



**Phase I Archeological Survey
of the Army Creek, Buttonwood and
Gambacorta Dikes
New Castle, New Castle County, Delaware**

prepared for
New Castle Conservation District

by
John Milner Associates, Inc.

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PHASE I ARCHEOLOGICAL SURVEY
OF THE
ARMY CREEK, BUTTONWOOD, AND GAMBACORTA DIKES
NEW CASTLE, NEW CASTLE COUNTY, DELAWARE

prepared for

New Castle Conservation District

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ABSTRACT

This report presents the purpose, goals, methods, and results of Phase I archeological surveys of the Army Creek Dike, the Buttonwood Dike, and the Gambacorta Dike in New Castle, New Castle County, Delaware. The investigation was undertaken by JMA (John Milner Associates, Inc.) from April 23 to May 6, 2013 for the New Castle Conservation District. The purpose of the survey was to assess the archeological sensitivity of the project area for the occurrence of intact precontact and/or historical archeological sites. The assessment included historic background research, an archeological survey with twenty-three (23) shovel tests units (STUs) placed at the Buttonwood Dike, fourteen (14) shovel tests units (STUs) and four (4) excavation units (EUs) placed at the Gambacorta Dike, and recordation of a section of an erosional scarp at the Army Creek Dike. In addition, a ground-penetrating radar survey was conducted along the northern portion of the Gambacorta Dike to investigate for possible archeological resources.

In general, the archeological testing resulted in the documentation of considerable amounts of fill within the project area. At the Army Creek Dike, the recordation of the erosional scarp resulted in the identification of four fill episodes related to the construction, and expansion or maintenance of the dike. The Buttonwood Dike berm was found to contain recent materials, such as plastics and asphalt. No early fill layers were encountered. The upland portion of the APE for the Buttonwood Dike consisted primarily of fill layers related to burying of a marshy area. However, an intact, buried A-horizon was noted along the northeastern part of the STU grid. Artifacts recovered from the buried A-horizon covered a broad date range. At the Gambacorta Dike, extensive filling with household debris and that related to disposal of waste materials and building demolition from the Tasker Iron Works were noted at the western end of the APE. While the remains of core structures of the New Castle Gas Works, and a carriage shop were found at the eastern end of the dike through a combination of a GPR survey and unit excavation.

JMA's recommendation is that each dike is eligible for placement on the National Register of Historic Places (NRHP) under Criterion A for agriculture, transportation, and conservation; Criterion C as representing vernacular landscape architecture; and Criterion D for their potential to provide information important to research questions in historical archeology. JMA also recommends a finding of No Adverse Effect for proposed rehabilitation efforts.

JMA recommends that Phase I archeological investigation may be necessary at the northern end of the Army Creek Dike, but not at the southern end. The need for investigations could not be fully determined at the time of investigations in April because the APE had not been defined. Once the APE has been defined, an assessment should be made as to the necessity of conducting additional investigations.

JMA recommends that no additional work is necessary within the upland portions of the APE for the Buttonwood Dike

JMA recommends in-place preservation at the eastern end of the Gambacorta Dike. If in-place preservation is not feasible, then a Phase II Archeological Evaluation is recommended. Additional work is not necessary at the western end of the dike.

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1.0 INTRODUCTION

1.1 PURPOSE AND GOALS OF THE INVESTIGATION

This report presents the purpose, goals, methods, and results of Phase I archeological surveys of the Army Creek Dike, the Buttonwood Dike, and the Gambacorta Dike in New Castle, New Castle County, Delaware. The investigation was undertaken by JMA (John Milner Associates, Inc.) from April 23 to May 6, 2013 for the New Castle Conservation District. The purpose of the survey was to assess the archeological sensitivity of the project area for the occurrence of intact precontact and/or historical archeological sites. The assessment included historic background research and an archeological survey with twenty-three (23) shovel tests units (STUs) placed at the Buttonwood Dike and fourteen (14) shovel tests units (STUs) and four (4) excavation units (EUs) placed at the Gambacorta Dike. A section of an erosional scarp was recorded at the Army Creek Dike. The extent of the project area for the Army Creek Dike had not been defined at the time fieldwork was conducted; therefore, it was not possible to devise additional investigations. Lastly, a ground-penetrating radar survey was conducted along the eastern portion of the Gambacorta Dike and the adjacent uplands to investigate for possible archeological resources.

JMA's archeological investigations were conducted under Section 106 of the National Historic Preservation Act of 1966, as amended, and conformed to the Secretary of the Interior's *Standards and Guidelines for Archeology and Historic Preservation* (September 1983), as well as guidelines specific to the State of Delaware, including, but not limited to, *A Management Plan for Delaware's Prehistoric Cultural Resources* (Custer 1986a), *A Management Plan for the Prehistoric Archaeological Resources of Delaware's Atlantic Coastal Region* (Custer 1987), the *Management Plan for Delaware's Historical Archaeological Resources* (De Cunzo and Catts 1990), and the *Delaware Statewide Comprehensive Historic Preservation Plan* (Ames et al. 1987). Field investigations were conducted in accordance with DESHPO guidelines (Delaware State Historic Preservation Office 1993, 1997). The project was undertaken through close coordination with the New Castle Conservation District (NCCD), the Delaware Department of Natural Resources and Environmental Control (DNREC), and the Delaware State Historic Preservation Office (DESHPO).

1.2 DESCRIPTION OF THE PROJECT AREAS

The project areas are located in New Castle, New Castle County, Delaware. The areas encompass three dikes, and a portion of the surrounding marsh and uplands adjacent to each (Figure 1). The Buttonwood Dike lies to the north of the Town of New Castle. The dike is 1,800 feet long, and has an elevation spanning from 6 to 10 feet. The Army Creek Dike and the Gambacorta Dike are to the south of town. The Army Creek Dike is 3,600 feet long, and has an elevation spanning 5.5 to 9 feet. The Gambacorta Dike is 1,600 feet long, and has an elevation spanning 5.8 to 8 feet. The width of each dike is from 8 to 10 feet (City of New Castle DMAC). The sluice gates for the Army Creek Dike and the Buttonwood Dike are centrally located. For the Gambacorta Dike, the gate is at the eastern end.

The Delaware River runs along the eastern side of each dike, while the landward side is dominated by marsh. Either a walking path or roadway runs over the top of the dikes. The majority of the length of the banks of each dike are overgrown with trees and brush, and animal burrows are common (Plates 1 and 2). Erosion suffered during Hurricane Sandy varies from severe to marginal. The river side at the Army Creek and Gambacorta dikes underwent substantial erosion at locations along the face and adjacent uplands (Plates 3 and 4). Little erosion is evident at the Buttonwood Dike, where the dike face has been strengthened with riprap in the recent past. Elevations within the project areas range from 0 to 8 feet AMSL (above mean sea level).

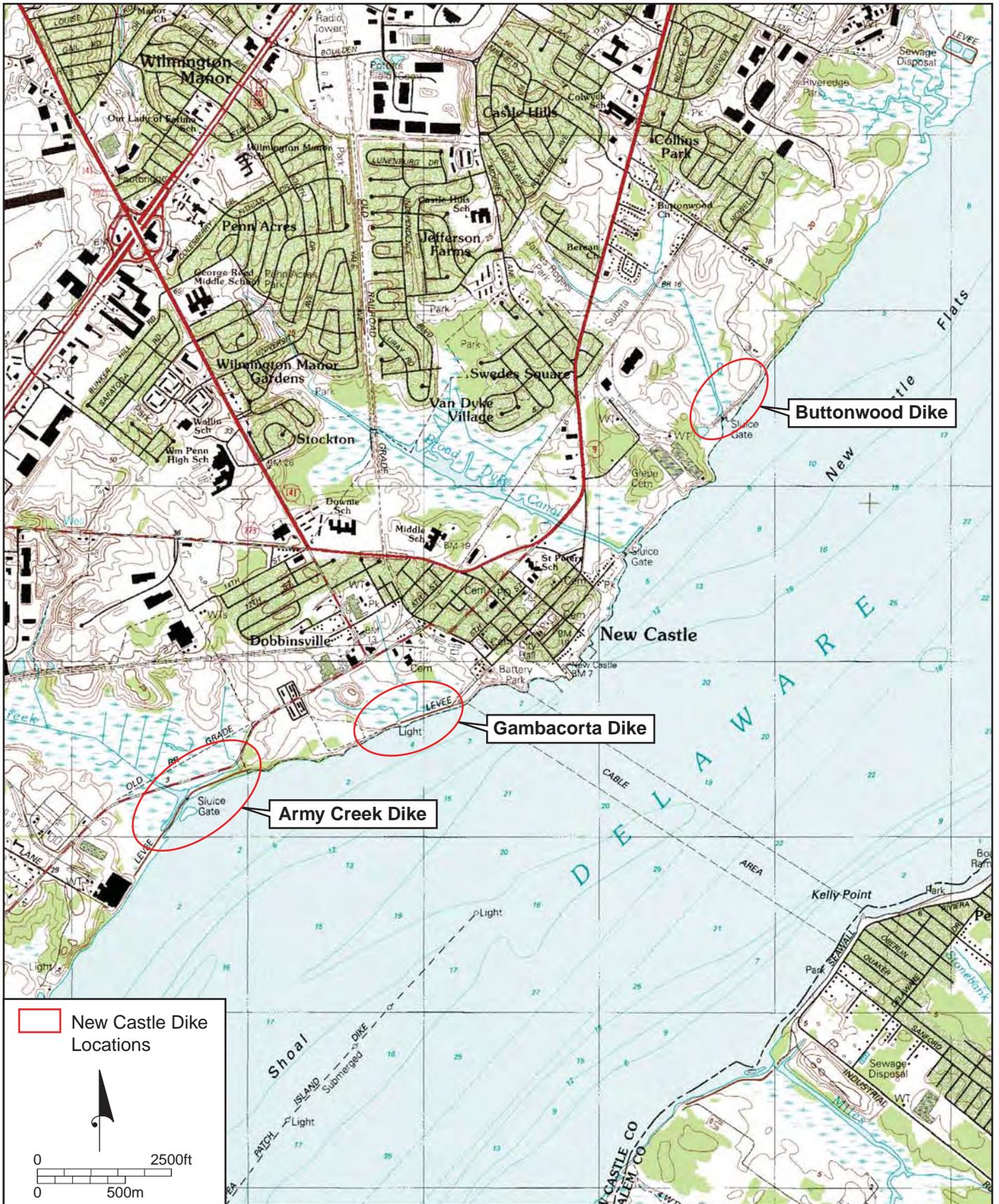


Figure 1. The locations of the Army Creek Dike, the Buttonwood Dike, and the Gambacorta Dike shown on the 1993 7.5-minute USGS Wilmington South, Delaware quadrangle.



Plate 1. View to the south along the top of the Army Creek Dike from the north end.



Plate 2. View to the southeast along the southwest end of the Buttonwood Dike.



Plate 3. A section of the Army Creek Dike bank eroded from the effects of Hurricane Sandy.

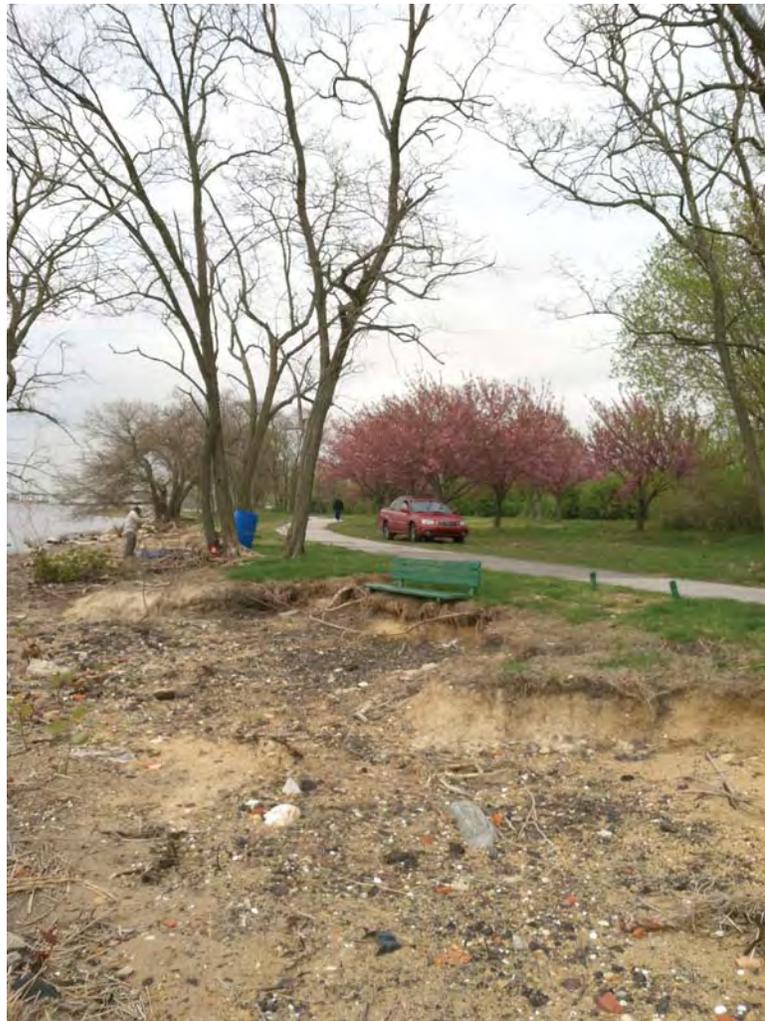


Plate 4. View to the west of erosion of the uplands at the western end of Gambacorta Dike.

Despite commonalities of setting, the landscapes of each dike vary where they meet the uplands. At the Army Creek, the upland portion is a wooded area adjacent to industrial and warehouse structures at the southern end, and a wooded portion of Dobbinsville Park at the eastern end. At Buttonwood, each end of the dike has overgrowth that abuts land associated with industrial and warehouse structures. Lastly, Gambacorta Dike abuts open parkland, with West Fourth Street and Battery Park at the eastern end, and Dobbinsville Park at the western end.

2.0 ENVIRONMENTAL AND CULTURAL CONTEXT

2.1 ENVIRONMENTAL SETTING

The project area lies in the Coastal Plain physiographic province, a relatively flat expanse of Pleistocene/Holocene-age terraces dissected by small rivers (Jordan 1964). The geology within the survey area is classified as the Scotts Corners Formation, a upper-Pleistocene aged deposit. It consists of a heterogeneous unit of light-gray to brown to light yellowish brown, coarse to fine sand, gravelly sand and pebble gravel with rare discontinuous beds of organic-rich clayey silt, clayey silt, and pebble gravel. Sands are quartzose, with some feldspar and muscovite, and laminae of heavy minerals are common. The unit underlies a terrace parallel to present Delaware River that has elevations less than 25 ft. It is interpreted to be a transgressive unit consisting of swamp, marsh, estuarine channel, beach, and bay deposits (Ramsey 2005).

The soils adjacent to the dikes consist primarily of marsh sediment (Figure 2). The USDA has classified the marshes as Transquaking and Mispillion soils (TP), which are tidal, and therefore frequently flooded. At the Army Creek Dike the upland portions are classified as Mattapex-Urban land complex (MuB) with 0 to 5 percent slopes at the southern end, and Othello silt-loam (OtA) with 0 to 2 percent slope at the eastern end. MuB soils are deep and moderately well-drained, and consist of about a meter of yellowish brown to light brownish gray silty loam overlaying a light brownish gray to light gray sandy loam. The Urban classification denotes that the soils have been removed, graded, filled, or otherwise disturbed. OtA is deep and poorly-drained, and consists of a gray to grayish brown silt loam that transitions at approximately 90 cm below surface to a sandy loam, then to sand.

The soil at the southern end of the Gambacorta Dike is also classified as an Othello silt-loam (OtA) with 0 to 2 percent slope. At the northern end the soil is classified as Udorthents (UwA) with 0 to 2 percent slope and a wet substratum. UwA describes areas where the upper soil layers have been removed, filled or graded. They are moderately well-drained, gravelly and sandy soil areas located within areas of glacial fluvial deposits.

The soil at the southern end of Buttonwood Dike is classified as a Mattapex silt loam (MtB) with 2 to 5 percent slopes. At the northern end the soils are classified as a Hambrook-Urban land complex (HmB) with 0 to 5 percent slopes. HmB is a deep and well-drained, and consists of a grayish brown then yellowish brown loam that transitions to a yellowish brown sandy loam at roughly 35 cm below surface, then to brownish yellow to gray sand.

2.2 PRECONTACT CONTEXT

The precontact archeological record of the northern Delmarva Peninsula has been divided into five major periods (Custer 1989):

- 1) Paleo-Indian Period (ca. 14,000–8,500 years before present [B.P.]);
- 2) Archaic Period (8,500–5,000 years B.P.);
- 3) Woodland I Period (5,000–1,000 years B.P.);
- 4) Woodland II Period (1,000–350 years B.P.), and;
- 5) Contact Period (A.D. 1650–A.D. 1750).

The summaries of the precontact time periods given below are based on Custer (1986a, 1984a, 1989), the *Management Plan for Precontact Archaeological Resources of Northern Delaware* (Custer and DeSantis 1986), and Kellogg (1993).

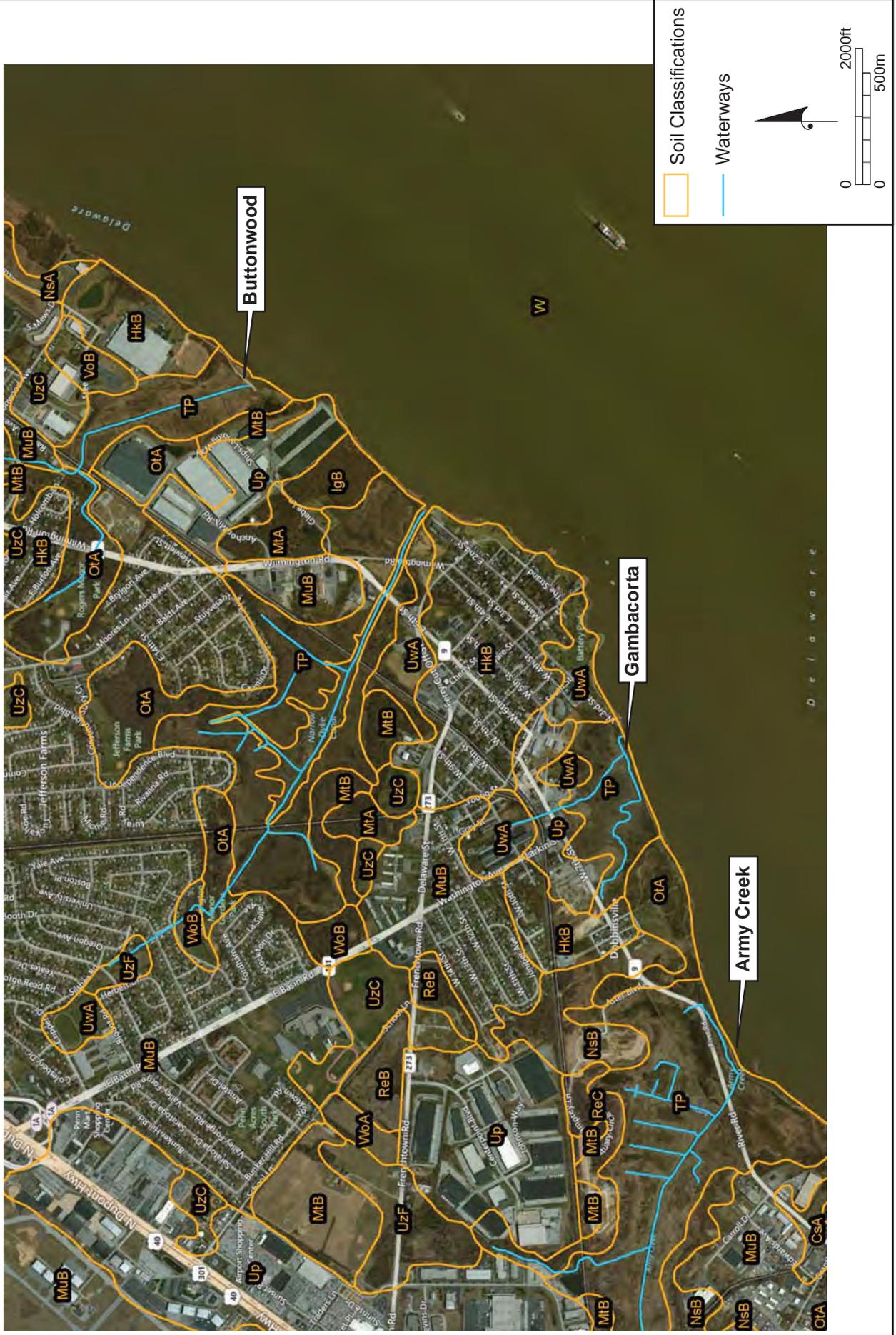


Figure 2. USDA Web Soil Survey Map showing the locations of the Army Creek Dike, the Buttonwood Dike, and the Gambacorta Dike.

2.2.1 Paleo-Indian Period (ca. 14,000–8,500 years B.P.)

Native Americans first inhabited Delaware sometime after 14,000 years B.P., beginning during the recession of the last glaciation, based on dates from Paleo-Indian period sites in the eastern United States (Custer 1989:81–86). Paleo-Indian peoples probably led a wandering existence in small family groups living mainly by hunting on the shifting woodland and grassland mosaics of the postglacial landscape. Game animals may have included musk ox, caribou, moose, and the extinct mastodon; however, modern game animals, such as white-tailed deer, were also present in the region (Custer 1989:95–98). The Paleo-Indian stone tool kit was designed for hunting and processing animals. Careful resharpening and maintenance of tools was common because of a preference for rare, fine-grained, and often colorful lithic material. Distinctive fluted points are diagnostic of the early Paleo-Indian period and show the preference for high-quality stone (Custer 1984b). Fresh water became a critical resource for both game animals and the hunters who stalked them as solar warmth increased in the early Holocene. Late Paleo-Indian period sites dating after 10,000 years B.P. are relatively rare in Delaware and in the Mid-Atlantic region in general. The known sites are often small and ephemeral, indicating a transitory occupation and a low population density (Custer 1989:120–121).

2.2.2 Archaic Period (8,500–5,000 years B.P.)

The beginning of the Archaic period in Delaware is marked by major changes in human adaptations (Custer 1989:122). By 9,000 years B.P., solar radiation had reached a maximum, and northern species of plants and animals had migrated northward out of the Mid-Atlantic region. Temperate plant and animal species were more common, and climatic patterns had become more like those of the present. The Blueberry Hill site in Kent County, Delaware is one of only a few well-documented, Early Archaic sites known in Delaware (Heite and Bloom 1995). The Early Archaic occupation is buried under windblown sand. Few other Archaic sites have been excavated in Delaware, so much of what is known is extrapolated from other areas (Custer 1989:127–129).

During the Archaic period, human adaptations became more generalized, and foraging for plant food resources was an important activity. Archaic tool kits were less specialized than the earlier Paleo-Indian tool kits and included a wide variety of plant-processing tools, such as grinding stones, mortars, and pestles. A seasonal, mobile lifestyle exploiting a wide range of resources and settings was probably common. Some archeological evidence suggests resources were exploited on a seasonal basis by flexible kinship-based groups (Custer 1989:129). A study of Archaic site distributions on the Delmarva Peninsula (Custer 1986b) found that despite the changes in adaptations between the Paleo-Indian and Archaic time periods, the types of places chosen for occupation were similar. Archaic sites, however, occur in a wider variety of settings. Site-distribution maps for the Delmarva Peninsula (Custer 1989:132) show that swamp settings were still preferred by people using bifurcate-base stone points that date to approximately 7,500 years B.P. Archaic-period sites appear to have been occupied for longer periods of time. Exchange of stone tools tied together people across large areas of the eastern United States, providing a basis for the more elaborate exchange networks established later (Custer 1989:140).

2.2.3 Woodland I Period (5,000–1,000 years B.P.)

The Woodland I period has been correlated with dramatic changes in local climates and environments that occurred throughout the Mid-Atlantic region (Custer 1984a:75, 1989:176–184). Although Custer considers warmer and drier conditions as one cause for the cultural changes seen, in actuality, the climate was becoming generally cooler and moister (Joyce 1988; Stevens 1991). Continued sea-level rise brought extensive brackish water marshes with high biological productivity to within the vicinity of the present coastline of Delaware (Fletcher et al. 1990; Knebel et al. 1988). Woodland I settlement patterns reflect a

much more extensive use of the landscape, higher population densities, and a more sedentary lifestyle. Many sizable “macroband” base camps occupied by large numbers of people occur in many areas of the Delmarva Peninsula. The sites suggest a higher population density than earlier base-camp sites, and some sites may have been occupied year-round. From large base camps, smaller task or kin groups exploited the surrounding countryside, establishing smaller base camps and procuring and processing food. Woodland I sites are, thus, very common in the region.

Woodland I tool kits include some major new additions. Soapstone, and then ceramic, containers were added to the artifact assemblages. These durable containers allowed more efficient cooking of some types of food and also may have facilitated storage of surplus food. Plant-processing tools became increasingly more common, as well, indicating intensive wild plant harvesting for food. Chipped-stone tools changed little from the preceding Archaic period; however, broad-bladed, knife-like processing tools increased in number. Also, the presence of nonlocal lithic raw materials indicates that regional trade and exchange systems were beginning to develop (Custer 1984c). Caching (storage) of special artifact forms may also signify the development of class, or status, differences in the societies.

2.2.4 Woodland II Period (1,000–320 years B.P.)

In some areas of the Mid-Atlantic region, agriculture and large-scale village life mark the Woodland II period (Custer 1996:263–300; Stewart 1994). In northern Delaware, subsistence patterns in the Woodland II period are similar to those of the Woodland I period, but small amounts of cultivated plants were added to the diet. In general, settlement patterns appear to have changed little from the Woodland I period, and the Management Plan Study Units for the Woodland II period are the same as for the Woodland I period (Custer and DeSantis 1986:54–58).

Changes in ceramic technologies and projectile point styles make Woodland II archeological sites recognizable. Triangular projectile points appeared in stone tool kits immediately before the beginning of the Woodland II period, and by 1,000 years B.P., triangular projectile points are the only styles found. Woodland II ceramics of northern Delaware fall within the Minguannan series (Custer 1984a:146–157). The distribution of Minguannan pottery is not well established, but it is concentrated in northern Delaware. Townsend ceramics are common in southern Delaware but apparently are rare in New Castle County (Custer 1989:302–308). The appearance of more-complex decorations, including incised lines and cord-wrapped stick impressions, distinguish Woodland II ceramic styles from Woodland I ceramics.

2.2.5 Contact Period (A.D. 1630–A.D. 1750)

The Contact period began with the first substantial European settlements in Delaware. The archeology of the Contact period is problematic. Only two possible Contact-period Native American archeological sites have been proposed for Delaware. Site 7NC-E-42 (Custer and Watson 1985) is in the Clyde Farm Historic District. No diagnostic European artifacts were found in association with aboriginal material, but stratigraphic interpretation suggested a Contact-period component (Custer and Watson 1985:114). In southern Delaware, Contact-period occupation has been reported for the Townsend site (Omwake and Stewart 1963); however, the associations between European and Native American artifacts were not well documented (Custer 1984a:177).

2.3 HISTORICAL CONTEXT

Delaware’s recent past, comprising approximately three centuries, has been compartmentalized into five temporal study units, as defined by the *Delaware Comprehensive Historic Preservation Plan* (Ames et al.

1987). These units form the basis for an appropriate chronological framework for the investigation of the state's historic resources:

- 1) Exploration and Frontier Settlement (1630–1730);
- 2) Intensified and Durable Occupation (1730–1770);
- 3) Transformation from Colony to State (1770–1830);
- 4) Industrialization and Early Urbanization (1830–1880); and
- 5) Urbanization and Suburbanization (1880–1940).

2.3.1 Exploration and Frontier Settlement (1630–1730)

The first permanent European settlement in the area now encompassed by New Castle County occurred in 1638 when a group of Swedish settlers in the employ of the New Sweden Company constructed Fort Christiana in what is now part of the City of Wilmington. During the century between this initial settlement and the end of the period in 1730, New Castle County was under the political, social, and economic control of three separate and distinct colonial jurisdictions: Swedish (1638–1655), Dutch (1655–1664), and English (1664 to the American Revolution). Each of these colonial experiences left their particular mark on historic settlement patterns in northern Delaware.

For the nearly decade and a half that it existed, the New Sweden colony was sporadically supported by the Swedish government. Fort Christiana, located at the confluence of the Brandywine and Christina creeks, became one of the centers of the colony (Weslager 1987). Within a decade of settlement, the homesteads of Swedish and Finnish farmers extended along both sides of the Delaware River between present-day Wilmington and Philadelphia. Despite its geographic extent, the Swedish community remained small, with an estimated population of no more than 250–300 people (Munroe 1978). The Swedes either lived in small, fortified settlements like that which developed around Fort Christiana or on widely scattered, independent farmsteads located along the Delaware River and the lower reaches of its tributaries, such as the Christina. The Delaware River and its tributaries provided the major means of transportation and communication between the isolated homesteads of the New Sweden colony.

The purpose of the New Sweden Company was commerce, and the company employees were concerned primarily with profit-making ventures such as the cultivation of tobacco and trade with the Indians for pelts and hides. For most of the years that this settlement existed, Sweden had great difficulty finding people who were willing to emigrate to the colony on the Delaware, due to war, prosperity in the homeland, and the difficulties of the Atlantic voyage. Most of the early Swedish settlers were either employees of the company, bond servants, or convicts, and few of these individuals intended to become permanent inhabitants of the Delaware River valley. By 1647, after almost a decade of settlement, the colony of New Sweden consisted of fewer than 200 people, and in the six years between 1647 and 1653 no ships, individuals, or letters arrived in the colony from Sweden (Munroe 1978:25–27). The last expedition to arrive in New Sweden in 1654 contained approximately 350 settlers and soldiers.

In an effort to coordinate the study of above-ground and archeological cultural resources, these temporal study units were adopted unaltered in the *Management Plan for Delaware's Historical Archaeological Resources* (De Cunzo and Catts 1990:119).

By 1647, the Dutch West India Company in New Amsterdam recognized that the Swedes posed a potential threat to their colonial interests along the Delaware River, especially with regard to control of the fur trade. Accordingly, they reoccupied Fort Nassau on the east side of the Delaware River and erected a new fortification, called Fort Beversreede, at the mouth of the Schuylkill River in southeastern Pennsylvania (Myers 1912:43; O'Callaghan 1858:58). Essentially the Dutch claimed the land that the Swedish colony occupied — from the Schuylkill River south — by right of prior discovery. In 1651, the

West India Company responded to the Swedish colonization by building Fort Casimir at the Sandhook, the present site of New Castle. The Swedes, recently reinforced, retaliated by seizing the fort in 1654 and renaming it Fort Trinity (Trefaldighet). A year later, in 1655, the Dutch reacted by dispatching a large military expedition (7 ships and over 300 men) to the Delaware River valley. The expedition not only recaptured Fort Trinity, but also captured Fort Christina, the principal Swedish garrison in the colony (Dalhgren and Norman 1988). As a result, New Sweden ceased to exist as a political entity. Nonetheless, many Swedish and Finnish families remained in the region, continuing to observe and maintain their own customs and religion.

In 1657, as a result of peaceful negotiations, the City of Amsterdam acquired Fort Casimir from the West India Company, founding the town of New Amstel near the fort. This was a unique situation in American colonial history — a European city became responsible for the governance of an American colony. Two years later the Dutch erected a small fort near the mouth of the Delaware Bay (modern Lewes), known as the Whorekil (also spelled Hoerenkil, Horekill, and Hoorekill) for the purpose of blocking English incursions. The Dutch were most concerned with English settlers from the Chesapeake and Virginia, since Lord Baltimore considered the lands on the eastern shore of the Chesapeake and extending to the western shore of the Delaware River as part of his proprietorship (De Cunzo and Catts 1990:30).

For the decade that they maintained it, the Dutch colony along the Delaware River centered on their settlements at New Amstel (present-day New Castle), and at the Whorekil. Like the Swedes, the Dutch settlers appear to have resided on dispersed, subsistence farms where they engaged in general farming and animal husbandry. New Amstel served as the religious and commercial center of Dutch settlement in the lower Delaware River valley. Villages also developed around Swedish settlement sites at the remains of Fort Christina (Wilmington), Upland (Chester), and Wiccaco (the Southwark section of Philadelphia).

English hegemony of the lower Delaware River valley began in 1664 when Sir Robert Carr, acting on behalf of James Stuart, Duke of York, commanded a military expedition that attacked and captured the Dutch settlement at New Amstel. The settlement at the Whorekil was also seized and pillaged by the English. Initially, the former Dutch colonies in North America were governed by the English as a royal colony belonging to the Duke of York. The seizure of New Netherlands served to eliminate Dutch competition in the tobacco trade and to consolidate, under the control of Charles II, the Hudson and Delaware River valley settlements with those in New England and on the Chesapeake (Bridenbaugh 1976:157).

In 1682, the “Lower Counties,” consisting of New Castle, Kent, and Sussex, were conveyed to William Penn and annexed to Pennsylvania (Munroe 1978). In 1704, Delaware became a separate colony with the establishment of its own assembly but retained close ties with Pennsylvania until the American Revolution. Following Penn’s arrival in New Castle, the settlements along the western shore of the Delaware were incorporated into a larger English regional economy centered in Philadelphia, a commercial hub that quickly began to dominate the economic scene in the lower Delaware valley. The Lower Counties were part of Philadelphia’s economic hinterland, which also included western New Jersey, northeast Maryland, and southeastern and northeastern Pennsylvania (Lindstrom 1978; Walzer 1972). Farmers in the region sent their grains to local milling and shipping centers, where wheat flour and bread were then transported to Philadelphia or shipped directly for export to the West Indies, other North American colonies, and southern Europe. Farmers in New Castle County quickly adapted to this market system, having already adopted wheat in favor of tobacco as the basic cash crop by the beginning of the eighteenth century. During this period it has been estimated that over one-half of the farmsteads in the region were located within 8 miles (or a half-day’s journey) of a mill or shipping wharf (Walzer 1972:163). Other industries, notably lumber for naval stores and the mining and smelting of iron, were also begun in the county during this period, and by the start of the eighteenth century, a community of Welsh miners/settlers resided in the vicinity of Iron Hill in northwestern New Castle County.

During the 1680s, many English, Welsh, Scottish, and Irish Quaker settlers took up land in northern Delaware. Presbyterian Scottish and Scots-Irish servants began to arrive in the area after 1690 (Bridenbaugh 1976:162). Other immigrants to the valley included settlers relocating from other colonies, such as Virginia, Maryland, and New England, the Jerseys, and New York. Enslaved Africans were also brought to the lower Delaware River valley during this early period.

Under the jurisdiction of the Duke of York, the bounds of New Castle County were defined in 1673, and three years later, in 1676, the first county taxes were collected. In the vicinity of the project area, settlement on the north side of the Christina River had extended at least as far upstream as Bread and Cheese Island by 1670. By 1671, three individuals were listed as the residents of Bread and Cheese Island, and five persons were listed as inhabitants of “Christeene” (Gerhing 1977). In 1676, 65 taxables were recorded as residents along the north shore of the Christina River, and seven years later that number had increased to 87 taxables (Scharf 1888:611–612).

During this period, dwellings and, as they were termed, “plantations,” were generally situated on well-drained soils with small agricultural fields located close by. Agriculture remained the principal economic activity of the area. An agricultural system of this type suggests that plantations dating from this period will exhibit an intensive use of the land in the immediate vicinity of the dwelling and associated outbuildings, along with a patchwork of new and old fields, but with large portions of the tract kept in woodland and marsh for forage. Structures present on agricultural complexes dating to this early period would include small dwelling houses generally built of wood (log and frame), with fewer numbers constructed of brick and stone. Dwelling plans included a range of traditional options, such as hall, hall-parlor, double-cell, cross-passage, and four-room (Herman 1987:27). House foundations might occasionally be constructed of brick or stone, but more generally were of earthfast or impermanent construction, a building style that characterized much of the architecture in British North America during this period (Carson et al. 1981; Kelso 1984; Herman 1987:84). A range of outbuildings such as kitchens, tobacco and grain sheds, barns, springhouses, smokehouses, and meat houses would have been present on farmsteads (Herman 1987:61–72).

2.3.2 Intensified and Durable Occupation (1730–1770)

By the middle decades of the eighteenth century, population growth and commercial expansion spurred the growth of towns and the further development of transportation routes and industry. The continued shift in agricultural production from tobacco to marketable grain, begun in the previous period, was completed by the American Revolution, thus opening up new areas of cultivation during this period.

In New Castle County there was a tremendous influx of English and Scots-Irish immigrants during the thirty years between 1725 and 1755. The majority of these new arrivals were indentured servants but also included other Europeans as well as enslaved Africans (Munroe 1978; Bailyn 1986). By 1740 the population of New Castle County was estimated to be 6,000 (De Cunzo and Catts 1990:42).

During this period there was a renewal of town growth based on internal trade networks (Lemon 1967). Several villages, such as Newport, Christiana Bridge, and Cuckoldstown (modern Stanton), were either founded or began to prosper at this time. Willing-Town, later called Wilmington, experienced rapid growth as a market town, specializing in ships’ provisions and the shipment of agricultural products to the West Indies. With the increasing export of agricultural produce, milling became an important part of the local economy. By the time of the American Revolution, millseats were found on virtually every stream in northern Delaware capable of generating a sufficient head of water to support a merchant mill (Hancock 1987; Conrad 1908).

Farming and agricultural pursuits were the most significant occupations for between 80 and 90 percent of the region's population (Egnal 1975:201). In the project area, farming took the form of mixed husbandry, combining the cultivation of grains and the raising of livestock (Bidwell and Falconer 1941:84). During the 40 years spanned by this time period, farm sizes in the Piedmont and Upper Peninsula region of New Castle County averaged 320 acres, but properties ranging from 200 to 299 acres were advertised with the greatest frequency in the county. Cleared and/or cultivated land on these farms averaged between 15 and 20 percent of the total acreage (De Cunzo and Catts 1990:47).

The shift from earlier, primarily subsistence agriculture to large-scale commercial agriculture is apparent during this period and was mirrored by alterations in the placement of farms and farmstead layouts. More fields were necessary for grain agriculture, requiring the clearing of additional land and shifts in the locations of agricultural complexes. Beginning in the 1740s, Georgian architectural forms began to appear in the county, and more permanent methods of construction and material types were used (Carson et al. 1981; Herman 1987:26,109–110). Outbuilding types reflected the changes in agriculture, with a general disappearance of tobacco sheds, the erection of more durable granaries and barns, and the addition of structures related to home manufactures (De Cunzo and Catts 1990:49).

2.3.3 Transformation from Colony to State (1770–1830)

The American Revolution serves as a watershed for the both the end of the last period and the beginning of the new era. The Revolution had a significant impact on the economic and social lives of New Castle County's inhabitants. Maritime activities were disrupted along the Delaware River and its tributaries caused by the British blockade and by raiding activities of British foraging parties. Social and political unrest were widespread, in part caused by economic disorder but also by the pro-Loyalist outlook of some of the state's inhabitants.

Several military campaigns swirled through the project area, the first in the fall of 1777 when a large army composed of British and German auxiliaries disembarked at the head of the Chesapeake Bay and marched through Newark and Hockessin toward Philadelphia. After the battle of Cooch's Bridge (September 3, 1777), Continental troops occupied the villages of Christina, Stanton, and Newport. Shortly thereafter, British troops seized Wilmington, and during the harsh winter of 1777–1778 the port town was garrisoned first by British and then American forces (Cooch 1940). A second major, but equally brief, campaign passed through the project area in the summer of 1781, when Washington's army and its French allies headed south to besiege British troops at Yorktown, Virginia. The effects of nearly seven years of warfare and the social and economic upheavals associated with war strongly affected the general character of the project area, resulting in property damage, deterioration of overland and water transportation, destruction of agricultural crops and livestock, and diminished grain yields.

The project area and surrounding region remained predominantly agricultural during this period. However, a decline in wheat prices and increased competition for good land throughout the region were accompanied in the area by a decline in the fertility of agricultural lands. Wheat was still the dominant crop produced, but poor farming methods, erosion, and soil exhaustion from over a century of farming contributed to the economic woes of Delaware farmers. Out-migrations of frustrated farmers for newly opened western lands created a labor shortage that made cultivation of exhausted and marginal lands less profitable. In the Piedmont and Upper Peninsula areas of Delaware, a period of reorientation and reorganization of the agricultural landscape occurred, as less productive and worn-out farms were abandoned and consolidated into the larger holdings of wealthier farmers (Herman 1987).

While agriculture was in a state of decline and fluctuation, commerce and manufacturing, particularly in the Upper Peninsula and Piedmont regions of the state, flourished, and between 1790 and 1810 commerce

prospered as never before (Welsh 1956). After the Revolution the region saw relatively rapid industrial and urban growth, and the loss of agricultural jobs was partly offset by the development of new sources of industrial and commercial income and employment (De Cunzo and Catts 1990:59). By 1815, the Christina River and its tributaries, Red Clay and White Clay creeks, were the power source for 46 mills or manufactories including gristmills, sawmills, cotton and woolen mills, and paper, oil, snuff, slitting, and glazing mills (Coleman et al. 1984:47).

2.3.4 Industrialization and Urbanization (1830–1880)

The economic crises of the early decades of the nineteenth century contributed to an agricultural revolution in Delaware, and farmers in the area began to diversify their production. Developments in industrialization, urbanization, and transportation significantly affected the project area (De Cunzo and Garcia 1992:25).

Farmsteads in Delaware at the time averaged a little over 200 acres, but those in the Piedmont were generally about 100 acres in size, and by the start of the period most farmers had between 60 and 70 percent of their acreage improved. In New Castle County, farmland accounted for nearly 90 percent of the total available land in the county. Between 1830 and 1880, both the total number of farms and the number of acres of land in cultivation grew, indicating that land previously considered agriculturally marginal, such as drained marshland, was brought under cultivation (De Cunzo and Garcia 1992:26). Piedmont farms during this period were intensively cultivated, with emphasis on dairying and feeder cattle, supplemented by wheat and market truck farming. Farms tended to be family operated, with relatively little hired farm labor. The advent of farming machinery by the middle decades of the century aided in increasing output and profits from relatively small holdings (De Cunzo and Garcia 1992:64).

2.3.5 Urbanization and Suburbanization (1880–1940)

At the beginning of the twentieth century New Castle County held 59 percent of the population in the state, of which 70 percent lived in Wilmington (De Cunzo and Catts 1990:77). A large number of the population were recent Eastern and Central European immigrants (Hoffecker 1974). Between 1870 and 1900, Delawareans employed in agriculture declined from 39.5 percent to 26 percent, while the number employed in manufactures increased from 23.5 percent to over 31 percent. The value of manufactured products compared to agricultural products also increased proportionately, most notably in the Piedmont region near the industrial and commercial center of Wilmington (De Cunzo and Garcia 1992:27). The size of farms and the total farm acreage declined significantly, suggesting a period of farm abandonment or adaptation that was coincident with early suburbanization (De Cunzo and Catts 1990:78).

Large-scale industrialization occurred primarily in the Piedmont region, while small-scale manufacturing set within a largely agricultural economy was typical elsewhere in the state. Completion of the Dupont Highway in 1923 made new areas productive for agriculture, and enabled production for non-local markets to become dominant (De Cunzo and Catts 1990:84-85).

2.4 CULTURAL RESOURCES IN THE VICINITY OF THE APE FOR ALL THE DIKES

Archeological sites recorded with the Delaware State Historic Preservation Office within the vicinity of the APE for each dike exist only within the Town of New Castle. The only recorded site immediately adjacent to the APE for a dike is that of Fort Casimir (7NC-E-105E), which is located at the end of Chestnut Street, and southwest of the southerly end of the Broad Marsh Dike. The site will be discussed in the report on the Broad Marsh Dike, which will be submitted under separate cover (Mancl et al.

forthcoming). Archeological investigations have been conducted at twenty additional locations within the boundary of the New Castle Historic District, for a total of twenty-one recorded sites (Table 1).

Table 1: Locations of archeological investigations the boundary of the New Castle Historic District

Location	Archeological Site No.
New Castle Courthouse	7NC-E-105A
Immanuel Church	7NC-E-105B
George Read House and Gardens	7NC-E-105C
The Arsenal	7NC-E-105D
Fort Casimir	7NC-E-105E
Garden of the Dutch House	7NC-E-105F
Amstel House Garden	7NC-E-105G
Gunning Bedford House Garden	7NC-E-105H
Tile House Site	7NC-E-105J
S. Guthrie House (30 The Strand)	7NC-E-105K
1 The Strand	7NC-E-105L
28 The Strand	7NC-E-105M
58 The Strand	7NC-E-105N
128 East Second Street	7NC-E-105P
8 East Third Street	7NC-E-105Q
26 East Fourth Street	7NC-E-105R
54 East Fourth Street	7NC-E-105S
19 West Fourth Street	7NC-E-105T
Marble Hall	7NC-E-105U
312 Delaware Street	7NC-E-105V
8 The Strand	7NC-E-105W

In addition to site-specific investigations, in 1989 Heite Consulting, Inc. prepared an archeological preservation plan for the town (Heite and Heite 1989). Of the areas discussed in the plan, the northernmost boundary is the southern end of the Broad Marsh Dike, while the southernmost boundary is the eastern end of the Gambacorta Dike. Within Battery Park, the authors anticipated an inverse soil stratigraphy resulting from two major filling episodes, the first from filling of the marsh at the eastern end, and the second from creation of the park. Archeological sensitivity within the park was considered to be the former location of the New Castle Gas Works at the western end, and the locations of the New Castle and Frenchtown Railroad engine yard and a slaughterhouse that appeared on the 1804 Latrobe map at the eastern end. In addition, the slaughter house structure was reported to be a hospital for ship fever victims, with those that died being buried nearby. The location of the former battery, referred to in the preservation plan as “a small hill,” was considered to be sensitive for evidence of early settlement. Lastly, it had been reported to the authors that the former marsh at Battery Park was filled by the New Castle and Frenchtown Railroad with soils from Bull Hill, a formerly elevated area at the north end of New Castle. Therefore, the fill could contain human remains from the Potter’s Field that once existed at Bull Hill (Heite and Heite 1989:35-36). New Castle resident Irving Thatcher said, however, that the area of the Potter’s Field had been leveled in the 1940s, at which time local boys collected bones and reburied them on the hill at what is now 120 The Strand. The human remains were against displaced when a house was built at the location. Mr. Thatcher stated that he did not know to where the remains were removed, but suspected they could have been pushed downhill toward the river (Personal Communication June 6, 2013).

2.5 PROJECT AREA HISTORIC BACKGROUND

2.5.1 The Army Creek Dike

Army Creek was referred to historically as Mill Creek. The Mill Creek Company formed in 1775. A copy of the original act forming the company may be in county deed records, but was not located. The original enrolled bill no longer exists, having been taken by the British during the Revolutionary War. However, the legislature upheld its validity when the company petitioned to supplement the act in 1781. When passed, the 1781 act nullified the previous agreement, and Isaac Grantham, one of the owners, was appointed manager (Enrolled Bills 1781). In 1791 the act was supplemented to enable the digging of a canal along the creek channel to improve the drainage of upstream parts of the marsh (Enrolled Bills 1891). In 1843 the present owners, none of whom are named, petitioned to reform the company and be granted permission to undertake repairs (Enrolled Bills 1843).

Typical of bills submitted for the formation of a marsh company, the owners of the marsh, stipulated as being those who held at least five acres of meadow, marsh, or cripple behind the dike, were to be taxed proportional to their holdings (Table 1). Uncharacteristically, the act also divided proportionally sections of the dike among the owners, for which they were responsible for repair and maintenance. Excluded from the division of the dike were two sections allotted to the manager of the company, that which would contain a new sluice and that containing the old sluice, which was called Yeates's Trunk (Figure 3; Enrolled Bills 1781). In essence, individual owners were responsible for an assigned section of the bank, while collectively everyone belonging to the company contributed to the costs associated with the sluices.

The proposed new sluice, whose location matches that of the present-day sluice, was to be built 13.25 perches (218.6 feet) northeast of the old sluice. The old sluice fell within a 37-foot long space along the dike. The new sluice, stipulated as needing to be "large and sufficient," was to be constructed within a 123-foot space along the dike. When installing the new sluice, the manager was instructed to take the soils removed to fill the location of the old sluice. The manager was also made responsible for building a wharf or abutment at the southwest end of the dike beyond to keep the river from eroding the bank, and for providing a means of keeping the uplands at the north end from eroding (Enrolled Bills 1781).

Depictions of the dike, which are available starting in 1901, indicate that the path and location of the sluice, which matches the location described for the "new sluice" in 1781, has remained unchanged (Figures 4-9).¹

Table 2: Persons and Acreage owned of the Mill Creek Marsh in 1781.

Person	Acreage
Joseph Tallow	9
John Clark	24
Richard M. William	70
Thomas Moore	9.5
Samuel Ruth	16
Isaac Grantham	20
John & Donald Yeats	61

¹The dikes that are the subject of this study were not depicted on some maps from the second half of the nineteenth century that were consulted. In these instances only the waterway was shown at the location of a dike. An exception is at the Gambacorta Dike, which was depicted as a road, and later a railroad bed. In addition a short length of the north end of the Army Creek Dike was depicted in an Orphan's Court Plot dated 1810.

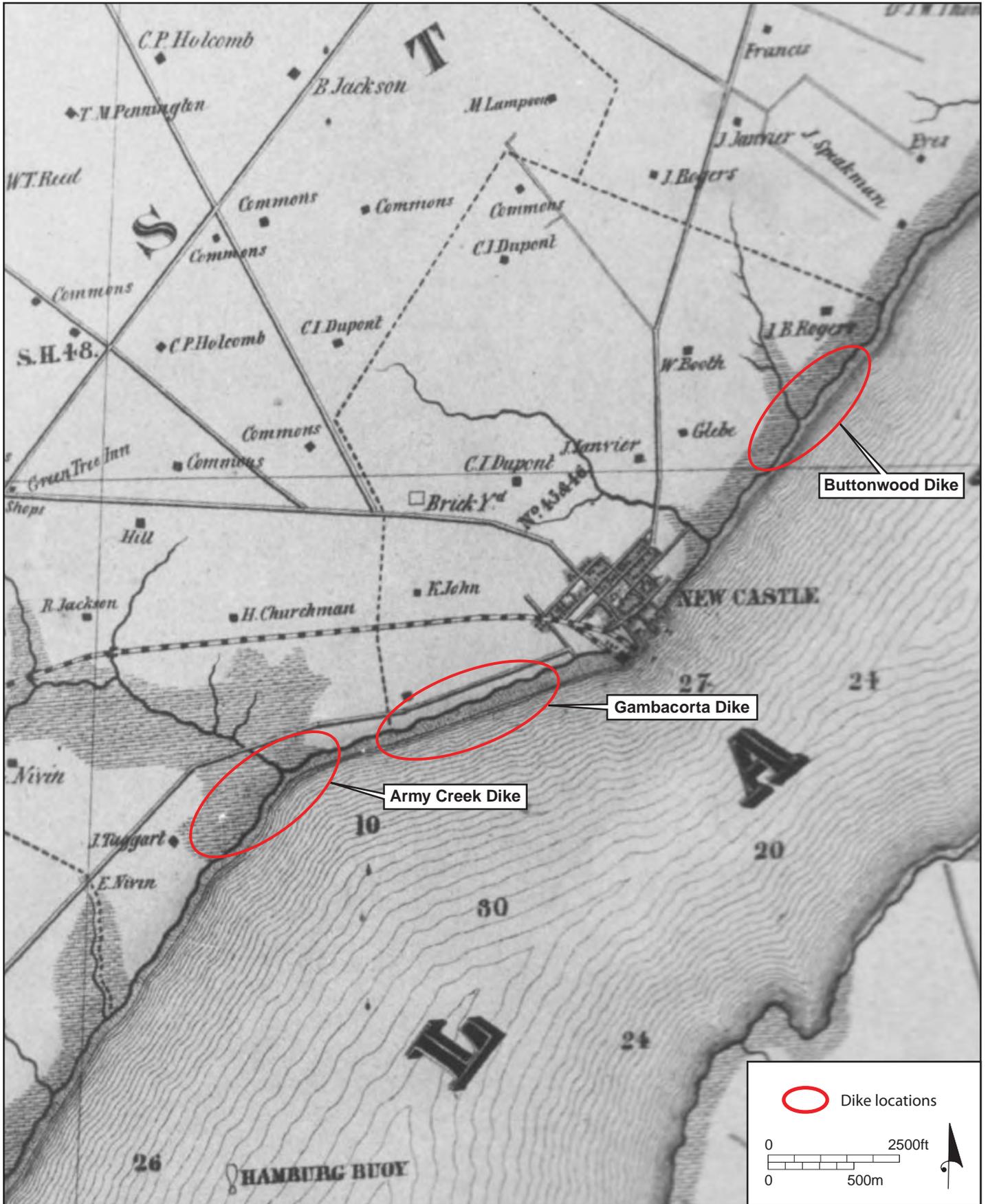


Figure 3. 1848 Rea and Price Map of New Castle County, showing the locations of the Army Creek Dike, the Gambacorta Dike, and the Buttonwood Dike.

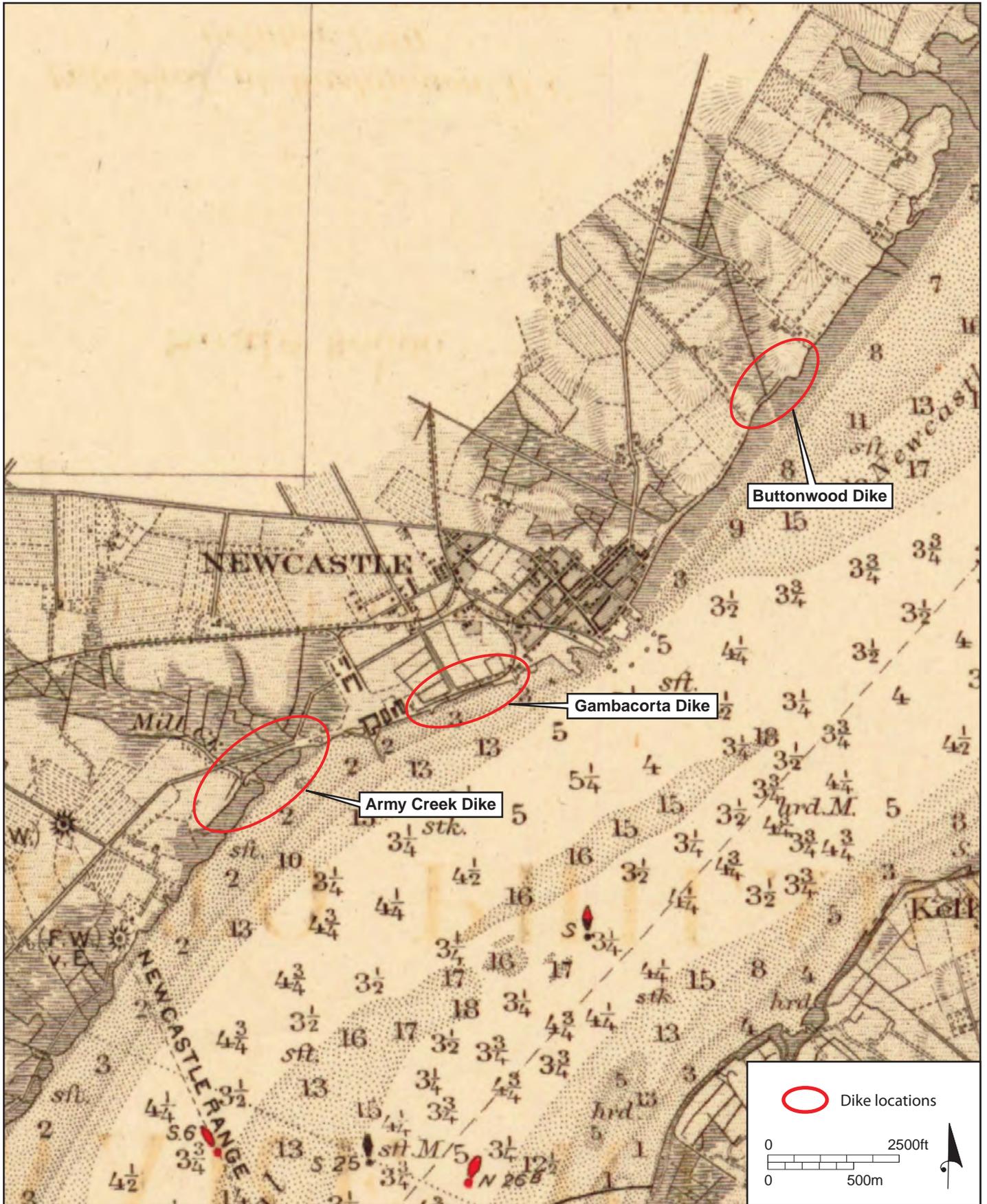


Figure 4. 1901 Coast and Geodetic Survey map showing the locations of the Army Creek Dike, the Gambacorta Dike, and the Buttonwood Dike.

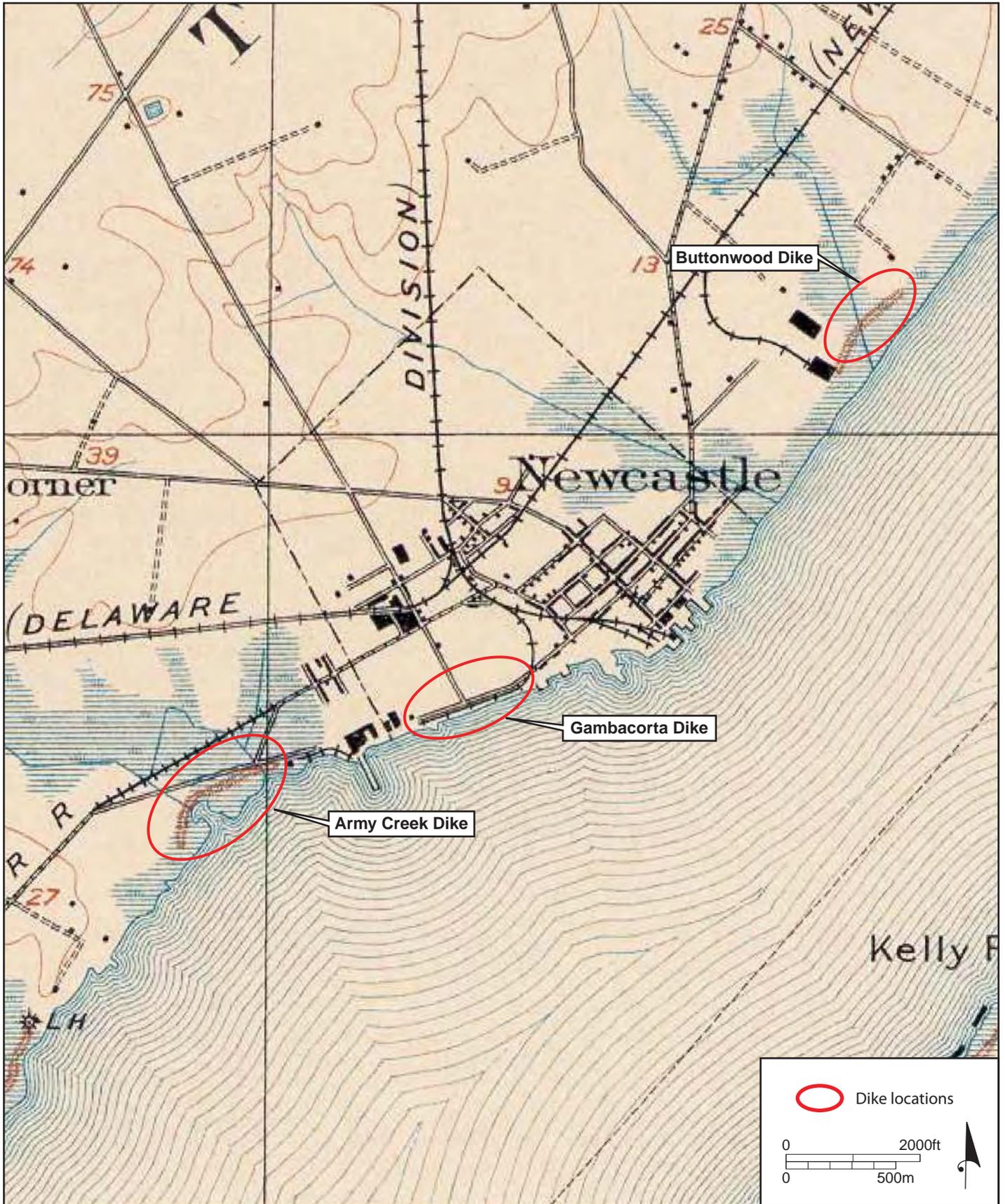


Figure 5. 1906 USGS *Wilmington* Quadrangle showing the locations of the Army Creek Dike, the Gambacorta Dike, and the Buttonwood Dike.

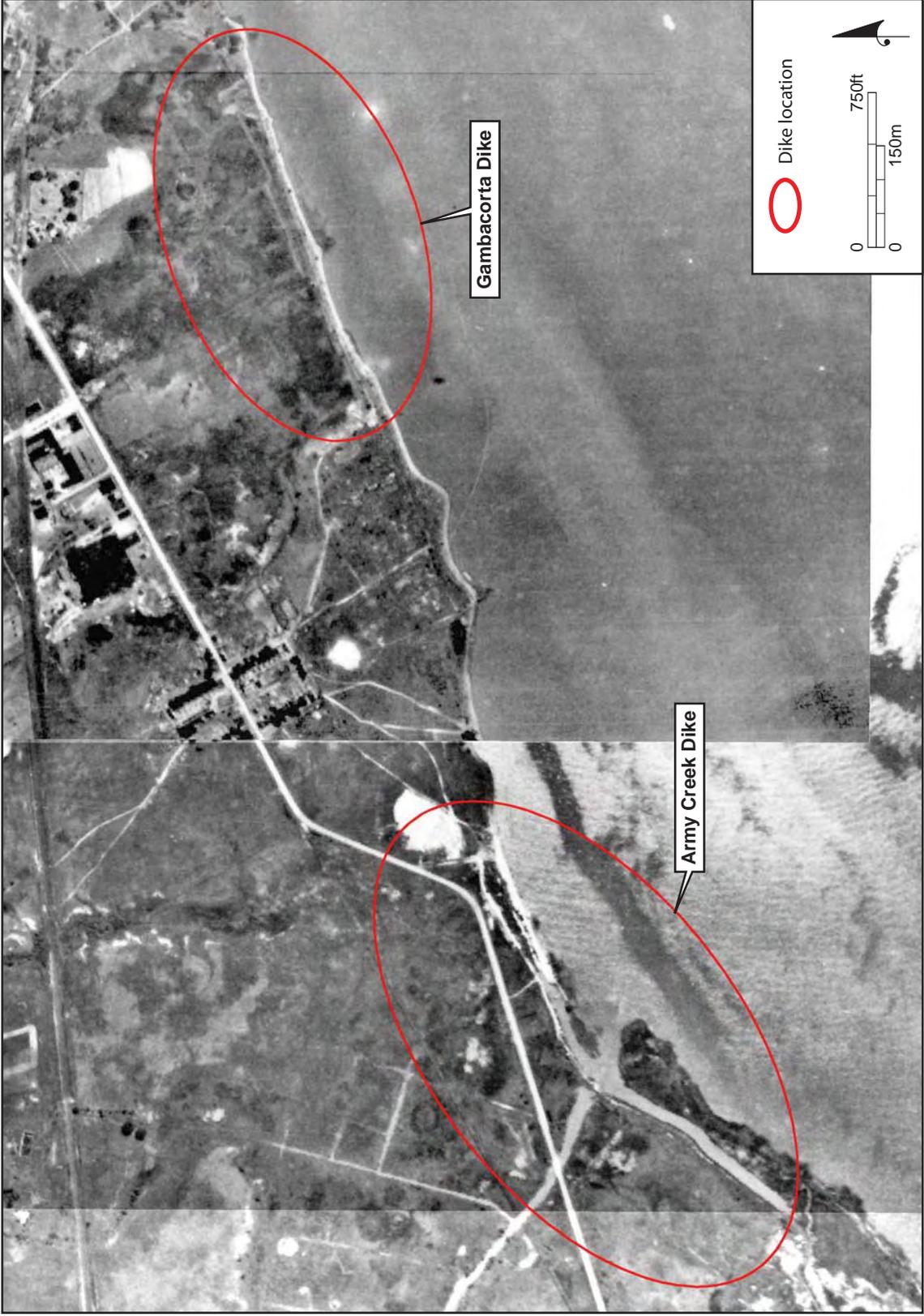


Figure 6. 1937 Aerial photograph showing the Army Creek Dike, and the Gambacorta Dike (USDA 1937).



Figure 7. 1961 Aerial photograph showing the Army Creek Dike, and the Gambacorta Dike, (USDA 1961).

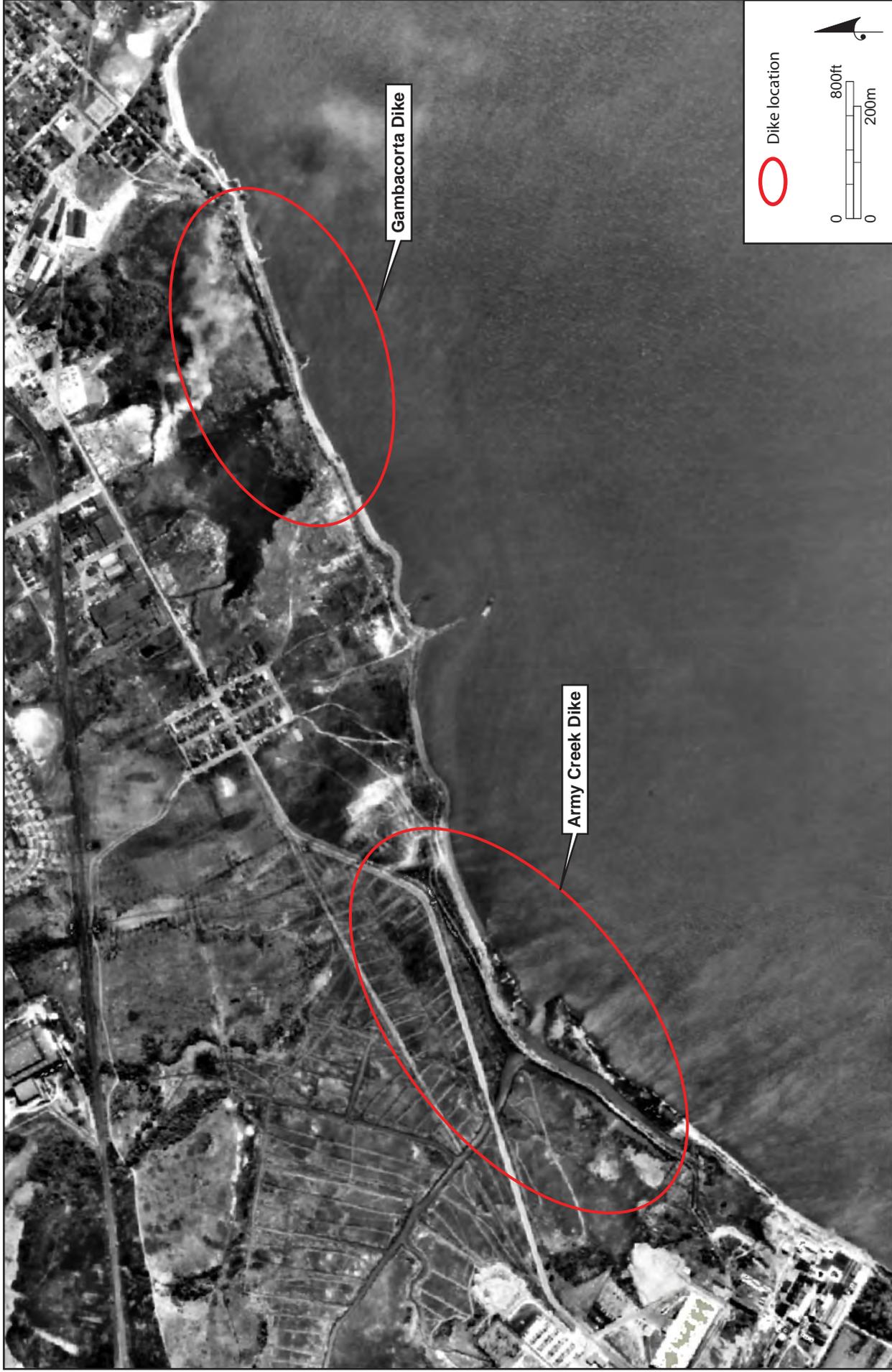


Figure 8. 1968 Aerial photograph showing the Army Creek Dike, and the Gambacorta Dike, (USDA 1968).



Figure 9. 1997 Aerial photograph showing the Army Creek Dike, and the Gambacorta Dike (DeIDOT 1997).

The uplands to the northerly and southerly ends of the Army Creek Dike were likely associated with agricultural activities during the nineteenth century. A house stood at the northern end, nearer to the Gambacorta Dike, in 1810 and 1848 (Figure 10 and Figure 3). In 1810, an Orphan's Court plot of the division of the lands of James Caldwell illustrated the house, it and the land being in the tenure of a John Hayes. The parcel associated with the house included 9+ acres of marsh behind the Army Creek Dike. The lands adjacent to Caldwell's to the west are shown as being that of the late Captain John E. Sword.

In 1868, the house on Caldwell's parcel is shown as "River View," being the estate of Reverend W. H. Paddock (Figure 11). Two houses stood nearer Mill Creek in 1868 on land behind the current dike, and depicted in 1848 as marsh. The house of Wm. G stood nearest the creek, while that of Mrs. Armstrong appears at the edge of the marsh.

By 1893, two of the houses had been removed, and the space between the Army Creek Dike and the Gambacorta Dike was occupied by the Delaware Iron Company (Figure 12). The rail spur into the company yard, which roughly followed the old route of Hamburg Road (Rt. 9), terminated at the northerly end of the dike at the rolling mill (Figure 13). The house attributed to Mrs. Armstrong in 1868, depicted as being made of brick, still stood along Hamburg Road. The house is not depicted in 1901 (Figure 4).

At the southerly end of the dike in 1848 were one, perhaps two houses (Figure 3). A house attributed to J. Taggart stood near the edge of the marsh. Adjacent to the nearest branch to the south likely stood the house of E. Niven.² The 1893 Baist Atlas depicts the area as being owned by "Dickson" (Figure 12). The map does not extend far enough west to show the location of the houses. The 1901 Coast and Geodetic Survey map of 1901 depicts the agricultural nature of the land associated with the houses (Figure 4). At some time after 1906 and before 1937, the area at the south end began to be used for industrial/commercial purposes (Figures 5 and 6).

2.5.2 The Buttonwood Dike

The Buttonwood Dike and associated marsh is the descendant of what was called Swanwick, or Swanwyck, marsh. Swanwick was an early colonial community situated north of New Castle, in New Castle Hundred. A house called Swanwyck was situated at 65 Landers Lane, and references the earlier community. It is possible, though not documented at this time, that what is now called Buttonwood Dike was an early foot dike that, together with Hans Blocks foot dike (present day Broad Marsh Dike), linked the Swanwick community to New Amstel (New Castle). A marsh company formed in 1786 to govern construction and care of a dike to enable reclamation of the marsh for agricultural purposes (Enrolled Bills 1786).

In 1791, the owners, who were not named, submitted a bill to the legislature stipulating a plan to raise and lengthen the dike (Enrolled Bills 1792). The owners assigned five men, James Booth, Archibald Alexander, William Stidham, Jacob Colsberry, and Robert Bryan, to determine a height and length sufficient to secure the meadows and marsh against encroaching tide waters, and to provide an estimate of the cost and labor required. Also stipulated was that the new bank was to be laid on the existing dike. Within the bill is mention of a survey and return of the entire meadow, marsh and cripple conducted in 1775 by a Robert Bail that stipulated the quantities held by the owners at the time of the survey. The return was not located during archival research. An 1887 bill negated the ability of the manager to collect taxes stipulated in the 1791 bill, and prohibited the corporation from contracting for services whose cost

²No structure is depicted on the map. However, in no other instance is a name listed without it being associated with a structure. In addition, a house is shown at the location in 1868 (Map 3), suggesting that a structure not being depicted in 1848 was an error.



Figure 10. Plot of the lands of the late James Caldwell (Manuscript Orphan's Court Plot in private hands). The eastern end of the Army Creek Dike, labeled "bank," is depicted at the lower right. The Gambacorta Dike was constructed to reclaim the area labeled "Marsh."



Figure 11. 1868 Beers *Atlas of the State of Delaware*, New Castle County (Plate 21), showing the locations of the Army Creek Dike, the Gambacorta Dike, and the Buttonwood Dike.

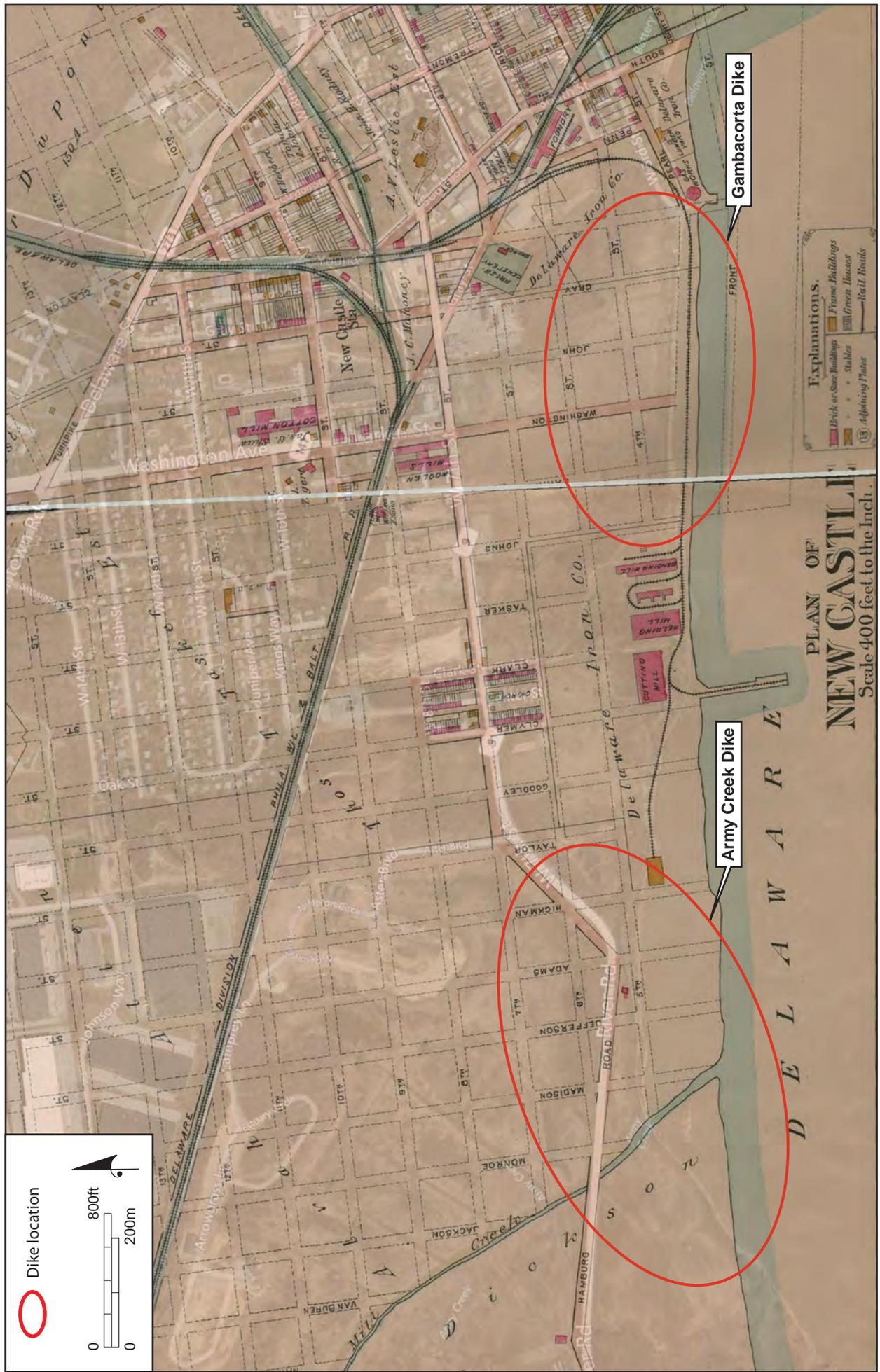
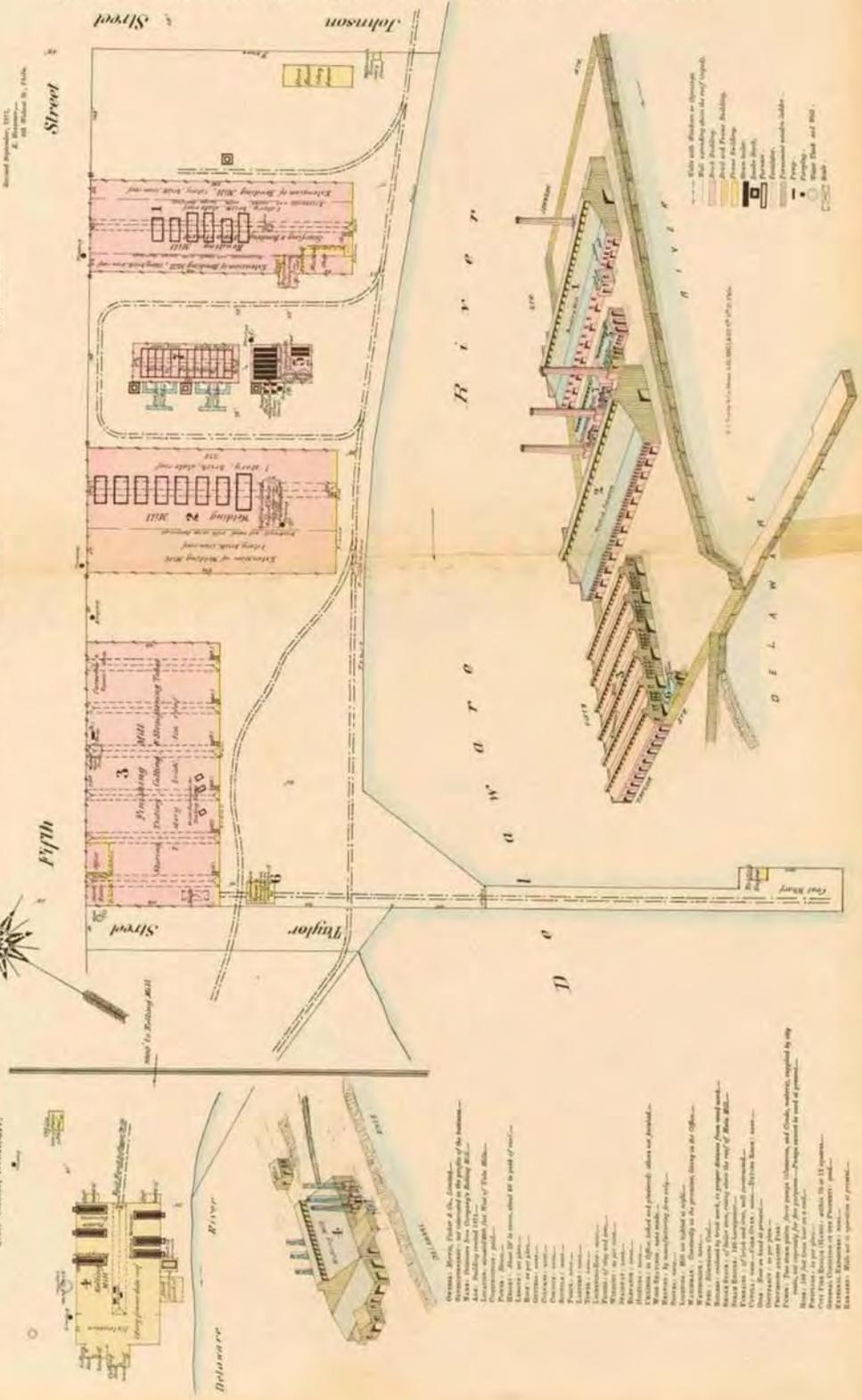


Figure 12. 1893 Baist Atlas of New Castle County, Delaware, showing the locations of the Army Creek Dike, and the Gambacorta Dike.

Delaware Iron Company's Rolling Mill,
Morris, Tasker & Co., Limited,
New Castle, Delaware.

Delaware Iron Company's Works,
Morris, Tasker & Co., Limited,
New Castle, Delaware.



Delaware Iron Company's Works, Morris, Tasker & Co., Limited.
 Blast Furnace, Rolling Mill, and various workshops, situated along the Delaware River. The plan shows the layout of the works, including the Rolling Mill, Blast Furnace, and various workshops, situated along the Delaware River. The plan is bounded by Fifth Street to the north, Taylor Street to the east, and Johnson Street to the south. A compass rose is located in the upper left corner of the plan area. The birdseye view shows the works from an elevated perspective, highlighting the large scale of the buildings and the proximity to the Delaware River. A legend in the upper right corner identifies different types of buildings and structures, such as Blast Furnace, Rolling Mill, and various workshops.

Figure 13. 1876 plan and birdseye view of the Delaware Iron Company (Hexamer General Survey, Volume 13).

exceeded the annual income. Also modified were the voting rules, wherein each owner was granted one vote for each acre in their possession (Enrolled Bills 1887).

A house owned by J. B. Rodgers is depicted just beyond the north end of the dike in 1848 (Figure 3). The property on which the house stood was owned by James Booth Sr. in the early part of the nineteenth century. Booth owned at least three farms in 1816: “Buttonwood”, “Hawthorne” and “Boothhurst”. In that year, each of the farms was occupied by a tenant, while Booth lived in the town of New Castle. Booth was a prominent person in Delaware, serving as Chief Justice of the Supreme Court of Delaware, and as secretary for the Delaware Constitutional Conventions in 1776 and 1792. On his death in 1828, the properties passed to his children, who sold Buttonwood to Molton C. Rogers, the brother of James Rodger, and the husband of Booth’s daughter Maria (McCarthy et al. 1996:4-5). The use of the name Buttonwood first appears on the 1868 Beers Atlas, wherein the house is shown at the northeast end of the dike, and is labeled as being owned by Mrs. Rodgers (Figure 11).

An 1893 Act establishing the Swanwicke Ditch Company stated that an earlier agreement had been between James Booth Sr., and Thomas Speakman, who owned the farm “Bloomfield.” The Act stated that a dike had been constructed, and the marsh ditched and otherwise improved. No obvious dike or berm is depicted on early maps of the nineteenth century; however, improvements likely began by or during 1786, the date of the original act regarding management of the marsh. By the latter part of the nineteenth century, ownership of the farms had changed, and it was anticipated that the lands would be divided further. Therefore, the owners petitioned to form the marsh company (Enrolled Bills 1893).

The 1906 USGS Wilmington Quadrangle, and aerial photographs showing the location of the dike, indicate that the location of the sluice was consistent through the twentieth century. In the 1930s the dike was breached southwest of the sluice, and repaired by the 1950s. By 1961 a roadway was constructed over the top of the dike. Later in the 1960s, vegetation was cleared, possibly as part of reconstruction efforts that might have included widening. By the 1990s, much of the vegetation had returned (Figures 5, and 14-17). The Buttonwood house was documented in 1996 before being moved to its present location at the northern end of the dike, immediately adjacent to the APE for the dike rehabilitation project (McCarthy, et al. 1996).

2.5.3 The Gambacorta Dike

Mention of embanking a marsh in the vicinity of the Gambacorta Dike was made in the papers of historian Jeanette Eckman. In reference to properties near Delaware Avenue, she mentioned that in 1706 property confiscated from Peter Alrichs, who had failed to drain the marsh, was granted to George Deakyne, “who drained the marsh, and built a dike along the river....” (Eckman 1947). Property records from the period New Castle was governed by the Duke of York do not mention a dike, and suggest that the area of marsh embanked and drained by Deakyne was located within what is now Battery Park (Heite 1978:77-81, 86-89). Latrobe’s map of New Castle County identifies Deakyne’s Marsh as the area immediately south of New Castle. The marsh depicted on an 1810 Orphan’s Court plot sits southwest of South Street (Map 1).

Also depicted on the Orphan’s Court plot is a parcel called the “Fort Lot,” where once stood a French and Indian War-era battery. Originally built in 1757, a manuscript plat of the battery entitled “Battery at New Castel on the Delaware” depicts the elements of the battery, including kitchen, powder magazine, and barracks (Figure 18). Built prior to the Forbes Expedition that captured Fort Duquesne in 1758, the drawing of the battery by Lieutenant Elias Meyer of the Sixtieth “Royal American” Regiment was rendered in the spring of 1757 but how long the battery remained is not currently known. Records indicate that workmen and laborers “employed for erecting the Battery at the Town of New Castle” were ordered to be paid in November 1757, indicating that the battery was under construction or completed by that date

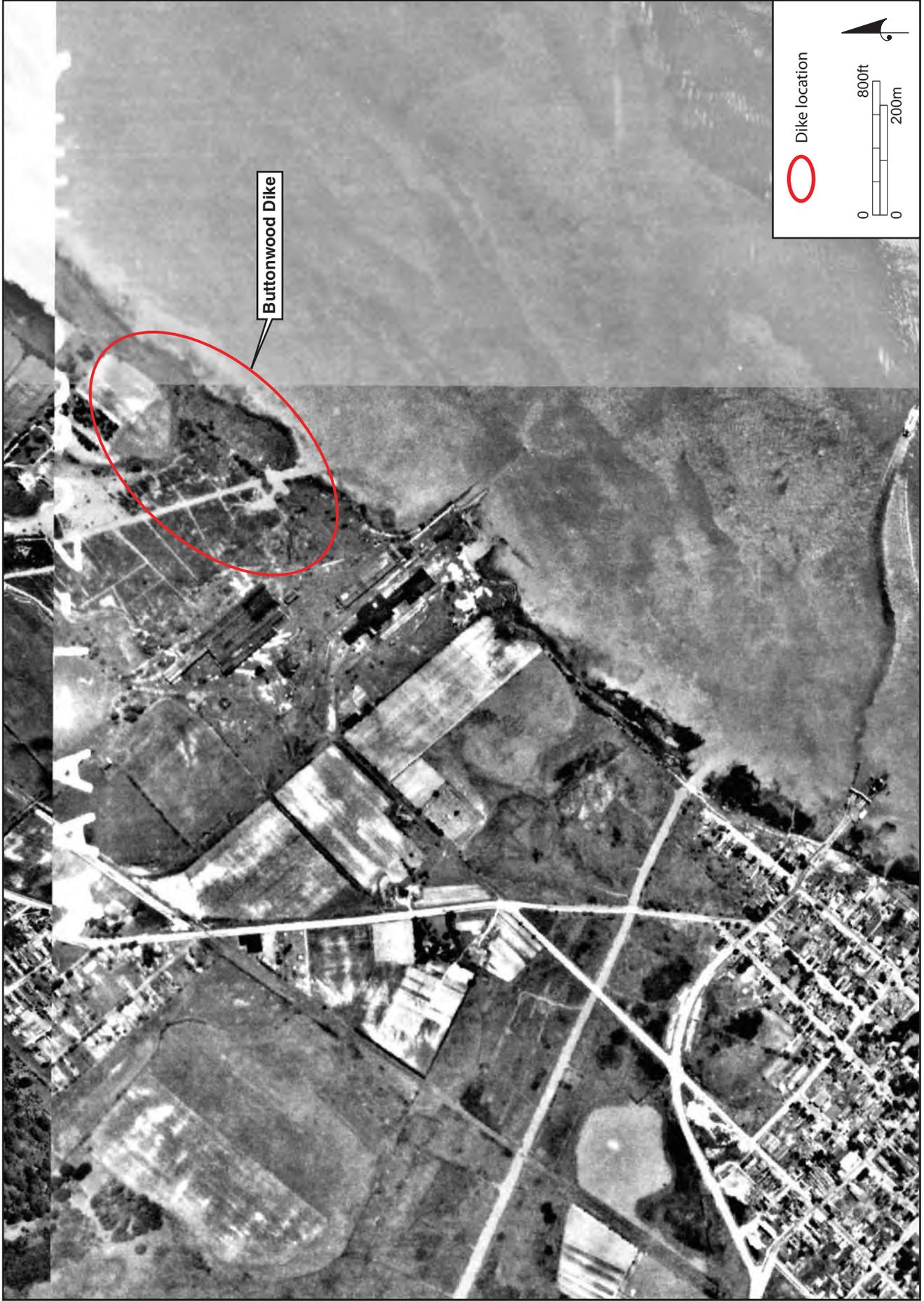


Figure 14. 1937 Aerial photograph showing the Buttonwood Dike (USDA 1937).



Figure 15. 1961 Aerial photograph showing the Buttonwood Dike (USDA 1961).

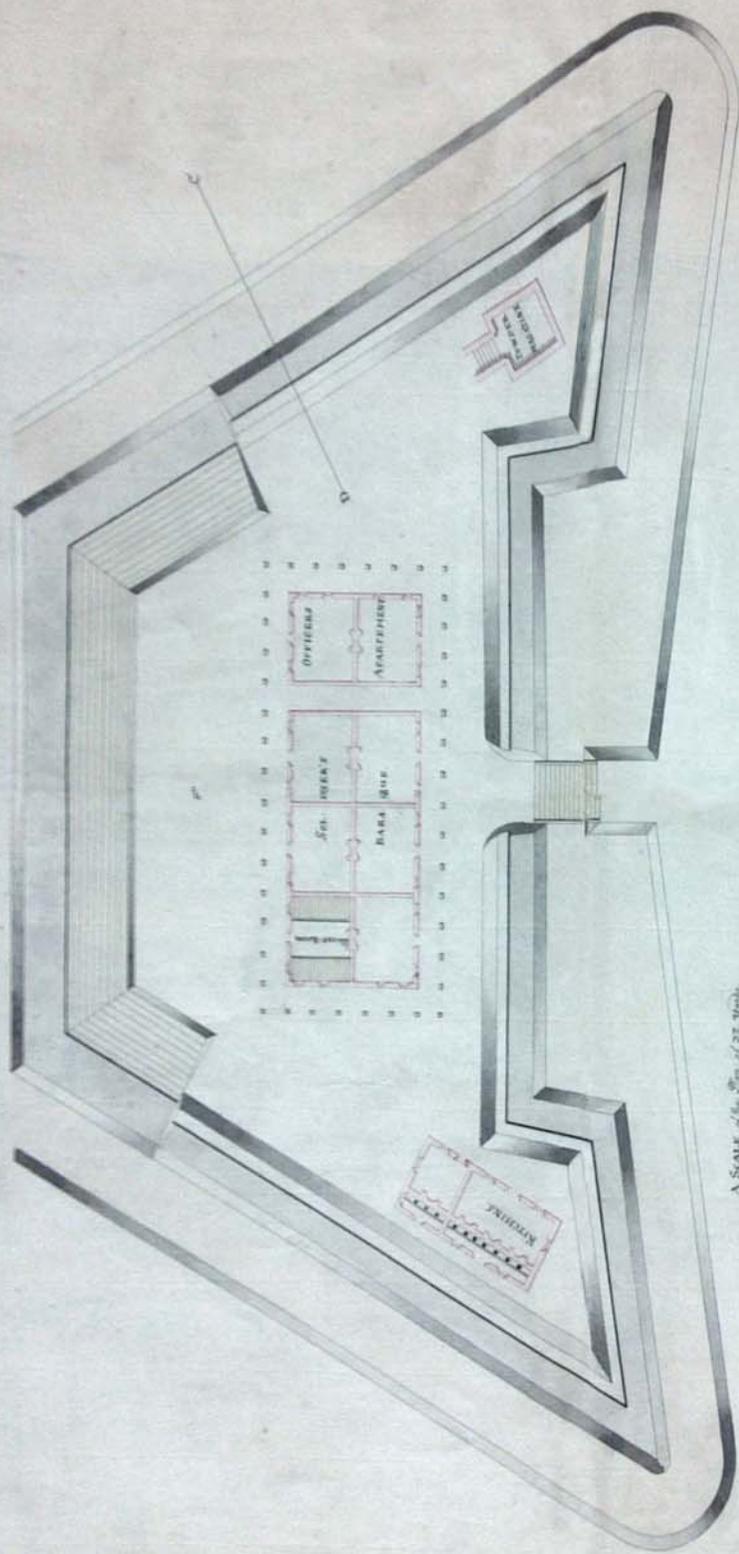


Figure 16. 1968 Aerial photograph showing the Buttonwood Dike (USDA 1968).



Figure 17. 1997 Aerial photograph showing the Buttonwood Dike (DeIDOT 1997).

PLAN OF THE BATTERY AT NEWCASTLE, ON DELAWARE, sketched and the 17th May 1757. By Don Meyer, Lieutenant of the 60th or Royal American Regiment, &c.



A SCALE of the Plan of 22 Yards.

PROFIL, according to the Line C. D.

PROFIL of the BATTERY, according to the Line A. B.



Figure 18. Plan of Battery at New Castle (Meyer 1757).

(Trustees of the Loan Office 1852:317). It does not appear on other maps located as part of this study, nor is it readily apparent on early aerial photographs, despite being a prominent, unnatural part of the landscape. The structure has received comparatively little attention in the histories of the town despite the large, geometric mound that persists today in Battery Park, whose name ironically memorializes that this defensive structure once stood south of town.

The path of the Gambacorta Dike was illustrated in maps produced by the middle of the nineteenth century. In the Rea and Price map of 1848 and the Beers atlas of 1868 the path of the dike is depicted as being part of present-day Route 9 (Figures 3 and 11). In 1893, the path of the dike was depicted as a spur of the New Castle and Frenchtown Railroad leading to the Delaware Iron Company at the southwest end of the marsh (Figure 12). Route 9 was depicted in its present location at the west end of the marsh.

While it is evident that a dike was in place by the nineteenth century along the path of the present-day Gambacorta Dike, none of the maps definitively indicate the location of a sluice or sluices. In fact, the marsh itself is not depicted as such except in 1810 (Figures 3-5, and 10-12). Similarly, aerial photographs from the twentieth century are not of sufficient resolution to clearly depict the location of a sluice (Figures 6-9). However, the paths of ditches within the marsh, when compared to that on present-day aerials, suggest that since 1937 a sluice existed at its current location.

The Delaware Iron Company (later called the Tasker Iron Works) was incorporated in 1876, four years after Henry G. Morris and Thomas T. Tasker moved their operation to New Castle from Philadelphia (Conrad 1908:515; Figure 13). Historian Henry Conrad described the works built in 1874 before closing in the early part of the twentieth century as follows:

This fine plant occupied thirty-five acres of ground on the Delaware within town limits, and consisted of a rolling mill capable of making daily one hundred tons of pipe iron; a bending mill; a welding mill; and a finishing room alone covering two acres, equipped with modern machinery run by powerful Corliss engines of six hundred horsepower. (Conrad 1908:515)

In addition to the site for modifying and finishing iron pipe described by Conrad, the company operated for a short time a foundry for the fabrication of unfinished pipe stock. The foundry was located at the western edge of town, along the Philadelphia, Wilmington, and Baltimore Railroad at the intersection of Union and South streets (Fifth and South). In 1885, the site was vacant.

The conversion of the path of Route 9 to the rail spur occurred in the decade before 1878, presumably as the iron works was developed. As reported in a newspaper article following the Hurricane of 1878:

The banks [in New Castle] were broken all along the river front. A bank refers both to the shore of a stream and to artificial dikes that were placed along the shores of a stream to keep out abnormally high tides. Tasker's Bank suffered the worst, with the employees at the Iron Works being driven from their avocations. The railroad along the shore was completely destroyed even though the bank was stone-faced and over 60 feet wide at the top. (*Daily Republican* 1878:1, cited in Ramsey and Reilly 2002:32)

No structures are depicted within the APE at the northern end of the dike until 1868, when those related to the New Castle Gas Company, and a carriage shop are shown (Figures 19 and 20). The New Castle Gas Company was chartered and organized in 1857. In the same year, under the direction of Thomas Tasker, the works were built, and gas was delivered to the town. In 1887, the town had 5 miles of gas mains and forty-one street lamps (Scharf 1888:863). As depicted in 1885, the gas works site consisted of a structure along Pearl Street (3rd Street) in which coal gas was produced (see Figure 20). Rooms within the structure are labeled, "Retort," "Exhaust Room," and "Purifying and Condensing." To the rear at the

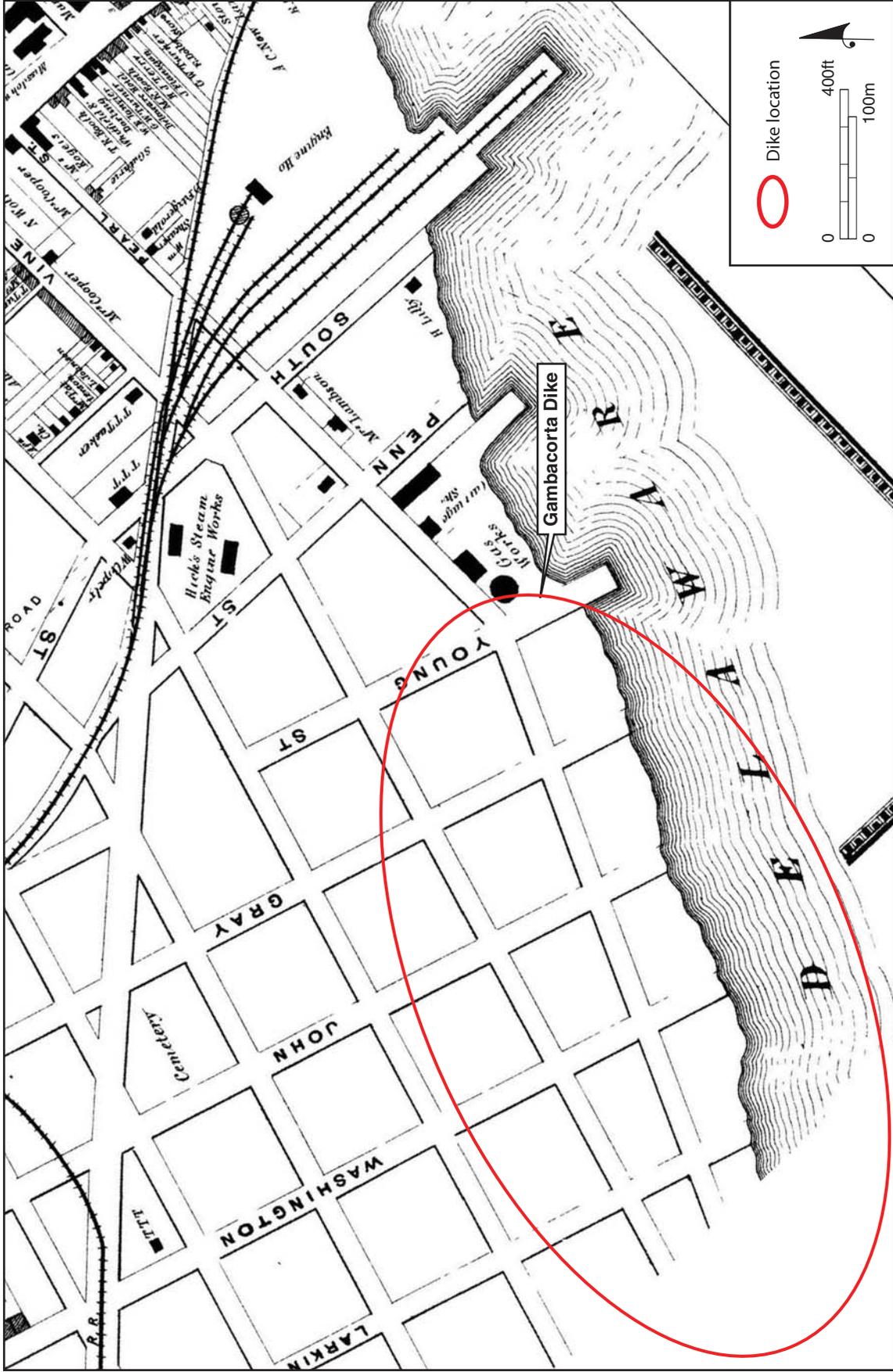


Figure 19. 1868 Beers *Atlas of the State of Delaware*, New Castle (Plate 23), showing the locations of the New Castle Gas Works and a Carriage Shop at the eastern end of the Gambacorta Dike.

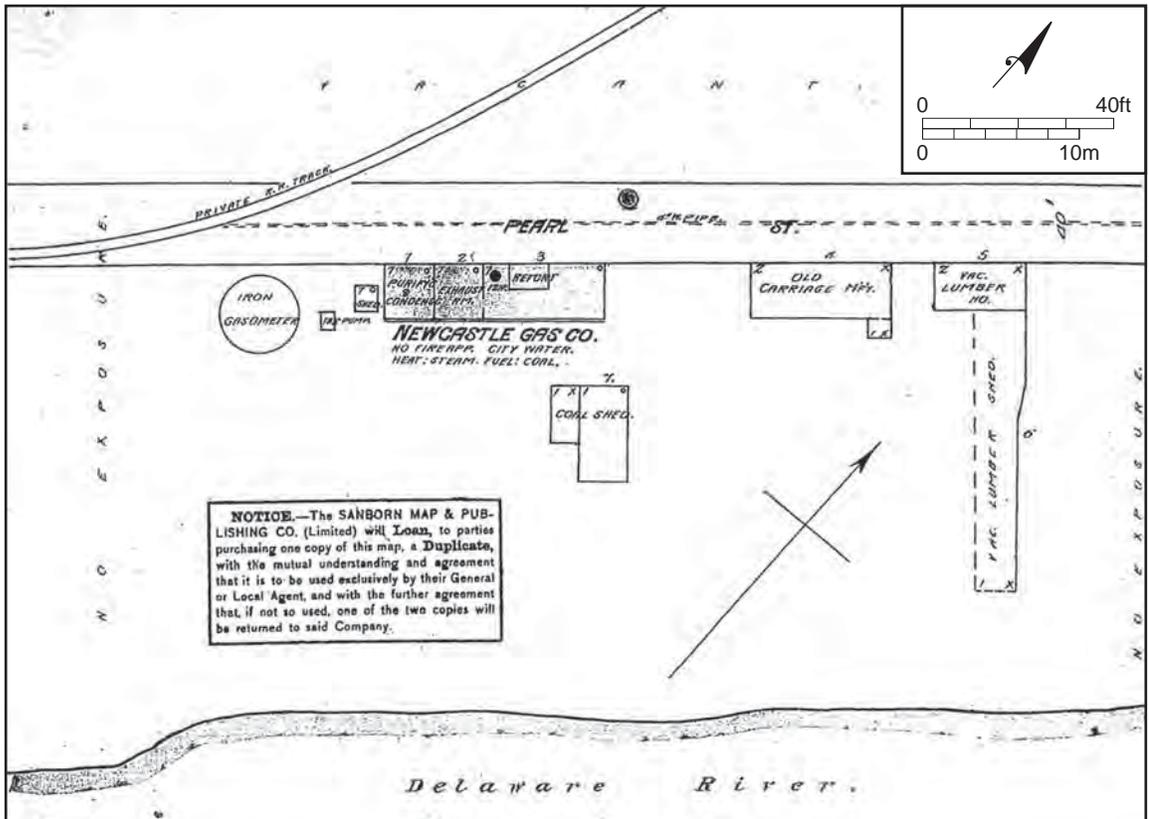


Figure 20. 1885 Sanborn Fire Insurance Map Co., showing the New Castle Gas Works, and the adjacent carriage shop.

northerly end was a coal shed. To the west was a shed, a “tar pump,” and a gasometer. The site was reconfigured by 1901, where the location of the shed and tar pump now held a lime storage building and kiln, and a “heater.” The tar pump had been moved, and a well added. The coal shed had been converted to house wagons and carts, and a repair shop. An additional gasometer had been constructed, which stood five hundred feet to the west, beyond the limits of the APE, and the only element of the gas works visible today at the surface. It was not depicted in 1893, indicating construction between this date and 1901 (see Figures 12 and 21).

In 1868 the area to the northeast of the gas works is depicted as containing a carriage shop and a long structure along the northerly property line (Figure 19). The 1885 Sanborn map indicates that the structures are, respectively, an “old” carriage manufacturer, and a vacant lumber house and shed (Figure 19). Only the shed is depicted in 1893 (Figure 12). During the second decade of the twentieth century, the carriage shop is depicted as a dilapidated two-story lumber shed, and an “old,” smaller structure stands to the northeast.

By 1937, the areas of the Tasker Iron Works, the gas works, and the carriage shop no longer contain structures (Figures 6-9). Aerial photographs spanning to the most recent available illustrate the transformation of the area from industrial use to a park. Throughout, however, the remnant of the gasometer that stood in the marsh, away from the other gas works structures, and beyond the limits of the APE, remains visible. Evidence of the iron works also persists above ground in the form of remnants of a wharf, bulkheads, and fragments of brick and foundry slag along the beach and within the marsh (Plate 5). Also in the marsh are larger elements of the works, such as a stone masonry machine base (Plate 6).



Plate 5. View to the east from between the Army Creek Dike and the Gambacorta Dike, showing a wharf, bulkhead and fragments of foundry slag and brick associated with the former Tasker Iron Works.



Plate 6. View to the southeast of a stone masonry machine base in the marsh at the western end of the Gambacorta Dike.

3.0 METHODS

3.1 RESEARCH DESIGN

The research design for the project was aimed at providing cultural contexts for identifying and evaluating archeological resources, if any, that might be affected by the proposed restoration and extension project particular to each dike. The approach focuses on settlement patterns during the various cultural time periods represented in the region based on previous investigations, syntheses of regional data, and management documents for the region. The context for precontact sites focuses on the influence of landscape and/or environmental variables on precontact settlement, as well as interactions between neighboring groups and the surrounding regions. This approach is congruent with the “biosocial” perspective on culture advocated by Custer (1984a:21–22; 1986a:2–8; 1987:1–3; 1989:23–25) and by Thomas et al. (1975). The basic assumption is that past cultures adapted to combinations of natural and social constraints operating in a given area at any particular time. Contexts for historical sites were based in part on a similar approach, augmented with knowledge of transportation networks and historical maps of the project region. In addition, a fuller knowledge of social processes, trends, and patterns is available for the historic period based on manuscript documents and published histories.

Investigations of the dikes themselves relied on a context of Delaware River dikes in New Castle County titled, *“To Keep the Banks, Dams and Sluices in Repair.”An Historical Context for Delaware River Dikes, New Castle County, Delaware*, which was prepared by JMA as part of the dike restoration projects being undertaken by the New Castle Conservation District (Catts and Mancl 2013). The purpose of context was to develop an understanding of the cultural and social processes associated with the construction and maintenance of dikes and their relationship to the exploitation of marsh resources in New Castle County, Delaware. Development of the context included 1) identification of the concept, time period and geographic limits of the context; 2) compilation and assessment of the existing information and data related to the context; 3) a written synthesis of the data, which identified important patterns, events, places, and persons of the context; 4) identification and definition of property types associated with the context; and 5) identification of gaps in the existing data to support refinement of the context.

Contexts providing information on agricultural properties and on archeological resources within the Town of New Castle were: *Historic Context: The Archaeology of Agriculture and Rural Life, New Castle and Kent Counties, Delaware, 1830–1940* (De Cunzo and Garcia 1992), and *Saving New Amstel: A Proposed City of New Castle Archaeological Preservation Plan* (Heite and Heite 1989).

JMA’s archeological research was conducted under the Secretary of the Interior’s *Standards and Guidelines for Archeology and Historic Preservation* (September 1983), as well as guidelines specific to the State of Delaware, including, but not limited to, *A Management Plan for Delaware’s Precontact Cultural Resources* (Custer 1986a), *A Management Plan for the Precontact Archeological Resources of Delaware’s Atlantic Coastal Region* (Custer 1987), the *Management Plan for Delaware’s Historical Archeological Resources* (De Cunzo and Catts 1990), and the *Delaware Statewide Comprehensive Historic Preservation Plan* (Ames et al. 1987). Field investigations were conducted in accordance with SHPO guidelines (Delaware State Historic Preservation Office 1993, 1997).

3.2 BACKGROUND RESEARCH

Background research for the dikes included a literature review of relevant geological, ecological, archeological, and historical sources. Previous JMA reports and gathered research for various other projects in the region were consulted, and archival research was conducted.

Online resources such as the USDA's Natural Resources Conservation Service (NRCS) Soil Survey Geographic (SSURGO) database and Official Soil Series Descriptions (OSDs) websites were consulted for soils information. Geologic data for the area was found on the Delaware Geological Survey website, DGS Geologic Map No. 13 (New Castle County) Dataset (Ramsey 2005). Historic maps and aerials were found from various resources including the Delaware DataMIL, Nationalmap.gov, coastal maps from NOAAs (National Oceanic and Atmospheric Administration) online Historical Map and Chart Collection, the New Castle Community History and Archaeology Program website, and other historic maps on file at the JMA office in West Chester. These were converted into digital format if necessary, and if the historic map had high enough a degree of accuracy, they were georeferenced in order to place the APE correctly on the map.

Historical archeological research consisted of consulting the *Management Plan for Delaware's Historical Archaeological Resources* (De Cunzo and Catts 1990) and "*To Keep the Banks, Dams and Sluices in Repair.*" *An Historical Context for Delaware River Dikes, New Castle County, Delaware* (Catts and Mancl 2013), which provided the basis for areas of investigation and delineation of property types. Regional historical data was gleaned from JMA's extensive library and various archival sources. Project specific history included the gathering of information from historic maps, State of Delaware Enrolled Bills, New Castle County Road Papers, Delaware Department of Transportation Annual Reports.

3.3 GROUND PENETRATING RADAR

Ground-penetrating radar (GPR) is an active, non-invasive geophysical method that records contrasts in the dielectric properties of subsurface materials. A pulse of transmitted electromagnetic energy is reflected or absorbed by dielectric contrasts and the intensity and two-way travel-time of the response is recorded to produce a vertical profile. Reflections are generated from deviations in propagation velocity at interfaces between materials of differing relative dielectric permittivity. A two-dimensional GPR profile consists of individual traces, resulting from a single pulse of energy and the resulting reflections at a given location, that are stitched together horizontally to produce an image of dielectric contrasts. In this sense GPR is not providing a stratigraphic profile, rather it is generating a vertical representation of local dielectric contrasts which provides a proxy for subsurface stratigraphic changes.

The depth of penetration for GPR depends on numerous factors, including but not limited to the antenna frequency, sediment type, moisture content, compaction, and salt content. Higher frequency antennas are capable of resolving smaller targets and interfaces, though depth penetration is sacrificed. Moisture content increases sediment density through filling of interstitial pore spaces, while compaction causes a similar effect through compressing spaces between particles. The presence of water, salts, and clay particles results in an increase in conductivity and thus a reduction in the quality of GPR data. Clays, shale, and other high conductivity materials may attenuate or absorb GPR signals.

For the survey of the Gambacorta Dike, JMA utilized a GSSI SIR-3000 GPR system with a 400 MHz central-frequency antenna. The system is mounted on a Utility Cart and utilizes odometer-triggered collection of 50 traces per meter (1 reading every 2 centimeters). JMA collected GPR data from eight (8) 20mx20m geophysical grids at the north end where the present dike will be extended. Post-processing routines for the GPR data are conducted in GSSI's RADAN Software included position correction (time zero), background removal, migration, and high and low pass filtering. The data were interpreted in cross-section view (2D). The vertical cross-section view allows an analysis of the vertical and horizontal patterning between subsurface anomalies.

3.4 ARCHEOLOGICAL SURVEY

Phase I field survey included initial surface inspection of exposed areas and the excavation of shovel test units (STUs). STUs were laid out on a 15-meter interval grid using geographic information system (GIS) software in order to ensure accuracy and to make sure testing was carried out only within the limits of the APE. The shovel test units were laid out using a sub-meter accurate Trimble GPS system. Radial STUs were laid out in the field using the GPS system at 7.5 meter intervals. Shovel test units were excavated 10 centimeters into subsoil, to one meter if subsoil was not encountered, or to the depth of the water table. Excavated soils were screened through one-quarter inch mesh screen, and any recovered artifacts were retained in bags marked with standard provenience information. Stratigraphy observed in the shovel test units was recorded on standardized forms with depth, soil texture, Munsell color, and posited depositional environment. Photographs were taken to document the setting of the study area and to illustrate the survey findings.

3.5 LABORATORY PROCEDURES AND ANALYSIS

Artifacts recovered in the course of the field investigations were cleaned and inventoried following curatorial guidelines and standards established by the Delaware State Historic Preservation Office. To the extent possible, the recovered artifacts were identified as to material, temporal or cultural/chronological association, style, and function. Analysis sought patterns in the relative composition of the recovered artifact assemblages, particularly to the extent that such patterns may indicate the functional nature of the assemblages and/or the site formation processes associated with their deposition. The attributes are particularly relevant for the evaluation for the site's archeological and interpretative potential. All cultural material resulting from the project and the associated documentation will be submitted to the Delaware State Historic Preservation Office.

4.0 RESULTS

4.1 EXPECTED PROPERTY TYPES

4.1.1 Precontact Archeology

Based on the background research, expectations for archeological resources in the vicinity of the APE were developed. For precontact archeological sites the discussion is guided by predictive modeling described and presented in *Delaware Prehistoric Archaeology* (Custer 1984a) and *A Management Plan for Delaware's Prehistoric Cultural Resources* (Custer 1986), and as refined in more recent studies focusing on the State Route 1 and State Route 301 corridors (Kellogg 1993; Kellogg and Custer 1994; Baublitz, et al. 2005).

Custer (1984a, 1986) proposed settlement models for each precontact period derived from data on environmental variables, which was then tested against the locations of known archeological sites and surveyed areas. In contrast, Kellogg (1993) used the environmental setting of known sites to develop a model predicting the likelihood of a location to contain a precontact site. Baublitz et al. (2005) also used data on environmental setting in the development of a predictive model, which was then subjected to a variety of statistical methods to refine breaks in predicted site probability. A significant divergence from prior studies was the use of cost distance analysis, rather than simply distance, which they defined as a measure of the energy or time expended while moving across the landscape. In addition, they added a consideration of "microdrainages" (Baubalitz et al. 2005:49-50). Baublitz et al. (2005:53) found that their model was not more effective at defining high and moderate probability areas; however, it was more useful in identifying low probability areas.

Custer (1986a:46-51) identified three clusters of sites dating to the Paleoindian period on the Delmarva Peninsula. The clusters outlined are located 1) in northeastern Cecil County, Maryland and northwestern New Castle County, Delaware, which coincides with the presence of outcrops of cryptocrystalline lithic material, 2) along the Eastern Shore of Maryland in the vicinity of the mouths of the Choptank and Nanticoke Rivers, and 3) along the Mid-Peninsular Drainage Divide. An isolated site is located to the south of the Red Lion Dike, a short distance north of the Chesapeake and Delaware Canal. In general, base camps might be expected in the Delaware Chalcedony Quarry Complex and the immediately outlying region, and along the Mid-Peninsular Drainage Divide, while procurement sites and stations might occur almost anywhere. For the project area, Custer (1986a:56) outlines Data quality is poor for the Paleoindian period, as all sites consist of fluted-points not found in an excavated context. Any finds of Paleoindian cultural material in the project area would be considered significant.

For the Archaic Period Custer (1986:76-82) defined four study units: 1) the Piedmont Uplands, 2) along major drainages, 3) fresh water swamps, and 4) along the Mid-Peninsular Drainage Divide. However, climatic conditions were probably drier ca. 9000 years BP (Kellogg and Custer 1994:21-24), so that Archaic sites might be expected closer to reliable or predictable water sources. Based on the locations of known Archaic Period sites in New Castle County, additional sites are predicted to be located on terraces along major and minor drainages and adjacent to fresh water marshes (Custer 1986:Table 6).

The archeology of the Woodland I and II periods is much better known than that of the preceding Paleoindian and Archaic periods. By 5000 years BP, climatic conditions had attained an essentially modern character, and the rate of sea-level rise had slowed. The slowing of sea-level rise led to the development of stable and more extensive coastal environments and estuarine resources. Precontact population densities increased, and large sites representing long-term camps were established (Custer

1986a:87). Woodland I sites are numerous in New Castle County. Five study units are defined in New Castle County for the Woodland I period (Custer 1986:130-132). The study units are: 1) Piedmont Uplands, 2) Interior Swamp, 3) Fall Line, 4) Delaware River Shore, and 5) Interior. Study Unit 4, the Delaware River Shore, applies to the project area. Anticipated site types are macro- and micro-band base camps on terraces along the Delaware River near lower-order stream confluences, and along low order tributaries.

The archeology of the Woodland II period is also well known for Delaware. The Woodland II study units are the same as for the earlier Woodland I period (Custer 1986a:159-162). A seasonal round of shifting base camps is hypothesized for the Woodland II period, with spring and summer camps near the coast and falls and winters spent farther inland (Custer 1987:52). Anticipated site types for the Woodland II are comparable to the Woodland I period (Custer 1986a:160).

Site locations for the Contact period are considered to be the same as for the Woodland II period (Custer 1986a:162-164). However, it is predicted that an increase in the duration and intensity of European settlement would result in fewer and less densely populated sites. Moreover, Contact period sites are predicted to be more likely near loci of European settlement, which for Delaware are the greater Wilmington area, and the area near Lewes.

In each of the models the environmental factors considered most relevant to precontact site location for all periods were nearness to water, moderate to well-drained soils and zero to moderate slope, which describes the portion of Red Lion Dike project area subject to archeological testing. Given this, the probability of locating a precontact site was considered high. Taking into account known site locations for each period, however, modified the range for site probability for the project area from low to high for the various time periods, with low or moderate probability for Paleoindian and Archaic sites, low to high probability for Woodland I and Woodland II sites, high probability for Woodland II sites, and low probability for Contact sites. Data quality, on the other hand, is generally considered poor or fair. Data for the Paleoindian, Archaic, and Contact periods are poor because so few sites are known. For the Woodland I and II periods, data quality is better (fair/good) because more sites are known. Relatively few sites have been excavated, however.

4.1.2 Historical Archeology

General historical archeological expectations are based more directly on the documentary sources. The state plan for Delaware's historical archeological resources (De Cunzo and Catts 1990) provides an initial basis for evaluating potential archeological sites of all time periods in the project area. In the upland portions of the APE, expected property types include: 1) Agricultural Dwelling: the residence of a farm owner-operator, tenant farmer, farm manager, or other free agricultural laborer and his or her family household. It encompasses at least one dwelling, as well as domestic outbuildings and yards, gardens, and associated activity areas (De Cunzo and Garcia 1992:251), and 2) Agricultural Outbuilding: One or more outbuildings of the same or different agricultural functions located on farms but isolated from the farmstead or agricultural complex (defined above). The outbuilding(s) also includes associated work and storage yards (De Cunzo and Garcia 1992:252).

A project-specific historical context has also been developed and will serve to guide the present investigation. In *"To Keep the Banks, Dams and Sluices in Repair. An Historical Context for Delaware River Dikes, New Castle County, Delaware"* (Catts and Mancl 2013), the authors define three primary elements of a dike and the marshland with which it is associated: banks, sluice gates, and ditches. Tools associated with the construction and maintenance of a dike and for exploitation of related marsh resources

could include draining, trenching, and ditching spades, cleaners, skivers, trenching forks, drain scoops, and a variety of wet soil and drainage plows.

4.2 ARCHEOLOGICAL INVESTIGATIONS

4.2.1 The Army Creek Dike

Archeological Investigations at Army Creek Dike consisted of recording sections of an erosional scarp at the eastern end of the dike on the side facing the Delaware River. The location chosen for recordation was determined during a field visit in April 2013 by the NCCD, DNREC, DESHPO, and JMA, as the APE for the project area was to be defined until June 26, 2013. Recordation consisted of profile drawings and photographs at the eastern end of the dike where it meets fastland (Figures 22 and 23). The scarp itself is approximately 25 meters in length; four vertical sections were scraped clean of debris and the stratigraphy of each was recorded (Plate 7). The goal of this geomorphic assessment was to determine if and how the dike ties into the terrestrial landscape within this exposed area. JMA was able to determine that there were four distinct fill packages related to the dike itself (Figure 24). The dates of these fill episodes could not be determined because no artifacts were recovered. The fill layers remained consistent across the scarp and thinned moving eastward. The tie-in end of the dike is not within this erosional scarp, as approximately 1.3 meters of fill was recorded at the eastern end of the scarp. The tie-in with the landscape is likely further to the east where the sediment is not currently exposed.

4.2.2 The Buttonwood Dike

Archeological investigations at the Buttonwood Dike consisted of shovel testing on the bank at the southern end, and within the lawn at the northern end (Figure 25). Three STUs were dug at the southern end, each of which demonstrated multiple periods of fill (Figure 26). Artifacts consisted of architectural debris (brick, mortar, cut stone, window glass, wire nail), boiler and foundry slag, and asphalt. Artifacts continued to a depth of nearly a meter, at which time excavations were stopped.

Excavations in the field at the northern end of the dike showed that the majority of the area had been marsh that was in-filled. A typical soil profile consisted of up to 60 centimeters of fill over marsh deposits composed of a mottling of brown (10YR4/3) and pale brown (10YR6/3) silt. The STUs nearest to but not on the dike (7, 7S, 12, 13, and 14), however, did contain a buried A-horizon (Figure 27). The depth to the buried A-horizon varied from 104 centimeters below ground surface at STU 12, to 16 centimeters below ground surface at STU 7. Contained in the A-horizon were a brick fragment, unidentified bottle fragments (n=4) a pressed-glass tableware fragment (1825-present), redware sherds (n=3), one being trail slipped (1670-1850), whiteware sherds (n=2), one plain (1810-present) and one with a hand-painted pinkish red decoration (1810-present) (Plate 8). Also recovered from the A-horizon were a piece of plastic (post 1915) and a clay pigeon fragment (1880-present).

In addition to historical-period artifacts, STU 7 held a chert flake in the layer below the A-horizon. A flake was also found in radial STU 7W; however, it was recovered from marsh sediments. Additional flakes, and two projectile points were recovered from fill layers. A jasper Madison Point (1150-300 BP) was recovered from fill in STU 2, and an unidentified quartzite point was recovered from fill in STU 14 (Plate 9).

4.2.3 The Gambacorta Dike

Archeological investigations at Gambacorta Dike consisted of shovel testing at the southern end, a GPR survey in the park at the northern end, and unit excavation to “ground-truth” anomalies detected in the

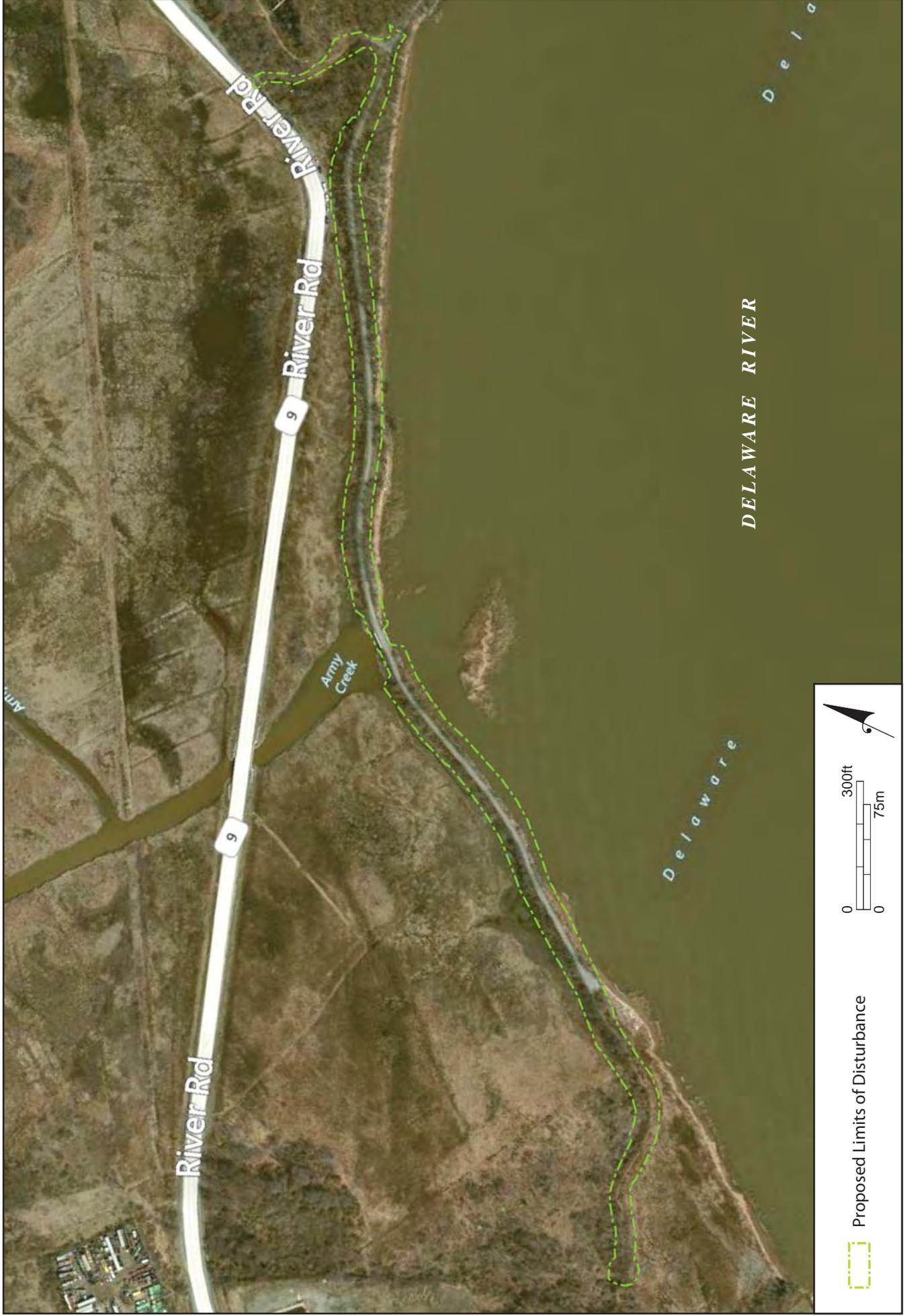


Figure 22. The APE at the Army Creek Dike and the locations of STUs shown on the 2010-1011 Microsoft® Bing™ aerial.

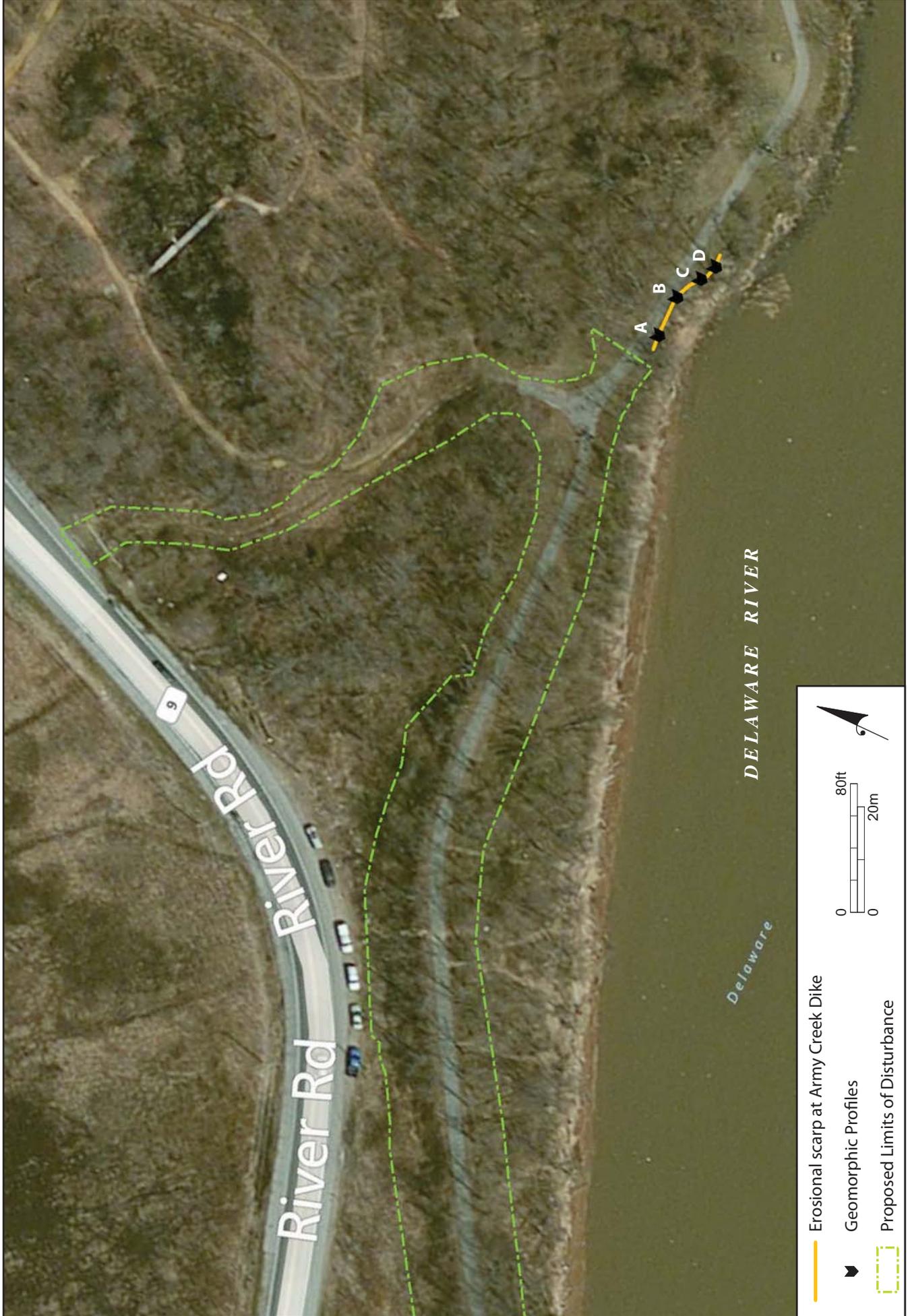
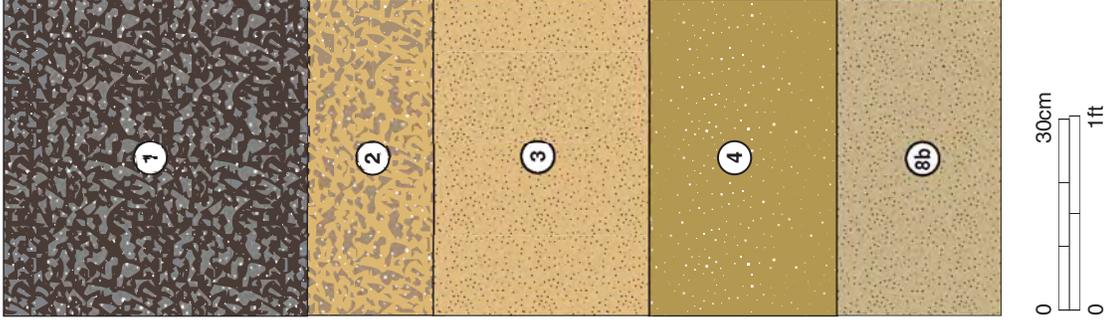


Figure 23. The location of the erosional scarp documented at the Army Creek Dike and its relation to the APE shown on the 2010-2011 Microsoft® Bing™ aerial.



Section D



- 1 10YR 3/2 very dark grayish brown coarse to fine sandy silt
- 2 10YR 5/6 yellowish brown sandy silt
- 3 10YR 5/6 silty fine sand
- 4 10YR 6/6 brownish yellow silty fine-medium sand
- 8b 2.5Y 6/2 light brownish gray clay with fine sand

Figure 24. Profile of Section D of the erosional scarp at the Army Creek Dike.

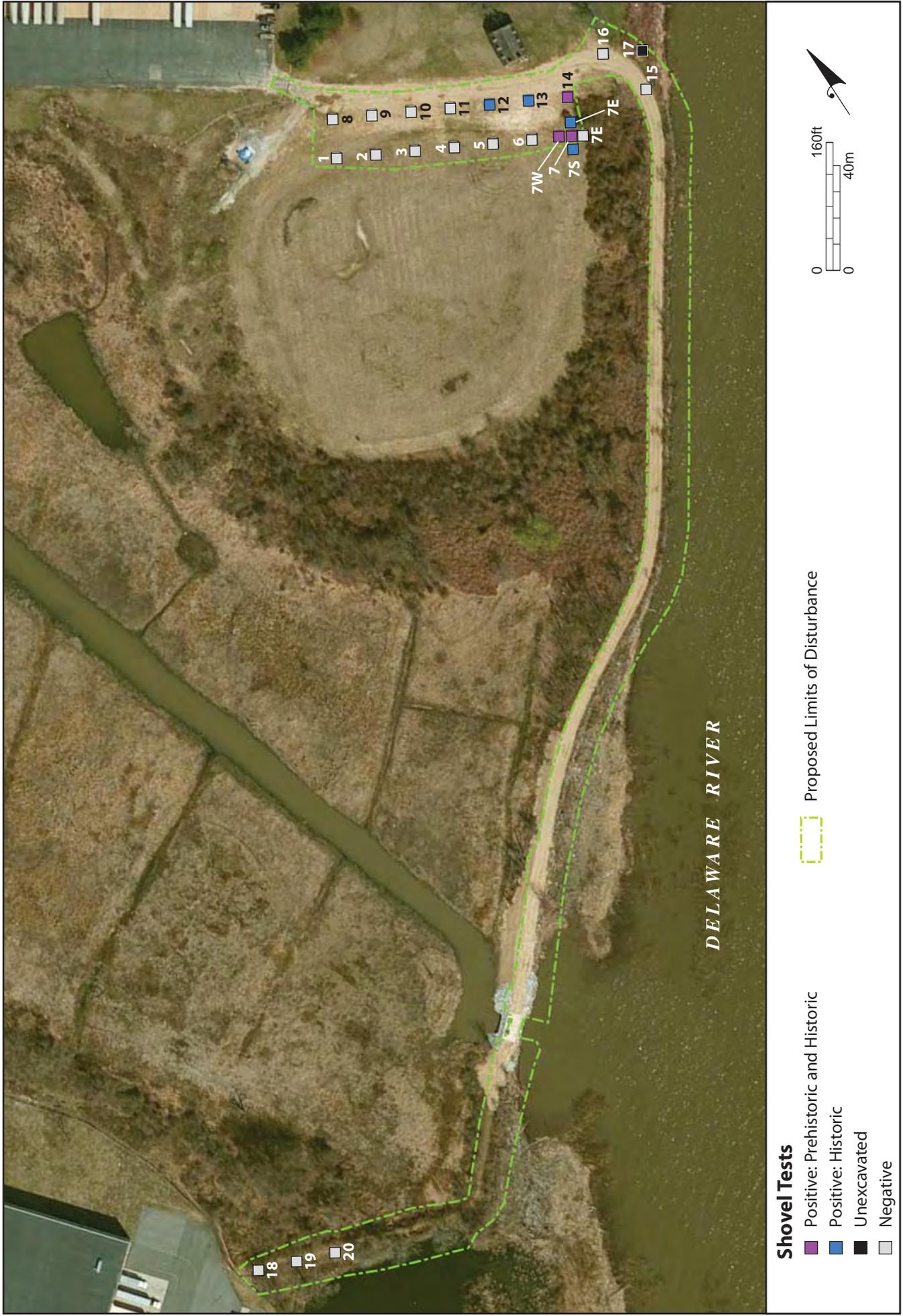


Figure 25. The APE at the Buttonwood Dike and the locations of STUs shown on the 2010-1011 Microsoft® Bing™ aerial.



STU 18

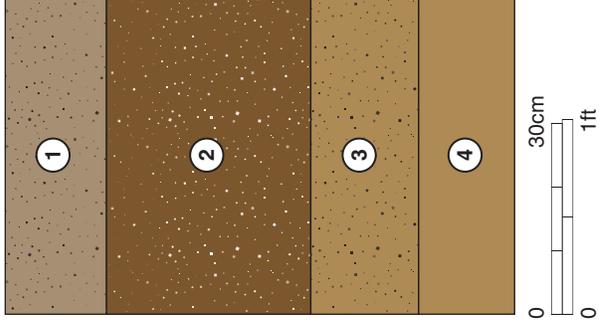


- 1 10YR 3/2 very dark grayish brown silt
- 2 10YR 4/4 dark yellowish brown silt mottled with 10YR 5/4 yellowish brown silt and 10YR 5/2 grayish brown silty clay
- 3 10YR 4/4 dark yellowish brown silt mottled with 10YR 6/3 pale brown clayey silt
- 4 10YR 5/4 yellowish brown sandy silt with asphalt and rubble in top, diminishing with depth

Figure 26. Profile of STU 18 at the Buttonwood Dike, showing the extent of fill at the southern end.



STU 7



- 1 10YR 4/3 brown sandy silt
- 2 10YR 3/4 dark yellowish brown sandy silt
- 3 10YR 5/4 yellowish brown sandy silt
- 4 10YR 5/6 yellowish brown clayey silt

Figure 27. Profile of STU 7 at the Buttonwood Dike, showing the buried A-horizon.



Plate 7. View of the erosional scarp at the Army Creek Dike.



Plate 8. Redware and handpainted whiteware recovered from the buried A-horizon at Buttonwood Dike.

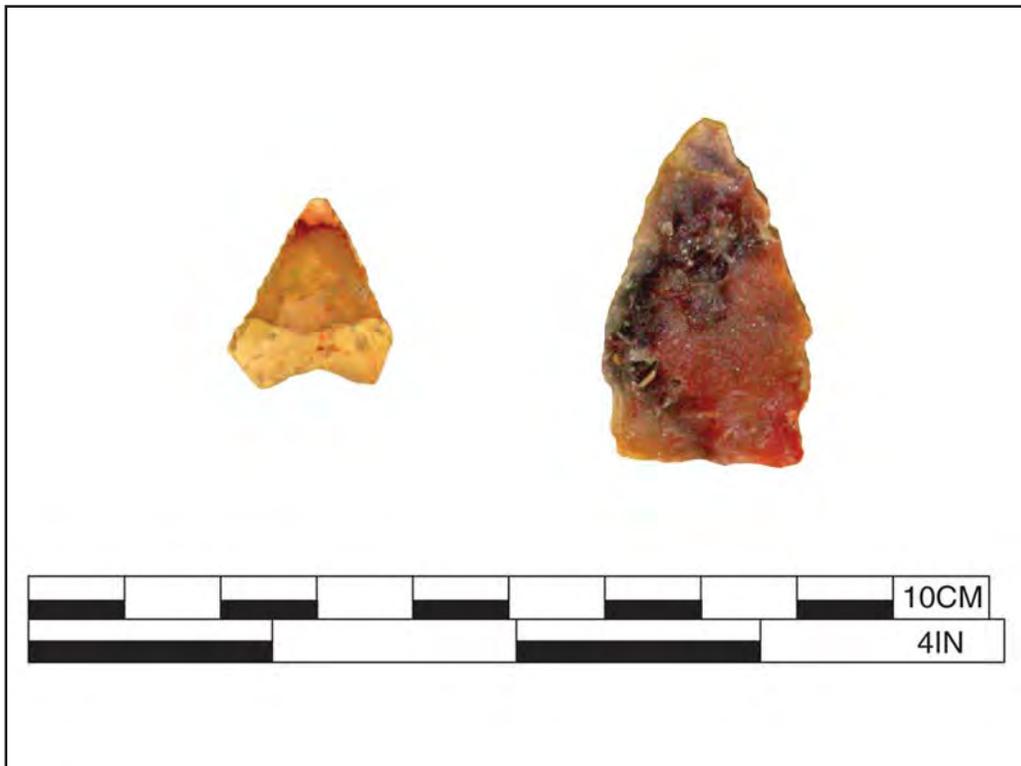


Plate 9. Projectile points recovered from the fill layers at the southern end of the Buttonwood Dike.

GPR data (Figure 28). Fourteen STUs were excavated along a transect at the southern end that ran from the shoreline to the modern dumping area for yard and lawn waste by the Town of New Castle. The entire path had undergone extensive disturbance, there being no consistency in the character or order of fill layers. Near the shoreline, fill layers contained foundry slag and household trash, especially fragments of glass and plastic containers (Figure 29, Plate 10). Moving into the wooded area along the path, recovered artifacts became primarily foundry slag and architectural debris. STU 2, however, was unique in its soil profile (Figure 30). From 24 to 70 centimeters below ground surface, where excavations were stopped, the soils consisted of first a dark brown (7.5YR3/5) coarse sand, then a dark brown (10YR3/3) silty coarse sand. Throughout both soil layers were corroded chunks of iron.

The GPR data indicated 12 anomalies within Battery Park at the northern end of the project area (Figure 31). The anomalies were interpreted as a berm, a linear feature related to either the dike or a former railroad bed, six related to utilities, and seven being structural remains within the former Gas Works and former lumber yard parcels. Because of concerns regarding soil contamination, anomalies within the Gas Works parcel were not investigated further.

EU 1 was placed to investigate Anomaly 12, interpreted from the GPR data as a berm (Figure 32). On top of Level 5, from 65 to 75 centimeters below ground surface, three large rocks (gneiss) were encountered in the western half of the unit is a dark brown fine sandy silt mottled with yellowish brown fine sandy silt. Level 5 pinched out at nearly the center of the east to west trending unit. The presence of the mottling suggests that Level 5 is not likely a natural deposit within the vertical stratigraphic section as it would be expected that other stratigraphic units below the level would also exhibit some mottling in a natural setting. It is assumed that the rocks and the soils of level 5 are a cultural deposit, one that was identified in the GPR data as a berm. However, excavation of the feature did not result in a clear definition of a berm, nor were artifacts recovered to aid to assigning a cultural affiliation.

EU 2 and EU 3 were placed to investigate possible foundation remains related to the carriage shop (Anomalies 8 and 10). In both instances, layers of fill were found above and adjacent to foundation walls constructed of mortared stone (Figures 33 and 34; Plates 11 and 12). The foundation wall in EU 2 measured 32 centimeters (1.05 feet) wide, and a height of 70 centimeters (2.3 feet) remained. The base of the wall was found at 100 centimeters (3.28 feet) below ground surface. No builder's trench was evident. The soil layers immediately adjacent to the base of the wall contained artifacts dating from the late nineteenth to early twentieth century.

The foundation wall in EU 3 was encountered at 70 centimeters (2.3 feet) below ground surface. The wall measured 28 centimeters (0.92 feet) wide. Only two courses of the wall remained. No builder's trench was evident. A few early artifacts were found in the soil layer adjacent to the base of the wall, such as a jasper flake, a rim fragment of agateware (1750-1810), a creamware sherd (1775-1820), and two trail-slipped redware sherds (1670-1850) (Plate 13). However, the soil layer also contained latter artifacts, such as a rim-fire cartridge (post 1866) and a sherd of white granite ware (1842-1995).

EU 4 was placed to investigate the northern end of the possible remains of the primary gas works building (Anomaly 5). Fill layers with artifacts dating from the present to the late nineteenth century were encountered to a depth of 120 centimeters (3.94 feet) below ground surface (Figure 35). A diffuse scatter of rocks was found from 60 to 90 centimeters (2 to 3 feet) below ground surface. Below 120 centimeters below ground surface a 25-centimeter (0.8 feet) thick deposit of wetland soils was encountered that overlaid upland subsoil. Other than the scatter of rocks, evidence of a structure was not apparent. However, subtle variation in soil compaction and texture was noted to the east and to the west of the rock scatter, suggesting the potential presence of an interior/exterior dichotomy.

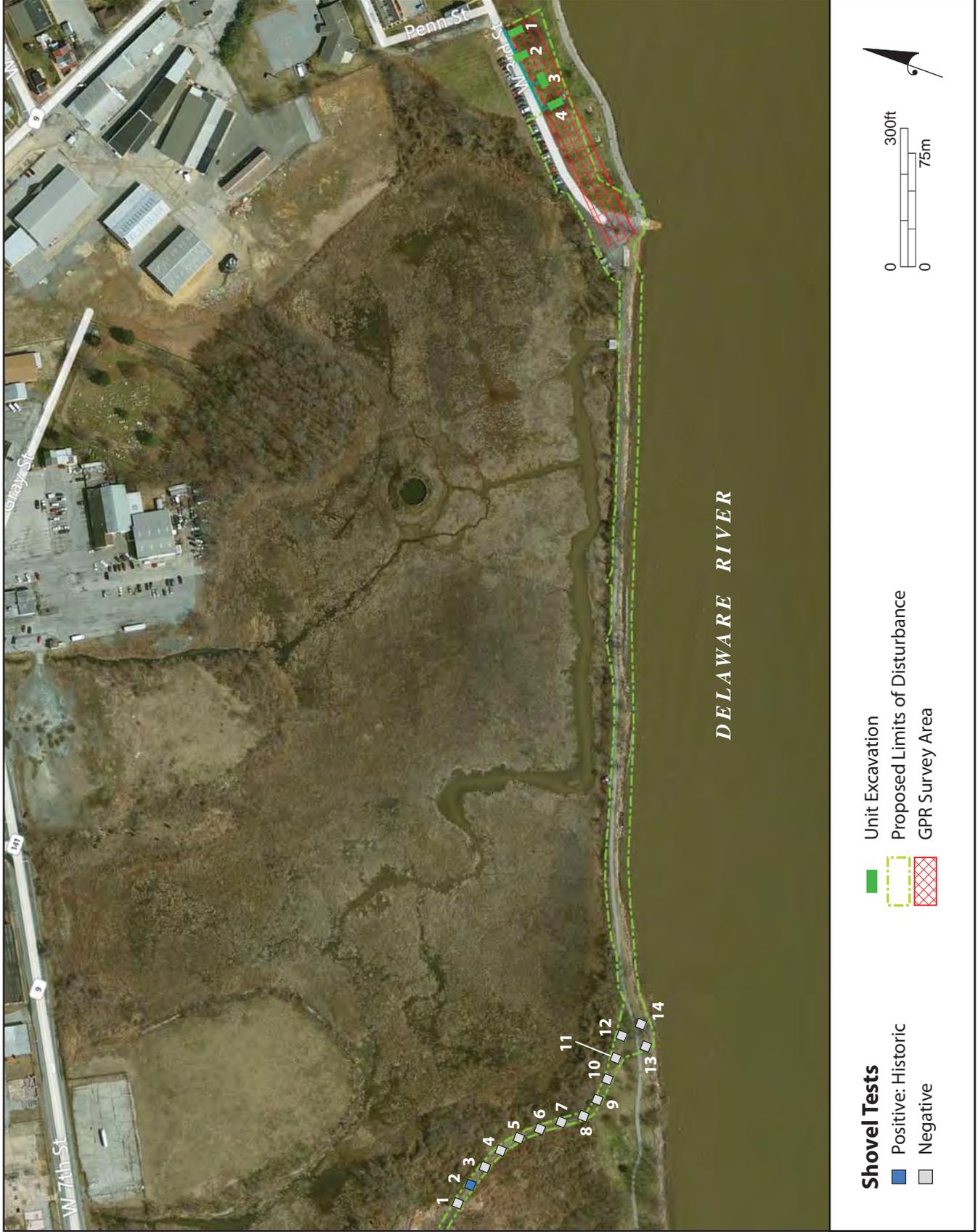


Figure 28. The APE at the Gambacorta Dike and the locations of STUs, EUs, and the GPR survey area shown on the 2010-1011 Microsoft® Bing™ aerial.



STU 11

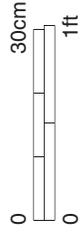


- 1 10YR 3/2 very dark grayish brown silty sand
- 2 10YR 2/1 black silty sand
- 3 10YR 3/2 very dark grayish brown mottled with 10YR 4/2 dark grayish brown silty sand
- 4 10YR 5/4 yellowish brown mottled with 10YR 4/3 brown sandy silt
- 5 10YR 3/2 very dark grayish brown mottled with 10YR 5/6 yellowish brown and 10YR 4/2 dark grayish brown sandy silt

Figure 29. Profile of STU 11 at the Gambacorta Dike, showing the variable fill layers

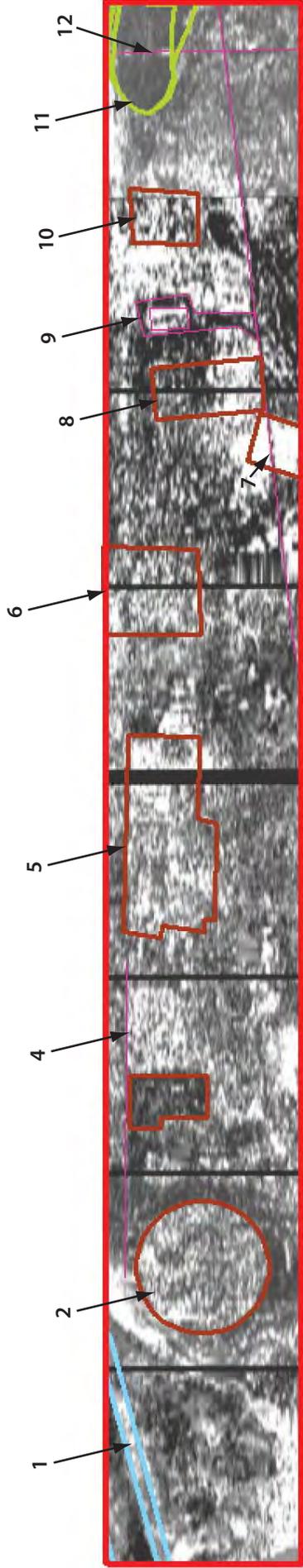


STU 2



- 1 10YR 3/2 very dark grayish brown silty sand
- 2 10YR 2/1 black silty sand with crushed gravel
- 3 10YR 4/2 dark grayish brown silty sand
- 4 7.5YR 3/4 dark brown mottled with 10YR 3/2 very dark grayish brown coarse sand
- 5 10YR 3/3 dark brown silty coarse sand

Figure 30. Profile of STU 2 at the Gambacorta Dike, showing the deposit of possible casting sand waste.



Geophysical Time Slice at an interpreted 3 feet below ground surface +/- 3 inches



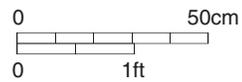
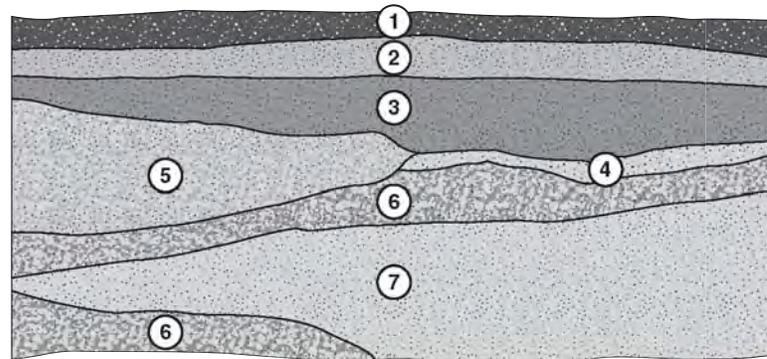
- GPR Survey Area
- Structures
- Buried Berm
- Dike/RR bed
- Bell vault
- Utilities

GPR Anomalies at the Gambacorta Dike, and Interpretations

Anomaly No.	Interpretation
1	Dike berm or Railroad Bed
2	Gasometer
3	Gas Works Shed
4	Utility
5	Coal Gas Production Building
6	Unknown structure
7	Unknown structure
8	Possible room within the Carriage Shop
9	Bell Telephone Vault and associated utility lines
10	Possible room within the Carriage Shop
11	Buried berm
12	Utility

Figure 31. Interpretation of GPR data at the Gambacorta Dike.

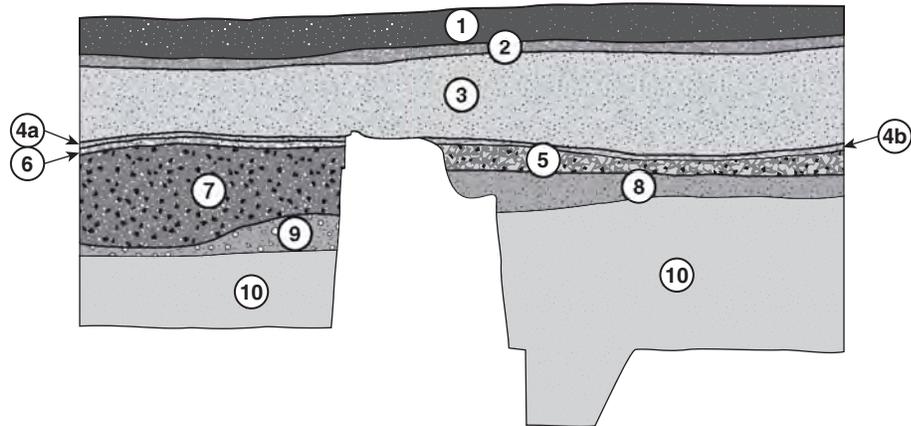
Unit 1 North Wall Profile



- 1 10YR 2/2 very dark brown sandy silt (fill/top)
- 2 10YR 3/6 dark yellowish brown fine sandy silt (fill)
- 3 7.5YR 5/6 strong brown silty very fine sand (fill)
- 4 10YR 6/6 brownish yellow sand
- 5 10YR 4/6 dark yellowish brown mottled with 10YR 5/4 yellowish brown fine sandy silt
- 6 7.5YR 5/6 strong brown silty fine to medium sand lumentated with 10YR 5/4 yellowish brown silty fine sand
- 7 10YR 5/6 yellowish brown fine sand

Figure 32. EU 1, profile of the north wall.

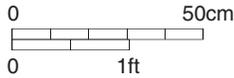
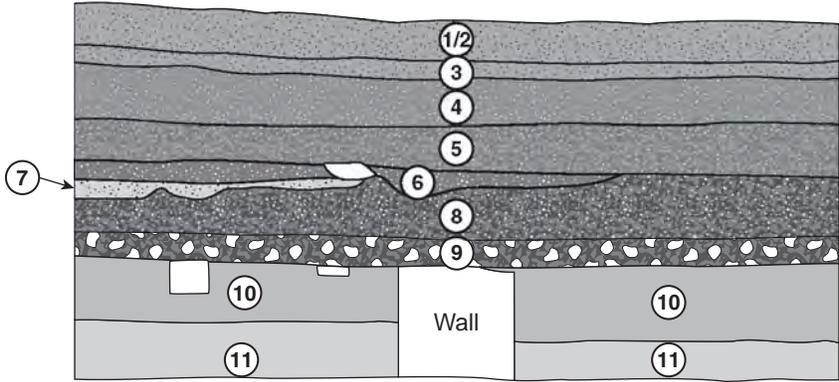
Unit 2 North Wall Profile



- 1 10YR 4/2 dark grayish brown sandy silt
- 2 10YR 4/3 brown mottled with 7.5YR 5/6 strong brown sandy silt
- 3 10YR 5/6 yellowish brown sandy silt
- 4a 10YR 4/3 brown mottled with 10YR 5/6 yellowish brown sandy silt and 10YR 3/1 very dark gray silty sand
- 4b 10YR 4/3 brown mottled with 10YR 5/6 yellowish brown sandy silt
- 5 10YR 3/3 dark brown mottled with 10YR 5/6 yellowish brown sandy silt with 50% coal and clinker
- 6 10YR 4/3 brown sandy silt mottled with 2.5Y 6/3 light yellowish brown and 10YR 3/1 very dark gray silty sand
- 7 2.5Y 4/2 dark grayish brown silty sand with 50% coal and clinker
- 8 10YR 4/3 brown silty sand
- 9 10YR 4/3 brown sandy silt with 50% pebbles
- 10 10YR 5/6 yellowish brown sandy silt

Figure 33. EU 2, profile of the north wall.

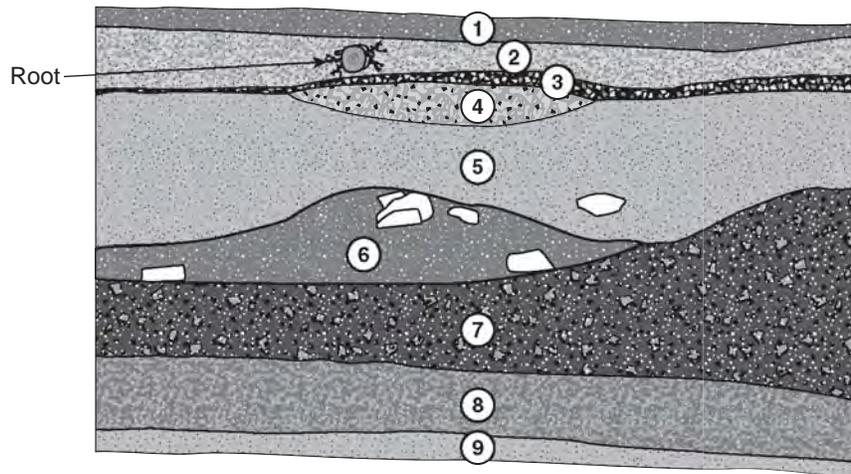
**Unit 3
East Wall Profile**



- 1/2 10YR 4/3 brown sandy silt
- 3 7.5YR 4/4 brown fine sandy silt
- 4 7.5YR 5/6 strong brown compact fine sandy silt
- 5 2.5Y 3/3 dark olive brown mottled with 7.5YR 5/6 strong brown compact fine sandy silt
- 6 2.5Y 4/2 dark grayish brown sandy silt
- 7 10YR 5/6 yellowish brown sandy silt
- 8 2.5Y 3/2 very dark grayish brown mottled with 10YR 4/2 dark grayish brown sandy silt
- 9 2.5Y 3/2 very dark grayish brown mottled with 10YR 4/2 dark grayish brown sandy silt with stone rubble
- 10 2.5Y 5/3 light olive brown silt
- 11 10YR 5/6 yellowish brown clayey silt

Figure 34. EU3, profile of the east wall.

Unit 4 South Wall Profile



- 1 10YR 4/2 dark grayish brown fine sandy silt
- 2 10YR 4/3 brown mottled with 10YR 5/6 yellowish brown fine sandy silt
- 3 10YR 2/1 black silt with gravel
- 4 10YR 4/3 brown mottled with 10YR 5/6 yellowish brown fine sandy silt mixed with coal ash; Feature 1
- 5 10YR 4/6 dark yellowish brown fine sandy silt
- 6 10YR 3/3 dark brown fine sandy clayey silt
- 7 10YR 3/2 very dark brown coarse sandy clayey silt with brick, coal ash, artifacts
- 8 2.5Y 4/3 olive brown mottled with 7.5YR 3/4 dark brown fine sandy clay
- 9 10YR 4/6 dark yellowish brown fine sandy clay

 Rock

Figure 35. EU 4, profile of the south wall.



Plate 10. Plastic and glass vessel fragments, fabric, leather, and a brick fragment from STU 11, LVL 5 (65 to 80 cmbgs) at the Gambacorta Dike.



Plate 11. Plan view of EU 2 at closing, showing the mortared stone wall.



Plate 12. Plan view of EU 3 at closing, showing the mortared stone wall.



Plate 13. Artifacts recovered from the soil layer (Level 10) adjacent to the mortared stone wall.

5.0 SUMMARY AND RECOMMENDATIONS

5.1 SUMMARY

JMA conducted a Phase I archeological survey on three dikes for this project: Army Creek, Gambacorta, and Buttonwood. The assessment included historic background research and an archeological survey with twenty-three (23) shovel tests units (STUs) placed at the Buttonwood Dike and fourteen (14) shovel tests units (STUs) and four (4) excavation units (EUs) placed at the Gambacorta Dike. A section of an erosional scarp was recorded at the Army Creek Dike. In addition, a ground-penetrating radar survey was conducted along the northern portion of the Gambacorta Dike to investigate for possible archeological resources.

In general, the archeological testing resulted in the documentation of considerable amounts of fill within the project area. At the Army Creek Dike, the recordation of the erosional scarp resulted in the identification of four fill episodes related to the construction, and expansion or maintenance of the dike. The berm at the Buttonwood Dike was found to contain recent materials, such as plastics and asphalt. No early fill layers were encountered. The upland portion of the APE for the Buttonwood Dike consisted primarily of fill layers related to prior infilling of a marshy area. However, an intact, buried A-horizon was noted along the northeastern part of the STU grid. Artifacts recovered from the buried A-horizon covered a broad date range. Noted at the western end of the APE for the Gambacorta Dike was extensive filling with household debris, and the disposal of waste materials and building demolition from the Tasker Iron Works. At the eastern end of the dike were the remains of core structures of the New Castle Gas Works, and a neighboring carriage shop, which were found through a combination of a GPR survey and unit excavation.

5.2 RECOMMENDATIONS

5.2.1 The Dike Structures

JMA's recommendation is that each dike is eligible for placement on the National Register of Historic Places (NRHP) under Criterion A for agriculture, transportation, and conservation; Criterion C as representing vernacular landscape architecture; and Criterion D for their potential to provide information important to research questions in historical archeology. JMA also recommends a finding of No Adverse Effect for proposed rehabilitation efforts. This finding is consistent with the NRHP eligibility recommendation for the Red Lion Dike offered in a May 15, 2013 letter from DNREC to the USACE (Clark to Minnichbach, May 15, 2013). Also contained in the letter was the observation that proposed rehabilitation efforts were consistent with historical repairs to preserve the dike structures, and therefore, would not constitute an adverse effect.

5.2.2 Uplands at the Army Creek Dike

The APE at the Army Creek Dike was defined in June 26, 2013, after the conclusion of JMA's archeological investigations (see Figure 22). After reviewing the proposed project area, JMA concludes that archeological testing of the uplands at both ends of the Army Creek Dike is warranted. Historical evidence suggests extensive disturbance of the uplands adjacent to the project area at both ends of the dike resulting from the demolition of the Tasker Iron Works to the east, and from more recent industrial development and filling to the west. However, there is the potential for archeological remains at both locations. At the eastern end the APE is immediately adjacent to the former location of the Tasker Iron Works rolling mill. Judgmental shovel testing along the eastern boundary of the APE were it extends to

Route 9 is recommended to identify the presence or absence of significant archeological resources. At the extreme western boundary of the APE there is a potential for an intact historical uplands surface not affected by previous filling episodes. Limited testing at the location for the presence or absence of significant archeological resources is recommended.

5.2.3 Uplands at the Buttonwood Dike

No additional work is necessary for the upland portions of the Buttonwood Dike project area. Only a small area to north and east at the northern end of the dike contained an intact ground surface; however, artifact concentrations were of insufficient quantity or character to constitute an archeological site. Moreover, the intact ground surface is of sufficient depth that it will not be affected by the rehabilitation project.

5.2.4 Uplands at the Gambacorta Dike

No additional work is necessary for the upland portions within the western part of the project area at the Gambacorta Dike. Extensive disturbance was found at the southern end of the dike, all of which overlays former marsh land; therefore, further investigations are not needed. In addition, the project area is to the north of the former Tasker Iron Works; therefore, industrial remains in context are unlikely to be encountered.

Archeological evidence of structures associated with the gas works, and the carriage shop were identified during investigations of the eastern end of Gambacorta Dike. Current design plans and a verbal commitment in the field for avoidance and minimization of disturbance to the gas works features should ensure preservation in place. However, the use of heavy construction equipment, especially during wet conditions, could damage the resources. If sufficient care cannot be taken to ensure preservation, additional documentation would be recommended. If preservation in place is not viable, a Phase II Archeological Evaluation is recommended.

6.0 REFERENCES CITED

- Ames, D. L., M. E. Callahan, B. L. Herman, and R. J. Siders
1987 *Delaware Comprehensive Historic Preservation Plan*. Center for Historic Architecture and Engineering, College of Urban Affairs and Public Policy, University of Delaware, Newark.
- Baublitz, R., J. Branigan, J. Lawrence, and P. Schopp
2005 *Archaeological Predictive Model, U.S. 301 Project Development, St. Georges and Pencader Hundreds, New Castle County, Delaware*. Prepared for the Delaware Department of Transportation and Rummel, Klepper and Kahl, LLP by A. D. Marble and Company.
- Bailyn, B.
1986 *The Peopling of British North America: An Introduction*. Knopf, New York.
- Baist, G. W.
1893 *Atlas of New Castle County, Delaware*. G. W. Baist, Philadelphia.
- Beers, D. G.
1868 *Atlas of the State of Delaware*. Pomeroy and Beers, Philadelphia.
- Bidwell, P., and J. I. Falconer
1941 *History of Agriculture in the Northern United States, 1620–1860*. Peter Smith, New York.
- Bridenbaugh, C.
1976 The Old and New Societies of the Delaware Valley in the Seventeenth Century. *The Pennsylvania Magazine of History and Biography* 100:143–172.
- Carson, C., N. F. Barka, W. M. Kelso, G. W. Stone, and D. Upton
1981 Impermanent Architecture in the Southern American Colonies. *Winterthur Portfolio* 16:135–196.
- Catts, Wade P. and Timothy Mancl
2013 “To Keep the Banks, Dams and Sluices in Repair.” *An Historical Context for Delaware River Dikes, New Castle County, Delaware*. Prepared for the New Castle Conservation District and the Delaware Department of Natural Resources by John Milner Associates.
- City of New Castle Dike Management Advisory Committee (DMAC). *City of New Castle Dike Management and Improvements*. <http://www.swc.dnrec.delaware.gov/coastal/Pages/CityofNewCastle.aspx> [accessed April 15, 2013].
- Conrad, H. C.
1908 *History of the State of Delaware*, 3 volumes. Henry C. Conrad, Wilmington, DE.
- Coleman, E. C., K. W. Cunningham, J. O’Connor, W. P. Catts, and J. F. Custer
1984 *Phase III Data Recovery Excavations of the William M. Hawthorn Site (7NC-E-46), New Churchman’s Road, Christiana, New Castle County, Delaware*. Delaware Department of Transportation Archaeology Series 28, Dover.
- Cooch, E. W.
1940 *The Battle of Cooch’s Bridge*. Edward W. Cooch, Cooch’s Bridge, DE.

Custer, J. F.

1984a *Delaware Precontact Archaeology: An Ecological Approach*. University of Delaware, Newark.

1984b An Analysis of Fluted Points and Paleo-Indian Site Locations From the Delmarva Peninsula. *Bulletin of the Archaeological Society of Delaware* 16:1–28.

1984c Paleoecology of the Late Archaic: Exchange and Adaptation. *Pennsylvania Archaeologist* 54:32–47.

1986a A Management Plan for Delaware's Precontact Cultural Resources. Monograph No. 2, University of Delaware Center for Archaeological Research, Newark.

1986b Analysis of Early Holocene Projectile Points and Site Locations on the Delmarva Peninsula. *Archaeology of Eastern North America* 14:45–64.

1987 *Management Plan for the Precontact Archaeological Resources of Delaware's Atlantic Coastal Region*. Monograph No.4, University of Delaware Center for Archaeological Research, Newark.

1989 *Precontact Cultures of the Delmarva Peninsula*. University of Delaware, Newark.

1996 *Precontact Cultures of Eastern Pennsylvania*. Anthropological Series No. 7, Pennsylvania Historical and Museum Commission, Harrisburg.

Custer, J. F., and C. DeSantis

1986 *A Management Plan for the Precontact Archaeological Resources of Northern Delaware*. Monograph No. 5, University of Delaware Center for Archaeological Research, Newark.

Custer, J. F., and S. C. Watson

1985 Archaeological Investigations at 7NC-E-42, a Contact Period Site in New Castle County, Delaware. *Journal of Middle Atlantic Archaeology* 1:97–116.

De Cunzo, L. A., and W. P. Catts

1990 *Management Plan for Delaware's Historical Archaeological Resources*. University of Delaware Center for Archaeological Research, Newark.

De Cunzo, Lu Ann, and Ann Marie Garcia

1992 *Historic Context: The Archaeology of Agriculture and Rural Life, New Castle and Kent Counties, Delaware, 1830–1940*. Center for Archaeological Research, Department of Anthropology, University of Delaware, Newark.

Delaware Department of Transportation, Aerial Photograph Collection, as cited.

Delaware State Highway Department (DSHD)

1954 *Report of the State Highway Department, 1954*. Delaware State Highway Department, Dover.

Delaware State Historic Preservation Office (DESHPO)

1993 *Guidelines for Architectural and Archaeological Surveys in Delaware*. Delaware State Historic Preservation Office, Dover.

1997 *DE SHPO Archaeological Site Survey Instructions* (as revised 29 April 1997).

Delaware State Historic Preservation Office, Dover.

Egnal, M.

- 1975 The Economic Development of the Thirteen Continental Colonies, 1720–1775. *William and Mary Quarterly* 32(2):191–222.

Enrolled Bills, State of Delaware

- 1781 A supplementary Act to an Act entitled, “An act to enable the Owners and Possessor of a certain Tract of Meadow Marsh and Cripple on both sides of Mill Creek below the Town of New Castle to keep the Banks, Dams, and Sluices in Repair, and to raise a Fund to defray the Expense thereof.”
- 1791 An additional supplementary Act to an act entitled, “An act to enable the Owners and Possessor of a certain Tract of Meadow Marsh and Cripple on both sides of Mill Creek below the Town of New Castle to keep the Banks, Dams, and Sluices in Repair, and to raise a Fund to defray the Expense thereof.”
- 1792 An Act to enable the Owners and Possessors of a certain Tract of Meadow Ground, Marsh, and Cripple situate at the North End of the Town of New Castle to repair, support and maintain the Banks, Dikes, and Sluices belonging to the same.
- 1843 An Act concerning certain meadow ground, marsh, and cripple on both sides Mill Creek in the neighborhood of the Town of New Castle.
- 1887 An act to amend the act entitled An act to enable the owners & possessors of a certain land of Marsh Meadow ground, marsh & cripple situated in the north end of the Town of New Castle to repair, support and maintain banks, dams and sluices belonging to the same
- 1893 An Act to enable the owners and possessors of a certain tract of meadow ground, marsh and cripple situated at the north end of New Castle to repair and maintain the Banks, Dykes and Sluices belonging to the same.

Fletcher, C. H., III, H. J. Knebel, and J. C. Kraft

- 1990 Holocene Evolution of an Estuarine Coast and Tidal Wetlands. *Geological Society of America Bulletin* 102:283–297.

Gerhing, C. T. (editor)

- 1977 *New York Historical Manuscripts*. Volume XX–XXI. Genealogical Publishing Company, Baltimore.

Hancock, H. B.

- 1987 *Delaware Two Hundred Years Ago: 1780–1800*. The Middle Atlantic Press, Wilmington.

Heite, E. F., and C. L. Blume

- 1995 *Data Recovery Excavations at the Blueberry Hill Precontact Site (7K-C-107)*. Delaware Department of Transportation Archaeology Series No. 130, Dover.

Heite, Louise B., and Edward F. Heite

- 1989 *Saving New Amstel: A proposed City of New Castle Archaeological Preservation Plan*. Prepared for the Trustees of the New Castle Common by Heite Consulting.

-
- Herman, B. L.
1987 *Architecture and Rural Life in Central Delaware, 1700–1900*. University of Tennessee Press, Knoxville.
- Hexamer E.
1876 *Hexamer General Survey*, Vol. 13. Ernest Hexamer, Philadelphia.
- Hoffecker, C. E.
1974 *Wilmington, Delaware: Portrait of an Industrial City, 1830-1910*. University of Virginia Press, Charlottesville.
- Jordan, R. R.
1964 *Columbia (Pleistocene) Sediments of Delaware*. Delaware Geological Survey Bulletin No. 12, Newark.
- Joyce, A. A.
1988 Early/Middle Holocene Environments in the Middle Atlantic Region: A Revised Reconstruction. In *Holocene Human Ecology in Northeastern North America*, edited by G. P. Nichols, pp. 185–214. Plenum Press, New York.
- Kellogg, Douglas C.
1993 *A Cultural Resources Reconnaissance Planning Survey of the Proposed Delaware Route 301 Corridor, New Castle County, Delaware*. Archaeology Series No. 98, Delaware Department of Transportation, Dover.
- Kellogg, Douglas C., and Jay F. Custer (editors)
1994 *Paleoenvironmental Studies of the State Route 1 Corridor: Contexts for Prehistoric Settlement*. Archaeology Series No. 114, Delaware Department of Transportation, Dover.
- Kelso, W. M.
1984 *Kingsmill Plantations, 1619–1800: Archaeology of Country Life in Colonial Virginia*. Academic Press, Orlando, FL.
- Knebel, H. J., Fletcher, C. H., III, and J. C. Kraft
1988 Late Wisconsinan - Holocene Paleogeography of Delaware Bay; A Large Coastal Plain Estuary. *Marine Geology* 83:115–133.
- Lemon, J. T.
1967 Urbanization and Development of 18th Century Southeastern Pennsylvania and Adjacent Delaware. *William and Mary Quarterly* 24(4):501–542.
- Lindstrom, Diane
1978 *Economic Development in the Philadelphia Region, 1810–1850*. Columbia University, New York.
- Mancl, Timothy, Peter Leach, Elizabeth LaVigne, William Chadwick, and Wade P. Catts
Forthcoming *Phase I Archeological Survey of the Broad Marsh Dike New Castle, New Castle County, Delaware*. Prepared for the New Castle Conservation District by John Milner Associates, Inc.
- McCarthy, Deirdre, Rebecca J. Siders, Bernard L. Herman, Julie C. Darsie, Dawn Melson, and Louis P. Nelson

- 1996 *Delaware Valley Threatened Buildings Survey: Buttonwood, New Castle Vicinity, New Castle County, Delaware (HABS DE-7)*. Manuscript prepared by the Center for Historic Architecture and Engineering, College of Urban Affairs and Public Policy, University of Delaware, Newark.
- Meyer, Elias
1757 *Plan of the Battery at New Castle, on Delaware, Laid-out the 2nd May, 1757*. MG-11 Map Collection, Map 517. Pennsylvania State Archives, Harrisburg.
- Munroe, John A.
1978 *Colonial Delaware: A History*. KTO Press, Millwood, NJ.
- Myers, A. C. (editor)
1912 *Narratives of Early Pennsylvania, West Jersey, and Delaware, 1630–1707*. Original Narratives of Early American History Series, vol. 12. Charles Scribner's Sons, New York.
- O'Callaghan, E.B. (editor)
1858 *Documents Relative to the Colonial History of New York: Holland Documents, Volume II*. Weed and Parsons, Albany, New York.
- Omwake, G., and T. D. Stewart
1963 The Townsend Site Near Lewes, Delaware. *Archeolog* 15(1):1–72.
- Ramsey, Kelvin W.
2005 *Surficial Geology of the State of Delaware, New Castle County*. Delaware Geological Survey. 1:100,000.
- Rea, S. and J. Price
1848 *Map of New Castle County*. Smith and Wistar, Philadelphia.
- Sanborn Fire Insurance Map Company
1885 *Town of New Castle, Delaware*, Plate 4.
- Scharf, J. Thomas
1888 *History of Delaware, 1609–1888*. L.J. Richards and Company, Philadelphia.
- Secretary of the Interior
1983 *Standards and Guidelines for Archeology and Historic Preservation*. Washington, DC.
- Stevens, J. S.
1991 A Story of Plants, Fire, and People: The Paleoecology and Subsistence of the Late Archaic and Early Woodland in Virginia. In *Late Archaic and Early Woodland Research in Virginia*, edited by T.R. Reinhart and M.E.N. Hodges, pg. 185–220. Special Publication Number 23, Archaeological Society of Virginia, Richmond.
- Stewart, R. M.
1994 *Precontact Farmers of the Susquehanna Valley: Clemson Island Culture and the St. Anthony Site*. Archaeological Services, Bethlehem, CT.
- Thomas, R. A., D. R. Griffith, C. L. Wise, and R. E. Artusy Jr.
1975 Environmental adaptation on Delaware's Coastal Plain. *Archaeology of Eastern North America* 3:35–90.
- Trustees of the Loan Office of New Castle

-
- 1852 Order to Pay Workmen At Battery At New Castle, 1757. *Pennsylvania Archives*, First Series, Volume 3. Joseph Severns & Company, Philadelphia.
- United States Department of Agriculture Natural Resource Conservation Service (USDA). Web Soil Survey. Available online at <http://websoilsurvey.nrcs.usda.gov/>. Accessed [05/23/2013].
- United States Department of Agriculture, Aerial Photograph Collection, as cited.
- United States Geological Survey (USGS)
1993 *Delaware City, Del-N.J. 7.5 Minute Quadrangle*. United States Geological Survey, Washington D.C.
- Walzer, J. F.
1972 Colonial Philadelphia and its Backcountry. *Winterthur Portfolio* 7:161–173.
- Welsh, P. C.
1956 Merchants, Millers, and Ocean Ships: The Components of an Early American Industrial Town. *Delaware History* 7:319–337.
- Weslager, C. A.
1987 *The Swedes and the Dutch at New Castle*. The Middle Atlantic Press, Inc., Wilmington.

Appendix I:
Artifact Inventory

Buttonwood Dike

Gambacorta Dike

Buttonwood Artifact Inventory
 New Castle Dikes, Phase I
 New Castle County, Delaware
 JMA April-May 2013

Prov. Cat. No.	STU/EU	LEVEL	DEPTH (CMBS)	CT	DESCRIPTION	COMMENTS	DATE RANGE
1	STU 01	1	0-28	1	Gardening, Ceramic: Flower Pot		
1	STU 01	1	0-28	2	Brick, Fragment: Unidentified, Unglazed		
1	STU 01	1	0-28	2	Machine-Made Bottle Fragment: Clear	Embossed Lettering	1903-2000
1	STU 01	1	0-28	1	Nail: Unidentified		
1	STU 01	1	0-28	1	Window Glass: All Thicknesses		
2	STU 02	1	0-22	1	Madison Point: Jasper	1 Tang Broken	1150-300 BP
2	STU 02	1	0-22	1	Whiteware: Polychrome Hand Painted		1830-1875
2	STU 02	1	0-22	1	Brick, Fragment: Unidentified, Unglazed		
2	STU 02	1	0-22	1	Unidentified Bottle Fragment: Aqua	Threaded Neck	
2	STU 02	1	0-22	1	Unidentified Bottle Fragment: Clear		
3	STU 02	2	22-27	1	Whiteware: Plain		1810-2000
4	STU 02	3	27-44	2	Unidentified Bottle Fragment: Clear		
5	STU 04	1	0-30	1	Creamware: Light-Colored Yellow		1775-1820
5	STU 04	1	0-30	1	Pressed-Glass Tableware: Paneled		1825-2000
5	STU 04	1	0-30	1	Unidentified Bottle Fragment: Clear		
5	STU 04	1	0-30	1	Machine-Made Bottle Fragment: Amber		1903-2000
5	STU 04	1	0-30	1	Stone: Unidentified Tile	Possibly Synthetic Building Material	
6	STU 04	2	30-50	1	Coca-Cola Bottle Frag, Hobble Skirt: Coke-Bottle Green		1915-2000
7	STU 05	1	0-20	1	Plumbing, Ceramic: Drainage Pipe		
7	STU 05	1	0-20	1	Fastener, Metal: Screw		1846-2000
7	STU 05	1	0-20	1	Tile: Ceramic	Painted Red	
8	STU 06	1	0-24	1	Redware: Manganese Lead Glaze	Interior/Exterior	
8	STU 06	1	0-24	1	Unidentified Bottle Fragment: Clear	Threaded Neck, Possible Jar	
8	STU 06	1	0-24	1	Pipe Stem: 5/64th-Inch Ball Clay		1710-1750
9	STU 06	3	60-95	1	Redware: Manganese Lead Glaze	Flat Rim Sherd	
9	STU 06	3	60-95	1	Redware: Unglazed	1 Surface Missing	

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10	STU 07	2	16-48	1	Brick, Fragment: Unidentified, Unglazed		
10	STU 07	2	16-48	1	Unidentified Bottle Fragment: Clear		
10	STU 07	2	16-48	1	Unidentified Bottle Fragment: Aqua		
11	STU 07	3	48-65	1	Flake Fragment: Chert		
12	STU 07N	3	26-54	2	Redware: Manganese Lead Glaze	Interior Only	
12	STU 07N	3	26-54	1	Window Glass: All Thicknesses		
13	STU 07W	3	20-48	1	Flake 10-15mm: Jasper		
13	STU 07W	3	20-48	1	Redware: Manganese Lead Glaze	Interior/Exterior	
13	STU 07W	3	20-48	1	Redware: Manganese Lead Glaze	Interior Only	
13	STU 07W	3	20-48	1	Unidentified Bottle Fragment: Olive Green		
13	STU 07W	3	20-48	1	Miscellaneous, Ceramic: Clay Pigeon	1 Surface Painted Yellow	1880-2000
13	STU 07W	3	20-48	1	Dinnerware, Plastic: Plate/Cup	Yellow	
13	STU 07W	3	20-48	1	Unidentified Plastic: Fragment		Post 1915
14	STU 07W	4	48-54	1	Decortication Flake 15-30mm: Jasper		
15	STU 07S	3	26-50	1	Redware: Trailed Slip, Clear Glaze		1670-1850
16	STU 11	3	6-56	1	Decortication Flake 30-45mm: Jasper		
16	STU 11	3	6-56	1	Mortar: Unidentified	Attached to Stone	
16	STU 11	3	6-56	1	Fastener, Metal: Screw		1846-2000
16	STU 11	3	6-56	1	Floral: Wood Fragment		
17	STU 12	4	104-119	1	Redware: Clear Glaze With Brown Mottling	Interior Only	
17	STU 12	4	104-119	1	Whiteware: Monochrome Hand Painted	Pinkish Red	1810-2000
18	STU 13	3		2	Whiteware: Plain		1810-2000
18	STU 13	3		1	Brick, Fragment: Unidentified, Unglazed		
18	STU 13	3		1	Machine-Made Bottle Fragment: Clear		1903-2000
18	STU 13	3		1	Coal: Lump/Nugget		
18	STU 13	3		1	Unidentified Metal Object: Slag		
19	STU 13	4		1	Whiteware: Plain	Eroded Surfaces	1810-2000

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19	STU 13	4		1	Miscellaneous, Ceramic: Clay Pigeon	1 Surface Painted Yellow	1880-2000
20	STU 14	2	17-44	1	Unidentified Point: Quartzite		
20	STU 14	2	17-44	1	Creamware: Light-Colored Yellow		1775-1820
20	STU 14	2	17-44	1	Window Glass: All Thicknesses		
21	STU 14	3	44-64	1	Redware: Manganese Lead Glaze	1 Surface Missing	
21	STU 14	3	44-64	1	Pressed-Glass Tableware: Paneled		1825-2000
21	STU 14	3	44-64	1	Unidentified Bottle Fragment: Aqua		
21	STU 14	3	44-64	1	Unidentified Plastic: Fragment	Thin W/ Black Text	Post 1915
Total						66	

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1	STU 2	4	24-36	4	Miscellaneous, Metal: Unidentified	Sample	
2	EU 1	1		1	Redware: Unglazed	1 Surface Missing	1842-1930
2	EU 1	1		1	White Granite Ware: Plain		1880-1915
2	EU 1	1		1	Unidentified Bottle Fragment: Amethyst		
2	EU 1	1		2	Unidentified Bottle Fragment: Clear		
2	EU 1	1		1	Unidentified Bottle Fragment: Aqua		
2	EU 1	1		1	Window Glass: All Thicknesses		
2	EU 1	1		1	Brick, Fragment: Unidentified, Unglazed		
2	EU 1	1		1	Domestic Coin: 25-Cent Piece	1987	Post 1987
2	EU 1	1		1	Domestic Coin: 10-Cent Piece	1986	Post 1986
3	EU 1	2	12-23	1	Redware: Manganese Lead Glaze	Interior/Exterior	
3	EU 1	2	12-23	1	Redware: Clear Glaze With Brown Mottling	Interior Only	
3	EU 1	2	12-23	1	Redware: Trailed Slip, Clear Glaze	Interior Only	1670-1850
3	EU 1	2	12-23	1	Whiteware: Plain		1810-2000
3	EU 1	2	12-23	1	Toy, Glass: Machine-Made Marble	Green Center	1901-2000
4	EU 2	2		1	Redware: Plain, Clear Glaze		
4	EU 2	2		2	Brick, Fragment: Unidentified, Unglazed		
4	EU 2	2		1	Domestic Coin: Small Cent	Lincoln, Broken, No Date Visible	1856-2000
4	EU 2	2		1	Domestic Coin: Small Cent	1976	Post 1976
4	EU 2	2		1	Unidentified Nail: Cut or Wrought		
5	EU 2	3A		1	Creamware: Light-Colored Yellow	1 Surface Missing	1775-1820
5	EU 2	3A		1	Whiteware: Plain		1810-2000
5	EU 2	3A		1	Unidentified Bottle Fragment: Clear		
5	EU 2	3A		2	Brick, Fragment: Unidentified, Unglazed		
5	EU 2	3A		1	Domestic Gray Stoneware: Gray Salt Glaze w/Albany Slip Interior		1805-1920
6	EU 2	3B		1	Redware: Brown Glaze	Interior Only	
6	EU 2	3B		1	20th-Century Refined Earthenware: Plain		

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6	EU 2	3B		4	Whiteware: Plain		1810-2000
6	EU 2	3B		1	Hard-Paste Porcelain: Molded		
6	EU 2	3B		1	Kitchen Glass: Canning-Lid Liner, Milk Glass		Post 1869
6	EU 2	3B		2	Unidentified Bottle Fragment: Clear		
6	EU 2	3B		1	Machine-Made Bottle Fragment: Clear		1903-2000
6	EU 2	3B		1	Unidentified Bottle Fragment: Cobalt Blue		
6	EU 2	3B		1	Unidentified Bottle Fragment: Light Green		
6	EU 2	3B		1	Flat Glass: Colored	Green	
7	EU 2	4		1	Redware: Manganese Lead Glaze	Overfired	
7	EU 2	4		6	Whiteware: Plain		1810-2000
7	EU 2	4		1	Whiteware: Molded	Rim	1810-2000
7	EU 2	4		1	White Granite Ware: Plain	Rim	1842-1930
7	EU 2	4		2	Hard-Paste Porcelain: Plain		
7	EU 2	4		1	Decorated/Embossed Glass Fragment: Clear		
7	EU 2	4		1	Decorated/Embossed Glass Fragment: Aqua		
7	EU 2	4		4	Unidentified Bottle Fragment: Clear		
7	EU 2	4		2	Unidentified Bottle Fragment: Light Green		
7	EU 2	4		1	Unidentified Bottle Fragment: Aqua		
7	EU 2	4		1	Unidentified Bottle Fragment: Milk Glass		
7	EU 2	4		1	Flat Glass: Colored	Green	
7	EU 2	4		3	Unidentified Nail: Cut or Wrought		
8	EU 2	5		1	Coarse Earthenware: Buff Body, Slip Glaze	Mottled Glaze	
8	EU 2	5		4	Whiteware: Edge Decorated	Mend, Blue Painted Edge	1810-1900
8	EU 2	5		4	Whiteware: Plain		1810-2000
8	EU 2	5		3	White Granite Ware: Plain		1842-1930

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8	EU 2	5		1	White Granite Ware: Molded	Rim	1842-1995
8	EU 2	5		1	Domestic Gray Stoneware: Plain Salt Glaze		1705-1930
8	EU 2	5		1	Hard-Paste Porcelain: Hand-Painted Overglaze	Polychrome Floral	
8	EU 2	5		1	Hard-Paste Porcelain: Japanese		1868-2000
8	EU 2	5		1	Toy, Ceramic: Bisque Doll	Fragment of Head	1870-1930
8	EU 2	5		1	Kitchen Glass: Canning-Lid Liner, Milk Glass		Post 1869
8	EU 2	5		1	Grooming/Hygiene, Glass: Milk Glass Cold-Cream Jar	Whole, Lid Missing	
8	EU 2	5		2	Pressed-Glass Tableware: Paneled	Mug/Pitcher	1825-2000
8	EU 2	5		1	Machine-Made Bottle Fragment: Clear	Hazel-Atlas Glass Co. 1920-1964	1920-1964
8	EU 2	5		5	Unidentified Bottle Fragment: Clear		
8	EU 2	5		2	Machine-Made Bottle Fragment: Clear	Bases, One Marked "PHILA."	1903-2000
8	EU 2	5		1	Unidentified Bottle Fragment: Amber		
8	EU 2	5		1	Window Glass: 7 - 8mm Thick	Plate Glass	
8	EU 2	5		2	Fastener, Metal: Spike		
8	EU 2	5		1	Projectile: Center-Fire Cartridge		
8	EU 2	5		1	Faunal: Bone		
9	EU 2	8		3	White Granite Ware: Plain		1842-1930
9	EU 2	8		2	Brick, Fragment: Unidentified, Unglazed		
9	EU 2	8		1	Unidentified Bottle Fragment: Milk Glass		
9	EU 2	8		4	Unidentified Bottle Fragment: Clear		
9	EU 2	8		1	Unidentified Bottle Fragment: Amber		
9	EU 2	8		1	Nail: Unidentified		
9	EU 2	8		1	Mortar: Unidentified		
9	EU 2	8		2	Faunal: Bone	Cut	
10	EU 2	9		1	Unidentified Bottle Fragment: Aqua		
10	EU 2	9		1	Brick, Fragment: Unidentified, Unglazed		

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10	EU 2	9		1	Nail: Unidentified		
10	EU 2	9		1	Unidentified Hardware, Metal: Iron		
10	EU 2	9		1	Faunal: Oyster Shell Fragments		
11	EU 2	Feature 1	75-79	bd	3 Unidentified Nail: Cut or Wrought		
12	EU 3	1		1	Decorated/Embossed Glass Fragment: Clear	Bottle	
13	EU 3	3		1	Redware: Manganese Lead Glaze	Interior/Exterior	1670-1795
13	EU 3	3		1	Buff-Bodied Earthenware: Yellowware, Staffordshire		
13	EU 3	3		1	Wire Common Nail: Complete		1850-2000
13	EU 3	3		3	Nail: Unidentified		
13	EU 3	3		1	Domestic Coin: Small Cent	1974	Post 1974
14	EU 3	4A		1	Free-Blown Bottle Fragment: Olive Green	Weathered	
14	EU 3	4A		1	Unidentified Bottle Fragment: Aqua		
14	EU 3	4A		1	Lamp Chimney, Glass: Clear		
15	EU 3	4B		1	Redware: Unglazed		
15	EU 3	4B		3	Unidentified Bottle Fragment: Clear		
16	EU 3	4B		2	Redware: Unglazed		
16	EU 3	5A		1	Redware: Manganese Lead Glaze	Interior Only	
16	EU 3	5A		1	Redware: Refined, Clear Glaze	Interior/Exterior	
16	EU 3	5A		2	White Granite Ware: Plain		1842-1930
16	EU 3	5A		1	Domestic Gray Stoneware: Blue Decorated Salt Glaze		
16	EU 3	5A		1	Chinese Export Porcelain: Overglaze, China Trade	Blue	
16	EU 3	5A		1	Kitchen Glass: Canning-Lid Liner, Milk Glass		Post 1869
16	EU 3	5A		3	Free-Blown Bottle Fragment: Olive Green		
16	EU 3	5A		1	Unidentified Bottle Fragment: Clear	Embossed Label	

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16	EU 3	5A			2 Unidentified Bottle Fragment: Clear		
16	EU 3	5A			1 Decorated/Embossed Glass Fragment: Clear		
16	EU 3	5A			1 Decorated/Embossed Glass Fragment: Aqua		
16	EU 3	5A			1 Unidentified Bottle Fragment: Amber		
16	EU 3	5A			2 Window Glass: All Thicknesses		
16	EU 3	5A			1 Electrical, Metal: Wire Fragment		
17	EU 3	5B			1 Whiteware: Plain		1810-2000
17	EU 3	5B			3 Unidentified Bottle Fragment: Clear		
17	EU 3	5B			1 Window Glass: 6 - 7mm Thick	Plate Glass	
17	EU 3	5B			1 Nail: Unidentified		
17	EU 3	5B			1 Fastener, Metal: Spike		
18	EU 3	6			1 Whiteware: Decal, Overglaze	Small Saucer, Possibly a Childs	1897-2000
18	EU 3	6			1 Whiteware: Mocha-Dendritic (Dipped)		1825-1840
18	EU 3	6			1 White Granite Ware: Plain		1842-1930
18	EU 3	6			2 Hard-Paste Porcelain: Plain		
18	EU 3	6			1 Chinese Export Porcelain: Plain		
18	EU 3	6			2 Kitchen Glass: Canning Jar, Screw Top	Clear, Large	1858-2000
18	EU 3	6			49 Unidentified Bottle Fragment: Clear	Assorted, Some Very Thick & Large	
18	EU 3	6			9 Unidentified Bottle Fragment: Aqua		
18	EU 3	6			7 Decorated/Embossed Glass Fragment: Clear		
18	EU 3	6			1 Unidentified Bottle Fragment: Amber		
18	EU 3	6			1 Brick, Fragment: Unidentified, Unglazed		
18	EU 3	6			1 Handwrought Nail: Complete		Pre 1820
18	EU 3	6			14 Nail: Unidentified		
18	EU 3	6			1 Storage, Metal: Crown Bottle Cap	Possible	1892-2000

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18	EU 3	6		1	Miscellaneous, Plastic: Phonograph Record	Melted	1895-2000
18	EU 3	6		1	Floral: Tar Paper	Roofing	
18	EU 3	6		2	Floral: Board		
18	EU 3	6		3	Auto/Garage/Machine: Graphite Battery Part		Post 1896
18	EU 3	6		12	Auto/Garage/Machine: Carbon Battery Part		
18	EU 3	6		1	Unidentified Metal Object: Slag		
18	EU 3	6		6	Faunal: Bone	1 Cut	
19	EU 3	7		2	Redware: Clear Glaze With Brown Mottling		
19	EU 3	7		1	Whiteware: Plain		1810-2000
19	EU 3	7		2	White Granite Ware: Plain		1842-1930
19	EU 3	7		1	Hard-Paste Porcelain: Hotel Ware	Painted Green	1860-2000
19	EU 3	7		1	Hard-Paste Porcelain: Plain		
19	EU 3	7		1	Free-Blown Bottle Fragment: Clear	Rim, Possible Tumbler	
19	EU 3	7		1	Unidentified Bottle Fragment: Amethyst		1880-1915
19	EU 3	7		9	Unidentified Bottle Fragment: Clear		
19	EU 3	7		1	Machine-Made Bottle Fragment: Clear	Embossed on Base	1903-2000
19	EU 3	7		4	Window Glass: All Thicknesses		
19	EU 3	7		4	Window Glass: 6 - 7mm Thick	Plate Glass	
19	EU 3	7		32	Nail: Unidentified		
19	EU 3	7		1	Unidentified Hardware, Metal: Iron		
19	EU 3	7		1	Unidentified Metal Object: Slag		
19	EU 3	7		1	Floral: Wood Fragment		
19	EU 3	7		7	Faunal: Bone	1 Cut	
19	EU 3	7		2	Faunal: Oyster Shell Fragments		
20	EU 3	8		1	Redware: Unglazed	1 Surface Missing	

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20	EU 3	8		1	Redware: Clear Glaze With Brown Mottling	Interior/Exterior	
20	EU 3	8		3	Whiteware: Plain		1810-2000
20	EU 3	8		1	Yellowware: Plain		1830-1930
20	EU 3	8		2	Unidentified Bottle Fragment: Amethyst		1880-1915
20	EU 3	8		5	Unidentified Bottle Fragment: Clear		
20	EU 3	8		3	Unidentified Bottle Fragment: Light Green		
20	EU 3	8		1	Unidentified Bottle Fragment: Green		
20	EU 3	8		7	Machine-Made Bottle Fragment: Amber		1903-2000
20	EU 3	8		1	Kitchen Glass: Canning-Lid Liner, Milk Glass		Post 1869
20	EU 3	8		1	Cut Common Nail: Fragment		1805-2000
20	EU 3	8		5	Nail: Unidentified		
20	EU 3	8		1	Auto/Garage/Machine, Metal: Railroad Spike, Machine Made		Post 1839
20	EU 3	8		1	Stable, Metal: Horseshoe		
20	EU 3	8		5	Faunal: Bone		
21	EU 3	10A		1	Flake 6-10mm: Jasper		
21	EU 3	10A		3	Redware: Brown Glaze		
21	EU 3	10A		2	Redware: Manganese Lead Glaze		
21	EU 3	10A		1	Redware: Triled Slip, Clear Glaze		
21	EU 3	10A		1	Coarse Earthenware: Agateware		1670-1850
21	EU 3	10A		2	Whiteware: Plain		1750-1810
21	EU 3	10A		1	White Granite Ware: Molded		1810-2000
21	EU 3	10A		1	Industrial Stoneware Bottle: Light-Brown Glaze		1842-1995
21	EU 3	10A		1	Domestic Gray Stoneware: Plain Salt Glaze		
21	EU 3	10A		2	Unidentified Bottle Fragment: Amber		
21	EU 3	10A		1	Unidentified Bottle Fragment: Light Green		

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21	EU 3	10A		1	Window Glass: All Thicknesses		
21	EU 3	10A		1	Projectile: Rimfire Cartridge		Post 1866
21	EU 3	10A		1	Unidentified Metal Object: Lead	Flat, Rectangular Strip	
21	EU 3	10A		4	Nail: Unidentified		
22	EU 3	10B		1	Redware: Trailed Slip, Clear Glaze	Interior Only	1670-1850
22	EU 3	10B		1	Creamware: Light-Colored Yellow	Incised Decoration	1775-1820
22	EU 3	10B		1	Free-Blown Bottle Fragment: Olive Green		
22	EU 3	10B		1	Window Glass: All Thicknesses		
23	EU 4	1		1	Domestic Gray Stoneware: Plain Salt Glaze	Waterworn, Handle Fragment	1705-1930
23	EU 4	1		1	Unidentified Bottle Fragment: Clear		
23	EU 4	1		1	Domestic Coin: 10-Cent Piece	1998	Post 1998
23	EU 4	1		1	Domestic Coin: 10-Cent Piece	1966	Post 1966
23	EU 4	1		1	Nail: Unidentified		
24	EU 4	2		1	Redware: Trailed Slip, Clear Glaze	Interior Only, Crimped Rim, Eroded	1670-1850
24	EU 4	2		1	Pearlware: Plain		1779-1830
24	EU 4	2		2	Machine-Made Bottle Fragment: Clear		1903-2000
24	EU 4	2		1	Machine-Made Bottle Fragment: Amber	Mouth	1903-2000
24	EU 4	2		1	Machine-Made Bottle Fragment: Amber	Owens-Illinois Glass Co. 1929-1954 Maker's Mark	1929-1954
24	EU 4	2		1	Brick, Fragment: Unidentified, Unglazed		
25	EU 4	3		1	Whiteware: Plain	1 Surface Missing	1810-2000
25	EU 4	3		1	Whiteware: Brown Transfer Print		1820-1915
25	EU 4	3		4	Unidentified Bottle Fragment: Clear		
25	EU 4	3		2	Unidentified Bottle Fragment: Aqua		
25	EU 4	3		1	Unidentified Bottle Fragment: Amber		
25	EU 4	3		2	Window Glass: All Thicknesses		
25	EU 4	3		5	Nail: Unidentified		
25	EU 4	3		10	Unidentified Metal Object: Slag		

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25	EU 4	3		1	Coal: Lump/Nugget		
25	EU 4	3		1	Coal: Coal Ash (Slag)		
26	EU 4	4		3	Domestic Brown Stoneware: 20th-Cent Bristol Glaze Blue Sponge Dec		
26	EU 4	4		5	Unidentified Bottle Fragment: Clear		
26	EU 4	4		2	Unidentified Bottle Fragment: Aqua		
26	EU 4	4		1	Unidentified Bottle Fragment: Milk Glass		
26	EU 4	4		1	Kitchen Glass: Canning Jar, Screw Top		Post 1743
26	EU 4	4		1	Brick, Fragment: Unidentified, Unglazed		1858-2000
26	EU 4	4		1	Unidentified Metal Object: Slag		
26	EU 4	4		1	Petroleum Product: Asphalt Paving		1871-2000
26	EU 4	4		2	Nail: Unidentified		
27	EU 4	5		1	Redware: Brown Glaze	Bottle	
27	EU 4	5		1	Pearlware: Blue Transfer Print		1783-1840
27	EU 4	5		1	Whiteware: Annular		1810-2000
27	EU 4	5		4	Whiteware: Plain		1810-2000
27	EU 4	5		1	White Granite Ware: Molded		1842-1995
27	EU 4	5		1	Yellowware: Annular/Banded		1830-1930
27	EU 4	5		1	Chinese Export Porcelain: Underglaze Blue		
27	EU 4	5		1	Pressed-Glass Tableware: Diamonds		1825-2000
27	EU 4	5		5	Unidentified Bottle Fragment: Clear		
27	EU 4	5		2	Unidentified Bottle Fragment: Aqua		
27	EU 4	5		1	Decorated/Embossed Glass Fragment: Amethyst		1880-1915
27	EU 4	5		1	Unidentified Bottle Fragment: Amber		
27	EU 4	5		1	Kitchen Glass: Canning Jar, Screw Top		1858-2000
27	EU 4	5		1	Window Glass: All Thicknesses		
27	EU 4	5		1	Lighting Glass: Clear		
27	EU 4	5		2	Nail: Unidentified		

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PROV. CAT. No.	STU/EU	LEVEL	DEPTH (CMBS)	CT	DESCRIPTION	COMMENTS	DATE RANGE
28	EU 4	6		1	Tin-Glazed Earthenware: Blue Glaze		1752-1771
28	EU 4	6		3	Ironstone: Plain White		1813-1900
28	EU 4	6		1	Ironstone: Black Transfer Print	Portion of a Maker's Mark, Royal Court of Arms	
28	EU 4	6		2	20th-Century Refined Earthenware: Underglaze Polychrome		
28	EU 4	6		1	Free-Blown Bottle Fragment: Olive Green	Weathered	
28	EU 4	6		6	Unidentified Bottle Fragment: Clear		
28	EU 4	6		1	Unidentified Bottle Fragment: Green		
28	EU 4	6		1	Unidentified Bottle Fragment: Light Green	Depression Glass?	
28	EU 4	6		1	Brick, Fragment: Unidentified, Unglazed	Weathered	
28	EU 4	6		5	Nail: Unidentified		
28	EU 4	6		1	Projectile: Rimfire Cartridge		Post 1866
28	EU 4	6		1	Petroleum Product: Asphalt Paving		1871-2000
28	EU 4	6		2	Faunal: Oyster Shell Fragments		
28	EU 4	6		1	Faunal: Clam		
29	EU 4	7		1	Redware: Trilled Slip, Clear Glaze	Interior Only, Rim, Eroded	1670-1850
29	EU 4	7		1	Buff-Bodied Earthenware: American Majolica	Jug Fragment	1851-1890
29	EU 4	7		1	Yellowware: Plain		1830-1930
29	EU 4	7		2	20th-Century Refined Earthenware: Underglaze Polychrome	Same Vessel As Level 6	
29	EU 4	7		3	Ironstone: Plain White		1813-1900
29	EU 4	7		5	Whiteware: Plain		1810-2000
29	EU 4	7		1	Whiteware: Green Transfer Print	Mark: Pattern "DERWOOD", Maker: W.S. George Pottery Company 1904-1960	1904-1960
29	EU 4	7		1	Hard-Paste Porcelain: Plain		
29	EU 4	7		1	Pipe Stem: 5/64th-Inch Ball Clay		1710-1750

Gambacorta Dike Artifact Inventory
 New Castle Dikes, Phase I
 New Castle County, Delaware
 JMA April-May 2013

PROV. CAT. No.	STU/EU	LEVEL	DEPTH (CMBS)	CT	DESCRIPTION	COMMENTS	DATE RANGE
29	EU 4	7		2	Unidentified Bottle Fragment: Olive Green		
29	EU 4	7		1	Machine-Made Bottle Fragment: Clear	Embossed Label	1903-2000
29	EU 4	7		1	Machine-Made Bottle Fragment: Amber	Embossed Label	1903-2000
29	EU 4	7		3	Machine-Made Bottle Fragment: Clear		1903-2000
29	EU 4	7		3	Machine-Made Bottle Fragment: Amber		1903-2000
29	EU 4	7		4	Unidentified Bottle Fragment: Aqua		
29	EU 4	7		1	Grooming/Hygiene, Glass: Milk Glass Cold-Cream Jar	Whole, Lid Missing	
29	EU 4	7		1	Fastener, Metal: Brass Hook & Eye		1836-2000
29	EU 4	7		1	Fastener, Metal: Spike		
29	EU 4	7		1	Wire Common Nail: Fragment		1850-2000
29	EU 4	7		18	Nail: Unidentified		
29	EU 4	7		2	Unidentified Metal Object: Slag		
29	EU 4	7		1	Unidentified Plastic: Fragment		Post 1915
29	EU 4	7		3	Faunal: Bone		
30	EU 4	8		1	Gardening, Ceramic: Flower Pot	Thin Body	
30	EU 4	8		1	Ironstone: Plain White	Rim	1813-1900
30	EU 4	8		1	Hard-Paste Porcelain: Japanese	Rim	1868-2000
30	EU 4	8		1	Free-Blown Bottle Fragment: Olive Green		
30	EU 4	8		4	Machine-Made Bottle Fragment: Cobalt Blue	Bromo-Seltzer Post 1914	Post 1914
30	EU 4	8		6	Unidentified Bottle Fragment: Clear		
30	EU 4	8		6	Unidentified Bottle Fragment: Aqua		
30	EU 4	8		1	Decorated/Embossed Glass Fragment: Clear		
30	EU 4	8		1	Unidentified Bottle Fragment: Green		
30	EU 4	8		7	Unidentified Bottle Fragment: Amber		
30	EU 4	8		4	Window Glass: All Thicknesses		
30	EU 4	8		2	Brick, Fragment: Unidentified, Unglazed		

Gambacorta Dike Artifact Inventory
 New Castle Dikes, Phase I
 New Castle County, Delaware
 JMA April-May 2013

PROV. CAT. No.	STU/EU	LEVEL	DEPTH (CMBS)	CT	DESCRIPTION	COMMENTS	DATE RANGE
30	EU 4	8		1	Miscellaneous, Metal: Hook		
30	EU 4	8		1	Lighting Glass: Clear		
30	EU 4	8		1	Wire Common Nail: Fragment		1850-2000
30	EU 4	8		17	Nail: Unidentified		
30	EU 4	8		1	Fastener, Metal: Spike		
30	EU 4	8		5	Faunal: Bone		
31	EU 4	9		1	Redware: Brown Glaze	Interior/Exterior	
31	EU 4	9		2	Ironstone: Plain White		1813-1900
31	EU 4	9		2	Whiteware: Plain		1810-2000
31	EU 4	9		1	Yellowware: Plain	Rim	1830-1930
31	EU 4	9		1	Domestic Gray Stoneware: Blue Decorated Salt Glaze	Rim	
31	EU 4	9		1	Hard-Paste Porcelain: Plain		
31	EU 4	9		7	Blown-In-Mold Bottle Fragment: Olive Green		
31	EU 4	9		3	Unidentified Bottle Fragment: Amber		
31	EU 4	9		1	Unidentified Bottle Fragment: Clear		
31	EU 4	9		1	Unidentified Bottle Fragment: Milk Glass		Post 1743
31	EU 4	9		1	Decorated/Embossed Glass Fragment: Amber		
31	EU 4	9		8	Window Glass: All Thicknesses		
31	EU 4	9		2	Lighting Glass: Clear		
31	EU 4	9		1	Writing: Slate Pencil		
31	EU 4	9		1	Wire Common Nail: Fragment		1850-2000
31	EU 4	9		7	Nail: Unidentified		
31	EU 4	9		2	Unidentified Metal Object: Slag		
32	EU 4	10		1	Redware: Brown Glaze	Interior/Exterior, Overfired	
32	EU 4	10		3	Pearlware: Underglaze Blue Painted Floral Motif		1775-1830

Gambacorta Dike Artifact Inventory
 New Castle Dikes, Phase I
 New Castle County, Delaware
 JMA April-May 2013

PROV. CAT. No.	STU/EU	LEVEL	DEPTH (CMBS)	CT	DESCRIPTION	COMMENTS	DATE RANGE
32	EU 4	10		2	Whiteware: Plain		1810-2000
32	EU 4	10		1	White Granite Ware: Plain		1842-1930
32	EU 4	10		1	Brick: Handmade, Unglazed	4" W x 2" T	
32	EU 4	10		4	Unidentified Bottle Fragment: Olive Green		
32	EU 4	10		1	Unidentified Bottle Fragment: Amber		
32	EU 4	10		1	Unidentified Bottle Fragment: Aqua		
32	EU 4	10		6	Unidentified Bottle Fragment: Milk Glass		Post 1743
32	EU 4	10		1	Unidentified Bottle Fragment: Green		
32	EU 4	10		6	Window Glass: All Thicknesses		
32	EU 4	10		5	Unidentified Nail: Cut or Wrought		
32	EU 4	10		2	Nail: Unidentified		
32	EU 4	10		1	Auto/Garage/Machine: Graphite Battery Part		Post 1896
32	EU 4	10		1	Unidentified Metal Object: Slag		
33	EU 4	11		2	Creamware: Light-Colored Yellow		1775-1820
33	EU 4	11		2	Pipe Stem: 6/64th-Inch Ball Clay	Mend	1680-1710
33	EU 4	11		1	Brick: Unidentified, Glazed		
33	EU 4	11		2	Window Glass: All Thicknesses		
33	EU 4	11		2	Nail: Unidentified		
33	EU 4	11		1	Unidentified Metal Object: Slag		
34	EU 4	Feature 1		1	Unidentified Bottle Fragment: Clear		
34	EU 4	Feature 1		1	Miscellaneous, Metal: Rivet	Brass, Machine Cut	
				Total	742		

Appendix II:
Personnel Qualifications



TIMOTHY J. MANCL

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tmancl@johnmilnerassociates.com (e-mail)

EDUCATION

M.S.	Michigan Technological University	Industrial Archaeology	2003
M.A.	University of Delaware	American History	2001
B.A.	Western Connecticut State University	American Studies	1998

PROFESSIONAL CERTIFICATIONS AND SPECIALIZED TRAINING

OSHA 40-hour Hazardous Waste Operations Certification since 2004.
Registered Professional Archeologist since 2003.

EXPERIENCE PROFILE

Timothy J. Mancl is a graduate of Western Connecticut State University, and holds Master’s degrees in American History from the Hagley Program at the University of Delaware and in Industrial Archeology from Michigan Technological University. Mr. Mancl specializes in the history and archeology of nineteenth century American industrial development and processes from New England to the Mid-Atlantic. He has researched and conducted archeological investigations of prehistoric, and urban, industrial, and rural historic-period sites in Connecticut, Delaware, Kentucky, Massachusetts, Michigan, New York, and Pennsylvania, and has conducted state-level documentation of engineering structures in Connecticut and Maryland.

KEY PROJECTS

- 2012 Project Archeologist, Archeological Investigations on a portion of the Dover Green., Kent County, Delaware. Delaware Department of Historical and Cultural Affairs.
- 2012 Project Archeologist, Phase I Archeological Survey and Phase II Archeological Evaluation of the proposed Phase 2A Expansion at the Inland Bays Regional Wastewater Treatment Facility, Sussex County, Delaware. Whitman, Requardt and Associates, LLP, and the Sussex County Engineering Department.
- 2011 Project Archeologist, Archeological Investigations at the Old Brick Church, Dover, Kent County, Delaware. Delaware Department of Historical and Cultural Affairs.
- 2011 Project Archeologist, Booklet on the Wilmington, Delaware Water Works and Documentation of the Brandywine Filtration Plant. City of Wilmington, Delaware.
- 2011 Project Archeologist, Archeological Investigations at the Dutch House, New Castle, Delaware. New Castle Historical Society.
- 2010 Project Archeologist, Archeological Evaluation of Industrial Sites at Birch Hill Dam, Worcester County, Massachusetts. Army Corps of Engineers. New England District.
- 2010 Project Archeologist, Archeological Inventory and Assessment of the Sayers Lake Shoreline, Centre County, Pennsylvania. Army Corps of Engineers. Baltimore District.

- 2009 Project Archeologist, Archeological Inventory and Assessment of the Barren River Lake Shoreline, Allen and Barren Counties, Kentucky. Army Corps of Engineers. Louisville District.
- 2009 Project Archeologist, Phase II Archeological Evaluation of the Button Site, and the Harmons Hill Road Site, Angola Neck Sanitary Sewer District, Sussex County, Delaware. Whitman, Requardt and Associates, LLP, and the Sussex County Engineering Department.
- 2008 Project Archeologist, Phase II Archeological Evaluation of the Delaware Airpark Wetland Mitigation Area, Blackiston, Kent County, Delaware. The Federal Aviation Administration, the Delaware Department of Transportation, and the Delaware River and Bay Authority.
- 2008 Project Archeologist, Phase III Archeological Data Recovery of Dodd-Moore Site, Cheswold, Kent County, Delaware. The Federal Aviation Administration, the Delaware Department of Transportation, and the Delaware River and Bay Authority.
- 2007 Principal Investigator, Burial Recovery and Cemetery Delineation within the Creekside Development, Millville, Baltimore Hundred, Sussex County, Delaware. Caldera Properties.
- 2006-2007 Principal Investigator, Phase I and II Archaeological Testing of the Joseph Bancroft & Sons Kentmere Mills, Wilmington, New Castle County, Delaware in connection with the Rockford Falls Development Project. O'Neill Properties Group.
- 2004-2008 Principal Investigator, fieldworker, and editor, Phase III Mitigation of the Laban Rogers House Site, the Herring Creek Site, and the Olla White Bay Site, and delineation of the Derrickson Cemetery, Baltimore County, Delaware. Carl M. Freeman Companies.
- 2004 Assistant Field Director, Phase III Data Recovery at the Cruttenden Carriage Works Site, New Haven, Connecticut. Fitzgerald & Halliday, Inc., and the Connecticut Department of Transportation.
- 2002 Field Director, Archaeological Investigations at the Carp River Forge, Negaunee, Michigan. The Michigan Iron Industry Museum/Michigan Department of History, Arts, and Libraries.

SUMMARY OF PROFESSIONAL ACTIVITIES

Mr. Mancl is the author or co-author of over forty (40) cultural resource reports, and four (4) cultural resource studies. He has served as President of the Archaeological Society of Delaware (2006 to 2011), as a Director for the Society for Industrial Archaeology (2008-2011), and as a board member of the New Castle Historical Society (2009-2012). He currently serves on the Nominations Committee for the Society for Industrial Archaeology (2011-2014).



ELISABETH LAVIGNE

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EDUCATION

M.A.	Boston University, MA	Geoarcheology	2009
B.A.	Wheaton College, IL	Archeology	2004

EXPERIENCE PROFILE

Elisabeth LaVigne, RPA serves JMA as a Project Geoarcheologist. She holds a Bachelor of Arts degree in Archeology from Wheaton College, IL, and a Master of Arts degree in Geoarcheology from Boston University where she specialized in micromorphology. Her training includes GIS, quantitative geomorphology, sedimentology, geochemistry, and paleoethnobotany. Before coming to JMA, she worked with the Monadnock Archeology Consulting and the State Conservation and Rescue Archeology Program in NH as a lab and field technician. She also has excavated at Gault, TX; Ashkelon, Israel; and Pompeii, Italy, and conducted sediment sample analysis from the Maya site of K'axob in Belize. Since joining JMA, she has been involved in archeological survey, deep testing and trenching projects, and topographic surveying within the Mid-Atlantic, primarily in Pennsylvania and Delaware. Elisabeth also has extensive experience with geographic information systems in archeological contexts. She has worked on numerous geospatial projects for JMA, creating and populating cultural resource geodatabases, modeling viewsheds, georeferencing historic maps, recreating historic survey data, creating archaeological survey maps, and processing field data.

LICENSES/CERTIFICATIONS/TRAINING

Registered Professional Archeologist since 2011
Section 106 Review Process workshop (Chester County Historical Society Cultural Center - 2011)
OSHA 40 Hour HAZWOPER (2011; updated)
OSHA 8 Hour Training for Supervisors (2011)
OSHA Excavation Safety training (2011)
OSHA Confined Spaces Safety training (2011)
UNH Cooperative Extension – ArcGIS 9.3 (2010)

SOFTWARE PROFICIENCIES

ESRI ArcGIS 9.0 – 10
Golden Software's SURFER
TDS Survey Works Foresight DXM
TDS Survey Works Survey Pro
Trimble Pathfinder Office
Microsoft Office Program Suite

PROFESSIONAL AFFILIATIONS

Registry of Professional Archaeologists

PROJECT EXPERIENCE (John Milner Associates, Inc.)

- 2012-2013 A Phase I archeological survey and GIS-based investigation at Red Lion Dike, New Castle Delaware undertaken in order to determine how the dike was built and changed over time. A prehistoric site was also located during the survey.
- 2012 Phase I archeological survey at Sandy Hook, NJ for a proposed biking path.
- 2012 Phase I archeological survey at the Hopewell Furnace National Historic. Evidence for a historic road for the furnace was located during the survey.
- 2012 Phase I archeological survey for Eastern University, Radnor, PA.
- 2012 Phase I and II archeological survey at the historic Dover Green, Delaware which identified the likely location of a historic prison and buried living surfaces.
- 2012 Archeological Investigation at West Shipyard, Philadelphia, PA. Trenching and archeological excavation were utilized to investigate the remains of a 17th century shipyard.
- 2012 Phase I archeological survey of field near Sunset Lake, Delaware. Participated in monitoring of metal detection survey, pedestrian survey, and performed historical, GIS-based investigation through the use of historic maps, road plans, and aerials.
- 2012 GIS-based investigation of the French Mill complex area in East Pikeland, PA, using historic aerials, maps, and road plans. Subsequent geomorphological investigations of the mill race, the possible location of historic races, and mill locations.
- 2012 Investigation of the Battle at Cooch's Bridge, Delaware. Participated in monitoring of metal detection survey and performed historical, GIS-based investigation through the use of historic maps, road plans, and aerials.
- 2012 Phase Ib archeological survey at Gettysburg, Pennsylvania. Tested previously identified GPR anomalies and metal detection artifact clusters.
- 2012 Phase I Archeological Investigation and Phase II Archeological evaluation at a wastewater facility in Sussex County, Delaware.
- 2011-2012 Phase II Geomorphic assessment, Cobb's Creek Water Reservoir Project, Cumberland County, VA, which included deep testing, trenching, and monitoring of engineering borings; Phase II archeological survey; topographic survey; and GIS-based viewshed analysis.
- 2011-2012 Fort Christina investigation, Wilmington, DE. Utilized GIS to overlay historic maps in order to locate where the fort may have once been located. Volunteered to assist with the GPR investigation and topography survey at possible location of Fort Christina.
- 2011 Phase I archeological survey for the proposed PEMA Headquarters in Harrisburg, PA.
- 2011 Phase I Geomorphic Assessment, Cobb's Creek Water Reservoir Project, Cumberland County, VA. Assessment conducted through deep testing with hand-operated Eijkelkamp Edelman augers. Located two different buried paleosols with archeological potential within the floodplain project area.
- 2011 Topographic survey at Old Brick Church, Dover, Delaware
- 2011 Archeological survey at the Dutch House undertaken to investigate sub-surface anomalies detected through a GPR investigation
- 2011 Topographic survey at the Allee House, Bombay Hook National Wildlife Refuge, Delaware.
- 2010-2011 NHPA Section 110 Compliance, Cultural resources Investigations, U.S. Army Corps of Engineers American Recovery & Reinvestment Act 2009. 17 Districts of the U.S Army Corps of Engineers. Geodatabase population of cultural resource locations and attributes.

- 2010 Geomorphologic Assessment, Virginia Avenue Tunnel Railroad Project for the CSX Transportation, Inc. National Gateway Initiative, Washington, District of Columbia. Assessment conducted through use of a geoprobe to locate potential buried landscapes.
- 2010 Geomorphologic Assessment, U.S. Wildlife Refuge – Mason Neck. Soil cores taken and analyzed to locate potential buried prehistoric landscapes.
- 2010 Historic Structure Integrity in the Barren Lake study area. Georeferenced historic maps to determine where historic structures may still be preserved for the Army Corps of Engineers.

PROJECT EXPERIENCE (other/previous)

- 2010 Ground Penetrating Radar and coring project in and around the wetland areas at the Paleoindian Potter Site, Randolph, NH.
- 2010 Phase Ib/ III Archeological Survey and Geoarcheological Evaluation at the Tenant Swamp Paleoindian site, Keene, NH. Worked as field technician and assisted geomorphologist in the augering and recording of off-site stratigraphy to determine past geomorphic processes and their relation to the site. (Monadnock Archeology Consulting)
- 2010 Phase I Archeological Surveys in Concord, Effingham, Pembroke, and Newbury, NH. (Monadnock Archeology Consulting)
- 2010 Rescue/Phase I Archeological Survey which located Paleoindian artifacts in Jefferson, NH.
- 2010 Excavation and paleomagnetism core retrieval within Archaic and Late Paleoindian levels at Gault, TX.
- 2010 Lab technician for the NH State Conservation and Rescue Archeology Program. Cleaned, identified, and catalogued artifacts in the state archeology lab.
- 2008-2009 Micromorphological Analysis of sediments from the Maya site of K'axob in Belize. Found evidence for anthropological activity, past change in water flow direction, and geochemical changes within the soil due to a possible number of causes.
- 2008 Leon Levy Expedition, Ashkelon, Israel. Participated in the excavation of Bronze and Iron Age levels and the geoarcheological evaluation of possible Iron Age Harbor at Ashkelon. Assisted geoarcheologist to determine the absence of proposed harbor through the use of bucket augering and sediment analysis.
- 2008 Rowley Marsh Project: Investigated the formation and deterioration of marsh surface ponds through surveying, the analysis of vibracores, and the use of GIS to determine past pond/channel locations and depositional history.



WILLIAM J. CHADWICK

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EDUCATION

Ph.D.	University of Delaware	Geology (Archeological Geology)	2000
M.A.	Temple University	Geology	1994
B.A.	University of Maine at Farmington	Geology/Geography	1990

KEY LICENSES/CERTIFICATIONS/TRAINING

Registered Professional Archeologist (National, #12322)

Licensed Professional Geologist (Utah, # 5556501-2250)

Section 106 Essentials (Advisory Council on Historic Preservation-2007)

Battlefield Grants Workshop for Contractors (NPS American Battlefield Protection Program-2010)

Theory and Practice of Applying Subsurface Interface Radar in Engineering and Geophysical Investigations (GSSI-2008)

Advances in Subsurface Exploration Methods (Geoprobe Systems-2007)

OSHA 40 Hour HAZWOPER (2001)

OSHA Hazard Communication (2002)

OSHA 8 Hour HAZWOPER Refresher (current)

OSHA Excavation Safety Training for Competent

OSHA 8 Hour Training for Supervisors (2001)

Persons (2002)

KEY PROJECT EXPERIENCE

2007-2013 Phase I/II Archeological Survey and Evaluation, Former Koppers Newport Superfund Site, Newport, Delaware. Archeological survey conducted for Langan Engineering and Environmental, Inc. using hand auger equipment to identify archeological site below intertidal marshes.

2011 Ground-Penetrating Radar Prospection for Three Underground Storage Tanks (USTs) at the US Department of Homeland Security Nebraska Avenue Complex, Washington, DC. Visual and Ground-Penetrating Radar Inspection of the current conditions of recently abandoned/removed USTs.

2009-2011 NHPA Section 110 Compliance, Cultural resources Investigations, U.S. Army Corps of Engineers American Recovery & Reinvestment Act 2009. For 17 Districts of the U.S Army Corps of Engineers. Constructed, populated, and Quality Controlled SDFIE compliant ESRI geodatabase and conducted deep testing on floodplains related to specific impoundments.

2008-2010 Geospatially-Based Phase IA of Cultural Resources Related to Wind Farm Development and Potential Visual Impacts, Eastern Seaboard of the Continental USA. Mineral Management Services

- 2009 Geophysical Prospection at Arlington National Cemetery, Arlington, VA. Project conducted for the Director and Deputy Director of ANC. Investigation of two specific graves site with ground-penetrating radar and electrical resistance sounding.
- 2009 Geomorphologic Assessment, 11th Street Bridge Replacement Project, Washington and Anacostia, District of Columbia. Assessment conducted for EAC/Archaeology and District Department of Transportation to identify buried landscapes.
- 2009 Ground-penetrating Radar and Magnetic Gradiometer Survey of Timbuctoo, Westampton Township, New Jersey. Survey conducted for Westampton Township, New Jersey to identify archeological features related to the core area a historic antebellum African-American town.
- 2008 Geophysical Survey Comprising of Gradiometry, Electrical Resistivity, and Ground-Penetrating Radar in the Potential Locations of Confederate Battery 1 and Battery 2, for Quantico Marine Base, Quantico Virginia.
- 2007-2008 Geomorphic Assessment of Deep Testing Locations in Spread 4 – Indiana and Phase III Testing for the Rockies Express East Pipeline Project, Indiana. Assessment for Natural Resource Group, Inc. to location buried landscapes associated with stream and river crossings.
- 2006 Ground-Penetrating Radar Survey of Three Historic Shearith Israel Cemeteries, Manhattan, New York, New York. Project conducted for 1654 Society to identify the location of burials within three cemeteries with ground-penetrating radar.
- 2006 Phase I/II Archeological Evaluation of a Portion of the Macungie Jasper Quarry Site (36LH11) for the Macungie Borough Trail System Stream Bank Restoration, Lehigh County, Pennsylvania. Archeological investigations resulting from geomorphic assessment for the Borough of Macungie.
- 2005-2006 Geophysical Prospection and Relocation of the April, 1945 Willie Sutton Escape Tunnel at the Eastern State Penitentiary, Philadelphia, Pennsylvania. Project conducted for the Eastern State Penitentiary Historic Landmark and Museum, Philadelphia top relocate a clandestine escape tunnel up to 16 feet below ground surface.
- 2005 3D Laser Scanning of Valley Creek Mill Ruins, Valley Forge National Historic Park. Project conducted for the National Park Service on several foundation fragments eroding out of a floodplain of Valley Creek.
- 2005 Geophysical Prospection of the Deshler-Morris, Bringham House Property, Germantown, Pennsylvania. Prospection conducted for the National Park Service, Philadelphia identify buried yard features related to the occupation of the property.
- 2003-2005 GIS-based Existing Conditions, Sensitivity Analysis of Cultural Resources, and Historic Context of U.S. Highway 113, North-South Study Area, Sussex and Kent County, Delaware. Rummel, Klepper, & Kahl and Delaware State Department of Transportation.
- 2003-2005 Archeological Phase I Survey and Archeological Phase II Survey of Three Prehistoric Archeological Sites for the Columbia Falls and Moscow OTHB-E Radar Stations, Washington and Somerset Counties, Maine Survey conducted for the United States Air Force Air Education and Training Command.
- 2003 Geophysical and Phase I Archeological Survey, Bridge No. 10043 over Bens Branch, Frederick County, Maryland. Survey conducted for the Maryland Department of Transportation to location razed historic grist and saw mills and associated landscape features.
- 2002 Ground-Penetrating Radar Survey: Ebenezer Cemetery, MD237: MD235 to Pegg Road, St. Mary's County, Maryland. Maryland State Department of Transportation

- 2002 Ground-Penetrating Radar Pilot Study of Independence Square, Independence National Historical Park, Philadelphia, PA. Pilot study conducted for the National Park Service, Northeast District to determine thus utility of conducting future GPR surveys within Independence Square.
- 2001-2002 Stage IB Archeological Survey of the Intertidal Zone, New Bedford Harbor Superfund Site, Bristol County, Massachusetts. Intertidal archeological survey for Tetra Tech FW, Inc. and the U.S. Army Corps of Engineers, New England District using hand auger equipment to identify archeological site below intertidal marshes.

KEY PRESENTATIONS AT PROFESSIONAL MEETINGS

- 2012 Chadwick, W.J. Changing the Role of Ground-Penetrating Radar (GPR) in Cultural Resource Management (CRM) at JMA: A Middle Atlantic Perspective. 2012 Middle Atlantic Archeological Conference.
- 2011 Chadwick W.J. & Leach, P.A. Coring Methods to Locate Buried Archeological Sites and Assess Buried Landscapes during Intertidal Archeological Surveys. 2011 Society of American Archeology Annual Meeting.
- 2010 Chadwick, W. J., & Leach, P.A. & Balicki, J.F. Geophysical Prospection of Civil War Military Sites, Quantico, Virginia. 43rd Annual Conference on Historical and Underwater Archaeology.
- 2009 Leach, P.A, Chadwick, W. J., Belknap, D. F. Multiple Phases in the Marine Transgression of Coastal Archaeological Sites in Maine and Delaware. Geological Society of America Annual Meeting, Portland, Oregon. GSA Abstracts with Programs Vol. 41, No. 7, p. 76
- 2009 Chadwick, W. J., & Leach, P.A. Geophysical Testing at the Site of Timbuctoo, Burlington County, New Jersey. Council for Northeastern Historical Archeology Annual Meeting, Université Laval, Québec, Canada
- 2008 Leach, P.A. & Chadwick, W. J. Coring Methods to Assess Buried Landscapes During Intertidal Cultural Resource Management Surveys. 2008 Joint Meeting of the GSA, SSSA, ASA, CSSA, Houston, TX.. GSA Abstracts with Programs, Vol. 40, No. 6, p. 384
- 2006 Chadwick, W. J. & Yamin, R. Rediscovery of the 1945 Escape Tunnel at Eastern State Penitentiary Historic Site, Philadelphia. Paper presented at the Geological Society of America 2006 Annual Meeting, Philadelphia, Pennsylvania. GSA Abstracts with Programs, Vol. 38, No. 7, p. 526
- 2004 Catts W.P. & Chadwick, W. J. & Harris, M.D. & Ziesing, G.H. Rivers, Roads, Dirt and Documents: A GIS-based Cultural Resource Project Management Tool for Delaware Department of Transportation. Paper presented at Byways to the Past V: The Fifth Annual Conference on Historic Preservation and Transportation Projects, Indiana, PA.
- 2003 “Come and Get Me Copper!” or “This is a Real Pane in the Glass!”: Archeological Evidence of Industrial Practices at Raritan Landing. Paper presented at Annual Meeting of the Council of Northeast Historical Archaeology, Lowell, MA. (with Wade P. Catts, Edward Morin, and Meta Janowitz)
- 2001 Harris, M.D. & Chadwick, W. J. “Predicting the Spatial Distribution of Prehistoric Archaeological Sites as Related to Water Resources using GIS Analysis in the Lehigh Valley, Pennsylvania.” Paper presented at the Geological Society of America Northeastern Section 2001 Meeting, Burlington, Vermont.
- 1998 Chadwick, W. J. “Ground Penetrating Radar Reveals the Relationship Between Sea-Level Rise and the Prehistoric Occupation of Relict Recurved Spits, Cape Henlopen, Delaware.” Paper presented at the Geological Society of America 1998 Annual Meeting, Toronto, Canada.

- 1995 Kraft, J.C. & Chadwick, W. J. "Paleogeographies of Historic and Prehistoric Archaeological Sites in the Coastal Zone." Eastern States Archaeological Federation, 62nd Annual Meeting, Wilmington, Delaware.
- 1993 Chadwick, W. J. "Alloccyclic Symmetry in the Hierarchic Structure of the Upper Silurian Tonoloway Formation." Paper presented at the Geological Society of America Northeastern Section 1993 Meeting, Burlington, Vermont.

SUMMARY OF PROFESSIONAL ACTIVITIES

Dr. Chadwick is author or co-author of twenty-seven (27) papers presented at professional meetings, over seventy-five (75) Cultural Resource Management reports, and one (1) scholarly article, and was organizer of one (1) symposium on geophysics at a professional meeting.



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EDUCATION

M.A.	University of Delaware	American History	1988
B.A.	University of Delaware	History/Anthropology	1981

PROFESSIONAL CERTIFICATIONS AND SPECIALIZED TRAINING

- 2003 Section 106: Principles and Practice Workshop
- 2003 Integrating Section 106 and the National Environmental Policy Act Workshop
- 1999 Registered Professional Archeologist
- 1998 OSHA 40-hour Hazardous Waste Operations Training

MEMBERSHIPS AND AFFILIATIONS

- President Elect, American Cultural Resources Association, 2011-2013
- Member, Delaware Military Heritage Education Foundation, 2012-2014
- Member, Middle Atlantic Archaeological Conference
- Member, Society for Historical Archaeology/Council for Underwater Archaeology
- Member, Council for Northeast Historical Archaeology (Board Member 1999-2001)
- Member, Society for Army Historical Research (UK)
- Member, Company of Military Historians
- Member, Delaware Academy of Science (past President)
- Member, New Castle County Historic Review Board, 1996-2009

HONORS/ASSISTANTSHIPS

- 1990 Graduate Assistant, Department of History, University of Delaware
- 1986 Member, Rotary Group Study Exchange Trip to Southeastern England, District 763
- 1981 Phi Alpha Theta, National History Honor Society

EXPERIENCE PROFILE

Wade P. Catts is a graduate of the University of Delaware, and he also holds a Master’s degree in American History from the same institution. Prior to joining JMA (John Milner Associates, Inc.) in 1993, Mr. Catts was employed for over a decade as a research historian and archeologist at a University of Delaware-based consulting division that focused its research efforts on the history and prehistory of the Delmarva Peninsula. Since joining JMA, Mr. Catts’ research efforts have included historical and

archeological data recovery investigations at the New Geneva Pottery Waster site in Fayette County, Pennsylvania, the eighteenth- century Ashcomb's Quarter site in Solomons Island, Maryland, Beverwyck Plantation in Morris County, New Jersey, New Castle Courthouse Museum in New Castle, Delaware, and Raritan Landing near New Brunswick, New Jersey. He has conducted Phase II evaluation investigations at numerous historic sites in Pennsylvania, Maryland, New Jersey, Delaware, and Virginia, and Phase I surveys throughout the Middle Atlantic region. Further, he has conducted historical background and archival research for a broad range of archeological and historical projects.

Mr. Catts' Revolutionary War historical and archeological experience spans several states. In Pennsylvania he has completed projects at Valley Forge and at the site of Camp Security, a British POW camp near York. In New Jersey he was involved in the Beverwyck Plantation project in Morris County – where Washington, his officers, and the French ambassadors were entertained – and excavations at Raritan Landing, where British forces cantoned during the winter-spring of 1777. He directed an ABPP-funded survey of the battlefield at Princeton, and managed the JMA team that completed an ABPP-funded archeological survey and draft National Register nomination for the Short Hills battlefield near Plainfield, New Jersey. In New York he managed the field component of an ABPP-funded project at Fish Creek, a portion of the Siege of Saratoga. Mr. Catts is a Registered Professional Archeologist (RPA), a member of national and regional professional archaeological organizations, and a member of both the Company of Military Historians (US) and the Society for Army Historical Research (UK). With the assistance of a McKinstry Award from the Delaware Heritage Commission, he is completing a book on the history and archeology of the Battle of Cooch's Bridge, Delaware's only Revolutionary War engagement.

Mr. Catts is a recognized historian and historical archeologist with research interests in the history of farmsteads and agricultural landscapes, urban development, military history and archeology, environmental history, African-American studies, and Middle Atlantic regional history and historic preservation.

REPRESENTATIVE PROJECTS

- 2012 Project Manager for the archeological mitigation planning for the site of the new Museum of the American Revolution, 3rd and Chestnut Streets, Philadelphia. The American Revolution Center.
- 2012 Principal in Charge of Phase I Archeological Survey of the proposed construction site of a water retention basin and dewatering system associated with the Sunset Lake project. New Castle Conservation District.
- 2012 Principal in Charge of geoarcheological and archeological survey of the site of seventeenth-century Fort Casimir, City of New Castle, Delaware. Delaware Division of Historical and Cultural Affairs.
- 2012 Project Manager for the terminal exhibits at the Delaware Airpark, Cheswold, Delaware. A series of interpretative panels relating the story to the visiting public of the Lenape Indians, the history of the village of Cheswold, the history and archeology of the Airpark, and the story of Flloyd Durham, the founder of the airpark. Delaware River and Bay Authority.
- 2012 Principal in Charge of historical, geoarcheological, and archeological investigations at the Cooch's Bridge Battlefield in New Castle County, Delaware. Delaware Division of Historical and Cultural Affairs.
- 2012 Principal in charge of historical, geoarcheological, and archeological investigations at the site of the Continental Powder Works and Gun Factory on French Creek, Chester County, Pennsylvania. An American Battlefield Protection Program (ABPP) grant. East Pikeland Township Historical Commission.

- 2011 Principal in charge of archeological investigations of the New Castle Green, a field project completed in advance of storm water management installation to the rear of the Arsenal Building. Delaware Division of Historical and Cultural Affairs.
- 2011 Managed, conducted historical research, directed archeological investigations, and co-authored the American Battlefield Protection Program (ABPP) project at the Short Hills Battlefield, New Jersey. Metuchen-Edison Historical Society.
- 2011 Managed, conducted historical research and archeological investigation, and co-authored a study of the Continental Powder Works site on French Creek, Pennsylvania. East Pikeland Township Historical Commission, Chester County, Pennsylvania.
- 2011 Project manager for the development of a traveling exhibit designed to tell the story of the archeology and history of Delaware farming. The Delaware River and Bay Authority.
- 2010 Managed archeological investigations and oversaw historical research associated with the study of an unmarked historic-period cemetery beneath River Road, Oak Orchard, Sussex County, Delaware. Subsequent historical research identified the site as a family cemetery on a tract called Batchelor's Lott. Sussex County Engineering Department.
- 2010 Managed, conducted archeological investigations, and co-authored the Fish Creek Cultural Landscape Study and archeological verification of a purported Revolutionary War earthwork. Schuylerville, New York. Funded by the American Battlefield Protection Program. Saratoga Preserving Land and Nature (PLAN).
- 2010 Managed, conducted historical and archeological research, and co-authored the Princeton Battlefield mapping project, funded by the American Battlefield Protection Program (ABPP). Princeton, New Jersey. Princeton Battlefield Society.
- 2008 Served as Principal-in-Charge of archeological and historical Phase I investigations of the Hershey Run project area, associated with the former Koppers Newport Superfund Site, Delaware. Langan Environmental.
- 2008 Directed archeological and historical investigations of three root cellars on the campus of Moravian College, Bethlehem, Pennsylvania. Moravian College.
- 2007 Managed the archeological and historical Phase I and II investigations of the former Koppers Newport Superfund Site, Delaware. The site area contains numerous prehistoric and historic archeological sites, including two seventeenth-century settlement sites. Langan Environmental.
- 2006 Directed the JMA team that developed a feasibility study for the Dennis Farm Charitable Land Trust, Susquehanna County, Pennsylvania, a property owned by the descendants of an African-American family for over 200 years. Dennis Farm Charitable Land Trust and Endless Mountains Heritage Region, Inc.
- 2006 Managed archeological investigations and historical research of the former New Castle County Almshouse, part of Section 106 requirements associated with the improvements of I-295. Rummel Klepper & Kahl, L.L.P.
- 2005 Managed data recovery investigations, including field investigations and historical research, at 1803 and 1805 North Market Street, two National Register-listed historic properties in Wilmington, Delaware. Wilmington Senior Center.
- 2005 Conducted historical research and field investigations at the location of a Revolutionary War musketry range at Valley Forge National Historical Park. Boyles, Smyth Inc.

- 2004 Co-authored the National Register of Historic Places nomination for the Beverwyck Plantation archeological site, Morris County, New Jersey. The site was listed to the National Register in 2004.
- 2003 Managed archeological investigations, including historical research and report authorship, at Old New Castle Courthouse, New Castle Delaware, as part of renovation/restoration activities. Delaware State Museums.
- 2003 Managed historical documentation compilation, including GIS data inventory, of the Indian River Bridge Project, Sussex County, Delaware. Rummel, Klepper & Kahl, LLP, for Delaware Department of Transportation.
- 2002-2003 Directed Data Recovery Investigations at two historic sites as part of the multi-consultant team at Raritan Landing Archeological District, Route 18 Extension Project, Middlesex County, New Jersey. New Jersey Department of Transportation.
- 2001-2003 Conducted historical research regarding British military occupation and copper processing at Raritan Landing as part of the Route 18 Extension Project, Middlesex County, New Jersey. New Jersey Department of Transportation.
- 2002 Conducted Historical Research for Historic Structure Report of United States Marine Hospital National Historic Landmark, Louisville, KY. City of Louisville, Louisville Development Authority.
- 2002 Directed Phase I and Phase II archeological and historical research at the proposed site of the Delaware National Guard Readiness Center, Smyrna, Delaware. Delaware National Guard.
- 2002 Directed archeological overview and assessment of Hopewell Furnace National Historic Park, Birdsboro, PA. National Park Service.
- 2002 Conducted historical research and assisted in the preparation of a Historic Structures Report for the U.S. Marine Hospital, National Historic Landmark. Louisville, KY.
- 2001 Conducted historical and archeological investigations of five eighteenth and nineteenth century historic sites of Hopewell Furnace National Historic Park, Birdsboro, PA. National Park Service.
- 2001 Co-directed data recovery investigations and conducted historical research of the Raritan Landing Project, New Brunswick, NJ. New Jersey Department of Transportation.
- 2001 Conducted historical research and assisted in developing historic commemorative contexts for seven national military parks (Chickamauga/Chattanooga, Gettysburg, Shiloh, Vicksburg, Antietam, Valley Forge, Minute Man). National Park Service.
- 2001 Conducted historical research and directed Phase I archeological investigations at Hopewell Furnace National Park. National Park Service.
- 2001 Conducted historical research and co-directed data recovery investigations for the eighteenth-century Beverwyck Plantation site, Morris County, New Jersey. New Jersey Department of Transportation.
- 2000 Directed archeological investigations at Block III, John Dickinson Plantation, Delaware. Delaware State Museums.

- 2000 Conducted historical research and assisted in preparing historic contexts for Valley Forge National Historic Park. National Park Service.
- 2000 Conducted historical research and Phase I archeological survey at site of Camp Security/Camp Indulgence, a British Revolutionary War Prisoner-of-War encampment, York County, Pennsylvania. Pasch Construction.
- 2000 Directed historical research and prepared historic context for the Blue Ball Properties Master Plan, New Castle County, Delaware. Wallace, Roberts & Todd.
- 2000 Directed historical research and prepared historic context for Phase IA cultural resources investigation for a proposed parking facility at the site of the eighteenth and nineteenth century Second Street Market, Lower Market Street Historic District, Wilmington, Delaware. Wilmington Renaissance Corporation.
- 2000 Directed historical research and developed historic context for the Triangle Woods Archeological Site, New Castle County, Delaware. Delaware Department of Natural Resources and Environmental Control. The site was the location of an early twentieth century gypsy camp.
- 1999 Directed and conducted historical research on the AstraZeneca Triangle Property, New Castle County, Delaware. AstraZeneca Pharmaceutical, Inc.
- 1999 Conducted historical research on the North Pownal Tannery, North Pownal, Vermont. Stone and Webster.
- 1999 Directed historical research of the Lincoln Cemetery, an African-American burial ground, Gettysburg, Adams County, Pennsylvania. Borough of Gettysburg.
- 1998 Conducted historical research for the Jacob M. Zook House, Exton Square Mall expansion, Chester County, Pennsylvania. The Rouse Company.
- 1998 Conducted historical research for Buena Vista Conference Center, former home of Senator John M. Clayton, New Castle County, Delaware. Delaware State Museums.
- 1998 Conducted historical research for the Diggs-Monroe and Culp-Mundorff sites, Gettysburg, Pennsylvania. The Borough of Gettysburg.
- 1998 Directed historical research and prepared historic context for the Joseph Carrell, Jr. Farmstead site, Street Road Commercial Development Project, Bucks County, Pennsylvania. Newman Development Group of Warrington, L.L.P.
- 1997 Prepared historical context and conducted historical research for Governors Island, New York Harbor. General Services Administration.
- 1997 Prepared historical context and conducted historical research for the Thonsville and Gabel Park Woods Sites, Lancaster Township, Lancaster County, Pennsylvania. Pennsylvania Department of Transportation, District 8-0.
- 1997 Prepared historical context and conducted historical research for Phase IA cultural resources investigation of sediment removal areas in the Christina River, Newport, New Castle County, Delaware. DuPont Environmental Remediation Services.

- 1997 Conducted historical research for Phase I archeological survey of the proposed Andorra Glen Apartment Complex, Whitmarsh Township, Montgomery County, Pennsylvania. The Andorra Group.
- 1996 Conducted historical research for Phase IB archeological survey of the former Koppers Company, Inc. Property, Newport, New Castle County, Delaware. Beazer East and DuPont Specialty Chemicals in association with Woodward-Clyde Consultants, Inc.
- 1995 Conducted historical research for Phase II evaluation of the Motts Run Water Filtration Plant Site, Spotsylvania County, Virginia. Hayes, Seay, Mattern & Mattern, Inc.
- 1994 Conducted historical research for Phase I archeological investigations at the Pennell House Site, Delaware County, Pennsylvania. Wawa Dairies, Inc.
- 1993 Prepared historical context and conducted historical research for data recovery excavations at the New Geneva Pottery Waster Dump Site, Fayette County, Pennsylvania. Pittsburgh District, U.S. Army Corps of Engineers.
- 1992 Prepared historical context and conducted historical research of the Mermaid Tavern Blacksmith and Wheelwright Shops, New Castle Co., Delaware, Delmarva Department of Transportation.
- 1991 Conducted extensive historical research for community of Christiana Bridge and the Eagle Run Tenant House Site and the William Patterson Mansion House and Boat Dock, New Castle County, Delaware. Delaware Department of Transportation.
- 1990 Prepared historical context and conducted historical documentary research of the Thomas Williams Site (7NC-D-130), an African American household, New Castle County, Delaware. Delaware Department of Transportation.
- 1990 Prepared historical context and conducted historical research for Delaware's management plan for historical archeological resources. University of Delaware and Delaware State Historical Preservation office.
- 1989 Prepared historic context and conducted extensive historical research for the southeast Sussex Corridor cultural resources survey, Sussex County, Delaware. Delaware Department of Transportation.

SELECTED PUBLICATIONS

- Forthcoming Archaeology, Computer Technology and the Battle of Princeton as a Cross-Cultural, Trans-Atlantic Encounter. Springer Press.
- 2007 "Newark and Newarkers in the Era of the American Revolution", in *Histories of Newark, 1758-2008*, edited by Deborah Haskell, pgs. 18-29 (Wallflower Press, Newark, DE).
- 2001-2002 Research Questions for the Archaeology of Rural Places: Experiences from the Middle Atlantic. *Northeast Historical Archaeology* 30-31:143-154.
- 1999 "Down on the Farm": Questions, Directions and Interpretations of the Archeology of Delaware Agriculture and Farm Life, 1800-1950 (with LuAnn DeCunzo). *Bulletin of the Archaeological Society of Delaware* 36:19-27.
- 1993 From "White Man's Garbage" to the Study of Material Culture: A review of Historical Archaeology in Delaware (with Lu Ann De Cunzo). *Delaware History* 25(3):174-199.

- 1993 Small Wonder, There's Diversity! Current Historical Archaeology in Delaware (with David Grettler). *Bulletin of the Archaeological Society of Delaware* 30.
- 1993 "Entertained . . . at ye Tavern Close By." Historical Archaeological Inquiry at Thomas Ogle's Tavern, Ogetown (with Angela Hoseth and Ellis C. Coleman). *Bulletin of the Archaeological Society of Delaware* 30:5-16.
- 1991 A Report of the Archaeological Investigations at the House of Thomas Cuff, A Free Black Laborer, 108 Cannon Street, Chestertown, Kent County, Maryland (with Doug McCall). *North American Archaeologist* 12(2):155-181.
- 1990 Building a Framework for Research: Delaware's Management Plan for Historical Archaeological Resources (with LuAnn DeCunzo). *Northeast Historical Archaeology* 19:1-49.
- 1988 *Slaves, Free Blacks, and French Negroes: An Archaeological and Historical Perspective on Wilmington's Forgotten Folk*. M.A. thesis, Department of History, University of Delaware, Newark.
- 1986 Soil Chemistry and Historic Archaeological Site Activity Areas: A Test Case from Northern Delaware (with Jay F. Custer, Ellis C. Colman, and Kevin W. Cunningham). *Historical Archaeology* 20(2):89-94.

SELECTED PRESENTED PAPERS

- 2011 Archaeology, Computer Technology and The Battle Of Princeton As A Cross-Cultural, Trans-Atlantic Encounter. Presenter and Co-author a paper presented at the International Committee on Archaeological Heritage Management (ICAHM) at the International Council on Monuments and Site (ICOMOS) annual meeting, Paris, France.
- 2011 "We Have Allowed the Rebels too much Time in Which to Become Soldiers": Deciphering Revolutionary War American Military Formations through Historical Archeology. Paper presented at the Annual Meeting of the Council for Northeast Historical Archeology, Utica, New York.
- 2010 Family, Farm, and Freedom: The Legacy of the Dennis Farm, Susquehanna County, Pennsylvania. Paper presented at the Pennsylvania Byways Conference, Harrisburg, Pennsylvania.
- 2010 "Built At Ye Back Side Of Ye Towne": Archeology At The New Castle Court House Museum, New Castle, Delaware. Paper presented at the annual meeting of the Society for Historical Archaeology, Amelia Island, Florida.
- 2008 The Perambulations of Lieutenant Nutt's Button: Camp Security and Camp Indulgence, York County, Pennsylvania. Paper presented at the Annual Meeting of the Middle Atlantic Archeological Society, Ocean City, MD.
- 2008 Quakers in the Philadelphia Hinterland: The Archaeology of Public Spaces and Domestic Places. Co-authored with Rebecca Yamin. Paper presented at the annual meeting of the Society for Historical Archeology, Albuquerque, New Mexico.
- 2007 From the Mountains to the Sea: Using the Delaware River Watershed as a Model for Regional Farmstead Archeology. Paper presented at the annual meeting of the Society for Historical Archeology, Williamsburg, Virginia.

- 2007 Give Them As Much Trouble As You Possibly Can: The Battle of Cooch's Bridge, September 3rd, 1777. Paper presented to the Washington DC Revolutionary War Roundtable.
- 2007 "Make Sure You Aim, For One Shot Well-Pointed is Worth a Dozen Thrown Away: Archeological Evidence of a Musketry Range at Valley Forge National Historical Park, Pennsylvania, USA. Paper Presented at the Council for Northeast Historical Archeology Annual Meeting, Buffalo, NY.
- 2006 "A System of Easy Manuvers..." Archeological Evidence of a Musketry Range at Valley Forge National Historical Park, Pennsylvania, USA. Paper presented at the 4th Annual Fields of Conflict Conference, Leeds, UK.
- 2006 A Spirited Little Affair: History and Archeological Potential of the Cooch's Bridge Battlefield, New Castle County, Delaware. Paper presented at the Society of Historical Archeology Annual Meeting, Sacramento, CA.
- 2005 Tradition, History and the Archeological Potential of the Cooch's Bridge Battlefield, New Castle County, Delaware. Paper presented at the annual meeting of the Middle Atlantic Archeological Conference, Rehoboth Beach, DE.
- 2005 Wintering on the Raritan: The Private Correspondence of a British Officer. Paper presented at the annual meeting of the Council for Northeast Historical Archeology, Trenton, NJ.
- 2000 "We Live in a World of Company": Archeology and History of Beverwyck Plantation, Morris County, New Jersey during the American Revolution. Paper presented at the annual meeting of the Society for Historical Archaeology, Mobile, AL.
- 2000 "The Keep the Banks, Dams, and Sluices in Repair...": An Archaeological Study of Marsh Architecture. Paper presented at the annual meeting of the Society for Historical Archaeology, Quebec, Canada.

SUMMARY OF PROFESSIONAL ACTIVITIES

Mr. Catts is author or co-author of over sixty-five (65) cultural resources reports, fourteen (15) scholarly articles and monographs, five (5) book reviews, thirty-one (31) papers presented at professional meetings, six (6) symposia organized at professional meetings, and one (1) professional conference organized.