SECTION 2.0 RESEARCH GOALS AND DESIGN

The goals of the Phase II archaeological survey were to evaluate the eligibility of the Stroud site (CRS # N-6693, 7NC-G-180) for listing on the NRHP. Determinations of significance or potential significance are based on the NRHP Criteria of historic and/or archaeological significance.

The research design for the Phase II archaeological survey included archival research to develop an historic context, archaeological fieldwork to investigate archaeological integrity, and artifact analysis.

2.1 National Register of Historic Places Criteria

Potentially significant historic properties include districts, structures, objects, or sites which are at least 50 years old and which meet at least one National Register criterion. Criteria used in the evaluation process are specified in the Code of Federal Regulations, Title 36, Part 60, National Register of Historic Places (36 CFR 60.4). To be eligible for inclusion in the NRHP, a historic property(s) must possess:

> the quality of significance in American History, architecture, archaeology, engineering, and culture [that] is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and:
>
> (a) that are associated with events that have made a significant contribution to the broad patterns of our history, or
>
> (b) that are associated with the lives of persons significant in our past, or
>
> (c) that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components lack individual distinction, or
>
> (d) that have yielded, or may be likely to yield, information important in prehistory or history (36 CFR 60.4).

There are several criteria considerations. Ordinarily, cemeteries, birthplaces, or graves of historical figures, properties owned by religious institutions or used for religious purposes, structures that have been moved from their original locations, reconstructed historic buildings, properties primarily commemorative in nature, and properties that have achieved significance within the past 50 years shall not be considered eligible for the NRHP. However, such properties will qualify if they are integral parts of districts that do meet the criteria or if they fall within the following categories:

(a) a religious property deriving primary significance from architectural or artistic distinction or historical importance, or

(b) a building or structure removed from its original location but which is significant primarily for architectural value, or which is the surviving structure most importantly associated with a historic person or event, or

(c) a birthplace or grave of a historical figure of outstanding importance if there is no other appropriate site or building directly associated with his/her productive life, or

(d) a cemetery which derives its primary significance from graves of persons of transcendent importance, from age, from distinctive design features, or from association with historic events, or

(e) a reconstructed building when accurately executed in a suitable environment and presented in a dignified manner as part of a restoration master plan, and when no other building or structure with the same association has survived, or

(f) a property primarily commemorative in intent if design, age, tradition, or symbolic value has invested it with its own historic significance, or

(g) a property achieving significance within the past 50 years if it is of exceptional importance. (36 CFR 60.4)

When conducting National Register evaluations, the physical characteristics and historic significance of the overall property are examined. While a property in its entirety may be considered eligible based on Criteria A, B, C, and/or D, specific data is also required for individual components therein based on date, function, history, and physical characteristics, and other information. Resources that do not relate in a significant way to the overall property may contribute if they independently meet the National Register criteria.

A contributing building, site, structure, or object adds to the historic architectural qualities, historic associations, or archeological values for which a property is significant because a) it was present during the period of significance, and possesses historic integrity reflecting its character at that time or is capable of yielding important information about the period, or b) it independently meets the National Register criteria. A non-contributing building, site, structure, or object does not add to the historic architectural qualities, historic associations, or archeological values for which a property is significant because a) it was not present during the period of significance, b) due to alterations, disturbances, additions, or other changes, it no longer possesses historic integrity reflecting its character at that time or is incapable of yielding important information about the period, or c) it does not independently meet the National Register criteria.

2.2 Criteria of Adverse Effect

Whenever a historic property may be affected by a proposed undertaking, Federal agency officials must assess whether the project constitutes an adverse effect on the historic property by applying the criteria of adverse effect. According to the Advisory Council on Historic Preservation, the criteria of adverse effect (36 CFR 800.5), is as follows:

(1) An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that would qualify it for inclusion in the National Register, in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation for the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance or cumulative.

(2) Adverse effects on historic properties include, but are not limited to (36 CFR 800.5(a)(2)):

(i) Physical destruction of or damage to all or part of the property;

(ii) Alteration of a property, including restoration, rehabilitation, repair, maintenance, stabilization, hazardous material remediation and provision of handicapped access, that is not consistent with the Secretary's Standards for the Treatment of Historic Properties (36 CFR part 68) and applicable guidelines;

(iii) Removal of the property from its historic location;

(iv) Change of the character of the property's use or of physical features within the property's setting that contribute to its historic significance;

(v) Introduction of visual, atmospheric or audible elements that diminish the integrity of the property's significant historic features;

(vi) Neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance to an Indian tribe or Native Hawaiian organization; and

(vii) Transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance.

A finding of adverse effect or no adverse effect could occur based on the extent of alteration to a historic property, and the proposed treatment measures to mitigate the effects of a proposed undertaking. According to 36 CFR 800.5(3)(b):

> The agency official, in consultation with the SHPO/THPO, may propose a finding of no adverse effect when the undertaking's effects do not meet the criteria of § 800.5(a)(1) or the undertaking is modified or conditions are imposed, such as the subsequent review of plans for rehabilitation by the SHPO/THPO to ensure consistency with the Secretary's Standards for the Treatment of Historic Properties (36 CFR part 68) and applicable guidelines, to avoid adverse effects.

2.3 Research Design and Methodology

The Phase II archaeological survey of the Stroud site (CRS # N-6693, 7NC-G-180) evaluated the site's eligibility for listing on the National Register of Historic Places. An archaeological site generally must have the potential to yield important new information in prehistory or history to be considered significant (NRHP, Criterion D). Significance evaluations are dependent upon the quality of archaeological data retrieved from the ground, integrity or intactness of the deposits, prior research activities in the region, and the development of prehistoric and/or historic contexts that define gaps in the documentary and archaeological database that further work at the site may address.

Background/Archival Research

The area surrounding the intersection of Hyetts Corner Road and the Dupont Parkway (also known as U.S. Route 13) contains numerous historic architectural and archaeological resources, many of which have been identified through previous investigations during construction of the Korean War Veterans Highway (U.S. Route 1) and other improvements to U.S. Route 13. Three historic architectural properties, the Idalia Manor (N-3947), the Biddle House (N-3935), and the Retirement Farm (N-5201), are adjacent to the site area examined in this study. The two farm properties, Idalia Manor and Retirement Farm, are both contributing resources to the NRHP multiple-property listing, "Rebuilding St. George's Hundred." The Biddle House was not included in the 1989 nomination of Rebuilding St. George's Hundred, but the resource meets many of the registration requirements and significant criteria outlined in the "Dwellings of the Rural Elite in Central Delaware: 1770−1830s" multiple-property documentation form.

Archival research for this project involved examining primary and secondary documents to better understand the ownership and land-use history of the project area, and assist with interpreting the origins and functions of the cultural resources within it. The detailed historic context resulting from

this research was used to inform and support Phase II archaeological investigations at the Stroud site. In August and September of 2011, Dovetail staff visited the Delaware Public Archives, New Castle County Circuit Court, the Historical Society of Delaware, the Morris Library and Center for Historic Architecture and Design (CHAD) at the University of Delaware, and consulted online resources such as Ancestry.com. Primary historic sources reviewed in this effort include Federal Population and Agricultural Census records, Orphans Court records, Court of Common Pleas records, will and probate records, warrants and surveys, historic maps, deeds and mortgages, and various tax assessments, dating as early as 1708. The chain of title for the study area is presented herein as Appendix C. Secondary sources consulted for this project included genealogical records and historical publications, historic contexts, as well as previous architectural and archaeological surveys of cultural resources in the project vicinity.

The detailed Stroud site historic context developed during the research component of the project served as the framework to evaluate the site's significance. A preliminary history of the Stroud site was initially developed based on the results of cursory archival and archaeological investigations during the Phase I study (Dovetail Cultural Resource Group. 2011). The Phase II archaeological survey expanded upon this research and evaluated the site's eligibility for listing on the NRHP. As such, the Phase II archaeological survey was guided by several overarching goals.

The first goal was to conclusively determine the horizontal extent of the Stroud site and better understand the internal configuration of the site through the identification of features and activity areas. Although the Phase I survey suggested a site nucleus, the historic research demonstrated that the Stroud house was part of a much larger plantation property. Following the Phase I survey, the exact location of the Stroud family's home on the property was unclear, but domestic and architectural material initially suggested the dwelling was in or adjacent to the identified site. Moreover, the road system throughout this region, including those that partially bound the known site, were established in the eighteenth century. Therefore it was possible that the site could extend beyond the currently defined nucleus in the southeastern corner of the site. he Phase II archaeological survey aimed to place the site remains in their appropriate contexts and determine the quantity and size of all architectural and archaeological remains recorded within the archaeological site boundaries.

The second research goal was to assess the vertical and horizontal integrity of the Stroud site. Based on data retrieved during the Phase I archaeological survey, the site had moderate to good physical potential to contain undisturbed cultural features or artifact deposits with the potential to provide notable information on local history and possibly prehistory. The vertical and horizontal integrity of the site was determined through systematic archaeological excavations.

A third goal involved gaining an understanding of the chronological history of the site. During the Phase I survey, Dovetail (2011) conducted limited archival research to uncover details on area history. Due to the overarching scope of the research, though, the data retrieved from the investigation encompassed a regional perspective on historical occupation rather than a site-specific narrative. Additional archival research combined with the archaeological testing, helped unravel the history of this specific piece of land. This, in turn, aided in the site's evaluation for NRHP eligibility under Criteria A, B, C and D, and will help guide future field initiatives in this area.

These three research goals are addressed herein. The goals outlined here inspired a variety of research questions that also shaped investigations at the Stroud site. These include:

1. What is the temporal variation, if any, in project parcel use?
2. Does the property change from an owner-occupied farmstead to a tenant- or servant-based segment of a larger plantation or vice versa?
3. Were there notable differences in material and/or architectural assemblages across the site?

Archaeological Survey

The Phase II archaeological survey consisted of both a pedestrian survey and subsurface testing. Phase II testing included close-interval STP and TU excavation on the one acre (0.4 hectare) site. A 25-foot (7.6-m) grid system across the entire Phase II area was established and STPs were excavated at 25-foot (7.6-m) intervals. Shovel test pits measured approximately 12 inches (30.4 cm) in diameter and were excavated to penetrate at least 4 inches (10.1 cm) into sterile subsoil where possible. All STPs were excavated in 4-inch (10.1-cm) arbitrary levels to 3 feet (0.9 m) in depth or to culturally sterile strata, whichever came first. The matrix was screened through one-quarter inch (0.6-cm) mesh. All cultural material recovered during the investigation was collected and bagged according to provenience. Soil conditions, weather information, and notations on disturbances were recorded within field notes (see Appendix D). The location of each STP was plotted using either a GPS receiver or detailed topographic maps, as needed. Details of each STP were recorded on appropriate project field forms, and photographs were taken to document the general site area.

Upon completion of the shovel testing, stratigraphy and artifact data was closely examined to identify specific areas to target during the excavation of TUs. Dovetail staff entered project data into Surfer software to pinpoint areas where TU excavation would be most likely to address the project goals and research questions. All of the TUs measured 3 feet by 3 feet (0.9 x 0.9 m). When deemed appropriate, TUs were placed adjacent to one another or in a checkerboard pattern to uncover details of area stratigraphy, artifact deposit characteristics, and landscape patterns.

Units were excavated in natural levels. Arbitrary 4-inch (10-cm) levels were excavated where natural levels exceeded 4 inches (10 cm) to provide vertical control of the recovered artifact assemblage. All soil was screened through one-quarter inch (0.6-cm) mesh. All cultural material recovered was collected and bagged according to provenience. Profile photographs were taken and scaled drawings made of at least one wall from each unit. Soil profiles exposed in TUs were tabulated and are presented as Appendix E. Features were photographed and scaled plan view drawings made. Depending on size, features were bisected and excavated in arbitrary 4-inch (10-cm) levels or natural levels if they were less than 4 inches (10 cm) in depth. If materials appropriate for chronometric testing were encountered, such as charcoal, samples were removed with appropriate methods to maintain the integrity of the samples. The locations of all TUs were documented through a hand-held GPS unit.

The scope of the Phase II archaeological survey included a contingency for archaeological stripping using a backhoe to delineate features and areas of subsurface interest, if deemed necessary by the DelDOT. During field meetings on September 5, 2011, October 14, 2011, and October 27, 2011 with the DelDOT, it was decided that given the lack of subsurface features at the site, mechanical stripping would not be utilized at the Stroud site.

Soil Survey

The analysis of soil chemistry variations and patterning of specific geochemical anomalies within plowed archaeological sites has been employed in many studies of historic period archaeological sites in the Mid-Atlantic region in order to locate sites, define site areas, and interpret the possible uses of outdoor space around a dwelling. In the fall of 2011, a soil chemistry study was conducted by Dovetail at the Stroud site in order to locate and guide further investigations of possible activity areas such as middens, gardens, and animal pens. A total of 199 soil samples was collected from the Stroud site and processed by the University of Delaware's Soil Testing Program (see Appendix F: F1 - F5). In addition, soil textural analysis was conducted on three samples. These include plowzone samples from coordinates N540/E485 N570/E425, and N850/E455 (see Appendix F: F1 - F5).

In total, 154 soil cores were taken at 15-foot (4.8-m) intervals across the approximately one-acre (0.4 ha) site, targeting the plowzone stratum. At each soil sample location, a one-inch (2.5-cm) Oakfield soil corer was used to extract approximately one cup of soil and then bagged into pre-ordered kits provided by the University of Delaware. In addition to the 154 samples taken for the plowzone distribution study, three off-site control samples were collected outside the site boundary in order to assess the 'natural' soil chemistry of the area. Three additional samples were suspected to contain feature soils due to their depth. Ten of the plowzone soil core locations were sampled and tested twice to evaluate the variation possible in both sampling strategy and laboratory results. Also, 31

samples were taken from plowzone, feature, and subsoil contexts from 13 TUs excavated in October 2011.

All samples were submitted to the University of Delaware where a "Routine Soil Test" was run including a Mehlich 3 extraction and inductively coupled plasma-optical emission spectrometry (ICP-OES) for 11 elements: phosphorus (P), calcium (Ca), potassium (K), magnesium (Mg), manganese (Mn), copper (Cu), zinc (Zn), iron (Fe), boron (B), aluminum (Al), and sulfur (S). The Routine Test package also includes tests for pH, organic matter content, phosphorus saturation ratio (PSR), cation exchange capacity (CEC), and base saturation. The testing program is designed for agricultural uses but P, Ca, K, Mn, Cu, Zn, and Fe results can be interpreted archaeologically (Gall 2013). Quantified geochemical analysis results are presented as Appendix F: F-6 herein.

Cation Exchange Capacity (CEC)

The quantity of weakly sorbed element forms in the site soils is determined by the cation exchange capacity (CEC), expressed as the total amount of exchangeable cations (or positively charged ions such as Ca^{2+}, Mg^{2+}, K^{+}, Al^{3+}, Fe^{2+}, Mn^{2+}, Zn^{2+}, and Cu^{2+}) that a soil can adsorb and that are available for plant nutrient uptake. The CEC is dependent on organic matter content and/or soil texture. Clays, for example, have a negative charge that remains permanent irrespective of pH changes. Soil pH-dependent CEC, or the CEC of organic matter, can change based on soil pH. That is, the CEC of a soil with pH-dependent charge will increase with an increase in soil pH. Soils with a high CEC number, characterized by alkaline clays and organic soils with a high number of negatively charged receptor sites, have a greater efficiency to adsorb exchangeable cations through electrostatic forces than sandy more acidic soils with a low organic matter content (Ketterings et al. 2007).

Percent of Organic Matter by Loss on Ignition (OM)

Organic matter by loss on ignition is a calculation of the percent of organic matter or carbon by weight lost by heating soil samples in an oven. Percent of OM can have a high positive correlation with CEC and has been found to have a direct correlation with former activity areas within archaeological sites (Gall et al. 2014). This soil attribute is rarely examined as an archaeological marker on archaeological sites in Delaware.

Potential Hydrogen (pH)

Soil pH provides information on the acidity and alkalinity of site soils. Soil pH can affect the availability and form of main and trace element ions in the soil due to its relation to and influence on pH-dependent CEC (Sopko 1983: 25). For example, the availability of weakly sorbed P is maximized in soil with a pH range from 5.5 to 6.5, K from 5 to 7 pH, Ca from 5 to 8.5 pH, and Mg from 4.5 to 7.5 pH. Soil pH may be affected by agricultural fertilization, the type and proximity of bedrock to

the ground surface, soil type and texture, and anthropogenic additions like refuse and building material deposition.

Aluminum (Al)

Aluminum has a direct correlation to soil pH and forms bonds with P, resulting in Al-phosphates. Aluminum has been found to have a very high correlation with former historic activity areas and features on archaeological sites (Gall et al. 2014). Consequently, Al normally has a strong positive or negative correlation with P. Aluminum is rarely examined in Delaware as an anthropogenic chemical attribute.

Boron (B)

Boron has been found to be highly influenced by agricultural fertilization activities and a poor indicator of anthropogenic chemical residues associated with former site occupation activities (Gall et al. 2014)

Calcium (Ca)

Calcium, like K and Mg, is a relatively mobile alkaline element and common in most soils. Oonk and associates (Oonk, Slomp, Huisman 2009: 39, 41) argue that while Ca is indicative of organic and inorganic occupation waste, such as bone, shell, manure, charcoal, and mortar, which load anthrosols with the element, organisms that require Ca can reduce the element's density (Middleton and Price 1996: 675; Pogue 1988: 3; Wilson, Davidson, Cresser 2008: 416). Studies undertaken in the United Kingdom identified a correlation between Ca and domestic hearths and determined that Ca can be more strongly influenced by functional area within a site than by general site-wide human occupation (Wilson, Davidson, Cresser 2008: 416). Once loaded into the soil, Ca rapidly bonds with P to form Ca-phosphate. In sandy soils with a low CEC, unbound Ca quickly leaches through occupation layers and accumulates in deeper soil horizons, and can be a poor anthropogenic indicator in such soils (Oonk, Slomp, Huisman 2009: 41). However, unbound Ca is better stabilized in occupation layers composed of silts and clays. Mixed reagents like Mehlich-3 can be used to dissolve a portion of Ca-P bonds and extract the alkaline element, but its anthropogenic and Ca-P forms cannot be differentiated.

Copper (Cu)

Copper is a relatively stable element, particularly in acidic soils, and can be released from decaying organic matter like bone and charcoal, refuse, and excreta (Entwistle, Abrahams, Dodgshon 2000:300). Copper has also been found in elevated concentrations in buildings and near objects painted or dyed in metallic-based pigments (Terry et al. 2004:1239; Wells et al. 2000:456-457). It may also be released by highly fractured ceramics containing copper-oxide decoration. This trace element

is a strong indicator of anthropogenic chemical residue (Oonk, Slomp, Huisman 2009:42). Copper may also be deposited by rain and wind-blown dust.

Iron (Fe)

Where conditions permit, Fe concentrations have been found to have a high correlation with former butchering activities, deposition of ferrous metal, painted buildings and objects, and charcoal concentrations (Cook et al. 2006:636; Fernández et al. 2002:490; Parnell, Terry, Nelson 2002:381; Parnell, Terry, Sheets 2002:332-333, 338; Terry et al. 2004:1239; Wells et al. 2000:456-457; Wilson, Davidson, Cresser 2008:421). Like Mn, the lower oxidation state of Fe prevalent in reduced soils (i.e., poorly drained gley soils), are more stable than the higher oxidation states of the two elements. However, the lower oxidations states of Mn and Fe are more soluble and may have a greater mobility (Evangelou 1998: 229). In hydric silt loams, a strong positive correlation between Fe and S can occur (Gall et al. 2014), which may be due to their bond in the sulfate $FeSO_4$, which develop in intermediate reduced environments (Evangelou 1998: 229). For this reason, it may be assumed that Fe-bound sulfate occurs due to the anthropogenic loading of S into hydric soils, possibly through organic refuse decomposition.

Potassium (K)

Potassium is an alkaline element often found in identifiably high levels within archaeological soils, and is less mobile in acidic sandy and silty soils compared to other alkaline elements like Ca and Mg (Oonk, Slomp, Huisman 2009: 41). The extractable quantity of K is often dependent on micro-environmental conditions such as soil pH and texture (Pogue 1988: 3). High K levels generally indicate the presence of intense *in situ* wood burning or the accumulation of re-deposited charcoal, which also enriches the soil with Mg and Ca (Pogue 1988: 3).

Magnesium (Mg)

Magnesium is an alkaline element and generally follows a similar geochemical path as Ca. Magnesium is typically a poor indicator of former human activity due to its mobility in soil, but has been found in instances to mark former fence lines (Gall et al. 2014).

Manganese (Mn)

Data suggest Mn is one of the best indicators of former activity areas and structures, particularly the use of the heavy metal on painted objects and buildings (Gall 2014; Terry et al. 2004:1238-1239; Wells et al. 2000:456-457). Manganese, however, is mobile in soils exhibiting redox characteristics like those at the site, and may not be suitable for identifying anthropogenic chemical residue patterns (Tan 2011: 286).

Phosphorous (P)

Phosphorous, particularly available P, has been intensively examined by archaeologists since the mid-20th century and elevated P densities often have a high correlation with activity areas on archaeological sites. Significant research has focused on the formation and interpretive value of total and available soil P (Holliday and Gartner 2007). Phosphorous is present in inorganic and organic waste, such as bone, plant waste, and charcoal, and remains in place for thousands of years (Custer et al. 1986a:93; Sjöberg 1976:448). Organic P is generally found in the surface soil where it is easily absorbed by plants, and therefore less stable than inorganic P, which accumulates in the subsoil and serves as the best indicator of human activity (Pogue 1988:3; Schuldenrein 1995:107; Sjöberg 1976:448). When added to the soil, P can rapidly form bonds with Ca, Al, and Fe ions to form phosphates. The Ca-phosphate occurs in higher frequency in alkaline soils, while acidic soils produce more Al- and Fe-phosphates. The Mehlich-3 solution used in this study extracts Fe-, Al- and a portion of Ca-phosphate, but does not differentiate between its forms. Available P comprises a minute percent of total P, the latter of which also includes non-anthropogenic P formed from natural sediments and weathering (Holliday and Gartner 2007: 313).

Holliday and Gartner (2007:303) argue that differentiation of the various P forms in terms of chemistry, the biochemical cycle, and sequential extraction is key to utilizing P in archaeological contexts. In sandy soil, soil P can leach through the stratigraphic profile. Phosphorous mobilization also increases in neutral and near neutral pH soils. Though significantly reduced from its total forms, available P is often present at archaeological sites in elevated levels relative to off-site locations or control samples and can be broadly indicative of human activity (Holliday and Gartner 2007:304, 306, 309, 313). The reduction of P in certain microenvironmental conditions highlights the necessity to examine and combine P data interpretation with that of additional elements, such as Ca, Cu, Fe, Mn, and Zn (Cook et al. 2006:629; Holliday and Gartner 2007:307; Middleton and Price 1996; Milek and Roberts 2013; Oonk, Slomp, Huisman 2009; Parnell, Terry, Nelson 2002; Terry et al. 2004; Wilson, Davidson, Cresser 2008:412-421).

High P densities have proven useful in identifying areas of concentrated human and animal wastes, hearths, outbuildings, and animal pens (Sullivan and Kealhofer 2004). Elevated P can result from human excrement; organic waste, such as bone, meat and plants; human burials; and charcoal (Holliday and Gartner 2007:302, 306). Areas within archaeological sites that have low P and other element densities have been attributed through archaeological and ethnoarchaeological research to represent high traffic pathways and ritual areas where anthropogenic chemical residues from unwanted wastes did not accumulate (Sarris et al. 2004: 937). This pattern is evinced by chemical residue analysis undertaken as part of ethnoarchaeological studies of Q'eqchi' Maya houses at Las Pozas, Guatemala and at a modern Maya farmstead in San Pedro, Belize where identified patterns of

low P and trace elements were associated with heavily trafficked and continuously cleaned areas (Fernández et. al. 2002:503-4; Holliday and Gartner 2007:308).

Sulfur (S)

Sulfur has been found to have a high correlation with former activity areas and feature locations in silty loam hydric soils, but is rarely subject to geochemical testing on archaeological sites in Delaware (Gall et al. 2014).

Zinc (Zn)

Zinc is known to accumulate in site soils from burning of wastes, decaying organic matter, refuse, excreta, and charcoal (Entwistle, Abrahams, Dodgshon 2000:300; Wilson, Davidson, Cresser 2008:418). This element has a strong positive correlation with OM, estimated CEC, Ca, Cu, Fe, K, Mg, and Mn from on-site plowzone samples, and a strong negative correlation with soil pH, P, and S. Zinc is relatively mobile in acidic soils (Entwistle, Abrahams, Dodgshon 1998: 66).

The results of the tests were evaluated statistically and those from the plowzone soil coring were mapped and analyzed using ArcGIS software, versions 9.3 and 10.1.

Laboratory Methodology

All recovered artifacts were washed with water and rubbed with a soft brush in groups according to provenience. Once cleaned, artifacts were cataloged according to type and bagged in 4 millimeter archival quality resealable bags with the field tag (see Appendix G). For this portion of the work, the artifact catalog recorded general provenience information and quantity for each artifact type. Artifacts were broken into two general categories: historic and natural. Artifact type was assigned according to a variety of generally accepted systems.

Historic artifacts were divided into material type [*Architectural* (ARC), *Arms and Ammunition* (ARM), *Ceramic* (CER), *Glass* (GLS), *Metal* (MET), *Organic* (ORG), *Other* (OTH), and *Personal* (PER)] for basic analysis. The artifacts were then identified as to specific wares or manufacturing techniques.

Architectural artifacts generally included any items that were used in the construction of a building such as nails, window glass, brick, cut stone, mortar, plaster, roofing slate, etc. Specifically, nails were recorded as hand-wrought, machine cut with wrought heads, machine cut with machine cut heads, and wire (galvanized and ungalvanized). Window glass was divided into pre- and post-industrial categories, and brick was classified as either hand-made or machine-made. The *Arms and Ammunition* category included flints, bullets, bayonets, sabers, mortar shells, etc. that were used during battle activity or for personal use such as hunting.

Ceramics were subdivided into refined and coarse earthenware, refined and coarse stoneware, porcelain, and semi-porcelain. Decoration, such as applied paint, transfer print, and molding, were also noted, and each fragment was examined to determine specific vessel aspect (i.e., body, base, handle, rim). Specific ware types and manufacture dates were identified using Noel-Hume (1991), South (1977), Bartoviks (1980), Pittman, McFaden and Miller (1987), Greer (1970), and Digital Archaeological Archive of Comparative Slavery (DAACS) (2006).

Glass included all domestic glass which was catalogued by manufacturing techniques, as well as color, use, attribute, and decoration (Jones and Sullivan 1985; Madden and Hardison 2002). This category was broken down by vessel and bottle glass distinctions to help identify their possible use without seeing the actual artifact, for example a piece of glass representing a candy dish versus a wine bottle.

Metal is a form category and generally includes flat pressed metal or unidentifiable metal fragments. An attempt was made to place other metal items in a functional category to aid in analysis.

Organic included shell, bone, and any other culturally but naturally occurring object.

The *Other* category included items that were not placed into a more specific category, such as ceramic insulators and porcelain toilet fragments. Although these items are technically ceramic they are placed within the *Other* category because they are not of a specific domestic use like a plate or bowl.

Personal items consist of buttons, pipe fragments, military accoutrements, jewelry, and etc.

All recovered artifacts and project documents are temporarily stored at the office of Dovetail, in Fredericksburg, Virginia. Artifact processing, marking, and containerization, as well as curation preparation of project documents will be completed by Dovetail and will adhere to the *Guidelines and Standards for the Curation of Archaeological Collections* prepared by the Delaware Division of Historical and Cultural Affairs (DHCA), Delaware State Museum and in consultation with Charles Fithian of the DESHPO.