northwest periphery of the Herbert Hoover National Historic Site (Figure 2). The project includes the geophysical investigations of the James Staples House property lot and the William Wright House property lot. Both lots face Poplar Street or Trace, which is located one block west of South Downey Street where the Hoover birthplace cottage stands. The Staples lot is located on the southwest corner of the intersection of Wetherell Street and Poplar Street (Figure 3). The Wright lot is located in the middle of the block on the south side of the Staples lot (Figure 4).

Originally, the land containing the two lots was granted to Aaron Baker in 1852 for his service in the Mexican War. He sold the 160 acres four months later to Samuel King. The King family sold 80 acres to Joseph Steer in 1853. Mr. Steer sold a five acre tract to John M. Wetherell. In 1871, Mr. Wetherell divided the five acres into town lots. The Staples House was built between 1869 and 1872 by Mr. Wetherell (see Bearss and Husted 1970:82-98; National Park Service 1995:2.1-2.83; Wagner 1982:209-245; and Wheeler 1993:17 for more on the history of the Staples House). The original house was a two story building on Lot 22 of Joseph Steer's Plat of West Branch (Harrison and Warner 1872). In 1876, Mrs. Eliza Staples, the wife of Dr. James Staples, bought Lots 16, 17, 18, and 22 including the house, from Mrs. Mary S. Wetherell, the widow of John M. Wetherell. After the deaths of the Eliza and James Staples, the property and improvements were left to their four grandchildren. In 1893, the guardians for the four grandchildren sold the Staples property consisting of Lots 16, 17, 18, 19, 20, 22, and half of 21 and the house to William Wren. Several families owned the Staples House and property until the Federal Government purchased the property in 1967 from its final private owners M. E. and Nellie M. Endsley for inclusion in the Herbert Hoover National Historic Site. Over the decades since the original construction of the house, numerous additions and modification have been made to it. A barn or stable was present in Lot 21 between 1900 and 1920. At least one outbuilding or structure (possibly a garage in Lot 20) was noted in the backyard during the 1920s. These changes were illustrated on the Sanborn fire insurance maps from the 1890s through the 1920s (National Park Service 1995; Wagner 1982). The William Wright House and property occupied Lots 23 and 24 (see Bearss and Husted 1970:167-180; National Park Service 1995:2.1-2.83; Wagner 1982; and Wheeler 1993:16 for more on the history of the Wright House). The house was built in 1873 after William and Mary J. Wright purchased the lots from John Wetherell. A small outbuilding was located in the southeast corner of Lot 24 and was present on the Sanborn fire insurance maps from 1895, 1900, 1906, and 1912. Mrs. Wright sold the house, outbuildings, and the two lots in 1920 after she had lived in the house for 48 years. Bert Pennock purchased the property and lived there until he sold it to the Federal Government in 1967. Mr. Pennock dismantled the barn on Lots 19 and 20 in the 1920s and constructed a garage on Lot 24 from the salvaged lumber. Over the decades since the original construction of the house, several modifications were made to it. In 1900, there were two small outbuildings in the rear of Lot 23. These were removed sometime before 1927. These changes were illustrated on the Sanborn fire insurance maps from the 1890s through the 1920s (National Park Service 1995; Wagner 1982).

Environmental Setting

The Park is located Middle Western Upland Plains in the Dissected Till Plains section of the Central Lowland province of the Interior Plains division of the United States (Fenneman 1938:588-605; Schermerhorn et al. 1979:1). The region consists of rolling submature to mature dissected plains on the exposed Kansan glacial drift. The Park is located in the southwest portion of the town of West Branch in Section 7, Township 79 North, Range 4 West of Cedar County, Iowa. The county is characterized by a gently undulating surface with low relief. The Cedar River along with its tributaries, including the West Branch of Wapsinonoc Creek, drains a major portion of the county. Initial Euro-American settlement of Cedar County occurred in 1831 when a trading post was established near the confluence of Rock Creek with the Cedar River (Schermerhorn et al. 1979:1).

The area is also part of the Illinoian biotic province of North America (Dice 1943:21-23). The province is dominated by alternating prairies and deciduous forests. Grasses dominate the prairie vegetation. Upland deciduous forests are represented by oaks and hickories. The flood plains and moist hillsides contain a rich mixture of deciduous trees including elm, sycamore, bur oak, eastern cottonwood, hackberry, redbud, maples, linden, willow, and buckeye.

The project area lies within the upland Tama-Downs soil association of "gently sloping to strongly sloping, well drained upland soils formed in silty material" (Schermerhorn et al. 1979:4-5). The Staples House and Wright House geophysical project is located within the moderately eroded Tama silt loam soil (mapping unit 120C2) on five to nine percent slopes (Schermerhorn et al. 1979:22,86). This gently sloping soil occurs on the convex side slopes and formed in thick deposits of loess. The soil is well drained with a moderate permeability and high available water capacity. Surface runoff is medium. The Tama soil also has a moderate shrink-swell potential. Reaction varies from strongly acid to slightly acid in the upper soil horizons. The loess parent material is neutral.

The area has a continental climate with cold winters and hot summers (Schermerhorn 1979:2,106-107). The average winter temperature is 23° F with an average daily minimum temperature of 14° F while the average summer temperature is 72° F with an average daily maximum temperature of 84° F. Average annual precipitation is 38.21 inches. Average snowfall for the year is 31 inches. Thunderstorms commonly occur in the late spring and summer months. Relative humidity is approximately 60 percent. Possible sunshine in the summer averages 68 percent while in the winter it averages 48 percent.

Survey Methodology

The geophysical survey was conducted at the request of Herbert Hoover National Historic Site staff. In order to identify any buried archeological resources in the proposed project area, the Midwest Archeological Center (MWAC) staff archeologists Steven De Vore and Dawn Bringelson applied magnetic gradient, resistance, conductivity, vertical electrical sounding, and ground penetrating radar survey techniques to investigate and identify the extent and location of possible archeological features associated with the Staples House and Wright House property lots. Initially, the Ushikata S-25 TRACON surveying compass (Ushikata 2005) was set up at a point in the northwest corner of the Staples lot near the corner of the service road and Wetherell Street. Using the surveying compass and 100-meter tape, this mapping station was used to establish the north and west base lines. The west base line extended 40 meters south of the mapping station while the north base line extended 45 meters east of the mapping station. The west base line was set up parallel to the paved service drive. The two base lines were oriented perpendicular to each other. The mapping station point was identified as N40/E0. Wooden stakes were placed at the 20-meter grid unit corners in the two adjacent yards and at the 5-meter end points along Poplar Street (Trace). Wooden stakes were also placed at the end of the geophysical grid line adjacent to the houses and garage where walls intersected the lines. Due to the gravel in the driveway to the Wright garage, a yellow plastic tent peg was set at the southwest corner of the grid. Tie lines anchored by plastic tent pegs around the three buildings were also established to aid in the establishment of the traverse survey lines. The geophysical grid was oriented on grid north, which was 10° east of magnetic north. A 40 meter north-south by 45 meter east-west geophysical survey area was established within the boundary of the Staples and Wright property lots for a total geophysical project survey area of 1,800 m^2 or 0.45 acres.

Twenty-meter ropes were placed along the east-west base lines connecting the grid unit corners. These ropes formed the north and south boundaries of each grid unit during the data collection phase of the survey. Additional ropes were placed at one-meter intervals across the grid unit in a north-south orientation. These ropes serve as guides during the data acquisition. The ropes were marked with different color tape at half-meter and meter increments designed to help guide the survey effort. A sketch map was completed for survey area after the guide ropes were placed on the grids (Figure 5). The data were acquired across the grid units beginning in the lower left hand or southwest corner of each grid unit (Geoscan Research 1987:43-54,2003:5/2-5/11).

Geophysical Techniques

Geophysical prospection techniques available for archeological investigations consist of a number of techniques that record the various physical properties of earth, typically in the upper couple of meters, however, deeper prospection can be utilized if necessary. Geophysical techniques are divided between passive techniques and active techniques. Passive techniques are primarily ones that measure inherently or naturally occurring local or planetary fields created by earth related processes under study (Heimmer and DeVore 1995:7,2000:55; Kvamme 2001:356,2005:424). The primary passive method utilized in archeology is magnetic surveying. Other passive methods with limited archeological applications include self-potential methods, gravity survey techniques, and differential thermal analysis. Active techniques transmit an electrical, electromagnetic, or acoustic signal into the ground (Heimmer and DeVore 1995:9,2000:58-59; Kvamme 2001:355-356). The interaction of these signals and buried materials produces altered return signals that are measured by the appropriate geophysical instruments. Changes in the transmitted signal of amplitude, frequency, wavelength, and time delay properties may be observable. Active methods applicable to archeological investigations include electrical resistance/resistivity, electromagnetic conductivity (including ground conductivity and metal detectors), magnetic susceptibility, and ground penetrating radar. Acoustic active techniques, including seismic, sonar, and acoustic sounding, have very limited or specific archeological applications. Additional information on the basic geophysical techniques used during the present survey may be found in publications by Dr. Bruce Bevan (1991,1998), Dr. Anthony Clark (2000), Dr. Lawrence B. Conyers (2004), Drs. Lawrence B. Conyers and Dean Goodman (1997), Andrew David (1995), Drs. Chris Gaffney and John Gater (2003), Dr. Chris Gaffney et al. (1991,2002), Don H. Heimmer and Steven L. De Vore (1995,2000), Dr. Kenneth Kvamme (2001,2003,2005), Dr. I. Scollar et al. 1990, and Dr. John Weymouth (1986).

Magnetic Gradient Survey

A magnetic gradient survey is a passive geophysical survey (see Bevan 1998:18-29; Clark 2000:64-98; David 1995:17-20; Gaffney and Gater 2003:36-42,61-72; Gaffney et al. 1991:3-5,2002:7-9; Heimmer and De Vore 1995:7-20,2000:55-58; Kvamme 2001:357-358,2003:441,2005:430-433; Lowrie 1997:229-306; Milsom 2003:51-70; Mussett and Khan 2000:139-180; Scollar et al. 1990:375-519; Sharma 1997:65-111; Telford et al. 1990:62-135; and Weymouth 1986:341-370 for more details of magnetic surveys). The Geoscan Research FM36 fluxgate gradiometer (Figure 6) is a vector magnetometer, which measures the strength of the magnetic field in a particular direction. The sensors must be accurately balanced and aligned along the direction of the field component to be measured. A reference point at N34/E7 was selected in the middle of the Staples backyard for balancing and aligning the gradiometer and for zeroing the conductivity meter. The gradiometer was balanced and the sensors aligned on magnetic north. The two magnetic sensors in the instrument are spaced 0.5 meters apart. The instrument is carried so the two sensors are vertical to one another with the bottom sensor approximately 30 cm above the ground. Each sensor reads the magnetic field strength at its height above the ground. The gradient or change of the magnetic field strength between the two sensors is recorded in the instrument's memory. This gradient is not in absolute field values but rather voltage changes, which are calibrated in terms of the magnetic field. The fluxgate gradiometer does provide a continuous record of the magnetic field strength.

A magnetic survey is a passive geophysical prospection technique used to measure the earth's total magnetic field at a point location. Its application to archeology results from the local effects of magnetic materials on the earth's magnetic field. These anomalous conditions result from magnetic materials and minerals buried in the soil matrix. Iron artifacts have very strong effects on the local earth's magnetic field. Other cultural features, which affect the local earth's magnetic field, include fire hearths, and soil disturbances (e.g., pits, mounds, wells, pithouses, and dugouts), as well as, geological strata. Magnetic field strength is measured in nanoteslas (nT; Sheriff 1973:148). In North America, the earth's magnetic field strength ranges from 40,000 to 60,000 nT with a inclination of approximately 60° to 70° (Milsom 2003:43; Weymouth 1986:341). The project area has a magnetic field strength of approximately 56,900 nT (Peddie 1992; Sharma 1997:72-73) with an inclination of approximately 70° 48' (Peddie and Zunde 1988; Sharma 1997:72-73). Magnetic anomalies of archeological interest are often in the ±5 nT range, especially on prehistoric sites. Target depth in magnetic surveys depends on the magnetic susceptibility of the soil and the buried features and objects. For most archeological surveys, target depth is generally confined to the upper one to two meters below the ground surface with three meters representing the maximum limit (Clark 2000:78-80; Kvamme 2001:358). Magnetic surveying applications to archeological investigations have included the detection of architectural features, soil disturbances, and magnetic objects/artifacts (Bevan 1991; Clark 2000;92-98; Gaffney et al 1991:6; Heimmer and DeVore 1995,2000; Weymouth 1986:343).

Two modes of operation for magnetic surveys exist: the total field survey and the gradient survey. The instrument used to measure the magnetic field strength is the magnetometer (Bevan 1998:20). The total field survey uses a single magnetic sensor. Three different types of magnetic sensors have been used in the magnetometer: 1) proton free precession sensors, 2) alkali vapor (cesium or rubidium) sensors, and 3) fluxgate sensors (for a detailed description of the types of magnetometers constructed from these sensors see Clark 2000:66-71; Milsom 2003:45-47; Scollar et al. 1990:450-469; Weymouth 1986:343-344).

The total field magnetometer is designed to measure the absolute intensity of the local magnetic field. This type of magnetometer utilizes a single sensor. Due to diurnal variation of the earth's magnetic field, the data collected with a single sensor magnetometer must be corrected to reflect these diurnal changes. One method is to return to a known point and take a reading that can be used to correct the diurnal variation. A second method is to use two magnetometers with one operated at a fixed base station collecting the diurnal variation in the magnetic field. The second magnetometer is used to collect the field data in the area of archeological interest. Common magnetometers of this types used in archaeological investigations include the proton precession magnetometer, the Overhauser effect magnetometer (a variation of the proton-precession magnetometer), and the cesium magnetometer.

The magnetic gradient survey is conducted with a gradiometer or a magnetometer with two magnetic sensors at a fixed vertical distance apart. The instrument measures the magnetic field at two separate heights. The top sensor reading is subtracted from the bottom sensor reading. The resulting difference is recorded. This provides the vertical gradient or change in the magnetic field. Diurnal variations are automatically canceled. This setup also minimizes long range trends. The gradiometer provides greater feature resolution and potentially provides better classification of the magnetic anomalies. Two commonly used gradiometers in archeological investigations are the cesium gradiometer and the fluxgate gradiometer. They are capable of yielding 5 to 10 measurements per second at a resolution of 0.1 nT (Kvamme 2001:358). Cesium gradiometers record the absolute total field values like the single sensor total field magnetometers. It also records the gradient change between the bottom and top sensors. The fluxgate sensors are highly directional, measuring only the component of the field parallel to the sensor's axis (Clark 2000:69). They also require calibration (Milsom 2003:46-47). Both cesium and fluxgate gradiometers are capable of high density sampling over substantial areas at a relatively rapid rate of acquisition (Clark 2000:69-71; Milsom 2003:46-47).

The magnetic gradient survey was designed to collect 8 samples per meter along 0.5-meter traverses or 16 data values per square meter. The data were collected in a zig zag fashion with the surveyor alternating the direction of travel along each traverse across the grid. A total of 6,400 data values were collected for a complete 20 by 20 meter grid unit surveyed during the project. The magnetic data were recorded in the memory of the gradiometer and downloaded to a laptop computer at the completion of the survey.

The magnetic data were imported into Geoscan Research's GEOPLOT software (Geoscan Research 2003) for processing. Both shade relief and trace line plots were generated in the field before the instrument's memory was cleared.

Conductivity Survey

The conductivity survey is an active geophysical technique, which induces an electromagnetic field into the ground (see Bevan 1983,1998:29-43; Clark 2000:171; Clay 2001:32-33,2002; Davenport 2001:72-88; David 1995:20; Gaffney and Gater 2003:42-44; Gaffney et al. 1991:5,2002:10; Heimmer and De Vore 1995:35-41,2000:60-63; Kvamme 2001:362-363,2003:441-442,2005:434-436; Lowrie 1997:222-228; McNeill 1980a,1980b; Mussett and Khan 2000:210-219; Scollar et al. 1990:520-590; Sharma 1997:265-308; Telford 1990:343-521; and Weymouth 1986:317-318,326-327 for more details of conductivity surveys). This survey technique measures the apparent soil conductivity. The present survey is conducted with a Geonics EM38 ground conductivity meter operating in the quadrature phase or conductivity component operating mode (Geonics 1992). The instrument is lightweight and 1.45 meters in length (Figure 7). The self-contained dipole transmitter (primary field source) and self-contained dipole receiver (sensor) coils are located at opposite ends of the meter. The intercoil spacing is 1 meter.

An electromagnetic field is induced into the ground through the transmitting coil. The induced primary field causes an electric current flow in the earth similar to a resistivity survey. In fact, a conductivity survey is the inverse of a resistivity survey. High conductivity equates to low resistivity and vice versa. The materials in the earth create secondary eddy current loops, which are picked up by the instrument's receiving coil. The interaction of the generated eddy loops or electromagnetic field with the earthen materials is directly proportional to terrain conductivity within the influence area of the instrument. The receiving coil detects the response alteration (secondary electromagnetic field) in the primary electromagnetic field. This secondary field is out of phase (quadrature or conductivity phase) with the primary field. The in-phase component of the secondary signal is used to measure the magnetic susceptibility of the subsurface soil matrix. The apparent conductivity data were recorded in units of millisiemens per meter (mS/m). The electrical conductivity unit or siemens is a represents the reciprocal of an ohm-meter (Sheriff 1973:197). The relationship between conductivity and resistivity is represented by the following formula (Bevan 1983; McNeill 1980a): mS/m = 1000/ohm/m.

Changes result from electrical and magnetic properties of the soil matrix. Changes are caused by materials buried in the soil, differences in soil formation processes, or disturbances from natural or cultural modifications to the soil. EM instruments are also sensitive to surface and buried metals. Due to their high conductivity, metals show up as extreme values in the acquired data set. On occasion, these values may be expressed as negative values since the extremely high conductivity signal of the metals cause the secondary coil to become saturated.

In archeology, the instrument has been used to identify areas of compaction and excavation as well as buried metallic objects. It has the potential to identify cultural features that are affected by the water saturation in the soil (Clark 2000; Heimmer and De Vore 1995:35-41). Its application to archeology results from the ability of the instrument to detect lateral changes on a rapid data acquisition, high resolution basis, where observable contrasts exist. Lateral changes in anthropogenic features result from compaction, structural material changes, buried metallic objects, excavation, habitation sites, and other features affecting water saturation (Heimmer and De Vore 1995:37). The conductivity survey can sometimes detect the disturbed soil matrix within the grave shaft. It can also locate large metal objects. Metallic trash on the surface and other small objects buried in the upper portion of the soil can degrade the search of the graves (Bevan 1991:1310).

The meter was connected to the DL720 Polycorder for digital data acquisition (Geonics 1998). The conductivity survey was designed to collect in the continuous or automatic mode with readings collected every 0.25 second resulting in 4 samples per meter. The data were collected in a parallel fashion or unidirectional mode with the surveyor conducting the data acquisition in the same the direction of travel for each traverse across the grid. The data and header files stored in the polycorder were downloaded into the laptop computer at the end of the survey. The survey of the grid unit began in the lower left hand or southwest corner of the grid. The EM38 was used in the quadrature or conductivity phase, the vertical dipole mode, and one orientation parallel to the direction of travel along the traverses. It provided an exploration depth of approximately 1.5 meters with its effective depth around 0.6 meters in the vertical dipole mode. The instrument was nulled and calibrated before the start of the daily survey at the same point used to balance and align the fluxgate gradiometer.

The conductivity data were collected at a sampling density of 4 samples per meter along every 0.5 meter traverse or 8 samples per square meter in the geophysical survey area. A total of 11,895 data measurements were collected during the survey. The data were downloaded to a laptop computer at the end of each day's survey effort.

Resistance Survey

The resistance survey is an active geophysical technique, which injects a current into the ground (see Bevan 1998:7-18; Carr 1982; Clark 2000:27-63; David 1995: 27-28; Gaffney and Gater 2003:26-36; Gaffney et al. 1991:3-5,2002:7-9; Heimmer and De Vore 1995:29-35,2000:59-60; Kvamme 2001:358-362,2003:441-442,2005:434-436; Lowrie 1997:203-219; Milsom 2003:83-116; Mussett and Khan 2000:181-232; Scollar et al. 1990:307-374; Sharma 1997:207-264; Telford et al. 1990:522-577; Van Nostrand and Cook 1966; and Weymouth 1986:318-341 for more details of resistivity surveys). The voltage is measured and by Ohm's Law, one may compute the resistance at any given point (**R=V/I** where **R** is resistance, **V** is voltage, and **I** is current). Due to the problem of contact resistance between two electrodes in the ground, a typical resistance survey makes use of four electrodes or probes. The current passes through two electrodes and the voltage is measured between the other two probes. The configuration of the electrodes also varies (see Milsom 2003:99 and Weymouth 1986:324 for common configurations).

Resistance or resistivity changes result from electrical properties of the soil matrix. Changes are caused by materials buried in the soil, differences in soil formation processes, or disturbances from natural or cultural modifications to the soil. In archeology, the instrument is used to identify areas of compaction and excavation, as well as, buried objects such as brick or stone foundations. It has the potential to identify cultural features that are affected by the water saturation in the soil, which is directly related to soil porosity, permeability, and chemical mature of entrapped moisture (Clark 2000; Heimmer and De Vore 1995:30). Its application to archeology results from the ability of the instrument to detect lateral changes on a rapid data acquisition, high resolution basis, where observable contrasts exist. Lateral changes in anthropogenic features result from compaction, structural material changes, buried objects, excavation, habitation sites, and other features affecting water saturation (Heimmer and De Vore 1995:37). The resistivity survey may sometimes detect the disturbed soil matrix within the grave shaft.

The Geoscan Research RM15 resistance meter uses the PA5 multiple probe array (Geoscan Research 1996). Arranged as a twin probe array, a current and voltage probes are located on a mobile frame, which is moved around the site (Figure 8). Two additional probes are located away from the survey area, which also consist of a current probe and voltage probe. The remote probes are set a distance 30 times the mobile probe separation. The probes on the frame are located at a fixed distance apart. A general rule of thumb for the depth investigation of resistance survey is the depth is equal to the distance of probe separation. This value is not a unique number but an average for the volume of soil 0.5 meters depth and a surface radius of 0.5 meters under the center point of the instrument frame. The probes are connected to the resistance meter, which is also on the frame. Wings may be added to the frame to expand the separation distance of the probes; however, this requires the resurvey of the grid for each change in the probe separation distance. The measurement is taken when the mobile probes make contact with the ground and complete the electrical circuit. The readings are stored in the resistance meter’s memory until downloaded to a lap-top computer.

The resistance survey was designed to collect 2 samples per meter along 0.5-meter traverses or 4 data values per square meter. The data were collected in a zigzag fashion with the surveyor maintaining the alternating the direction of travel for each traverse across the grid. A total of 1,600 data values were collected for a complete 20 by 20 meter grid unit. The resistance data were recorded in the memory of the resistance meter and downloaded to a laptop computer at the completion of each day’s survey effort. The resistance data were imported into Geoscan Research’s GEOPLOT software (Geoscan Research 2003) for processing. Both shade relief and trace line plots were generated before the instrument’s memory was cleared.

Vertical Electrical Sounding

The present vertical electrical sounding is conducted with the Gossen Geohm 40D earth tester (Figure 9) using an offset Wenner probe array and switching box (see Bevan 1998:7-18; Carr 1982; Gossen-Metrawatt GMBH 1995; Gaffney and Gater 2003:34-36; Lowrie 1997:215-217; Milsom 1996:71-73; Mussett and Khan 2000:186-194; Orellana and Mooney 1972; and Telford et al. 1990:283-292 for more details of vertical resistivity soundings). A resistivity survey is an active method that measures the resistance to the flow of an introduced electrical current in the soil. Resistance is dependent on several factors, including the soil structure, soil texture, soil water solution conductivity, capillary conductance, the depth of the archeological targets (i.e. features or objects), and the material comprising the archeological target. It primarily depends on the differential electrical resistance related to moisture content in the subsurface matrix (Carr 1982:47-105; Clark 1996:27; Heimmer and De Vore 1995:9,30).

The two types of resistivity surveying techniques used in archeology are the lateral profiling (horizontal) and the vertical electrical sounding (VES). Profiling is done with fixed electrode spacings. Resistance measurements in ohms are collected by moving the electrode array from point to point along fixed traverses. Profiling uses one of several different types of electrode configurations (Milsom 1996:71-73). The resulting data is integrated to provide areal coverage of the site under investigation (see the discussion of Resistance Survey). The VES is conducted over a single location by measuring several resistance values with increasing electrode separation. As the separation between the electrodes increases, the same proportion of current is disturbed through an increasing depth of soil. This results in a proportionally larger effect of the deeper layers on the apparent resistivity. The Wenner array is most commonly used probe array for VES. In this configuration, the electrodes are evenly spaced with the current electrodes on the ends and the voltage electrodes in the middle. The near surface conditions differ at each electrode for each reading resulting in a relatively high noise level. To produce a smoother sounding curve, the VES is produced by using an offset array where the electrodes are expanded in opposite directions. The two readings for each offset separation are averaged together. This suppresses the local effects at each electrode. The difference between the two readings indicates the significance of these effects. The resistance values using the Wenner probe array obtained are converted to apparent resistivity by the formula $\rho_{\mathbf{a}} \mathbf{= 2\pi Ra}$, where $\rho_{\mathbf{a}}$ is the apparent resistivity, **a** is the electrode spacing, and **R** is the measured resistance at each electrode separation. Resistivity is measured in units of ohm-meters (Sheriff 1973:156). The resulting apparent resistivity values are plotted by electrode spacing. Variation of the apparent resistivities with each increasing electrode spacing are compared to sounding curves or modeled in a computer program. This produces an estimate of the electrical stratification of the soil. This information provides the investigator with basis data that can be used to determine the applicability of the various techniques to the project area (i.e., if the resistivity is high, then ground-penetrating radar should work well on the site, or if the resistivity is extremely low, then a conductivity survey may not be practical).

The sounding was conducted along a twenty meter line centered at N30/E15 on the northwest side of the Staples House. The line extended in a north-south direction. The offset Wenner array of five electrodes was used to take resistance readings at the following increments: 0.1, 0.15, 0.2, 0.3, 0.4, 0.5, 0.7, 1.0, 1.5, 2.0, 3.0, 4.0, and 5.0 meters in both directions from the center probe to obtain data for the offset sounding. The distance between the probes also approximates the depth of investigation. The measurements were hand recorded for both directions of the offset.

Ground Penetrating Radar Survey

The ground-penetrating radar (gpr) survey is an active geophysical technique that uses pulses of radar energy (i.e., short electromagnetic waves) that are transmitted into the ground through the surface transmitting antenna (see Bevan 1998:43-57; Clark 2000:118-120; Conyers 2004; Conyers and Goodman 1997; David 1995:23-27; Gaffney and Gater 2003:74-76; Gaffney et al. 1991:5-6,2002:9-10; Goodman et al. 1995; Heimmer and De Vore 1995:42-47,2000:63-64; Kvamme 2001:363-365,2003:442-443,2005:436-438; Lowrie 1997:221-222; Milsom 2003:131-140; Mussett and Khan 2000:227-231; Scollar et al. 1990:575-584; and Weymouth 1986:370-383 for more details of ground penetrating radar surveys). This radar wave is reflected off buried objects, features, or interfaces between soil layers. These reflections result from contrasts in electrical and magnetic properties of the buried materials or reflectors. The contrasts are a function of the dielectric constant of the materials (Sheriff 1973:51). The depth of the object or soil interface is estimated by the time it takes the radar energy to travel from the transmitting antenna and for its reflected wave to return to the receiving antenna. The depth of penetration of the wave is determined by the frequency of the radar wave. The lower the frequency, the deeper the radar energy can penetrate the subsurface; however, the resulting resolution, or the ability to distinguish objects, features, and soil changes, decreases. These low frequency antennas generate long wavelength radar energy that can penetrate several tens of meters under certain conditions, but can only resolve larger targets or reflectors. The higher the radar wave frequency, the higher the resulting resolution but the penetration depth decreases. High frequency antennas generate much shorter wavelength energy, which may only penetrate a meter into the ground. The generated reflections from these high frequency antennas are capable of resolving objects or features with maximum dimensions of a few centimeters. A resulting tradeoff exists between subsurface resolution and depth penetration: the deeper the penetration then the resulting resolution is less or the higher the resolution then the resulting depth penetration is much shallower.

As radar antenna system (transmitting and receiving antennas) is moved along the survey line, a large number of subsurface reflections are collected along the line. The various subsurface materials affect the velocity of the radar waves as they travel through the ground (Conyers and Goodman 1997:31-40). The rate at which these wave move through the ground is affected by the changes in the physical and chemical properties of the buried materials through which they travel. The greater the contrast in electrical and magnetic properties between two materials at the interface results in a stronger reflected signal. As each radar pulse travels through the ground, changes in material composition or water saturation, the velocity of the pulse changes and a portion of the energy is reflected back to the surface where it is detected by the receiving antenna and recorded by ground-penetrating radar unit. The remaining energy continues to pass into the subsurface materials where it can be reflected by deeper reflectors until the energy finally dissipates with depth. The radar system measures the time it takes the radar pulse to travel to a buried reflector and return to the unit. If the velocity of the pulse is known, then the distance to the reflector or the depth of the reflector beneath the surface can be estimated (Conyers and Lucius 1996).

The success of the survey is dependent on soil and sediment mineralogy, clay content, ground moisture, depth of the archeological resource, and surface topography and vegetation. The ground-penetrating radar signal can be lost or attenuated (i.e., quickly dissipated) in soils that have high moisture content, high electrical conductivity, highly magnetic materials, or high clay contents. Dry soils and sediments, especially those with low clay content, represent the best conditions for energy propagation. A ground-penetrating radar survey, with its capability for estimating the depth and shape of buried objects, may be an extremely valuable tool in the search of grave shafts and trenches. At times, radar cannot profile deep enough or the strata may be so complex as to render the trenches, graves, and other types of excavations indistinguishable from the surrounding soil profile.

The TerraSIRch SIR System-3000 survey cart system (GSSI 2003) operated an antenna at a nominal frequency of 400 megahertz (mHz). The antenna was mounted in a cart that recorded the location of the radar unit along the grid line (Figure 10). The gpr profiles were collected along 0.5 meter traverses beginning in the southwest corner of the grid unit. The data were collected in a zigzag or bidirectional fashion with the surveyor alternating the direction of travel for each traverse across the grid. A total of 162 radar profiles were collected across the project survey area. Ground penetrating radar surveys generally represent a trade-off between depth of detection and detail. Lower frequency antennas permit detection of features at greater depths but they cannot resolve objects or strata that are as small as those detectable by higher frequency antennas. Actual maximum depth of detection also depends upon the electrical properties of the soil. If one has an open excavation, one can place a steel rod in the excavation wall at a known depth and use the observed radar reflection to calibrate the radar charts. When it is not possible to place a target at a known depth, one can use values from comparable soils. Reasonable estimates of the velocity of the radar signal in the site's soil can be achieved by this method (Conyers and Lucius 1996). Using one of the hyperbolas on a radargram profile (Goodman 2005:76), the velocity was calculated to be approximately 5 cm per nanosecond (ns). For a time slice between 5 and 15 ns with the center at 10 ns (two way travel time), the approximate depth to the center of the gpr slice would be 25 cm. With a time window of 70 ns, the gpr profile extended to a depth of 1.75 meters.

APPENDIX A

The TerraSIRch SIR System-3000 survey cart contained a data-logger with a display that allowed the results to be viewed almost immediately after they were recorded (GSSI 2003). The SIR 3000 was set to collect gpr data with the 400 mHz antenna at an antenna transmit rate of 100 mHz and the distance mode selected for use of the survey wheel on the cart. The scan menu was set with 512 samples, 16 bit format, 100 ns range or window, a dielectric constant of 8 (the default value), a scan rate of 100, and 50 scans per meter for the project area. In the gain menu, the gain was set to manual with a default value of 3. The gpr system was moved around the grid prior to the start of the survey to adjust the gain. If a location caused the trace wave to go off the screen, the gain was set to auto and then back to manual. The position was set to the manual mode with the offset value at the factory default and the surface display option set to zero. The filters were left at the default settings. With the setup completed, the run/stop button at the bottom of the display screen was selected and the collect mode was initiated. The gpr unit was moved across the grid and at the end of the traverse, the next file button was selected and data acquisition was halted. The gpr unit was placed at the start of the next line before saving the profile. Once the profile data was saved, the gpr unit was ready to collect the next profile line. The gpr data were recorded on a 512 mb compact flash card and transferred to a lap-top computer at the end of the survey.

Data Processing and Interpretation

Processing of geophysical data requires care and understanding of the various strategies and alternatives (Kvamme 2001:365; Music 1995; Neubauer et al. 1996). Drs. Roger Walker and Lewis Somers (Geoscan Research 2003) provide strategies, alternatives, and case studies on the use of several processing routines commonly used to process magnetic, resistance, and conductivity data in the GEOPLOT software. Dr. Kenneth Kvamme (2001:365) provides a series of common steps used in computer processing of geophysical data:

> *Concatenation* of the data from individual survey grids into a single composite matrix;
>
> *Clipping and despikin*g of extreme values (that may result, for example, from introduced pieces of iron in magnetic data);
>
> *Edge matching* of data values in adjacent grids through balancing of brightness and contrast (i.e., means and standard deviations);
>
> *Filtering* to emphasize high-frequency changes and smooth statistical noise in the data;
>
> *Contrast enhancement* through saturation of high and low values or histogram modification; and

Interpolation to improve image continuity and interpretation.

It is also important to understand the reasons for data processing and display (Gaffney et al. 1991:11). They enhance the analyst's ability to interpret the relatively huge data sets collected during the geophysical survey. The type of display can help the geophysical investigator present his interpretation of the data to the archeologist who will ultimately use the information to plan excavations or determine the archeological significance of the site from the geophysical data.

Processing Magnetic Gradient Data

Upon completion of the magnetic gradient survey, the data were processed in GEOPLOT. The grid data file was transformed into a composite file and a zero mean traverse was applied to remove any traverse discontinuities that may have occurred from operator handling or heading errors. Upon completion of the zero mean traverse function, the data were interpolated by expanding the number of data points in the traverse direction and by reducing the number of data points in the sampling direction to provide a smoother appearance in the data set and to enhance the operation of the low pass filter. This changed the original 8 x 1 data point matrix into a 4 x 4 data point matrix. The low pass filter was then applied over the entire data set to remove any high frequency, small scale spatial detail. This transformation may result in the improved visibility of larger, weak archeological features. The data were then exported as an ASCII dat file and placed in the SURFER 8 contouring and 3d surface mapping program (Golden Software 2002). An image map of the magnetic gradient data was generated for both survey grid areas. The magnetic data from the geophysical survey area ranged from -231.3 nT to 332.1 nT with a mean of -0.058 nT and a standard deviation of 45.828 nT (Figure 11).

Processing Conductivity Data

The data were processed using the DAT38W software (Geonics 2002). After the transfer of the data and header files to the laptop computer, the files were automatically converted from the raw EM38 format to DAT38W format with the extension name of G38 (Geonics 2002:12-14). The data were then displayed as data profile lines (Geonics 2002:14-15). The individual EM38 data file was then converted to XYZ coordinate file in the SURFER 8 data format. To create the XYZ file, the orientation or direction of the survey line was selected in the DAT38W program along with the data type and format (Geonics 2002:20-23). The resulting XYZ data file was transfer to the SURFER 8 mapping software (Golden Software 2002). The conductivity data were reviewed and an image plot was generated in SURFER 8. To further process the conductivity data, it was transferred to GEOPLOT. The conductivity data were stripped of the X and Y coordinates and then the Z values (measurements) were imported into GEOPLOT for further processing (Geoscan Research 2001). The resulting grid was formatted to form a composite file in GEOPLOT. The interpolation routine was applied to the data set to arrange the data in an equally spaced 4 x 4 square matrix. A high pass filter was then applied over the composite data set. The high pass filter was used to remove low frequency, large scale spatial detail such as a slowing changing geological 'background' trend. The data were exported as an ASCII *.dat file and placed in the SURFER 8 mapping program. Finally, the data were presented in an image plot (Figure 12) and a contour plot. The mean for the conductivity data from the project area was 31.754 mS/m with a standard deviation of 35.855 mS/m. The minimum value was -3221.7 mS/m and the maximum value was 134.9 mS/m.

Processing Resistance Data

Upon completion of the resistance survey, the data were processed in GEOPLOT. The grid files were combined to form a composite file and further processed in GEOPLOT. Due to a data recording glitch in the resistance meter's memory, a search and replace routine was run over the entire composite file to change the faulty reading of 204.7 to the default dummy value of 2047.5. This dummy value was recognized the GEOPLOT processing routines and not included in the resulting processing of the data but remained as a place holder in the data matrix. The resistance data composite file was then despiked to remove any erroneous measurements. Despiking may be accomplished with the processing routine in GEOPLOT or manually by editing each individual grid file. A high pass filter was applied to the composite data set to remove low frequency, large scale spatial detail such as a slowing changing geological 'background' trend. The resistance data from the project area after despiking ranged from 16.0 ohms to 141.95 ohms with a mean of 37.871 ohms and a standard deviation of 8.058 ohms (Figure 13). The data were then exported as an ASCII *.dat file and placed in the SURFER 8 mapping program. The data were gridded and both an image map and a contour map were generated for the project area.

Processing Vertical Electrical Sounding Data

The measurements were collected and hand recorded in the field then averaged and the resulting apparent resistivity was calculated (Table 1). The measurements were recorded in the RESIX software package (Butler 1999) for modeling (Table 2) the approximate subsurface electrical layering of the area south of the Miller House (Figure 14). The resulting data were transferred to GRAPHER 6 (Golden Software 2005) for the generation of line plots of the resistivity data and the generation of the three layer model curve.

Processing Ground Penetrating Radar Data

The gpr radargram profile line data are imported into GPR-SLICE (Goodman 2005) for processing. The first step in GPR-SLICE is to create a new survey project under the file menu. This step identifies the file name and folder locations. The next step is to create the information file. The number of profiles are entered, along with the file identifier name, .dzt for GSSI radargrams, the profile naming increment of 1, the first radargram name (generally this is 1), direction of profiling, x and y beginning and ending coordinates, units per marker (set to 1), the time window opening in nanoseconds (100 ns), samples per scan (512 s/scn), the number of scans per meter (these profiles were collected at 50 scans per meter), type of data (16 bit). Selecting the create info file button completes the information file for the project. The information file can be edited if necessary to correct profile lengths. The 16-bit GSSI radargrams are imported into the GPR-SLICE project folder for further processing. The 16-bit data are then converted to remove extraneous header information and to regain the data. During the conversion process, the signal is enhanced by applying gain to the radargrams. Once the conversion process is completed, the next step is to reverse the profile data. Since the radargrams were collected in the zigzag mode, every even line needs to be reversed. The reverse map button shows the radargrams that are going to be reversed. The next step is to insert navigation markers into the resample radargrams. The GSSI SIR 3000 and the artificial markers button are selected to apply markers based on the total number of scans in the radargram. The show markers button allows one to view an example of a radargram with the artificial markers in place. The next step is to create the time slices of the profile data (Conyers and Goodman 1997; Goodman et al. 1995). The program resamples the radargrams to a constant number of scans between the markers and collects the time slice information from the individual radargrams. The number of slices is set to 20 slices. The slice thickness is set to 30 to allow for adequate overlap between the slices. The offset value on the radargram where the first ground reflection occurs is viewed in the search 0 ns subroutine. This value is used to identify the first radargram sample at the ground surface. The end sample is 512. The offset value in entered in the samples to 0 ns box. The cut parameter is set to square amplitude with the cuts per mark set to 4. The slice/resample button is selected for processing the radargrams. The final step in the slice menu is to create the XYZ data file. The grid menu is entered next in the processing steps. The beginning and ending values for the x and y coordinate are entered. The help set button is selected to set the x search radius, y search radius and the blanking radius. The grid cell size is set to 0.1 and the search type is rectangular. The number of grids equal 20 for the number of slices, and the starting grid number is 1. The Kriging algorithm is utilized to estimate the interpolated data. The Varigram button is selected to set the Kriging range, nugget and sill parameters. The start gridding button is selected and the gridded dataset is created. In this menu, a low pass filter may be applied to the dataset to smooth noisy data in the time slices. At this point, one may view the time sliced radar data in the pixel map menu (Figure 15). In addition, the original processed grid slices and the low pass filtered grid slices can be exported in the Surfer grid format. The surfer grid file is transformed into an image plot in Surfer. Generally, one time slice is selected for further display and analysis. Time slice 10 from 29.8 to 33.9 ns (Figure 16) represents the gpr data from the project area. The gain may be readjusted for any time slice. This is done in the transforms submenu. The interpolations value is set to 5 and the interpolate grids routine is selected. The new interpolated grids are all normalized. The next step is to create the 3D dataset in the grid menu. The number of grids is now equal to 95 ((20-1)*5). The 3D database is created under the create 3D file routine. The 3D data may be displayed as a series of z slices in the creation of a 3D cube with a jpeg output for animating the 3D cube.

Interpretations

Andrew David (1995:30) defines interpretation as a “holistic process and its outcome should represent the combined influence of several factors, being arrived at through consultation with others where necessary.” Interpretation may be divided into two different types consisting of the geophysical interpretation of the data and the archaeological interpretation of the data. At a simplistic level, geophysical interpretation involves the identification of the factors causing changes in the geophysical data. Archeological interpretation takes the geophysical results and tries to apply cultural attributes or causes. In both cases, interpretation requires both experience with the operation of geophysical equipment, data processing, and archeological methodology; and knowledge of the geophysical techniques and properties, as well as known and expected archeology. Although there is variation between sites, several factors should be considered in the interpretation of the geophysical data. These may be divided between natural factors, such as geology, soil type, geomorphology, climate, surface conditions, topography, soil magnetic susceptibility, seasonality, and cultural factors including known and inferred archeology, landscape history, survey methodology, data treatment, modern interference, etc. (David 1995:30). It should also be pointed out that refinements in the geophysical interpretations are dependent on the feedback from subsequent archeological investigations. The use of multiple instrument surveys provides the archeologist with very different sources of data that may provide complementary information for comparison of the nature and cause (i.e., natural or cultural) of a geophysical anomaly (Clay 2001). Each instrument responds primarily to a single physical property: magnetometry to soil magnetism, electromagnetic induction to soil conductivity, resistivity to soil resistance, and ground penetrating radar to dielectric properties of the soil to (Weymouth 1986:371).

Interpreting the Magnetic Gradient Data

Interpretation of the magnetic gradient data (Bevan 1998:24) from the project requires a description of the buried archeological feature of object (e.g., its material, shape, depth, size, and orientation). The magnetic anomaly represents a local disturbance in the earth’s magnetic field caused by a local change in the magnetic contract between buried archeological features, objects, and the surrounding soil matrix. Local increases or decreases over a very broad uniform magnetic surface would exhibit locally positive or negative anomalies (Breiner 1973:17). Magnetic anomalies tend to be highly variable in shape and amplitude. They are generally asymmetrical in nature due to the combined affects from several sources. To complicate matters further, a given anomaly may be produced from an infinite number of possible sources. Depth between the magnetometer and the magnetic source material also affect the shape of the apparent anomaly (Breiner 1973:18). As the distance between the magnetic sensor on the magnetometer and the source material increases, the expression of the anomaly becomes broader. Anomaly shape and amplitude are also affected by the relative amounts of permanent and induced magnetization, the direction of the magnetic field, and the amount of magnetic minerals (e.g., magnetite) present in the source compared to the adjacent soil matrix. The shape (e.g., narrow or broad) and orientation of the source material also affects the anomaly signature. Anomalies are often identified in terms of various arrays of dipoles or monopoles (Breiner 1973:18-19). A magnetic object in made of magnetic poles (North or positive and South or negative). A simple dipole anomaly contains the pair of opposite poles that relatively close together. A monopole anomaly is simply one end of a dipole anomaly and may be either positive or negative depending on the orientation of the object. The other end is too far away to have an affect on the magnetic field.

Magnetic anomalies of archeological objects tend to be approximately circular in contour outline. The circular contours are caused by small size of the objects. The shape of the object is seldom revealed in the contoured data. The depth of the archaeological object can be estimated by half-width rule procedure (Bevan 1998:23-24; Breiner 1973:31; Milsom 2003:67-70). The approximations are based on a model of a steel sphere with a mass of 1 kg buried at a depth of 1.0 m below the surface with the magnetic measurements made at an elevation of 0.3 m above the ground. The depth of a magnetic object is determined by the location of the contour value at half the distance between the peak positive value of the anomaly and the background value. With the fluxgate gradiometer, the contour value is half the peak value since the background value is approximately zero. The diameter of this contour (Bevan 1998:Fig. B26) is measured and used in the depth formula where depth = diameter – 0.3 m (Note: The constant of 0.3 m is the height of the bottom fluxgate sensor above the ground in the Geoscan Research FM36 were I carry the instrument during data acquisition. This value needs to be adjusted for each individual that carries the instrument.). The mass in kilograms of the object (Bevan 1998:24, Fig. B26) is estimated by the following formula: **mass = (peak value - background value) * (diameter)^3/60**. It is likely that the depth and mass estimates are too large rather than too small, since they are based on a compact spherical object made of iron. Archeological features are seldom compact but spread out in a line or lens. Both mass and depth estimates will be too large. The archaeological material may be composed of something other than iron such as fired earth or volcanic rock. Such materials are not usually distinguishable from the magnetic data collected during the survey (Bevan 1998:24). The depth and mass of features comprised of fired earth, like that found in kilns, fireplaces, or furnaces could be off by 100 times the mass of iron. If the archeological feature were comprised of bricks (e.g., brick wall, foundation, or chimney), estimates could be off by more than a 1000 times that of iron. The location of the center of the object can also be determined by drawing a line connecting the peak positive and peak negative values. The rule of thumb is that the center of the object is located approximately one third to one half of the way along the line from the peak positive value for the anomaly. One should also be cautious of geophysical anomalies that extend in the direction of the traverses since these may represent operator-induced errors. The magnetic gradient anomalies may be classified as three different types: linear, 2) dipole, and 3) monopole.

The first step in interpreting the magnetic anomalies from the project area is to identify the positive magnetic gradient anomalies or the North pole of the dipole (Figure 17a). Numerous magnetic gradient anomalies occur across the project area. The northwest corner, the eastern edge, the southwestern area around the Wright garage, and the area surrounding the two houses contain an extremely dense concentration of anomalies. The ones in the northwest corner and along the east side of the geophysical grid are related to buried utility lines. The magnetic gradient anomalies on the west side of the garage are the effect of the rebar in the reinforced concrete curb. The anomalies immediately surrounding the houses and the garage are the effects of nails and other magnetic (ferrous) materials used in the construction of the buildings. There appears to be a dense sheet midden or concentrations of magnetic gradient anomalies in the back yards of the two houses and also in the northeast and northwest portions of the Staples House property, as well as, in the southeastern and southern portions of the Wright House property. The front yard of the Wright House lacks the concentration found in the Staples front yard. The area of the gravel parking pad at the back of the Staples property is also relatively clear of magnetic gradient anomalies. At least two buried structures appear to be present in the northern portion of the Staples House property to the northwest and to the northeast of the house. A strong magnetic gradient anomaly is also located between the two houses where a concrete ring with a wooden post was noted during the geophysical survey of the yards. The magnetic gradient contour lines provide another view for interpretation of the data (Figure 17b). The background contour intervals between -10 and 10 nT have been removed from the plot. This further illustrated the effects of the buildings on the local magnetic field and the buried locations of fairly strong magnetic materials. Several anomalies may represent buried ferrous metal objects while others may represent buried construction debris from remodeling episodes, construction and removal of outbuildings, and the discard of domestic refuse. The two garden areas and the gravel parking pad appear to contain less magnetic material than the rest of the survey area in the two yards.

Interpreting the Conductivity Data

Interpretation of the conductivity data results in the identification of lateral changes in the soil matrix. The conductivity data may be divided into three classes of anomalies including linear anomalies, point anomalies, and broad anomalous areas. Linear anomalies may represent foundations of buildings, trenches, buried utility lines, paths, trails, or roads that are longer that they are wide. Point anomalies tend to represent buried objects or vertical structures such as cisterns, wells, or storage pits. Occasionally, these anomalies may have negative values resulting from the saturation of the receiving coil by the overwhelming conductive metal response of buried metals to the generated electromagnetic field. Comparisons between these negative conductivity anomalies and the magnetic anomalies can elucidate the nature of the buried object. If the magnetic and conductivity point anomalies coincide, it is assumed that the buried object is made from ferrous material. The presence of a magnetic anomaly and the lack of a corresponding conductivity anomaly suggest that the magnetic anomaly is composed of non-metallic material such as fired clay typically found in fire related features (i.e., fire hearths or pits, concentrated areas of ceramics, or bricks). The presence of a negative conductivity anomaly and the absence of a corresponding magnetic anomaly strongly suggest that the buried object is some type of non-ferrous metal (e.g., brass, copper, lead, etc.). Broad anomalous areas typically represent large areas of soil disturbances or compaction often found associated with gardens, basements or cellars, parking pads, compacted dirt floors, or areas of concrete or asphalt.

There are a few negative value conductivity anomalies spread across the survey area (Figure 18a). Several of these coincide with magnetic anomalies suggesting that the use of these two complementary data sets helps in the identification of the buried ferrous metal objects. In addition, the density of these point conductivity anomalies is much less than the associated magnetic gradient dipole anomalies suggesting that these magnetic anomalies represent other materials, such as bricks, construction debris related to the remodeling episodes of the two houses and other associated outbuildings. There is a large area in the back yards of the two properties that contains numerous conductivity anomalies representing a sheet midden of domestic debris. A small area north of the northwest corner of the Staples House contains a number of conductivity anomalies in the same location as the anomalous magnetic area identified as a possible structure. Adjacent to the northwest corner of the Staples House addition, there is a strong square conductivity anomaly. The exact cause of this phenomenon is presently unknown but it does not appear to be caused by equipment drift or operator error. The two garden areas and the gravel parking pad behind the Staples House contain relatively few conductivity anomalies. The reinforced concrete curb next to the Wright garage is identified as a low value linear conductivity anomaly. The conductivity survey is also a great indicator of the location of buried utility lines. These are identified as low value linear conductivity anomalies. In some cases, the low value linear anomaly is surrounded by extremely high valve conductivity readings. The application of conductivity contour lines below -5 mS/m and above 5 mS/m helps to identify the low number of conductivity anomalies and further illustrate the locations of the buried utility lines (Figure 18b).

Interpreting the Resistance Data

Interpretation of the resistivity data results in the identification of lateral changes in the soil. Since the array parameters are kept constant through out the survey, the resulting resistance values varies with changes in the subsurface sediments/soil matrix and buried archeological resources. For each probe separation, the depth penetration is approximately the same as the distance between the current and potential probe on the mobile array frame, which was 0.5 meters. The resistance measurement for each point represents the average value for the hemispheric volume of soil with the same radius. If the soil below the survey area was uniform, the resistivity would be constant throughout the area. Changes in soil characteristics (e.g., texture, structure, moisture, compactness, etc.) and the composition of archeological features result in differences in the resistances across the surveyed grid. Large general trends reflect changes in the site’s geology whereas small changes may reflect archeological features.

The resistance data from the geophysical survey area also illustrates the existence of a fairly extensive sheet midden of domestic debris in the back yards of the two houses

(Figure 19a). The flower and vegetable gardens and the two gravel parking pads appear as low resistance anomalous areas. The possible structure in the back yard of the Staples house is also identified in the resistance data, as well as, a possible structure or disturbed area on the northeast corner of the Staples House. There is also a small anomalous area next to this possible structure. A few of the buried utility lines are also present in the resistance data; however, they are not as pronounced as in the conductivity data set. The edge of the asphalt service road is visible on the west side of the survey grid. There is also a high value resistance anomaly between the Staples and Wright Houses. This anomaly coincides with a small concrete ring on the surface. This may be a well or cistern. Applying the resistance contours (Figure 19b) to the data set further illustrates the resistance anomalies in the project area.

Interpreting the Vertical Electrical Sounding Data

The results of the modeling of the vertical electrical sounding data suggest a three-layer curve for the electrical stratification of the Staples property (Figure 20). The model indicates that the upper 0.46 meters have an apparent resistivity of 75.44 ohm-meters. The middle layer measures 8.29 ohm-meters and is 2.31 m thick while the bottom layer measures 0.705 ohm-meters. This model suggests the underlying range from a silt loam to clay. The model also suggests that ground-penetrating radar may not work well in this soil since signal attenuation could be a potential problem in this clayey soil.

Interpreting the Ground Penetrating Radar Data

Analysis and interpretation of the gpr data may be conducted in several different ways. The individual radargrams for each profile line may be analyzed for hyperbolic reflections. The radargrams may be combined and processed to provide planar time slices of the data. The time slices may also be combined to form 3D cubes of the gpr data. The majority of the gpr radargrams show numerous small reflections along any given profile.

The ground penetrating radar data illustrated by the time slice 10 layer (Figure 21a) contains several high amplitude strength reflections across the two yards. The gardens and parking pads have high amplitude responses, as well as the possible structure northwest of the Staples House and the area of the conductivity anomaly next to the northwest corner of the addition to the Staples House. The resistance anomaly suspected of being a well or cistern is also present in the gpr data. It appears to have significant depth further supporting the speculation that the anomaly is a well or cistern feature. The amplitude strength contour intervals over 20000000 further help illustrate the gpr anomalies (Figure 21b).

Conclusions

During the week of October 3rd through October 7th, 2005, Midwest Archeological Center staff archeologists Steven De Vore and Dawn Bringelson conducted geophysical investigations at the Staples House and Wright House properties at Herbert Hoover

National Historic Site in West Branch, Iowa. The geophysical investigations included a magnetic gradient survey with a fluxgate gradiometer, a conductivity survey with a ground conductivity meter, a vertical electrical sounding with a resistivity meter and offset Wenner probe array, a resistance survey with a resistance meter and twin probe array, and a ground penetrating radar survey with a ground penetrating radar cart system and 400 mHz antenna. A total of 1,800 square meters or 0.45 acres were surveyed with the geophysical instruments.

The surveys resulted in the identification of numerous subsurface anomalies. The magnetic gradient, resistance, and ground penetrating radar data collected at the Staples House and Wright House properties provided information of the physical properties (magnetic, soil conductivity, soil resistance, electrical stratification, and ground-penetrating radar reflection properties) of the subsurface materials.

Finally, refinement of the archeological and geophysical interpretation of the survey data is dependent on the feedback of the archeological investigations following geophysical survey (David 1995:30). Should additional archeological investigations occur at the site investigated during this project, the project archeologist is encouraged to share additional survey and excavation data with the geophysical investigator for incorporation into the investigator's accumulated experiences with archeological problems. Throughout the entire geophysical and archeological investigations, communication between the geophysicist and the archeologist is essential for successful completion of the archeological investigations. It is also important for the investigators to disseminate the results of the geophysical survey and archeological investigations to the general public through the publication of the results and the development of interpretive aids. It is through their support in funds and labor that we continue to make contributions to the application of geophysical techniques to the field of archeology.

This report has provided a cursory review and analysis of the geophysical data collected during the geophysical investigations of the Staples House and Wright House property lots at Herbert Hoover National Historic Site, Cedar County, Iowa. This information will be used by the Midwest Archeological Center and the Herbert Hoover National Historic Site staffs to guide further archeological inquiry into the nature of the archeological resources at the park and help direct future National Park Service archeological excavations of the geophysical survey areas.

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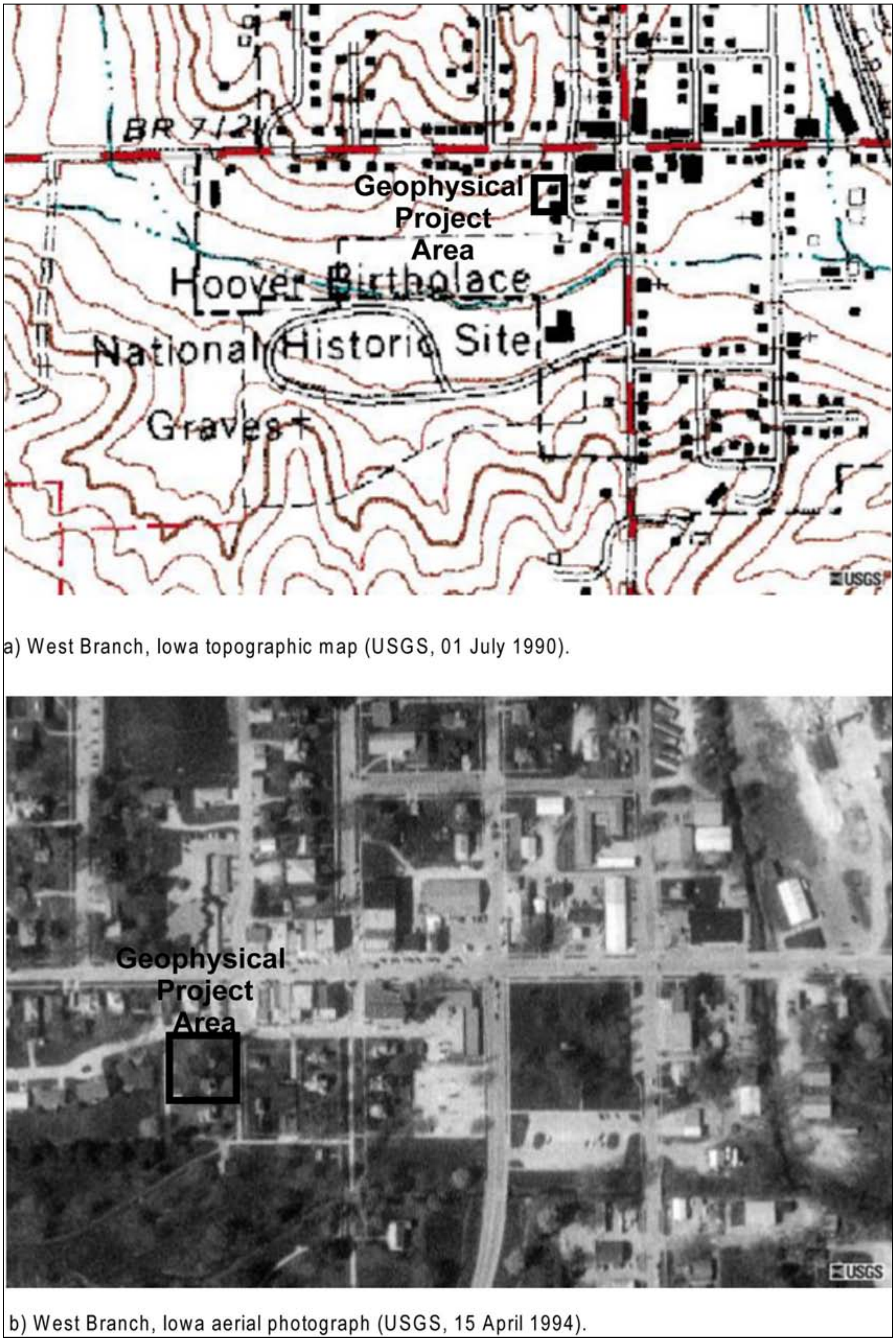
Table A1. Offset Wenner array resistivity data.

N10/E0				$\rho_a = 2\pi R a$	
Probe spacing (m)	South offset resistance reading (ohms)	North offset resistance reading (ohms)	average resistance reading (ohms)	Apparent resistivity (ohm-meters)	Synthetic resistivity (ohm-meters)
0.1	122.9	122.7	122.8	77.158	75.02
0.15	85.1	85.2	85.15	80.252	74.12
0.2	69.9	70	69.95	87.902	72.55
0.3	41.8	41.9	41.85	78.885	67.40
0.4	18.03	17.87	17.95	45.113	60.31
0.5	15	14.8	14.9	46.810	52.46
0.7	8.99	9	8.995	39.562	37.84
1.0	4.16	4.25	4.205	26.421	22.88
1.5	1.4	1.37	1.385	13.053	12.07
2.0	0.7	0.71	0.705	8.859	8.39
3.0	0.3	0.26	0.28	5.278	5.45
4.0	0.1	0.13	0.115	2.890	3.74
5.0	0.05	0.08	0.065	2.042	2.58

Table A2. Vertical electrical sounding model.

number of layers	apparent resistivity (ohm-meters)	thickness of layer (m)
1	75.44	0.459
2	8.29	2.31
3	0.705	



a) West Branch, Iowa topographic map (USGS, 01 July 1990).

b) West Branch, Iowa aerial photograph (USGS, 15 April 1994).

Figure A1. Geophysical project area at Herbert Hoover National Historic Site.

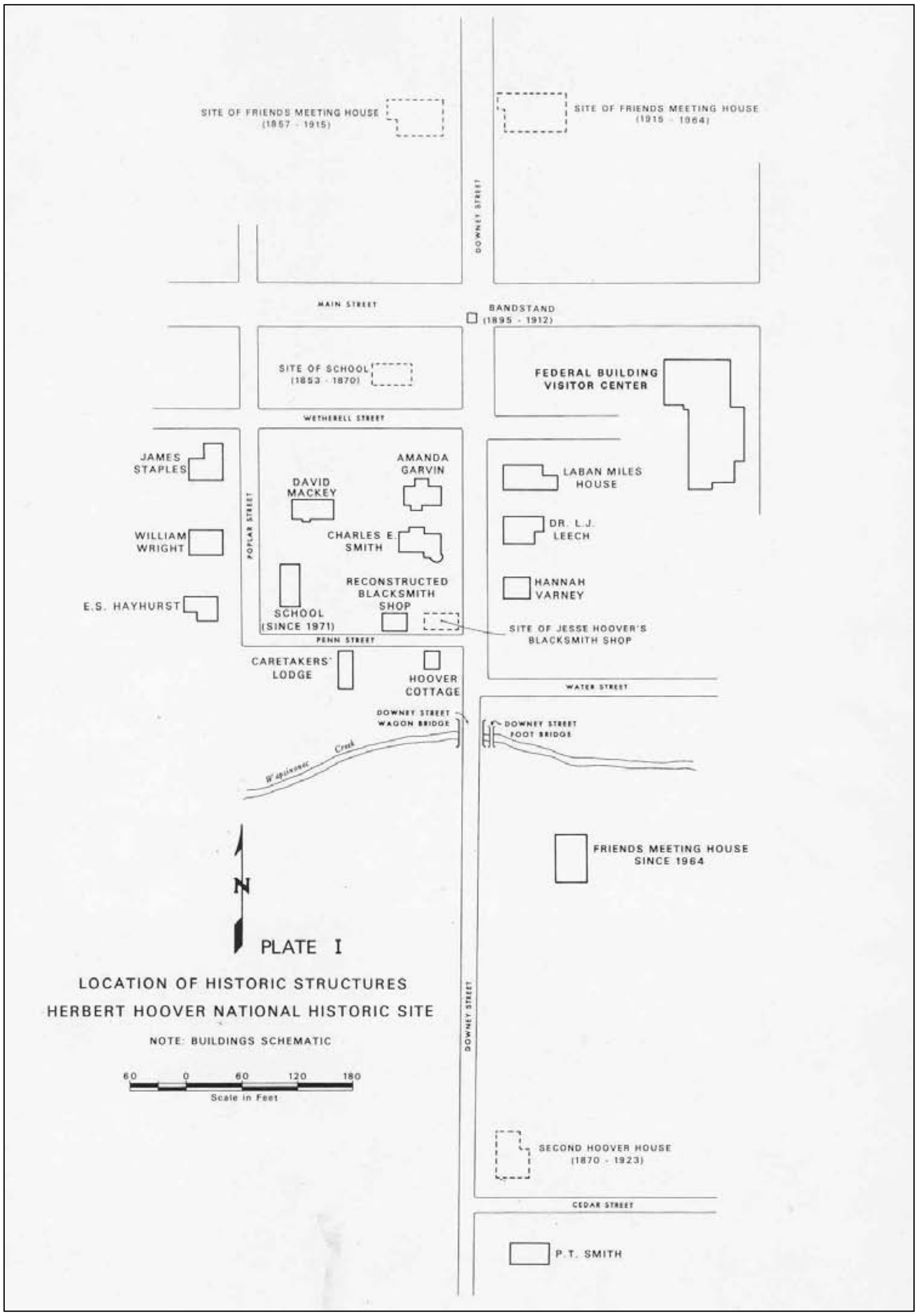


Figure A2. Location of historic structures at Herbert Hoover National Historic Site (National Park Service 1971:190).

a) Staples House and front yard (view to the west).

b) Staples House and back yard (view to the east).

Figure A3. General views of the Staples House and property.

a) Wright House and front yard (view to the west).

b) Wright House and back yard (view to the east).

Figure A4. General views of the Wright House and property.

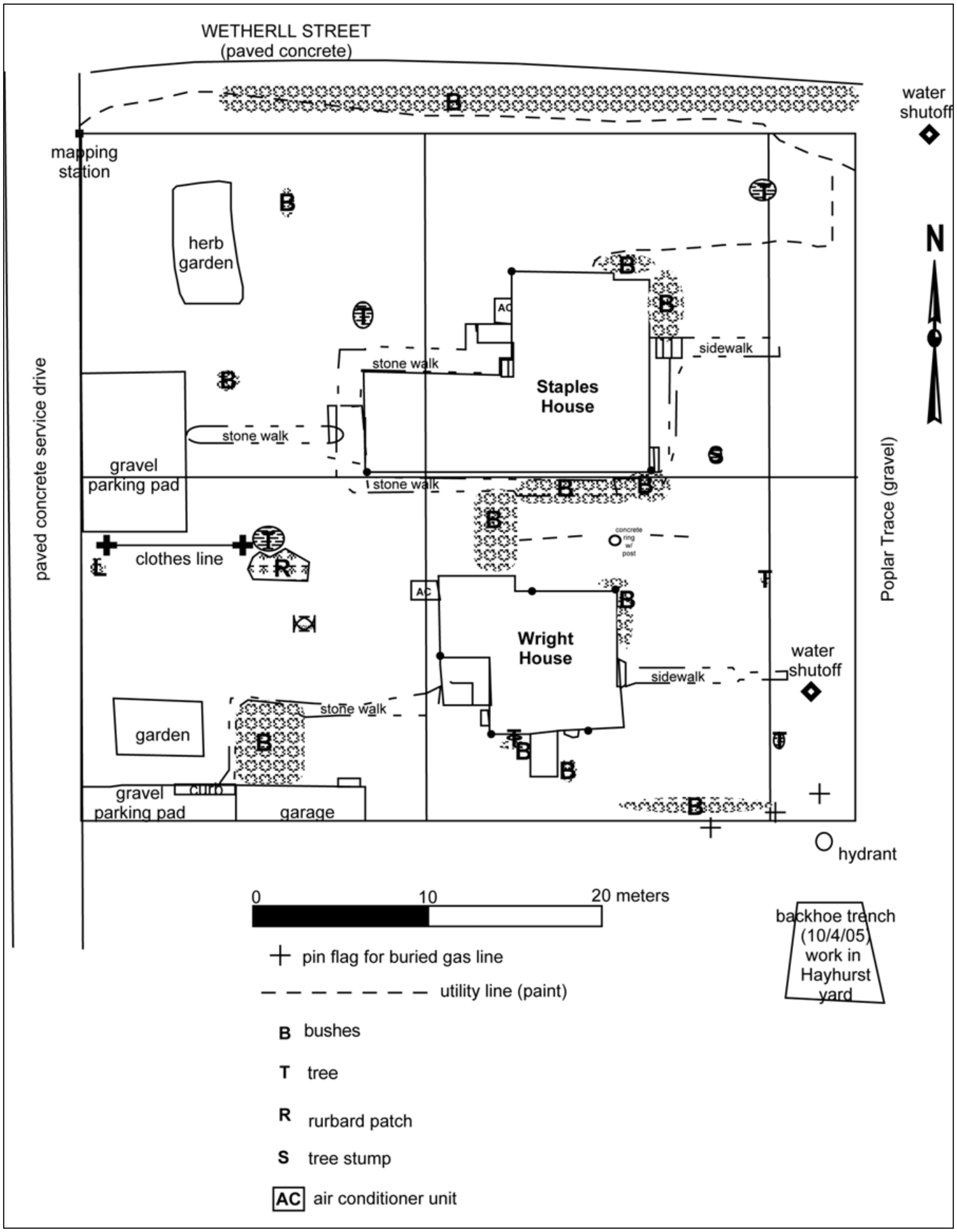


Figure A5. Sketch map of the geophysical project area in the Staples and Wright yards.

Figure A6. Magnetic gradient survey with fluxgate gradiometer (view to the west southwest).

Figure A7. Conductivity survey with ground conductivity meter (view to the east southeast).

Figure A8. Resistance survey with resistance meter and twin probe array (view to the west northwest).

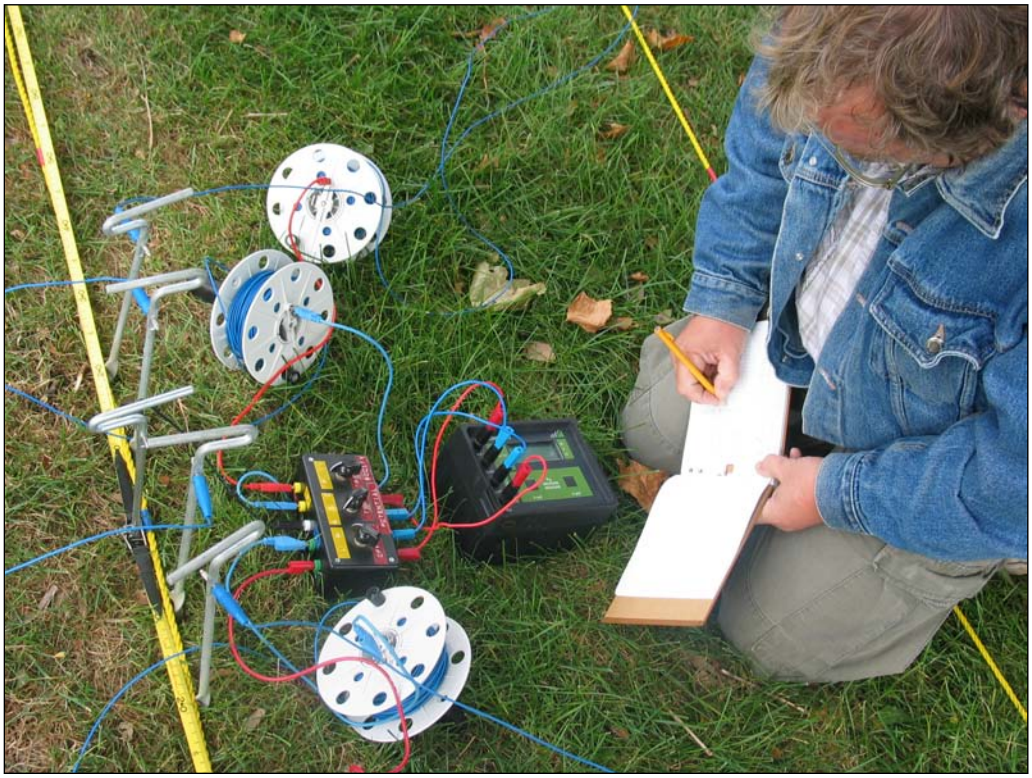


Figure A9. Conducting a vertical electrical sounding with resistivity meter and offset Wenner probe array.

Figure A10. Ground penetrating radar survey with cart system and 400 mHz antenna (view to the northeast).

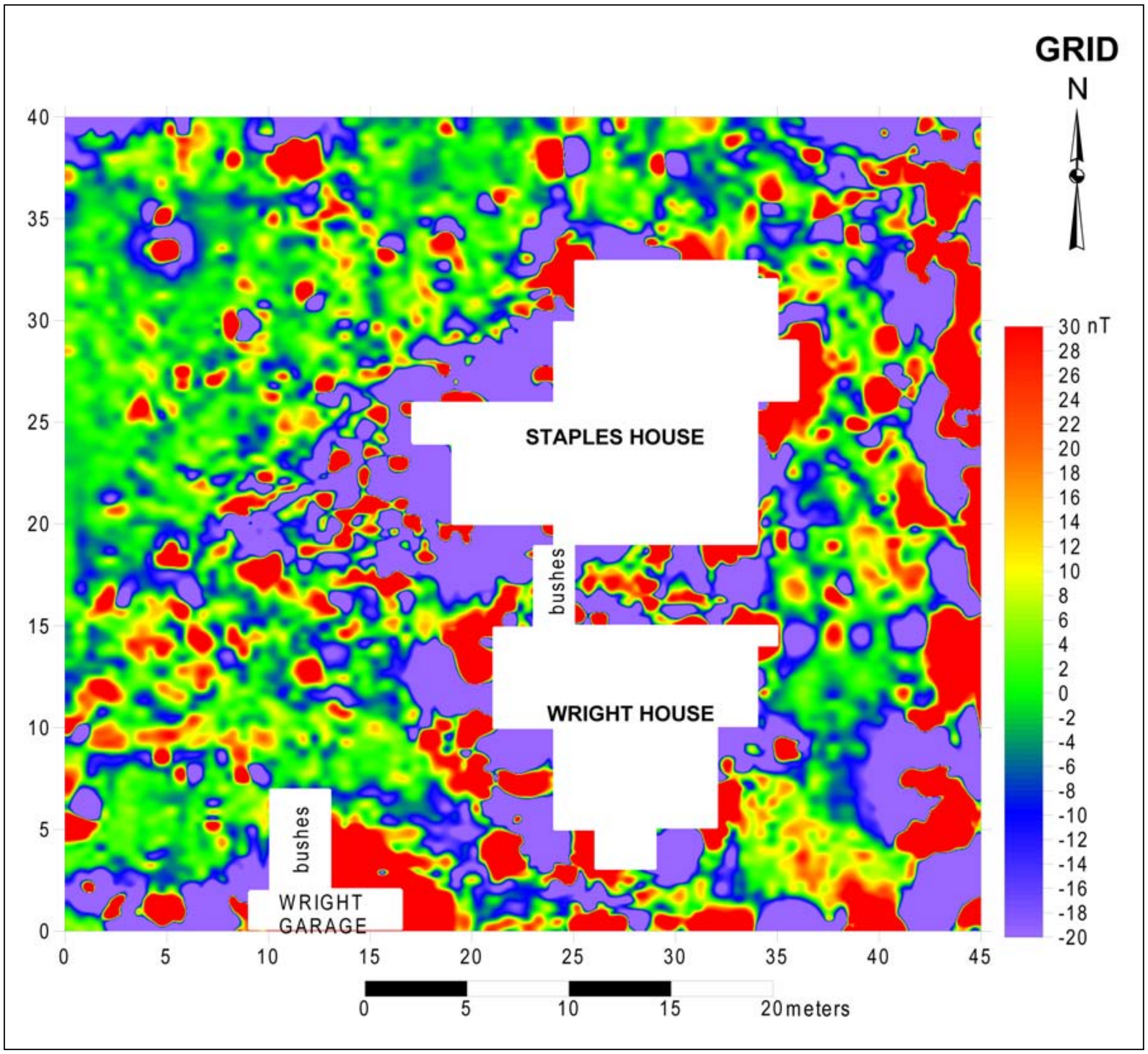


Figure A11. Image plot of magnetic gradient data from the project survey area.

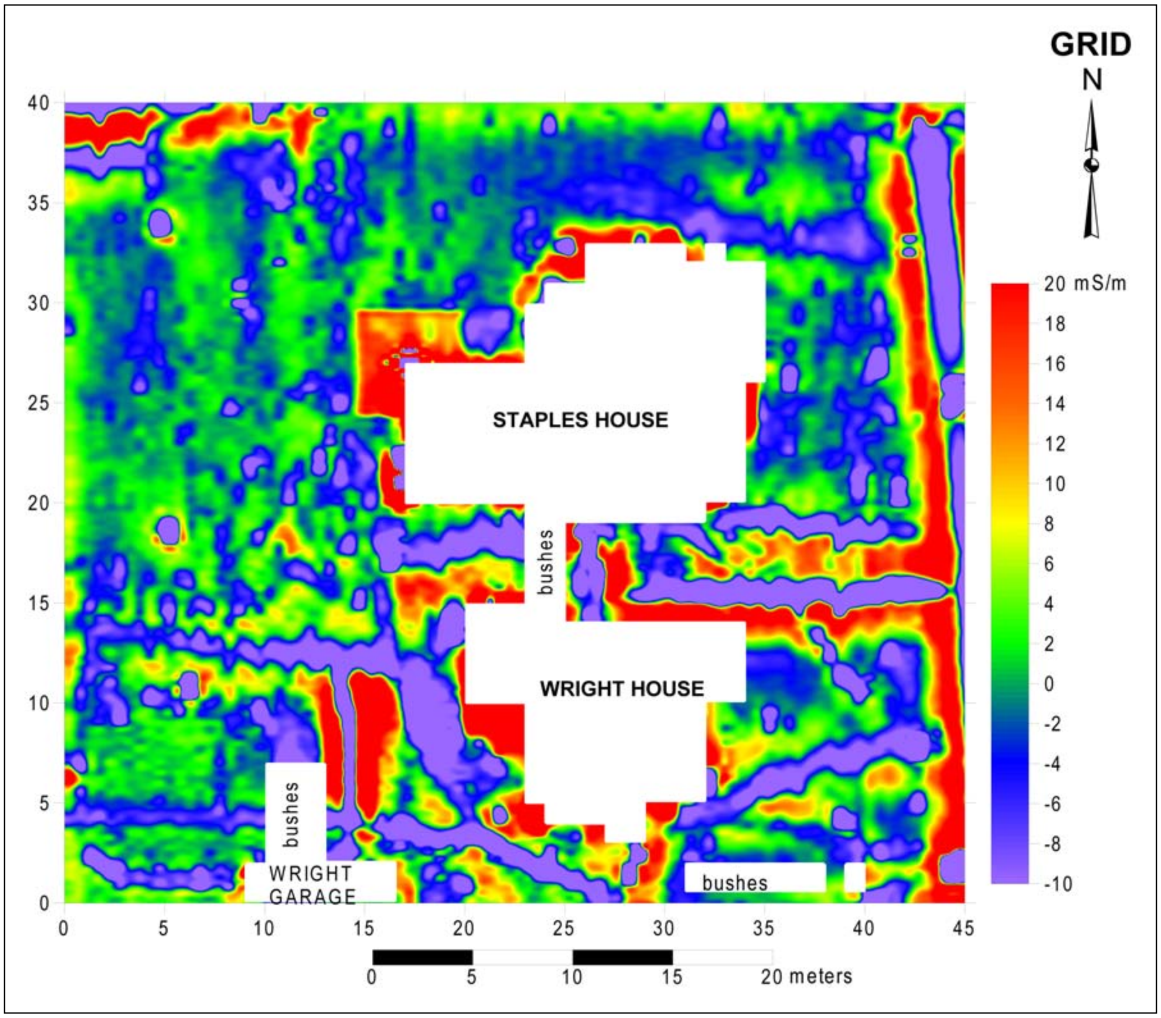


Figure A12. Image plot of conductivity data from project survey area.

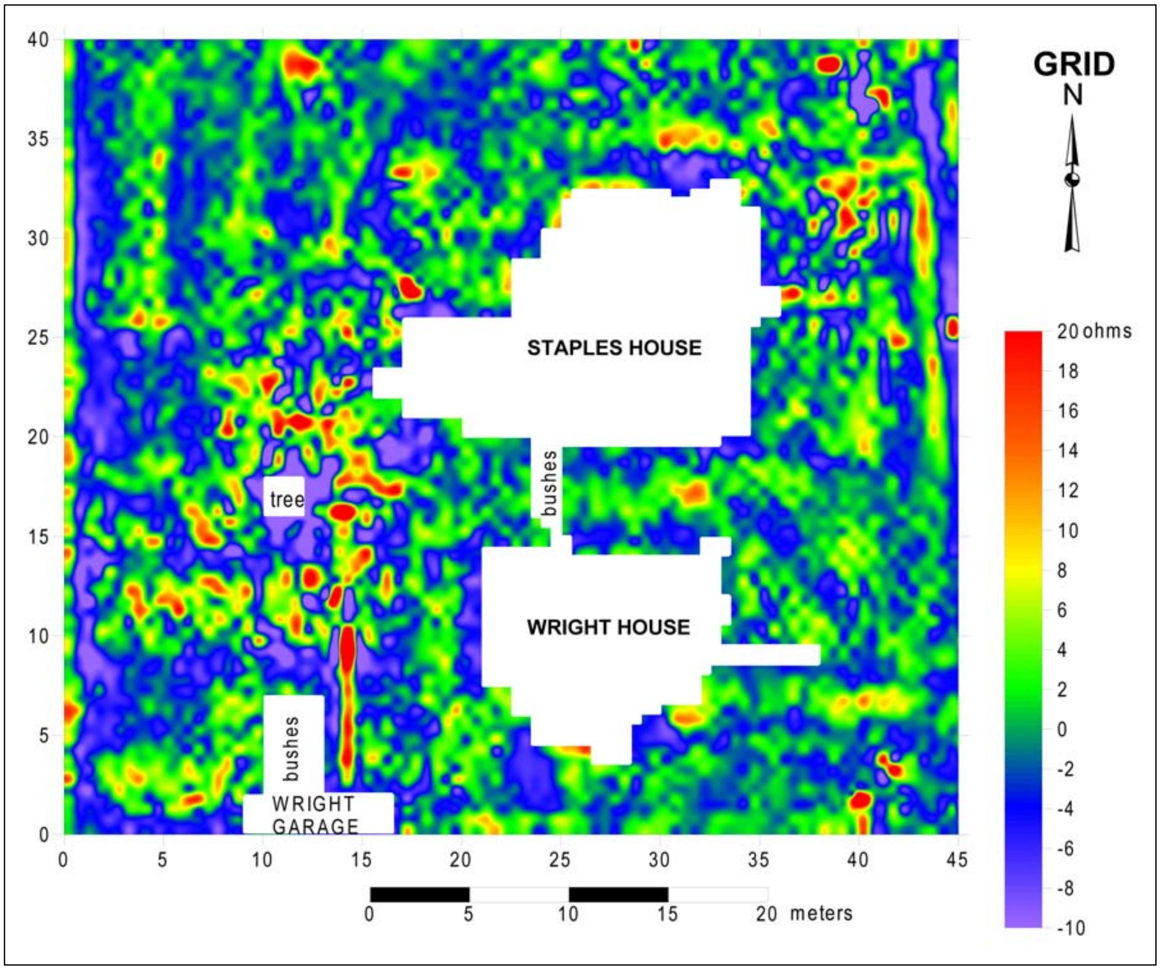
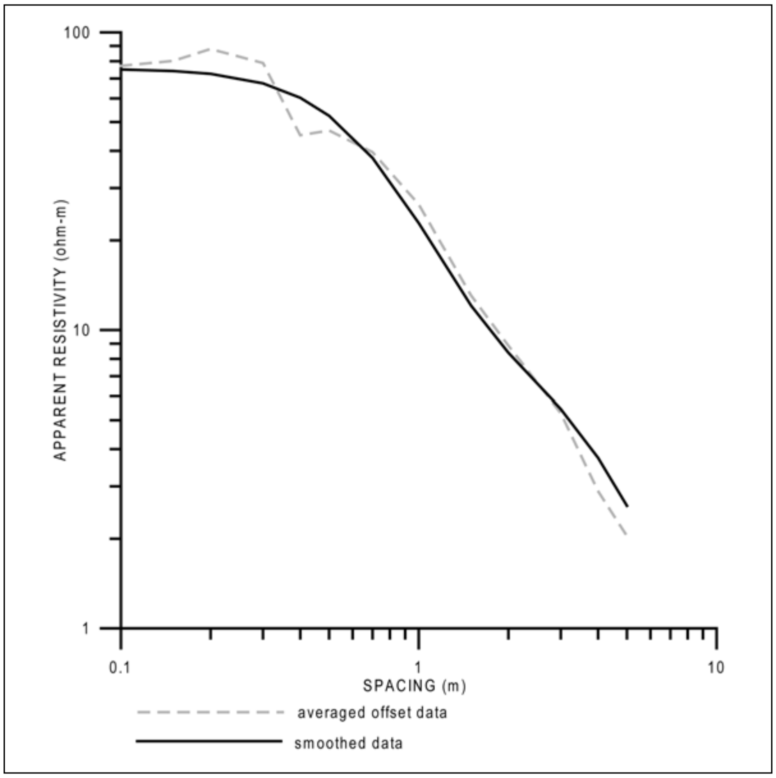
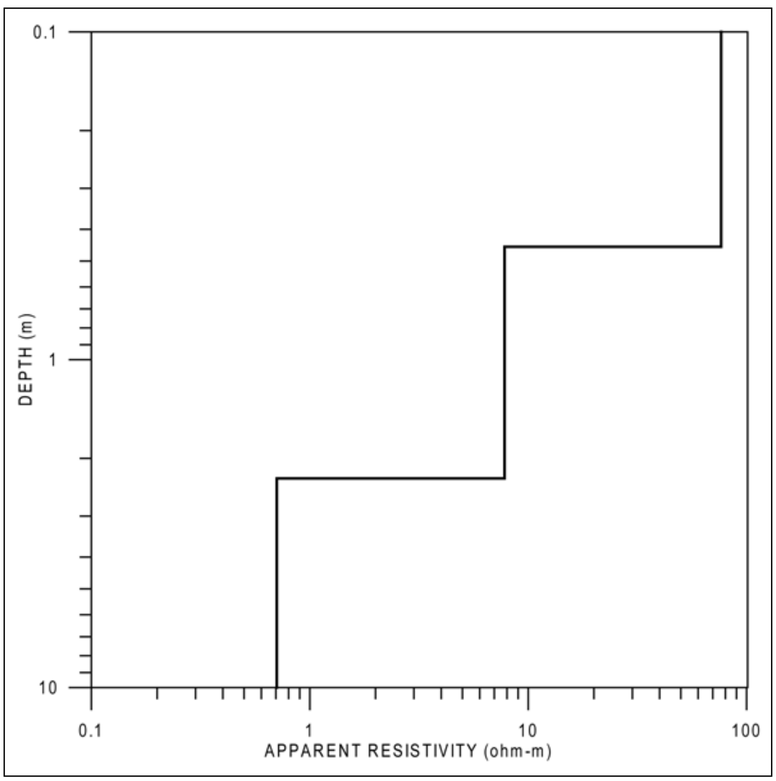


Figure A13. Image plot of resistance data from project survey area.



a) vertical electrical sounding data.



b) three-layer model of vertical electrical sounding data.

Figure A14. Data curve and three-layer model of vertical electrical sounding data.

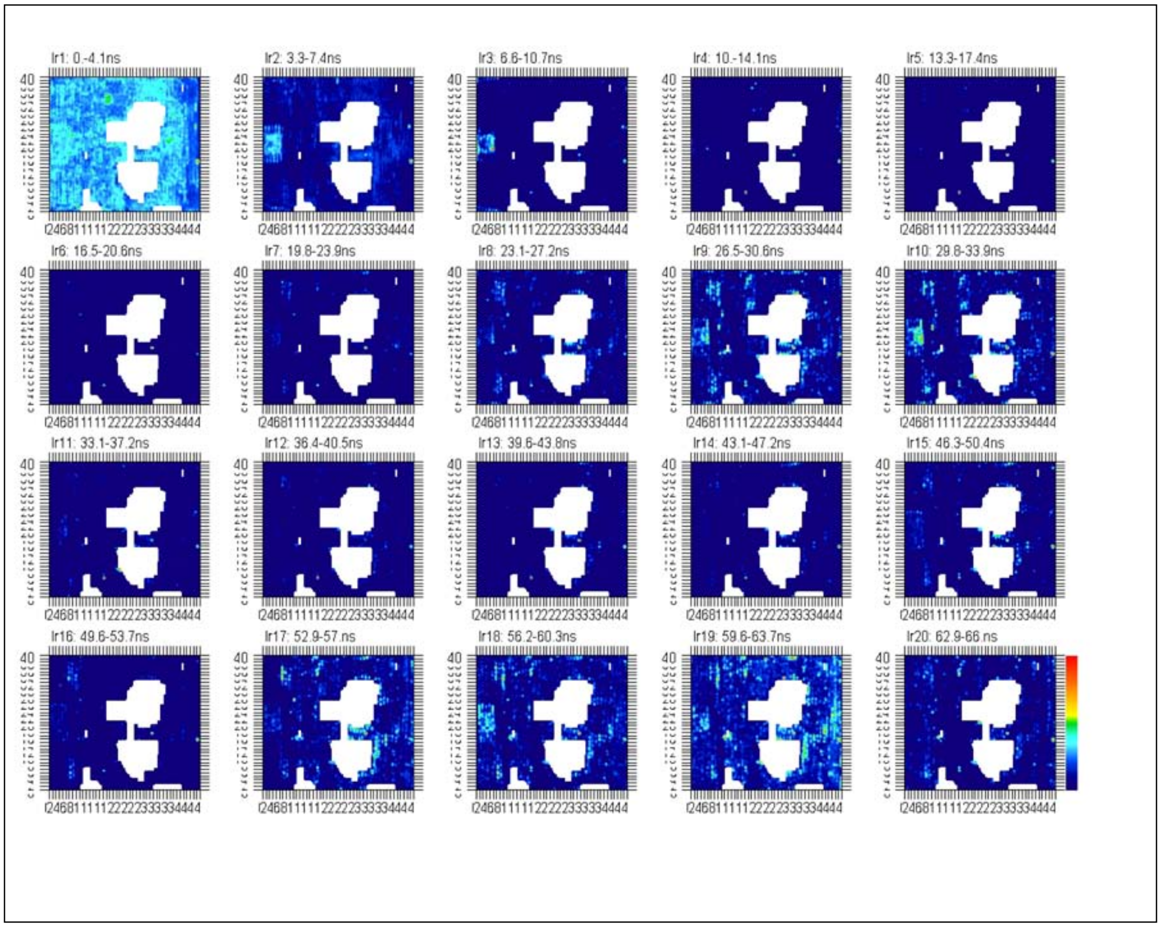


Figure A15. Time slice gpr data from project survey area.

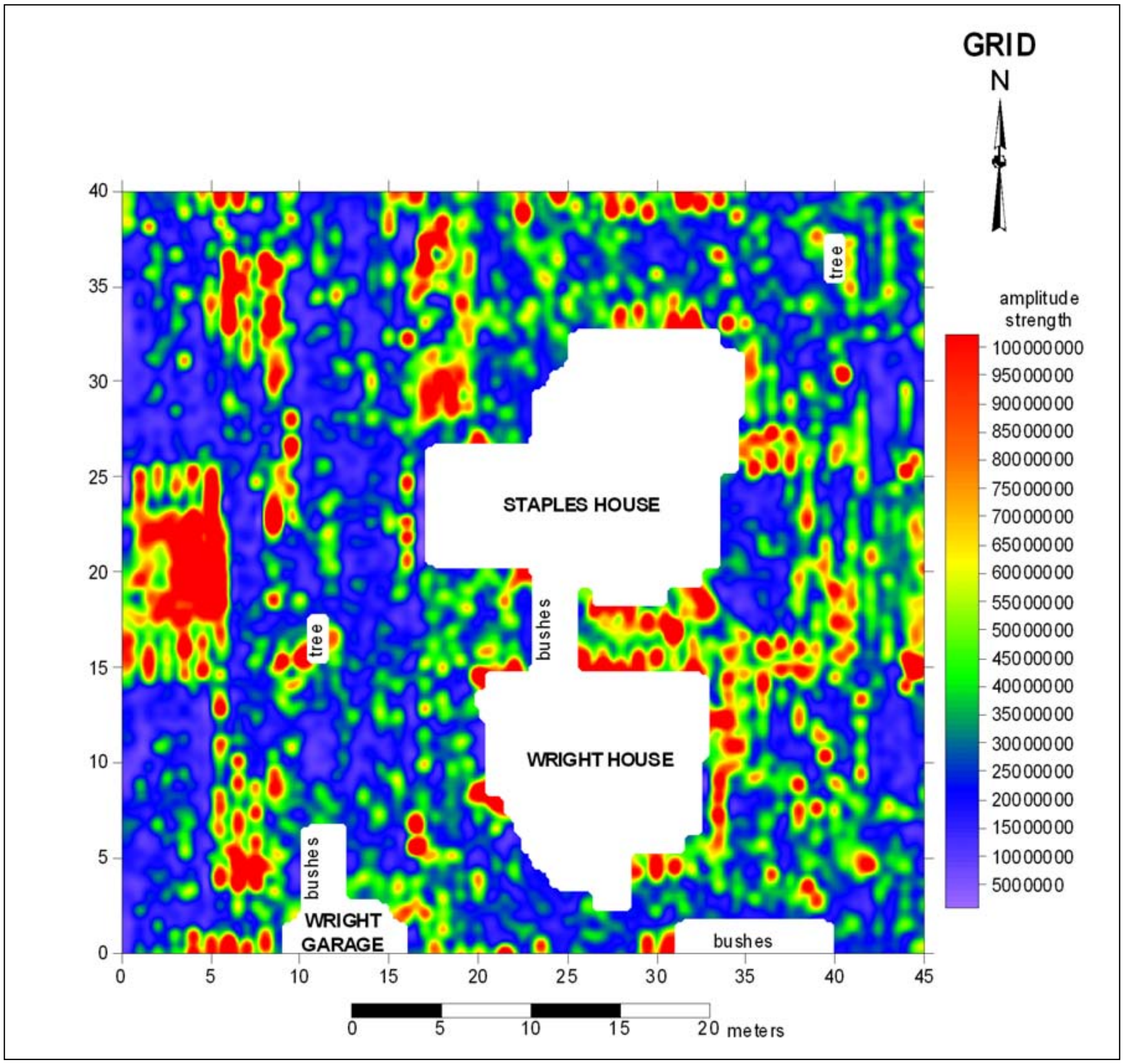
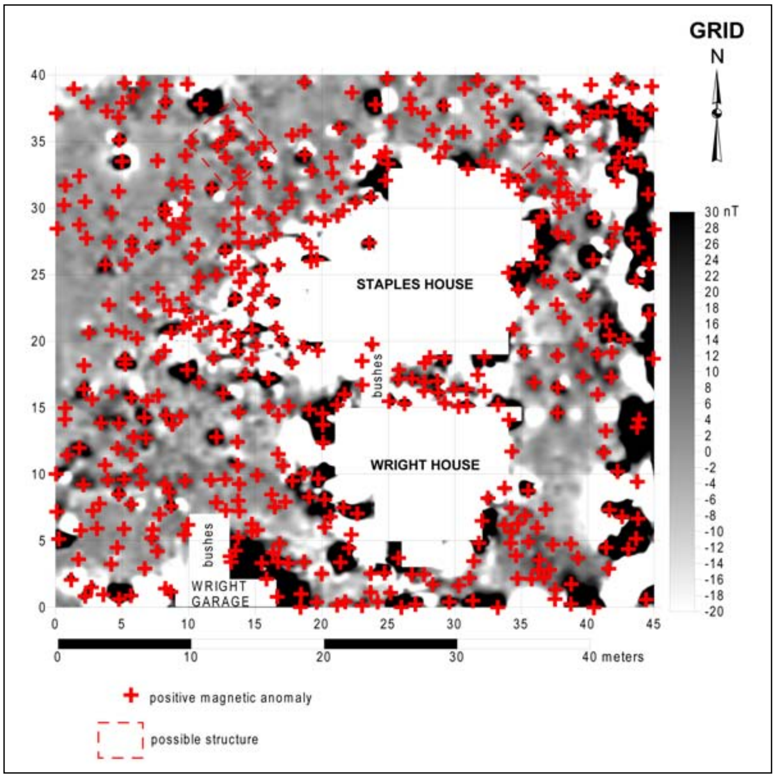
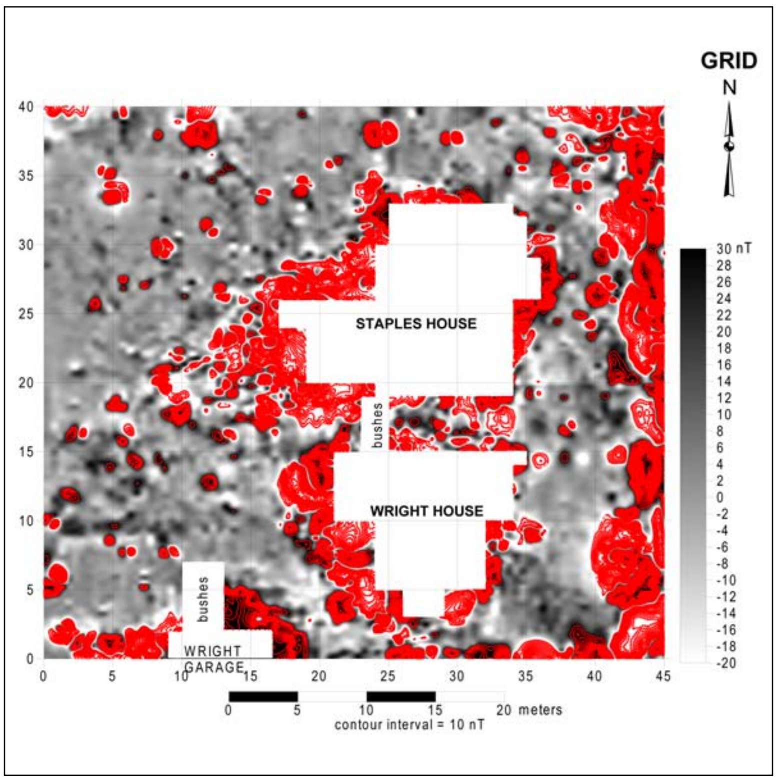


Figure A16. Image plot of time slice 10 ground penetrating radar data from project survey area.

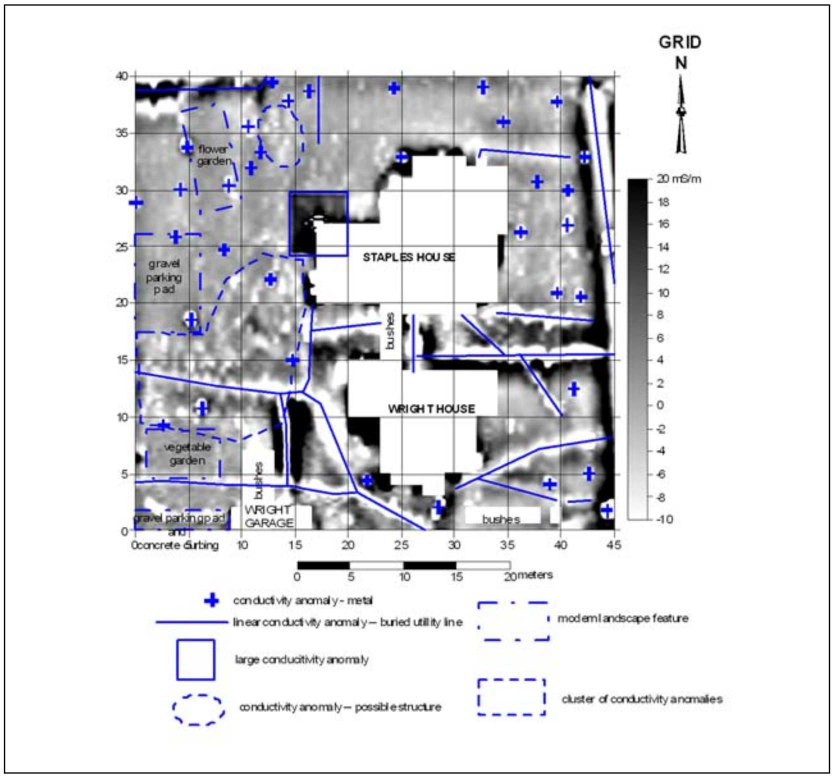


a) highlighted magnetic gradient anomalies.

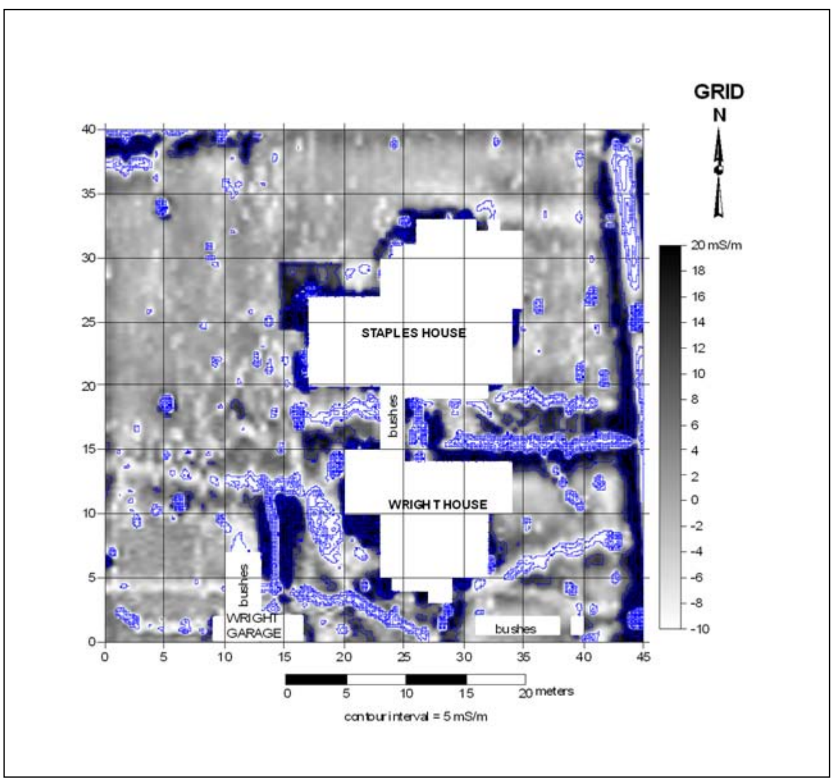


b) magnetic gradient contours below -10 nT and above 10 nT.

Figure A17. Interpretative map of magnetic gradient data from the project survey area.

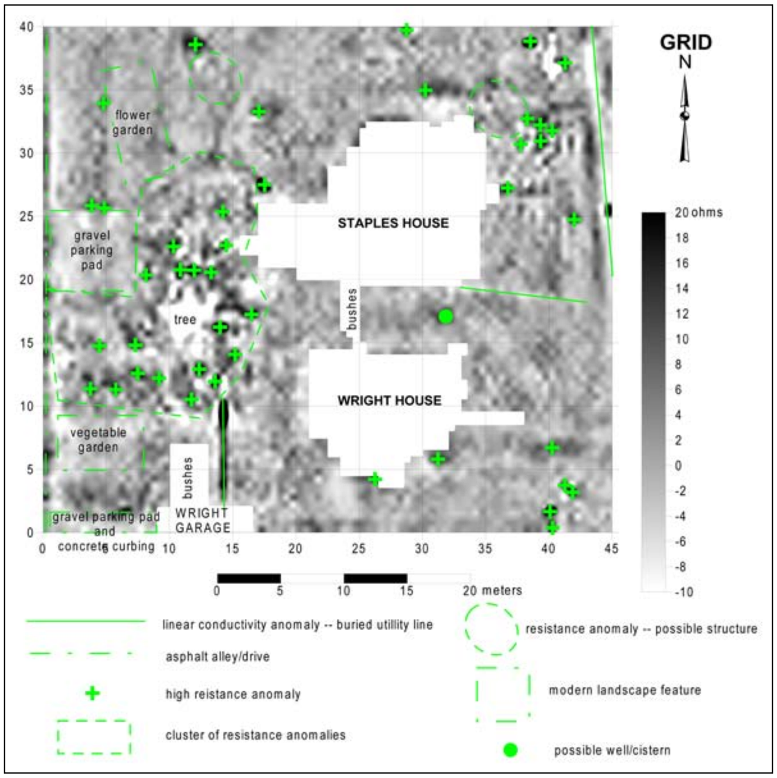


a) highlighted conductivity anomalies.

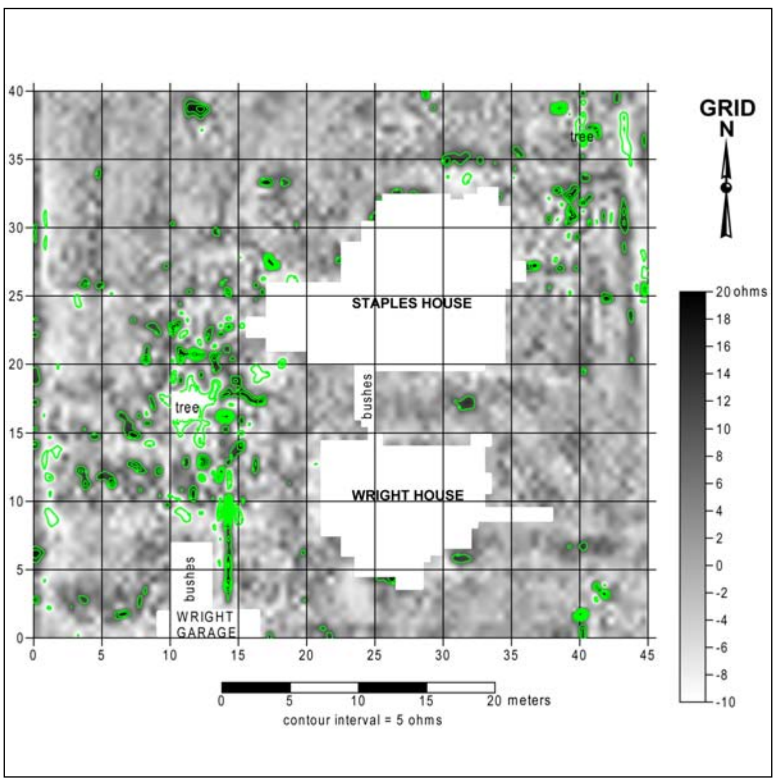


b) conductivity contours below -5 and above 5 mS/m.

Figure A18. Interpretative map of conductivity data from the project survey area.



a) highlighted resistance anomalies.



b) resistance contours below _5 and above 5 ohms.

Figure A19. Interpretative map of resistance data from the project survey area.

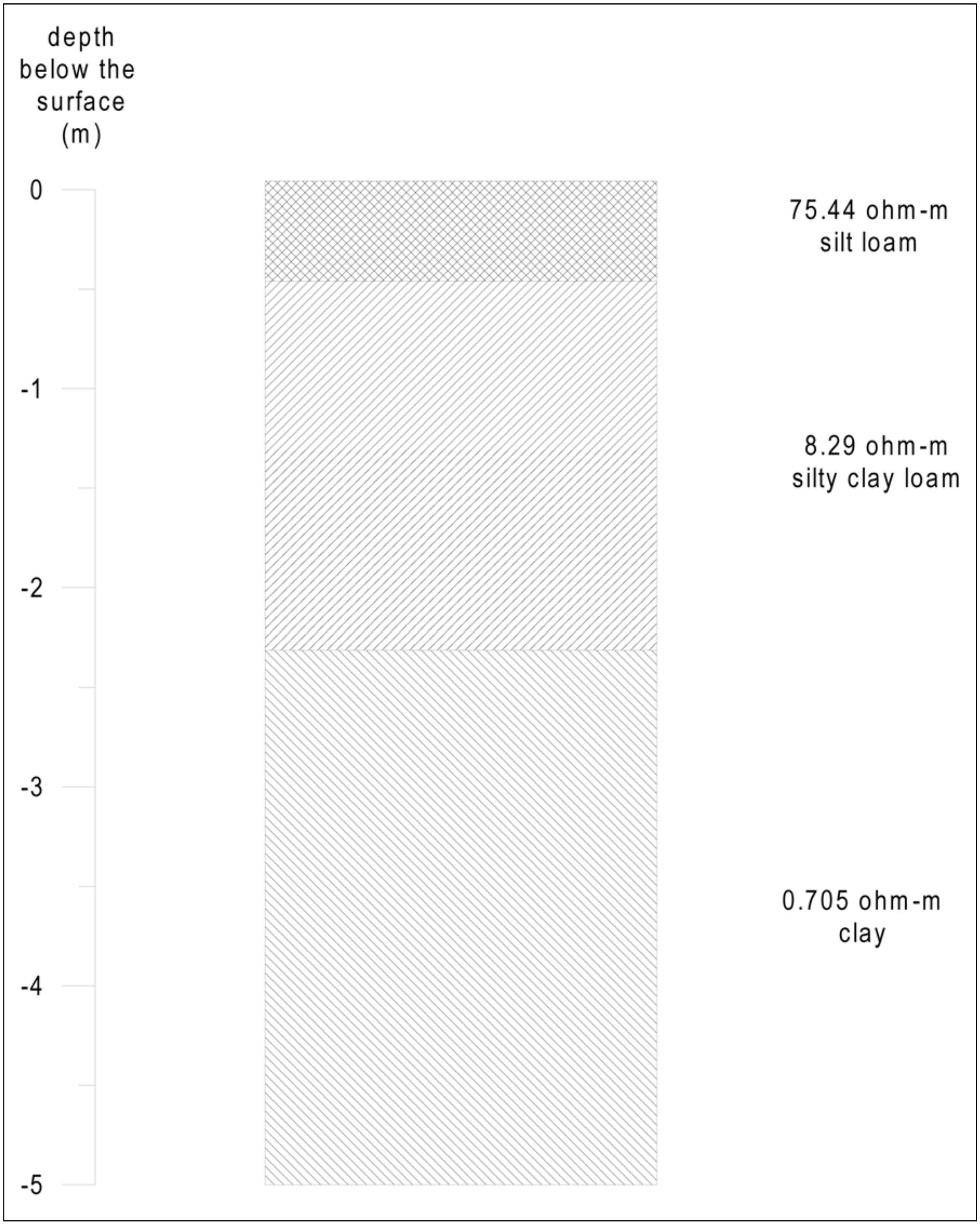
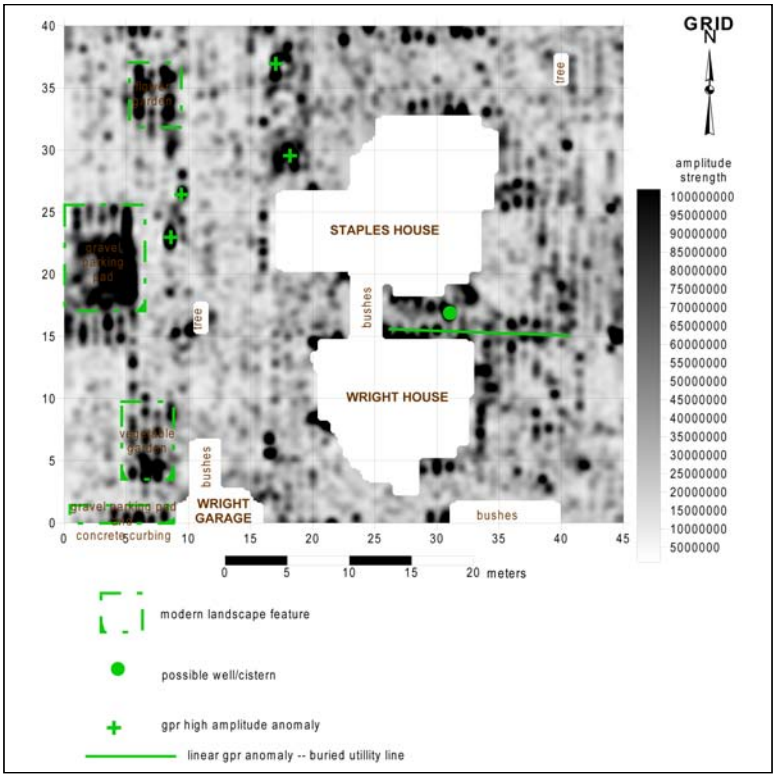
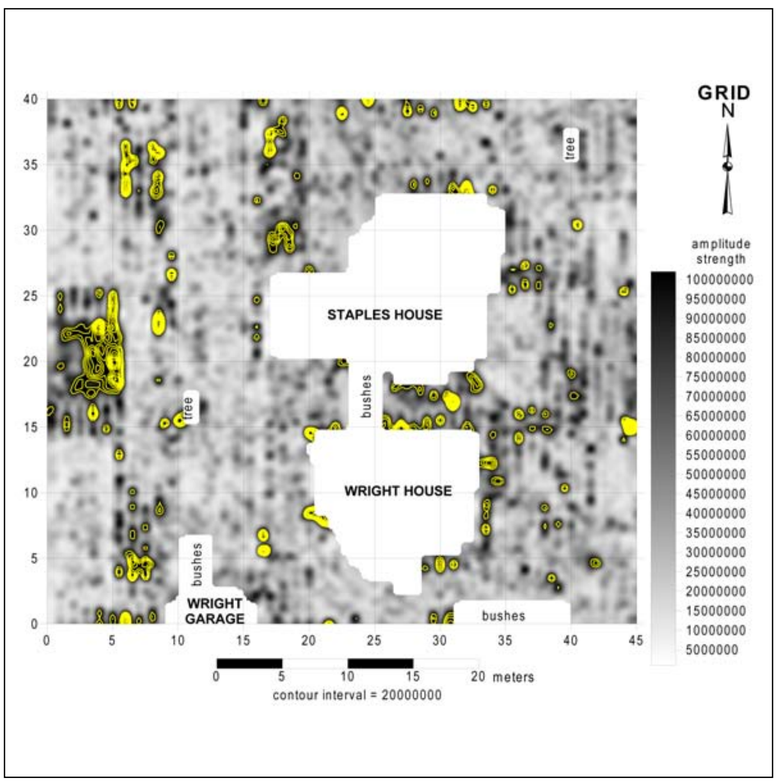


Figure A20. Electrical stratification of the soil in the geophysical project area.



a) highlighted gpr anomalies.



b) gpr amplitude strength contours above 20000000.

Figure A21. Interpretative map of time slice 10 (29.8 – 33.9 ns) gpr data with a 100 ns window from the project survey area.

APPENDIX B

Faunal Remains From Herbert Hoover Boyhood Home: 2005-2006 Field Investigations At Staples House (13co153)

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1 February 2008

Introduction

A limited sample of faunal remains were recovered during the 2005-6 field investigations by the Midwest Archeological Center under the direction of Dawn Bringelson. The assemblage represents almost exclusively domestic animals (hog, cattle, and chicken), with the exception of *Neotoma floridana* (bushy-tailed wood rat), *Sylivilagus floridanus* (eastern cottontail), *Felis rufus* (bobcat), and a small perching bird (Passeriformes). All of the species represented were probably discarded food remains. A total of 614 specimens were recovered during the two field seasons–294 identified specimens from the October and November 2005 investigations and 320 from the March 2006 investigations. The taxonomic groups represented by the assemblage are dominated by unidentifiable fragments that were grouped by size–Indeterminate mammal (n=353), Indeterminate small mammal (n=7), Indeterminate medium mammal (n=5), and Indeterminate large mammal (n=112). Other taxonomic groups include Indeterminate bird (n=8), Indeterminate fish (n=5), and small canid (n=1).

Analysis of the faunal remains was conducted at the Midwest Archeological Center using the Center's comparative faunal collection. Osteological guides were also consulted. These include Gilbert et al.'s (1996) *Avian Osteology*, Olsen's (1985) and Gilbert's (1980) mammalian osteology guides. Taxonomy of the species follows Banks et al. (1987).

All faunal materials are currently being curated by the Midwest Archeological Center under MWAC Accession Number 1104 and HEHO Accession Number 126 for 2005 and Accession Number 1119 and HEHO Accession Number 129 for 2006. All information was entered into a Microsoft Access 2003 file (HEHO Fauna).

The 2005 Assemblage

Three hundred and twenty specimens were recovered during the 2005 field season. This limited sample includes 12 taxonomic groups of birds and mammals. With the exception of the bobcat and possibly the small canid, all of the taxa represent domestic specimens. Over one-third (n=124) of the specimens have evidence of butchering either in the form of cut marks or were sawn, or are burned. Two cattle elements have evidence of carnivore gnawing.

Fish

Five fish vertebra were recovered from unit 15-16N/5-6E and probably represent a single individual discard.

Avifauna

Five elements from the 2005 assemblage were identified as bird bones. These include elements of domestic chickens (*Gallus gallus*) and the rib of an unidentified bird, that is also probably from a chicken.

Family Phasianidae: Pheasants, Grouse, and Quail

Gallus gallus (Domestic chicken)

Four elements from the 2005 assemblage were identified as belonging to domestic chickens. The elements include a vertebra, ilium, the distal epiphysis of left tibiotarsus, and the distal end of a right tarsometatarsus.

The specimens were recovered from two excavations units: 17N/35E and 17-6N/5-6E. The breakage may have occurred during the butchering and cooking process despite the lack of butchering marks.

Mammalian Faunal

The majority of the 2005 assemblage is represented by indeterminate mammal remains. Of the specimens identified more specifically these represent a single pig, cattle, a bobcat, and possible fox.

Order Carnivora

Family Canidae (Canids)

The left upper first molar was recovered from unit 20N/10E and was tentatively identified as a small canid and possibly a fox.

Family Felidae

Felis rufus (Bobcat)

The left innominate from a bobcat was recovered from unit 15-16N/5-6E.

<u>Family Suidae: Pigs</u>

Sus scrofa (Domestic pig)

Three specimens, an incisor, a sawn distal epiphysis of a metatarsal, and the left mandible of an immature hog were identified from three different contexts. These include 25N/10E, 15N/5E, and 39N/11E, respectively.

<u>Family Bovidae: Bovids</u>

Bos taurus (Cattle)

Thirteen specimens were identified as cattle, of which 10 have been sawn, and two exhibit signs of carnivore gnawing. The specimens include long bone and axial elements (vertebra, ribs, scapula) that were part of butchered cuts. The presence of the gonial angle from a right mandible is the exception and was recovered from unit 39N/11E. This unit produced other cattle elements.

<u>Indeterminate Mammals</u>

Two hundred and ninety specimens were too fragmentary for identification beyond general size classes: Indeterminate mammal (n=273), Indeterminate large mammal (n=7), Indeterminate medium mammal (n=4), and Indeterminate small mammal (n=6). Over one-third (n=111) of the specimens have been modified either through burning or butchering.

The 2006 Assemblage

The 2006 assemblage includes 294 specimens representing 11 taxa. The assemblage includes at least two bird species (domestic chicken and a perching bird), and mammalian taxa of cow, pig, cottontail, and bushy-tailed woodrat. Of the 294 specimens, over nearly a quarter (n=71) have modifications of either cut or saw marks. Twelve of the specimens have been burned, which is in sharp contrast to the 2005 material.

Avifauna

Thirty-one elements from the 2006 assemblage were identified as bird bones. These include the coracoid of a meadowlark-sized perching bird, 23 specimens of domestic chicken, and seven unidentified bird elements that based upon size and modifications are probably also from domestic chickens.

Family Passeriformes

The right coracoid from a meadowlark-sized perching bird was recovered from unit 1 m N/1 m W of the southeast corner of the Staples House. The specimen most likely represent a local bird that died naturally and became incorporated into the house fill.

Family Phasianidae: Pheasants, Grouse, and Quail

Gallus gallus (Domestic chicken)

Twenty-three specimens of domestic chicken were recovered from six excavation contexts. Three of the specimens have been cut across the diaphysis. The elements represent post-cranial elements that were probably discarded after meals. No evidence of cranial remains were identified and initial processing occurred in other areas, or these chickens represent store-bought items.

Other Bird Elements

Seven specimens could not be placed in a higher taxonomic group than bird. These include a six long bone fragments and a rib. Based upon the size of the elements they are probably from chickens.

Mammalian Faunal

The majority of the 2006 assemblage is represented by indeterminate mammals. However, the specimens identified to higher taxonomic levels represent at least two domestic species: cattle and hog. Of the 261 mammal elements, 73 have butchering marks (27.96%). Twelve elements have been burned. None of the non-domestic species exhibit any modifications. Two of the identified mammal bones from the assemblage were modified into buttons.

Family Muridae

Neotoma floridana (Bushy-tailed woodrat)

The right tibia from a bushy-tailed woodrat was recovered from 18-19N/14-15E. This specimen is unusual since the habitat of woodrats is typically areas with heavy cover and is typically not found in Iowa (Jones et al. 1985). The identification should be considered tentative due to the limited comparative material available in the MWAC collection.

Family Leporidae

Sylvilagus floridanus (Eastern cottontail)

The left and right glenoid fossa are of the scapula of cottontails were recovered from 17-18N/14E and 18-19N/15-16E, respectively. These specimens may represent natural deaths or the remains of hunted individuals. Neither elements exhibits butchering marks.

Family Suidae: Pigs

Sus scrofa (Domestic pig)

Three pig elements (a sawn rib fragement, the right tibia of an immature individual, and a molar), were recovered during the 2006 excavations. Two of the elements have butchering marks. The presence of the molar, like the mandible recovered in 2005, suggest some primary butchering of hogs may have been occurring around the house. However, this will have to be confirmed with additional evidence.

Family Bovidae: Bovids

Bos taurus (Cattle)

Sixty-six specimens were positively identified as coming from cattle. Forty-five of the elements have either been sawn or exhibit cut marks. A high proportion (71.2%) of the specimens represents axial elements (vertebrae and ribs).

Indeterminate Mammals

The largest percentage of mammalian remains were too incomplete for higher taxonomic identification. These include 81 Indeterminate mammals, 1 Indeterminate medium mammals, and 106 Indeterminate large mammals that are probably from cattle, of which 14 have either saw or cut marks from butchering. A single fragment of a tooth enamel was recovered from 19-20N/14-15E and may represent the cheek tooth from a cow.

Summary

Over 600 faunal elements were recovered during field investigations at the Staples House as part of ongoing restoration of structures at Herbert Hoover Boyhood Home. The materials were recovered under the direction of Dawn Bringleson during field sessions in 2005 and 2006. The faunal material almost exclusively represents discarded food items. The large percentage of species identified are domestic animals (cattle, hog, and chicken). Other species identified include fish, Passeriformes, a canid, bobcat, a possible busy-tailed woodrat, and eastern cottontail. With the exception of the fish and cottontail, these species probably represent non-food items that may have been hunted or coincidentally became incorporated into the archeological record.

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