Historical Documentation
and
National Register of Historic Places Evaluation

Lang Impoundment Dike Restoration and Rehabilitation Project
Port Penn, New Castle County, Delaware

prepared for

Delaware Department of Natural Resources and Environmental Control
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ABSTRACT

The Lang Impoundment project area contains an earthen and stone embankment with a steel and concrete sluice. The configuration of this human-built landscape element dates to circa 1920. The impoundment area has a long history of diking and embanking. It was originally called Doctors Swamp in the late seventeenth century, and by 1787 was the common property of the Little St. Georges Marsh Company, an entity that was still extant in 1917. An earlier dike configuration, dating to at least the late 1840s, shows a different shape to the configuration present at the Lang Impoundment today, indicating that considerable rebuilding and reconfiguration have taken place over time. Later work on the dike has included new sluice wing walls and gates, the addition of gravel and soil to the embankment, and the addition of stone riprap to the exterior, riverside of the dike.

While the Lang Impoundment has sufficient age and retains some of the aspects or qualities of integrity that would make it eligible for listing to the National Register of Historic Places, Commonwealth does not recommend the resource as National Register eligible. It is not an outstanding example of a dike from the early twentieth century since many of the dikes along the Delaware River were rebuilt and replaced at that time. The dike's original function, as part of the Little St. Georges Marsh Company, was to create arable land or meadow, and the dike no longer functions in this capacity. Today, the dike is used as a water control feature to protect Route 9 and to provide environmental conservation. While the impoundment at Little Creek Marsh Company has historical connections with the house known as Ashton, the Ashton National Register Historic District boundary does not extend east of Route 9, thus the Lang Impoundment is not within the district. Further, there is no connection, historical or otherwise, to the Port Penn Historic District.

TABLE OF CONTENTS

Figures

1. INTRODUCTION

1.1 Purpose and Goals of the Study

This report presents the results of a historical background review and National Register of Historic Places (NRHP) evaluation of the Lang Impoundment Dike (Figure 1). The Delaware Division of Fish and Wildlife (DDFW) intends to repair and reconstruct over 4,000 feet of dikes and installing new water control structures associated with the Lang Impoundment at Port Penn along the Delaware River. While it is surmised that the Delaware Department of Transportation undertook repairs on the dike circa mid-1950s to protect Route 9 from flooding, the Delaware State Historic Preservation Office (SHPO), in a letter of 30 September 2016, expressed concerns there may be elements of an older historic dike that could be affected by the proposed repair and reconstruction (Appendix I). Further, the SHPO noted that the project is adjacent to other historically significant properties that are eligible for listing on the National Register of Historic Places and that the project area is situated north of the Port Penn Historic District and east from the Ashton Historic District.

SHPO's letter dated 30 September 2016 suggests that the Lang Impoundment may be eligible for inclusion in the National Register of Historic Places (NRHP) and recommends an evaluation to find if this dike is eligible for listing. As the primary consideration for eligibility, National Register criteria require that a historic property possess integrity. As defined by the National Park Service, seven aspects of integrity must be considered: location, design, setting, materials, workmanship, feeling, and association. In addition to integrity, a historic property must meet one or more of the specific criteria for evaluation (A through D) in order to be eligible to the National Register. The historic context for Delaware's marshland cultural resources (Fisher et al. 1993:132) suggests that identified cultural resources should be evaluated under Criteria A and C of the National Register of Historic Places. Finally, dikes may be eligible for listing under Criterion D, as has been demonstrated with several of the Delaware River Dikes.

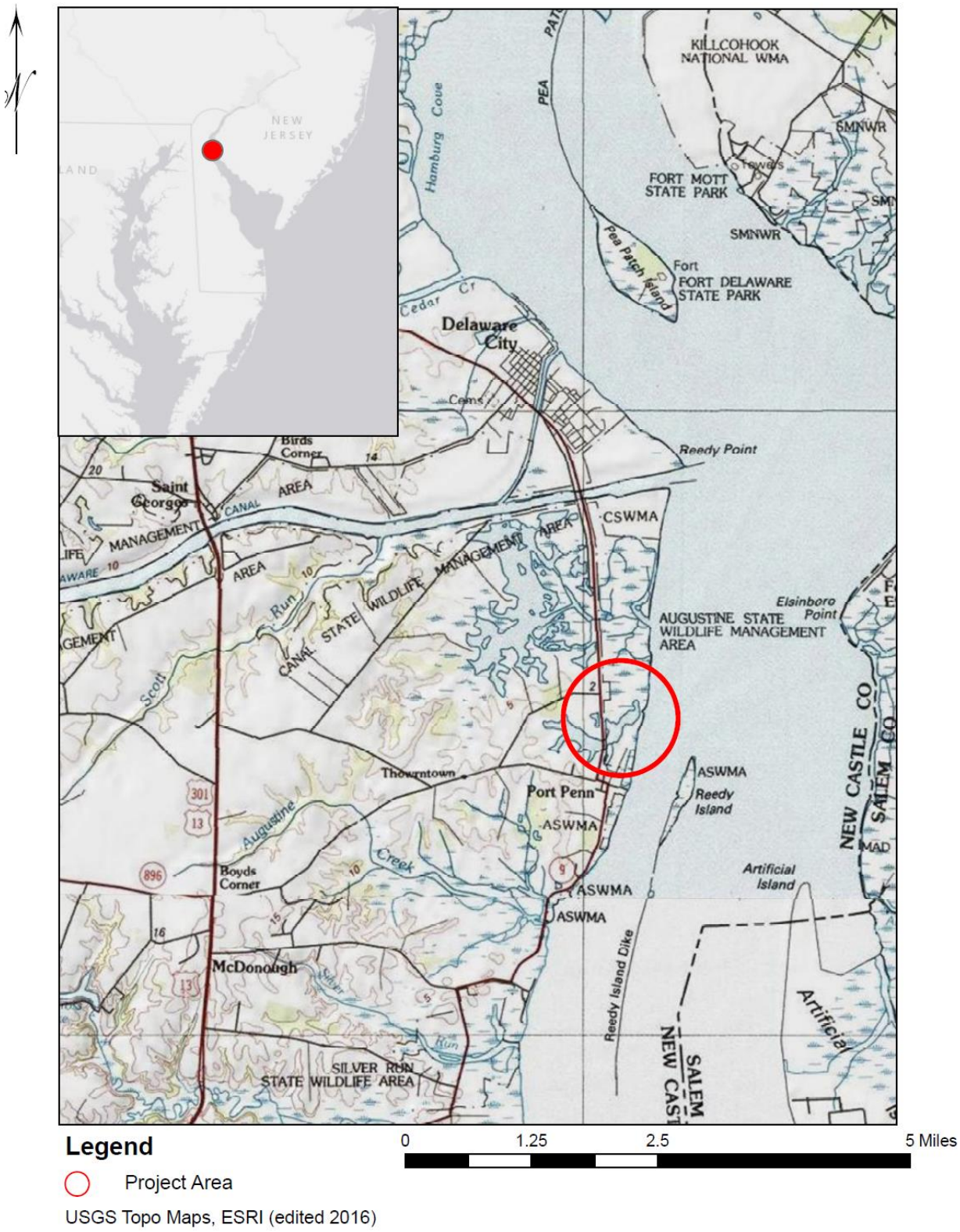

Figure 1. Project Area

2. METHODS

2.1 Background and Historical Research Methods

Commonwealth collected information concerning the history, prehistory, and environment of the project area, focusing on factors that affect the nature, distribution, and condition of historic and prehistoric archeological resources. The SHPO site files were examined to collect data on previously recorded sites in the project area and in the general project vicinity.

Commonwealth conducted research to create a historic overview of Lang Impoundment at Port Penn. The Delaware Public Archives and The Delaware Historical Society were searched to recover documentation related to the history and use of Impoundment. Previous survey completed by Commonwealth along the Christiana River above Newport and along the Delaware River were consulted, as was the marshland historic context prepared by the University of Delaware Center for Architecture and Design, and the marsh context prepared for southern New Jersey. In additional to the historic documentation, historic maps and manuscripts, historic aerials, and plats were georeferenced into a GIS workspace using ArcMap 9.3 or ArcMap 10. This georeferencing provides additional documentation regarding the history of Lang Impoundment. Pertinent maps are included in the report.

Commonwealth also relied on our previous experience studying the historical development of the dike system along the Delaware River, for which we prepared an historical context (Catts and Mancl 2012). Also utilized was our company archive of historical, archaeological and environmental data of the Delaware Bay region. A vast quantity of information potentially relevant to the present project has previously been collected in the course of conducting over thirty-five years of archaeological and historical projects in the region. These data include detailed studies of regional environments, hydrology, topography, and geomorphology, as well as reports and syntheses of previous historic and prehistoric archeological projects. Manuscript notes were compiled and materials photocopied as appropriate for inclusion in the report of the investigation.

2.2 Pedestrian Reconnaissance

Background research will also include a pedestrian reconnaissance and field view of the Impoundment area. This field survey was conducted on 6 December in order to familiarize Commonwealth's staff with the project area. Photographs of the entire project area were taken at that time. Such images are useful in assessing National Register eligibility.

3. HISTORICAL CONTEXT

3.1 Overview of Delaware River Dikes (taken from Catts and Mancl 2013:3-14)

Along the bay and river shores of Delaware Estuary, there are over 176,000 acres of fringing tide marsh, extending from Cape Henlopen and Cape May to the head of tide at Trenton (Figure 2). Tide marsh can be defined as an area of grasses, sedges, and other plants that have adapted to continual, periodic flooding. The action of tides is the dominating characteristic, and marshes of the Lower Delaware Valley can be divided into three parts based on the effects of the tide on the types of plants that can be found: salt marshes, fresh-water marshes, and brackish-water marshes. Any given marsh can be further divided into two areas: the low marsh that generally floods and drains twice a day, and the high marsh, that is flooded less often (Chase 1979; Daiber and Roman 1988:95-97; Scott 1991).

The extensive marshes of Delaware have long been an important resource for subsistence and economic activity. Until the early decades of the twentieth century, Delaware's marshes were exploited for their animal resources, such as fish, shellfish, turtle, waterfowl, and muskrat. Moreover, tide marshes along both sides of the Delaware River and Bay during the seventeenth, eighteenth and nineteenth centuries were used by farmers for hay for cattle and livestock during the winter months. One wetland reformer wrote:

> "When the country was first settled these marshes were depended upon a good deal for hay during the winter. Even fifty years ago [circa 1810] they were prized much more highly than they now are....The result of this former high estimate of these marshes is seen in the fact that they are now often owned in small parcels of from five to ten acres, having been inherited by farmers living far back in the country....They are chiefly valuable for yielding early pasturage, and the hay is better for bedding than for fodder" (Clift 1862:343).

In his study of coastal wetlands in Northwestern Europe, archeologist Stephen Rippon suggests that there are three stages of use for coastal wetlands, a framework that serves to help contextualize the historical role of wetlands. The first stage is exploitation, where wetland areas are used for their natural resources, but the landscape is essentially left unchanged. The second stage is modification, where coastal wetlands are altered through minor landscape changes, such as ditching and draining. The third stage is transformation, where major landscape changes, such as dikes and embankments, are constructed in order to reclaim land and permanently remove it from periodic inundation (Rippon (2000), cited in van der Noort 2012:116). The dikes along the Delaware River fall principally in the transformation stage of development, but earlier stages of exploitation and modification are also apparent.

Beginning with European settlement, marsh modification and transformation through ditching and diking was undertaken to add to land suitable for agricultural use, especially for pasturage and as a source of hay for fodder, and to create more healthy environmental settings (Fisher et al. 1993; Catts 2000). Marsh reclamation was labor-intensive, and therefore costly. In general, there was a main ditch measuring up to 20 feet across at the top, and five-foot in depth that drained to the nearest creek or river. Off the main ditch were "prongs" that ranged in size from roughly 5 to 10 feet across at the top, and had a depth of about 3-feet. In tidal areas, a dike, or bank was needed to prevent successive flooding. The height of the dike needed to be roughly 3 feet above the mean high tide, which along the Delaware River generally meant a height of from 6 to 8 feet. The breadth was dependent on location, with dikes along the Delaware measuring up to 18 feet across at the base, and 4 feet across at the top (Fisher et al. 1993:87; Catts 2000:5-6).

The manner of dike construction was dependant on the extent of exposure to open waters and tidal action, and the ubiquitous threat of weakening caused by the burrowing of muskrats. A nineteenth century expert on marsh reclamation recommended that dikes exposed to the ocean or subject to the action of heavy tides

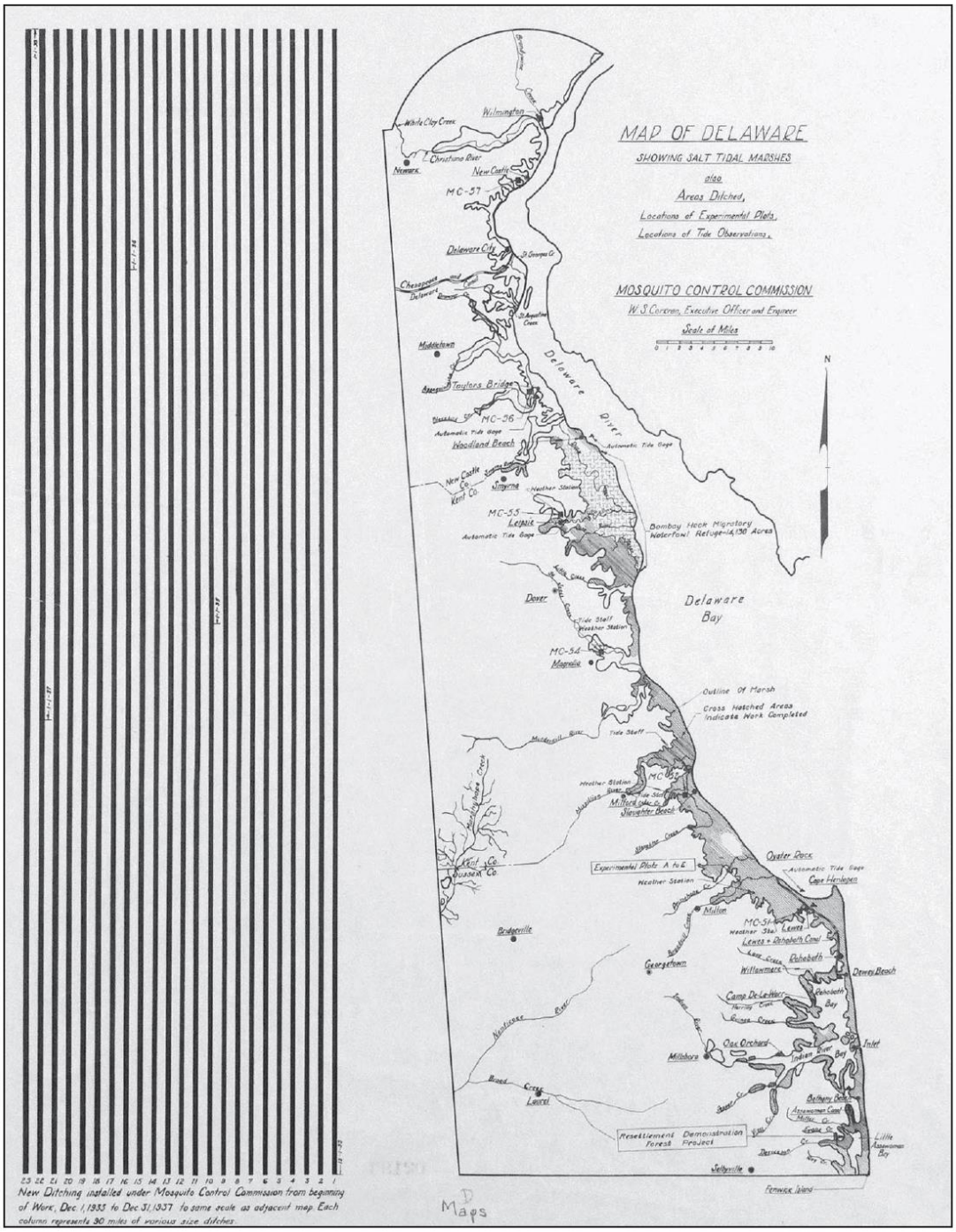

Figure 2. The extent of salt marshes in Delaware in the 1930s (Delaware Mosquito Control Division, 1938).

be faced with stone. Another added that a reed marsh on the river side could offer protection. Dikes along tributaries, however, generally could be less robust (Clift 1862:345; Reybold 1889:55). Keeping standing water away from the base of a dike, and the use of sheet-piling was recommended to discourage undermining by muskrats (Reybold 1889:55; Colburn 1889:52). With respect to sheet-piling, marsh expert A. Colburn wrote in 1888:

> For this purpose use 1-inch boards, 4 feet long, and drive a double row, breaking the joints. If they cut through one row, they will strike the center of the board of the next row, which will stop their progress, as they cannot gnaw through the center of a board. Some 3 miles of this piling, driven two years ago, has in no place been cut through. The piling should be driven as near the foot of the dike as practicable, and the space between the piling and the dike so graded that no water can stand on it, else the rats will work in the back of the piling. (Colburn 1889:52)

Archeological evidence from a dike along the Christina River at Holly Run in Newport, Delaware indicated that the sheet-piling consisted of 0.5- to 0.7-foot wide, primarily triangular timbers that were driven into the mud. The piling was composed of two rows offset from one another, with one row being roughly a foot further into the river. The timbers of the inner-most row rested on an unfinished timber lying parallel to the length of the piling at 3 feet above mean low tide (Kellogg and Catts 1997:23-24, Plate 13). The threat to dikes posed by muskrats was so problematic that it was recognized in legislation passed to protect them. Legislation passed in Delaware from 1875 to 1909 prohibited the killing or possession of a killed muskrat from March to December, except from marshes that were diked or otherwise improved (Enrolled Bills 1875, 1889a, 1889b, 1909)

Dikes were fitted with one or more sluices that held a self-acting gate that allowed water to drain from the marsh, yet kept it from entering. Typically the sluice was constructed of wood, the base of which was placed below the water line at low tide. Sluices were constructed of heavy timber framing, which at times rested on pilings driven in at the base. Gates could be made of wood or sheet iron. As recorded in the area of Delaware City, if the width of the sluice was greater than 3 feet, additional sections were placed, each having its own gate (Colburn 1889:51; Colton 1889:57). As depicted in the historical literature, and found archeologically, sluices were rectangular channels running perpendicular to the length of a dike (Figure 3). Unlike sluices and gates associated with water-powered mills, they did not run the full height of the dike. The method of construction was fitting to the use of self-acting gates, and reduced the cost of having to build a framing and gate substantial enough to withstand the water pressure to which a gate covering the full height of the dike would be subjected.

A sample of eighteenth-century Kent County Delaware inventories reveals that "tussock hoes" (or grass hoes), salt hay, and "stacks of marsh hay" appear in estate inventories by the 1740s (Bushman and Hawley 1987). Real estate advertisements in the *Pennsylvania Gazette* for lands in Delaware contain regular mention of drained meadows and marsh tracts in the 1750s; these tracts generally ranged from 5 to 25 acres. Until the second quarter of the eighteenth-century, beyond the settled communities along the Delaware River, such as New Castle, Salem, and Burlington, tide marsh banking was undertaken by individual farmers and landholders on small tracts of marsh, and generally at significant expense.

To defray the costs of construction and maintenance, marsh companies were formed in the first half of the eighteenth century on both sides of the Delaware Estuary (Lanier and Herman 1997; Sebold 1992). Most importantly, legal authority was needed by these companies to compel owners of marsh lots to contribute to the upkeep, either through physical action or taxation. Taxes charged by the companies were proportional to the amount of marshland owned. One of the first to be authorized by the legislature was a large tract of tide marsh called Conrad's Cripple, located along the Christiana River in New Castle County. In 1738 the colonial General Assembly passed an act "authorizing the owners of the Marsh Meadow near Newport, called Conrad's Cripple, to keep the banks, dams and sluices in repair, and raise

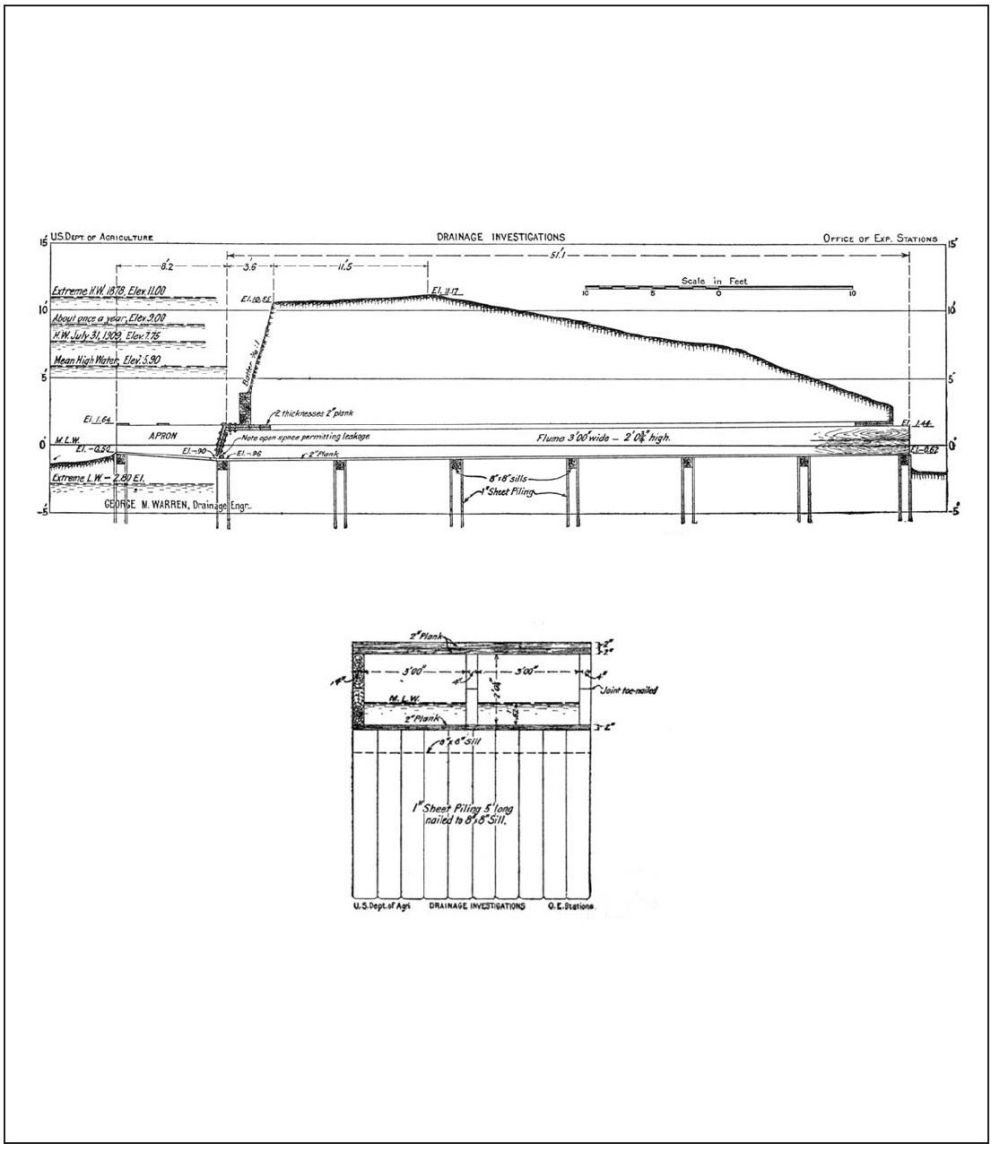

Figure 3. Cross-section views of the sluice installed in 1894 at the Colburn Marsh in Delaware City, Delaware (Warren 1911:Figures 6 and 7).

funds to pay the expenses thereof" (Conrad's Company 1865). The act was revived a year later, and again twenty years later when the colonial assembly passed an act for the banking of the Newport (or Conrad's) Marsh, authorizing the landholders to raise taxes to pay for the maintenance (Denny 1759). Other early marsh companies included Middleburgh Marsh Company, Mill Creek Marsh Company, and Deer Creek Marsh Company, all located east of Newport and west of Wilmington (Deer Creek Marsh Company 1759-1891). Along the river in Delaware companies were formed along Cedar Creek, Appoquinimink Creek, St. George's Creek, and Little St. Georges Creek by the 1770s and 1780s, and similar meadow companies were created in Salem, Cumberland, and Cape May counties in southern New Jersey (Chase 1979; Sebold 1992:57-65; Wacker and Clemens 1995).

Maintenance costs for embanked tide marshes were high, and often proved a deterrent to the initial or continued reclamation of a tract of salt marsh. Throughout the northeast, wrote marsh reclamationist William Clift of Stonington, Connecticut, salt marshes generally required "more capital to bring them into

upland grasses, and they are usually owned in company--a piece of a hundred acres not unfrequently [sic] having a dozen or more proprietors"(Clift 1862:344). Without incorporation, land owners would bicker over the responsibilities of maintenance and repair, and the costs could be heavy on individual owners (Wacker and Clemens 1995:122). The 1810 preamble to the Act of Incorporation for the Port Penn Marsh Company, allowing the owners to "keep the Banks, Dams, Sluices, and floodgates thereof..." described the problems of salt marsh maintenance, noting that the marsh had "for a considerable time hath been embanked, but of late hath been frequently impaired and out of order for want of proper management and regulation, and as such improvements are from their own nature subject to many casualties, and without constant care and expence[sic] are not only liable to decay, but the defect of one part is often injurious to the whole, and among owners such frequent disputes arise concerning repairs or the means of defraying the expenses thereof that often times from small neglects great damages ensue and the heavy charge of one owner rendered ineffectual through the default of another" (NCCD I-3:385). The extant records of other marsh companies in New Castle County, such as the Cedar Creek Marsh Company, the Cherry Island Company, and the St. Augustine Marsh Company, provide supporting documentation regarding the annual cycles of maintenance and repair (Cedar Creek Marsh Company 1859-1900; St. Augustine Marsh Company 1796-1821).

The minute books of the Deer Creek Marsh Company, kept for nearly a century, illustrate the high level of maintenance required to properly maintain the reclaimed marshland. Land owners were either taxed (according to the number of acres of marsh they owned) for the work, or provided manpower to undertake such repairs as cutting and clearing the banks, repairing tide gates, working on bridges, scouring drains, "stopping muskrat holes," planting herd grass on the banks, building new banks, working on lanes, facing the bank, and working on sluices (Deer Creek Marsh Company 1795-1891). Expenditures also included purchases of lumber, spikes, bolts and other hardware, and stone. Stone was apparently most useful in locations where tidal action was constant.

While the early efforts at marsh reclamation was initially undertaken by an individual, the undertaking was subject to permission being granted by the legislature through passage of a private act (Fisher et al. 1993:89). A landowner, at times in partnership with adjacent landowners, bore the labor and cost of creating and maintaining dikes and drainage ditches. Relations pertaining to ditches were briefly formalized in 1770 in an act regulating fences. In force for only three years, the act stipulated that where a ditch was desired by one party along a property line, both landowners were required to share the expense of digging and maintenance. Further, each was required to erect a fence at least 2.5 feet high within a foot of edge of the ditch (Laws 1797:451-455). Again in 1816, legislation was passed detailing the process of marsh reclamation (Fisher et al. 1993:90).

Beginning in the eighteenth century a number of landowners created formal agreements for marsh reclamation through mutual agreement or the formation of marsh companies (Fisher et al. 1993:89; Catts 2000:2). Modification of a waterway and the formation of a company were enabled by acts passed by the Delaware Legislature, landowners and marsh companies were given the authority to conduct and regulate reclamation efforts (Bendler 2013; Williams 2008:92). Legislation generally specified the individuals or the name of the company and the marsh in question. As applicable, also specified were the marsh company officers and the manner of succession, and the time and place of annual meetings. Stipulated at times were the numbers of acres that must be held to be a part of the company. Those owning less than the stated minimum number of acres could achieve representation by combining their holdings. Most importantly, companies could compel owners of the specified marsh to contribute labor or funding in proportion to their holdings for construction and maintenance of marsh infrastructure (essentially imposing a marsh tax on the individual owner). Changes in ownership of marshland associated with a company periodically resulted in a renegotiation of the terms under which it operated.

The banking and draining of tidal marshes became more widespread in the northeastern United States after the War of 1812 (Wacker and Clemens 1995:124). Following the American Civil War draining marshes to reclaim the land for agricultural use gained in popularity (Smith et al. 1989). The reasons offered were numerous, including ridding the country of "plague-breeding swamps", and the rich condition of the highly organic soils for agriculture (Clift 1862:344; Collins 1871:611). The economic benefits were also cited as incentive, particularly since "the subject of the reclamation of marsh lands is one which must claim the attention of the country in the immediate future, as agricultural lands advance in price and population increases"(Dodge 1871:600). Beginning in the 1860s, numerous agricultural reformers and civil engineers published "how-to" reports on the methods and techniques of draining and reclamation, including Delaware and New Jersey agriculturists (Grettler 1990; Lanier and Herman 1997; Sebold 1992).

Between 1779 and 1897, the Delaware legislature passed 229 bills pertaining to the creation and maintenance of marsh companies (Figure 4). Marsh companies were formed throughout the state in all three counties, along the Delaware and its tributaries and on inland rivers such as the Nanticoke. The six decades between 1820 and 1880 were the efflorescence of marsh companies in Delaware. The peak decade for passage of bills dealing with marsh companies was 1830-40, when 33 acts for marsh companies were passed. By 1885, Delaware was considered to be a model of successful land reclamation and had more diked land in proportion to its area than New Jersey (Nesbitt 1885).

Beginning in the last decade of the nineteenth century, marshes in Delaware began to be abandoned for agricultural use. The abandonment was a result of the overall decline in agriculture in the state, and the extensive damage to dikes and marshes caused by the 1878 hurricane and other damaging storms. The 23 October 1878 hurricane was of truly epic proportions and one contemporary wrote that "every embankment from Cape May to Trenton was broken, and many of them swept from their very foundations. No such storm of wind, and consequences, was ever known in our country before…" and the economic implications were unprecedented as "…many [marsh owners] on both sides [of the Delaware River] were completely ruined financially" (Clark 1879).

Following hurricanes and high storm tides in 1884, 1894, 1914, 1927, and 1933, Delaware farmers gradually abandoned marsh reclamation and the agricultural use of marshes (Fisher et al. 1993:90; see also Ramsey and Reilly 2002). The high cost of dike and sluice maintenance, the general aging of the structures (many on the Delaware River were a century or more in age by the 1930s), and the decline in the need for salt hay in packaging (it was used in the packaging of glass from southern New Jersey glass houses and in the packaging of ice), all contributed to the dissolution of the marsh companies and the degradation of the marsh structures (Sebold 1992).

At about the same time, the county, state, and federal governments began focusing on marsh drainage as part of efforts to control the mosquito population (Delaware State Highway Department 1940:23; Delaware State Highway Department 1942:41; hereafter DSHD). By the 1950s, repair and maintenance of dikes and related infrastructure fell into the hands of Public Works Division of the State Highway Department, where efforts focused on preventing the flooding or roads (DSHD 1954:74-77). A significant bipartisan Dike Bill was passed in the state legislature in July 1953. Sponsored by William Lester (Republican from Delaware City) and Harvey Moore (Democrat from Port Penn) the bill provided for funding to repair, construct, and reconstruct the dikes and sluices at Port Penn "so that the tidal waters of the Delaware River will no longer overflow the banks and damage adjacent properties and roads" Lester and Moore reported that because of breaches in the dikes, deterioration of the sluice gates, and loss of materials composing the earthen embankments, "flood and storm tides have rendered state and private roads impassable" contaminating wells and increasing the mosquito population (Anonymous 1953).

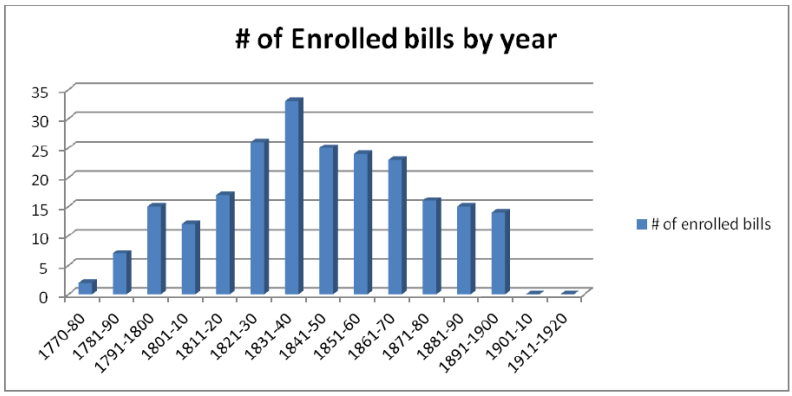

Figure 4. Summary of Enrolled Bills passed by the Delaware Legislature pertaining to Marsh Companies, 1770-1920.

The concerns for the state's transportation infrastructure and public health issues were the determining factors for the state's assumption of what was by this time referred to as a dike "system." In the discussion of the Port Penn dikes and tide gates, the Highway Department noted that "the unchecked forces of nature have accomplished progressive erosion and breaching of dikes and deterioration of tide gates in the Port Penn area. As a result, flood and storm tides have brought extensive flooding of lands. State and private roads are rendered impassible, wells are made unsafe and conditions detrimental to the public health are created by periodic flooding" (DSHD 1954:74). The scope of work at Port Penn included construction of new "protective dikes, including new sluices with tide gates," core walls for dike construction, removal of an existing sluice, and the raising and surfacing of two roadway sections (Figure 4). This level of effort was repeated at many of the dikes along the Delaware during the 1950s, and marks the beginning of state involvement in the maintenance of the dikes, and likely the period when the concept that the dikes represent a system of tidal control became generally accepted.

3.1 ELEMENTS OF MARSH ARCHITECTURE

As the *Marshland Resources in the Delaware Estuary, 1830 to 1950 +/-: An Historic Context* (Fisher et al. 1993:92) points out, there are three principal elements or property types associated with marsh architecture: 1) Banks or Dikes; 2) Ditches; and 3) Sluices Gates. Each is described below to provide the reader with some background on methods and materials of construction, placement of elements, and some of the hazards associated with the repair and maintenance of the dikes.

3.2.1 Banks and Dikes

Along the Delaware Estuary and its tributaries are the remnants marsh architecture required to drain the wetlands and bring them into agricultural "production." The most obvious and indeed crucial elements of tide marsh architecture are the banks and dikes. Embankments were generally made of soils excavated from within the marsh, but several contemporary observers noted that sometimes soil could be brought in, at a fairly great expense, to create the embankment (Colburn 1889:52). Soil banks ranged in size, but were intended to form a trapezoid when seen in profile. Along the Delaware River banks could be from 12 to 18 feet broad at the base, 3 to 4 feet broad at the top, and of necessity had to be extend at least three feet above the high water mark (Colton 1889:56; Riddle et al. 1813; Weslager 1961:206). Embankments along tidal streams that did not get direct ocean tides were often less massive. As prescribed in the literature by a Connecticut marsh reclamation expert: "if the marsh does not face the sea, and is not exposed to heavy tides or floods, a much less expensive embankment will answer. It may be made without stone, by having a

section of clay or clay loam, about eighteen inches in thickness, running through the middle of the embankment....This kind of embankment is well adapted to land upon small creeks and streams, where little violence is offered by the waves or by the pressure of high tides"(Clift 1862:345).

The remains of the vertical or upright timbers are called sheet piling (Colburn 1889:52) or, as it is known today, as Wakefield Sheeting or Piling (Chester Stachecki, personal communication May 1997). In many cases, because of lack of maintenance of the banks, piling may only be visible at low tide. In a section of sheet piling recorded at the Christina River dike, the timbers used in the piling ranged in width between 0.5' and 0.7' (Kellogg and Catts 1997). The timbers, with few exceptions, were triangular in shape, and were not anchored or fastened to each other or any other support, but were instead driven into the mud of the embankment. Several of the pilings were leaning at angles from 30 to 45 degrees. A large timber or log was observed protruding horizontally from the embankment, and the sheet piling was leaning on this log. The sheet piling was composed of two parallel line of driven timbers, one offset and further out in the river than the other. The ends driven into the mud were clearly sharpened by axe.

Historically, pilings were generally placed as close to the low water mark as possible. Sheet piling was necessary to protect the embankment from muskrats, and the double row of piling was one method used to exclude muskrats from burrowing into the earthen wall. One tide marsh engineer described the problem and the solution as follows: "Muskrats are very abundant and destructive if the dikes are left without protection. They can be protected from rats by sheet-piling. For this purpose use 1-inch boards, 4 feet long, and drive a double row, breaking the joints. If they cut through one row, they will strike the center of the board of the next row, which will stop their progress, as they cannot gnaw through the center of a board. Some 3 miles of this piling, driven two years ago, has in no place been cut through. The piling should be driven as near the foot of the dike as practicable, and the space between the piling and the dike so graded that no water can stand on it, else the rats will work in the back of the piling" (Colburn 1889:52).

The problem of destructive water rats was as old as the use of artificial embankments to hold back the tide. In the winter of 1749, Swedish naturalist Peter Kalm wrote of the efforts that settlers along the Delaware expended in order to destroy the muskrats. Kalm recorded that muskrats

> "make their nests in the dikes that are erected along the banks of rivers to keep them from the adjoining meadows; but they often do a great deal of damage by spoiling the dikes with digging and opening passages for the water to come into the meadows.....As they damage the banks so considerably, the people are endeavoring to destroy them when they can find their nests....It is very difficult to extirpate these rats when they are once settled in a bank. A Swede, however, told me that he had freed his dame or piece of dike along the river from them in the following manner; he sought and found their holes, stopped them all up with earth, excepting one, on that side from whence the wind came. He put a quantity of sulphur into the open entrance, set fire to it, and then closed the hole, leaving but a small one for the wind to pass through. The smoke of the sulphur then entered their most remote nests, and stifled all the animals. As soon as the sulphur was burnt, he was obliged to dig up part of the ground in the bank where they had their nests; and he found them lying dead in heaps"(Benson 1937:240-41).

The use of stone along the bank wall close to the sluice, and in places where the bank met the fast or upland, was advocated by several contemporary authors, particularly in places where the berm was subject to continuous tidal action (Clift 1862:345; Colburn 1889:52). In the case of the 1814 Red Lion Marsh embankment, where the earthen banks met the fast land they were to be secured to piers or wharfs "constructed of substantial logs well spiked together and filled with stone and mud" or by "substantial piles, well driven, and backed by brush and stone" (Riddle et al. 1813).

3.2.2 Ditches

The second element of marsh architecture was ditching. During the construction of the dike, the soil used for the dike was excavated from the interior of the bank, creating a ditch. These ditches were necessary to help carry water away from the embankment, and to drain the marshland for agricultural use. Along the interior (or marsh) face of the berm a drain or ditch followed the inside of the bank until it connects with the sluice gate. Other ditches were excavated leading from the upper marsh to larger, or "trunk" ditches, that also connected to the sluice.

3.2.3 Sluice Gates

The third element of marsh architecture is the sluice gate. Sluice gates are still extant in tidal marshes throughout the lower Delaware Valley, and are a relatively typical tidal marsh architectural feature (Mr. Chester Stachecki, personal communication, May 1997). Sluice, or tide, gates were necessary to regulate the flow of water in and out of the salt marshes located along the eastern seaboard (Collins 1871:607). The materials and construction of sluice gates varied according to where on the shoreline they were situated. Along the sea edge, tide gates and the associated berms and banks were of more substantial construction, often using stone in the creation of a sea-wall (Clift 1862:345). For tidal rivers and streams the construction was often of timber.

The length of the sluice depended on the size of the base of the overlying bank. A sluice gate investigated along the Christina River was approximately 44 feet long; a sluice described in 1813 along Red Lion Creek was nearly identical in length, suggesting that the embankment associated with the sluice was originally about 16 feet broad at the base (Riddle et al. 1813). The sluice investigated along the Christina River was constructed of two parallel sills with wooden planking in two sections, linked by a scarf joint in the center and fastened by large iron, square-headed bolts. The horizontal planks formed the upper and lower surfaces of the sluice (Kellogg and Catts 1997). The 16d common nails, made of steel wire and used in the construction, exhibited evidence of gripper marks on the shanks and flat, although somewhat bulbous, heads (Nelson 1968). The use of wire nails in the sluice suggests a date of construction sometime after circa 1880-1885, when nearly seventy-five percent of the nails produced in the United States were wire (Inashima 1994). No evidence of repair or maintenance of the sluice was apparent, such as replaced nails, or new nail holes.

In the vicinity of Delaware City, located along the brackish portion of the Delaware River, local resident A. Colburn wrote in 1889 that:

> "the sluices used in this section are built of wood, about 2 feet in depth and wide enough to vent the water. If a greater width than 3 feet is required they are divided into sections about 3 feet wide, in each of which is hung a self-acting gate. The sluices are placed below low-water mark. Great care is required to prevent the water running under or over them" (Colburn 1889:51).

Another contemporary reported that chestnut and white oak were the most durable types of wood to be used in building a sluice (Clift 1862:345). The Christina River sluice, since it was situated on a tidal river, but sheltered from extreme storm tides, was a smaller version of these Delaware River sluices.

A good description of a sluice was provided by agricultural reformer Sereno Todd. In an article published in 1871 on underdraining land, Todd described what he termed "outlet drains," stating that a wooden outlet was made "by placing a board or plank on the bottom of the ditch, while the ground is soft, then by setting a strip four inches wide one each side and covering with short pieces, as shown by the cut. A board is frequently laid on lengthwise, which is objectionable, as the covering will not be so strong as if the same

board were cut in pieces and laid crosswise. The water channel beyond the outlet should always be kept clear of mud and gravel, so that the water will flow away rapidly from the drain" (Todd 1871:595).

The sluice gate was generally fitted with a self-acting tide gate that remained closed during high tides and opened during low tides so that marsh waters could drain. Throughout the centuries, Delaware tide gates were of simple construction. In 1889, one marsh improver remarked that "the doors open and shut with the tide, and can be either of the "barn-door" or "trap-door" kind" (Reybold 1889:55). Seventy-five years earlier the technology was the same, and a trap-door gate was described in 1814 when the Red Lion Marsh embankment was realigned; the gate was to be constructed of "substantial white oak posts and Two inch plank and to work with two perpendicular Doors or flood gates fixed in at the Bottom on platforms"(Riddle et al. 1813).

It was common for sluices to not be permanently attached to the berm or bank. At the time of its construction the dike wall would extend over the sluice. The Red Lion Marsh sluice mentioned above specified that the sluice was to be placed at least six inches below the low water mark, ensuring that the sluice was always wet (Riddle et al. 1813). The weight of the earthen berm and the eventual waterlogging of the timbers served to hold the sluice in place, a practice still observable in Delaware tidal marshes (Mr. Chester Stachecki, personal communication, May 1997).

The Christina River sluice gate provides physical evidence of the problems of repair and maintenance associated with marsh architecture (Kellogg and Catts 1997). The portion of the sluice extending into the river has been stripped of its planking, probably through years of storm tides and particularly ice flows. Damages caused by rotting timbers were apparent on several of the planks and sills, and because the sluice was not continuously maintained the portion of the berm holding the sluice in place has been allowed to deteriorate, exposing the entire length of the sluice at low tide. Finally, muskrats were a major cause of destruction of timber sluices, and one observed noted that "it is also desirable that the gate should be lined with yellow metal, or with copper sheathing, to prevent the gnawing of muskrats, which are one of the greatest pests about these reclaimed marshes"(Clift 1862:345).

These problems were known to contemporary proponents of marsh reclamation. In 1870 a New Jersey civil engineer, Jerome Collins, reported extensively to the United States Commissioner of Agriculture about the efforts in several states to reclaim marshes. An advocate for the use of steam-powered pumps rather than sluices for drainage, Collins described the shortcomings of wooden sluicegates as follows: "the connection made between the embankment and the wood-work or masonry of the sluice is, in nine cases out of ten, the site of numerous leaks, which are continuously enlarging and are the more dangerous on account of their apparently trifling character....If made of wood, it [the sluice-gate] is liable to rot away under water, and be unexpectedly destroyed by a violent storm or other cause" (Collins 1871:607).

Flooding caused by storm tides was a major and very real fear and could result in the destruction of the dikes, financial ruin for individuals and bankruptcy for marsh companies (Higgins 1969). For example, high storm tides damaged the Cedar Creek marsh dikes in 1836, but these were repaired and the marsh company reorganized by 1859. However, the "Great" storm of October 1878 was a complete disaster, when "every embankment from Cape May to Trenton, was broken, and many of them swept from their very foundations" (Clark 1879). The embankments protecting the Chesapeake and Delaware Canal were all destroyed, and the losses on both sides of the Delaware River were astounding; according to one chronicler, "many men on both sides [of the river] were completely ruined financially (Clark 1879).

3.3 PROJECT AREA SPECIFIC HISTORY - THE LANG IMPOUNDMENT

The parcel containing the Lang Impoundment has a long Euro-American history. It may have been part of a tract referred to as Doctors Swamp in the late seventeenth century, and portions of it may have been

associated with a tract called Chesley. Originally granted to Ann Whale (or Wale) in 1675, the Chesley tract was situated on the "first neck of firm land" south of St. Georges Creek, abutting a plantation to the south called Groeningen owned by Peter Alrichs (a 560-acre tract located "behind' to Reedy Island) (NNCD A-1:9); Port Penn Papers n.d.). Noteworthy for this discussion is that in the 1674 metes and bounds description of Alrich's tract, one of the dividing lines between Chelsey and Groeningen was a "small sprout or creek called Little St. Georges Creek" (Port Penn Papers n.d.). The Chelsey parcel came into the ownership of Robert Ashton by the early eighteenth century. When Robert died in 1706 he left the tract to his two sons, John and Joseph Ashton. Joseph Ashton received the southern portion of the plantation, and the National Register nomination for the Ashton Historical District identifies the current Thornton Road as the dividing line between the northern (John Ashton) parcel and the southern (Joseph Ashton) parcel. In 1722, John Ashton assigned all of the land to his brother Joseph.

Joseph Ashton died circa 1721 and the land descended to his eldest son, Robert II, one of four children (Joseph II, Grace and Mary Ashton). Both Robert II and Joseph II died as minor children, leaving Mary and Grace to inherit. Mary married James Bayard of Cecil County, Maryland, and Grace married Robert Hall from Salem, New Jersey. In 1741 James Bayard and Mary (*nee* Ashton) sold the lands to Clement Hall of Salem multiple tracts of land, including a plantation with a dwelling house of about 88 acres, woodland of approximately 62 acres, 80½ acres of marsh, and 30¼ acres of swamp (NCCD N-1:231; N-1:235). The lands in 1741 were described as being part of the tract called Chelsey and bounded by the parcel called Groeningen, at that time owned by David Stewart. Twenty years later, in 1761, William Hall, the heir of Clement Hall sold 80 acres of the tract, including all the buildings and a large pond to his son, John Hall (NNCD U-1:521).

The marshlands associated with the Ashton holdings consisted of approximately 200 acres, and this marshland became the Little St. Georges Marsh Company in 1787 (Enrolled Bills 1787). The principal landowners of the marsh were heirs of Joseph Hart, John Hall, and John Stewart – the first two are referenced in the deed record as owners of the former Ashton lands (or Chelsey), and the latter is likely related to David Stewart. It is possible that embanking and ditching of the marsh that is today known as the Lang Impoundment started about this time.

By the early nineteenth century, the road papers depicting the road from Port Penn to New Castle and later to Delaware City (the modern road trace of Route 9), illustrate the marshy crossing of the road and the need for a dike for the road (Figures 5 and 6). The southern-most body of water crossed on the road as shown in 1813 is labeled St. Georges Marsh, linking this area with the Little St. Georges Marsh Company (the 1978 National Register nomination for Ashton also terms this area as Little St. Georges Creek). By this time the lands east of the road are under the ownership of William Cleaver, and the lands west of the road are owned by William Kennedy. The road is shown crossing two bodies of marsh as it is traced north out of Port Penn, and these two crossings are essentially the same two that have bridges across them today (Figure 1). The depiction on the map of these areas as marsh is verified by the depiction further north on the road of the causeway as it crosses the three branches of St. Georges Creek (creek shown in brown while marsh is shown in green). The triple bridging at St. Georges Creek is a significant feature of the road and is shown on many of the road plats during the nineteenth century.

The US Coast Survey of 1848 is the first detailed map depicting the dike walls of an impoundment in the project area along the Delaware River (Figure 7). This map shows a chevron-shaped embankment extending approximately a 1/4-mile from fast land at both the northern and southern termini of the dike. No obvious sluice is shown on the map and two other embankments are depicted, one to the north and running parallel to the river, and one to the south fronting the agricultural complex where the Augustine Wildlife Area headquarters buildings are today. The dike embanks the Little St. Georges Marsh area, and the two road crossings are also shown. A structure is depicted at the northwest corner of the intersection of the Thornton Road (established circa 1826) and Port Penn Road. Within the marsh are shown several

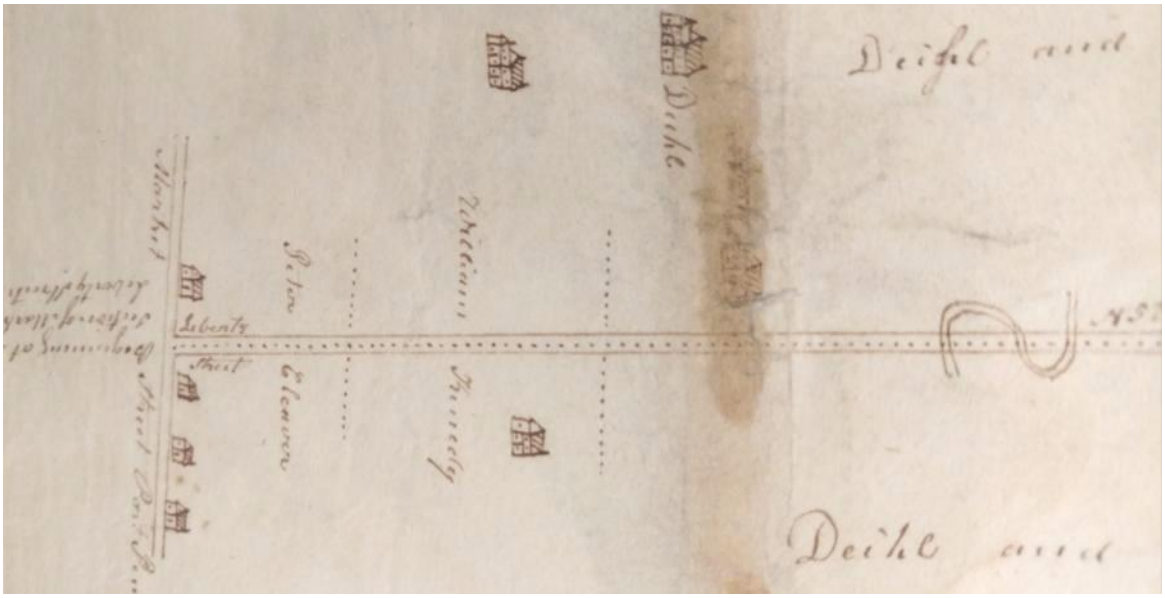

Figure 5. Detail of plat, Road from New Castle to the Port Penn Road (1806). Port Penn is at Liberty Street intersection to the left. Little St. Georges Marsh is not depicted, but the triple bridge crossing of St. Georges Creek is shown to the right of the image. Compare with Figure 6 below.

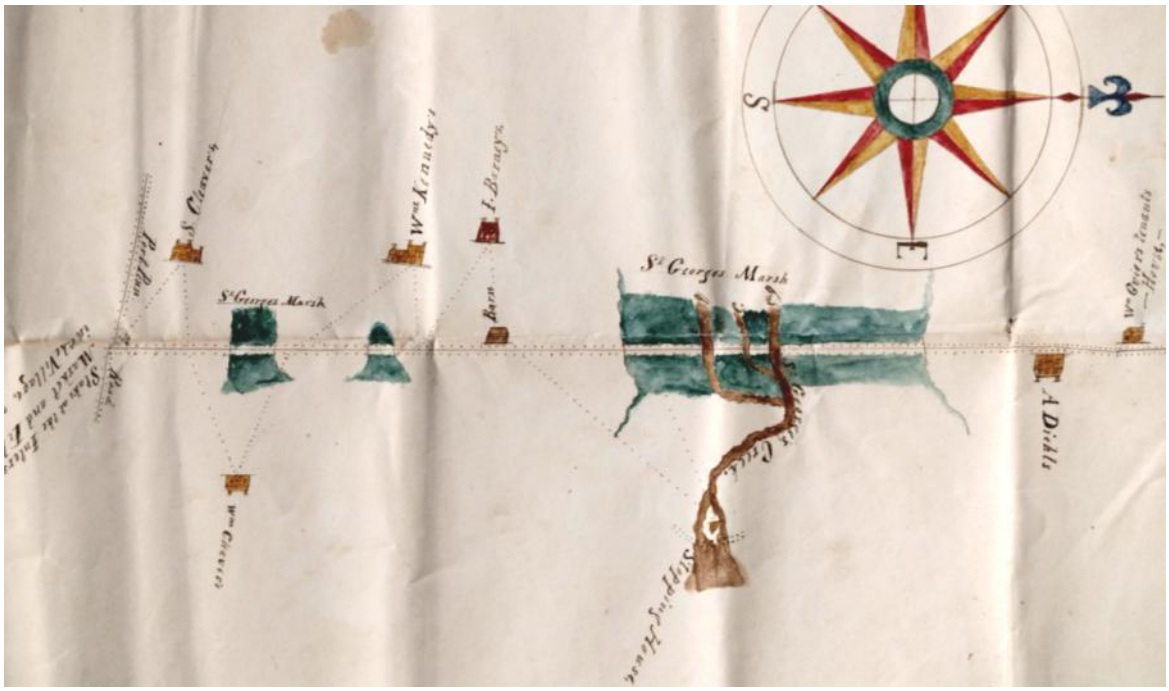

Figure 6. Detail of plat, road from Port Penn to the Hamburg Road (1813). Port Penn is the intersection to the left in this image and the marshes are depicted in green. From left to right the first two marshes are Little St. Georges Marsh and then the much larger St. Georges Marsh. The road as depicted is essentially the current roadbed of Route 9.

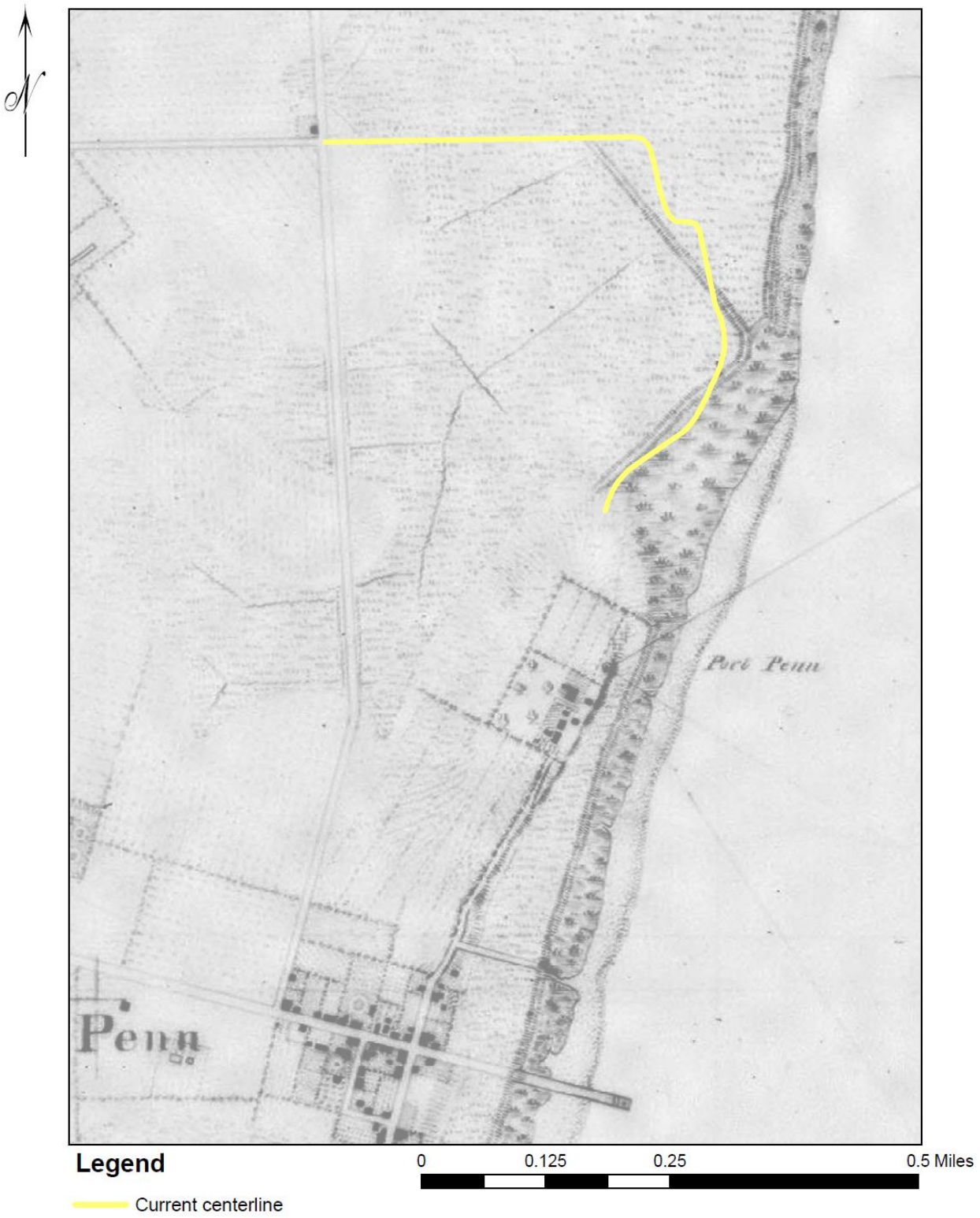

Figure 7. Detail of US Coast Survey, 1848, with current Lang Impoundment superimposed.

drains, one large one trunk line bisecting the marsh, and several "feeder" drains extending perpendicular to the main trunk line.

The National Register nomination for the Ashton Historic District notes that the Thornton Road served as the property division line between the two earlier Ashton brothers' holdings, and on the 1848 Coast Survey a faint dotted line extending east towards the Delaware River from the road intersection and abutting the northernmost terminus of the dike wall is visible on the 1848 plat (Figure 7). This dotted line suggests that a property line marked the end of the dike wall (and the current northern access road out to the Lang Impoundment is essentially marking this boundary line).

The 1849 map of New Castle County (Figure 8) provides no detail regarding the road, marsh, or embankments, but does show that the owner of the farm immediately south of the Lang Impoundment is W. Cleaver (as it was in 1813) and the owner of the property west of the Port Penn-Delaware City road is "W.Canada" - likely a corruption and misspelling of Kennedy. Nearly twenty years later, the 1868 St. Georges Hundred map from Beers' *Atlas* correctly identifies this same location as the estate of William Kennedy, and the tract south of the impoundment is a named parcel called "Mt. Airy" and owned by D. Cleaver. The Congress Street extension leading to Mt. Airy is shown, but no evidence of marshland, embankments, or any other topographical information is depicted (Figure 9).

The October 1878 storm severely damaged the embankments along the Delaware River. In the vicinity of Port Penn the Wilmington paper reported that a year after that storm "...farmers suffered greatly"(Anonymous 1879). The paper continued,

> "...urged on by wind and tide the waters piled themselves up against the artificial banks. A dozen breaches were made and a great flood swept inland carrying craft of all kinds right over the submerged fields, flooding acre upon acre of arable land and carrying away thousands of bushels of grain. Disgusted with fighting the Delaware bay and indirectly the Atlantic ocean some farmers seriously debated the question of abandoning their flooded lands to muskrat and water fowl; but the banks were rebuilt with legislative aid and these people have settled down once more like the hardy villagers at the foot of Vesuvius after oft-repeated eruptions...." (Anonymous 1879).

The damages to the Port Penn marshes south of the village were especially extensive, requiring the county to invest in road and marsh improvements. The recurring theme of tide damage and who was responsible to repair the damaged dikes (whether private or public funding) were repeated throughout the closing decades of the nineteenth century and well into the twentieth. By circa 1880 Port Penn and vicinity was considered to be a "thriving" community of about 400 inhabitants (Peninsular Directory 1882). This portion of New Castle County became an important peach production area in period circa 1870-1880 (Passmore 1975:21). The 1881 Hopkins *Map of New Castle County* shows that Mt. Airy was the J. Brewer estate of about 135 acres (Figure 10). No evidence of the marsh or the Lang Impoundment is shown on the map, but a small stream is depicted in the project area. Baists' *Atlas of New Castle County* was identical in its depiction of the project area - no evidence of marsh or impoundment was shown and the landowners were the same as in 1881. The Wilmington paper reported that March of 1895 the property called Mt. Airy (today's Lang Impoundment building complex) was occupied by Abram Vandegrift and his family (Anonymous 1895b).

A contemporary newspaper description of land surrounding Port Penn gives an impression of the region. The lands around the village were described as "the most wealthy landed portion of New Castle County" in the heart of Delaware peach country (Anonymous 1880). The author of this travel article continued

"From Port Penn piers to Philadelphia, in ordinary seasons, hundreds of thousands of baskets and boxes of peaches and berries of all kinds are shipped.... This portion of New Castle county [sic], back of the bay shore, is dotted with immense orchards and berry fields of cultivated fruits. In the gunning season Port Penn is a great resort for those who love to indulge in rail, reed, and snipe shooting. There are no better salt water bathing grounds on the bay shore, but it is too far from the landing to command much public patronage" (Anonymous 1880).

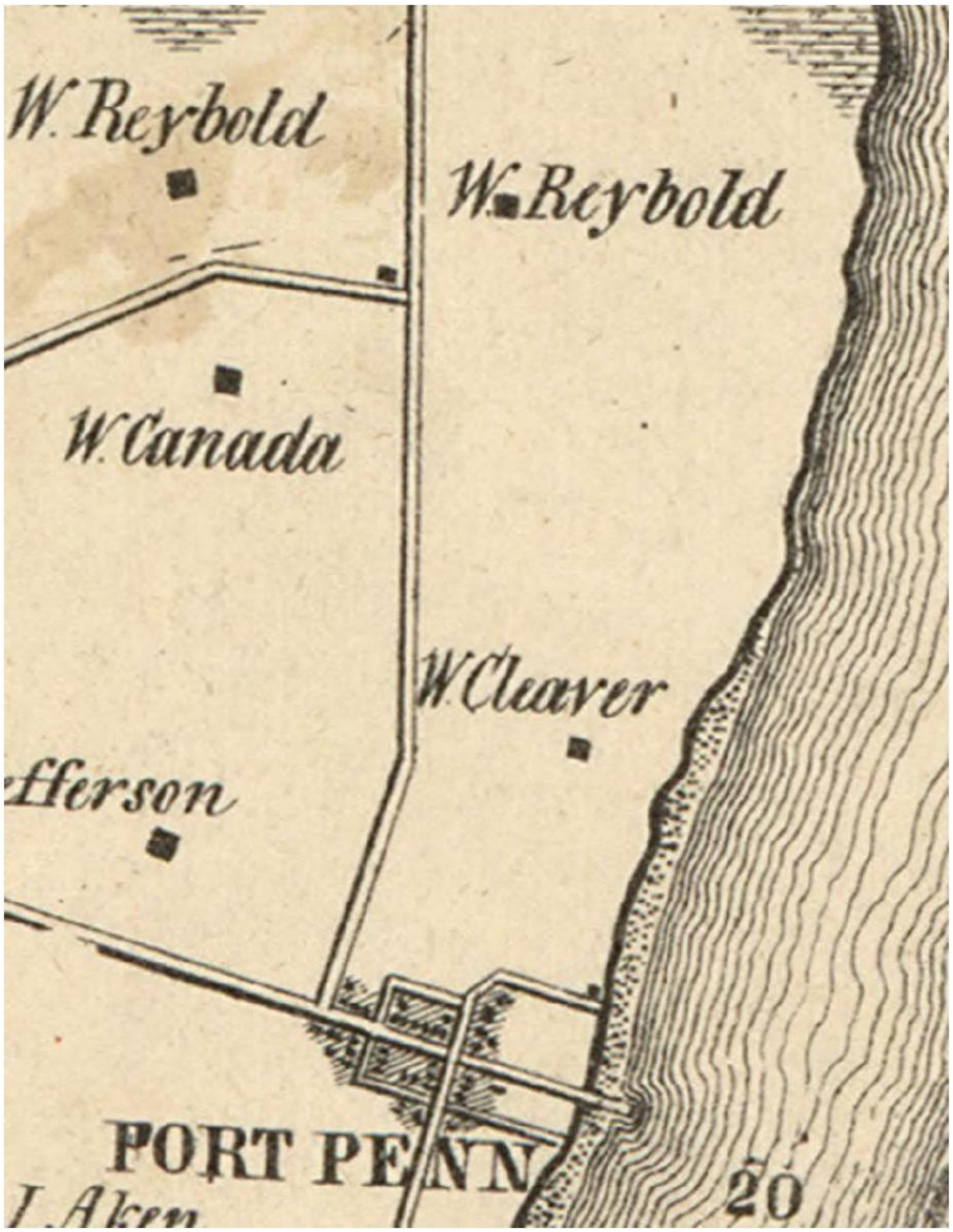

Figure 8. Detail of Rea and Price *Map of New Castle County* (1849)

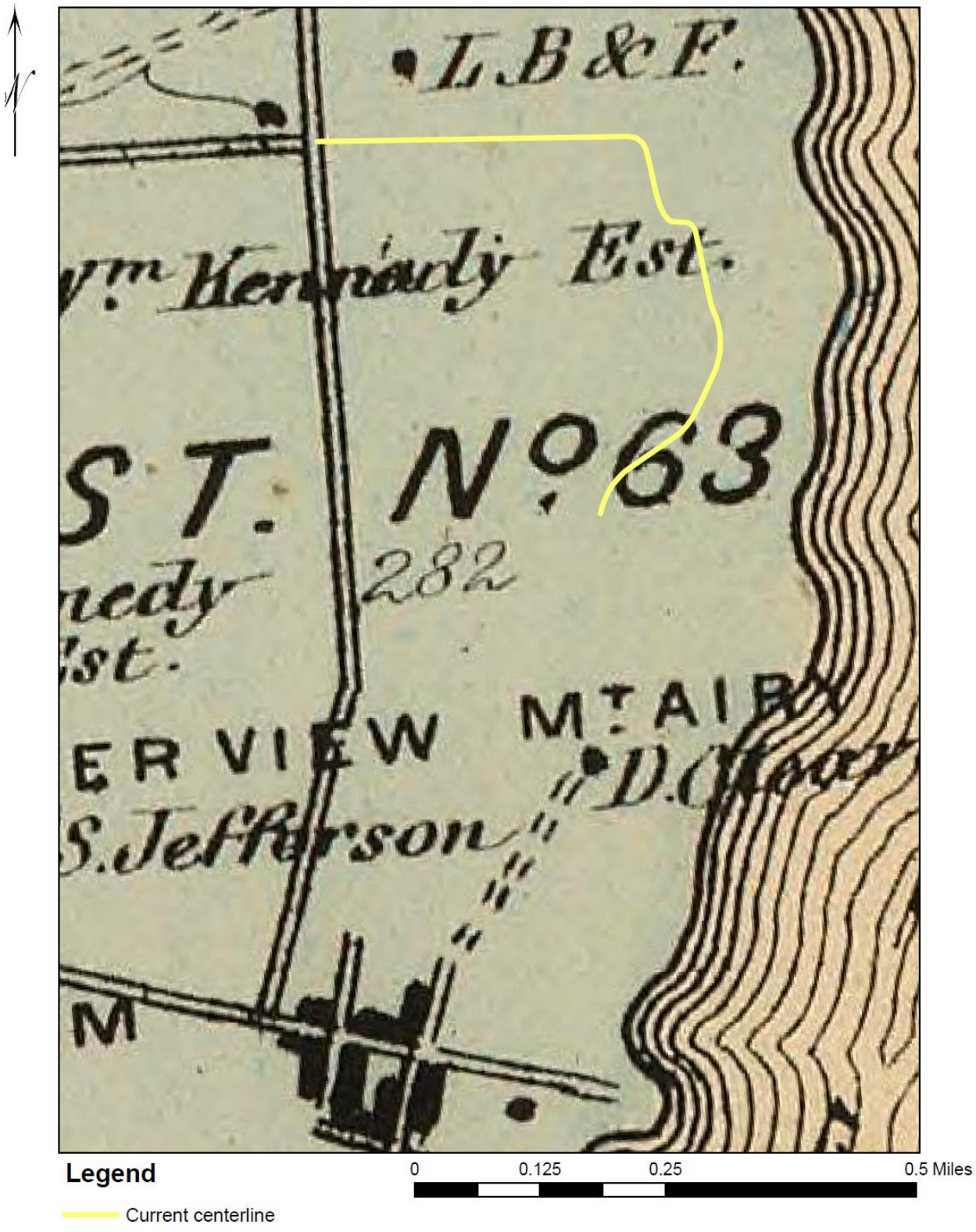

Figure 9. Detail of Beers' Map of St. Georges Hundred, from *Atlas of Delaware* (1868). Current Lang Impoundment is shown in yellow.

Figure 10. Detail of Hopkins *Map of New Castle County* (1881). Current Lang Impoundment is shown in yellow.

A series of US coast and geological survey maps and charts from 1880 to 1906 are the first maps since the 1848 Coast Survey map to show any sort of diking or ditching in the Lang Impoundment project area, but these maps seem to repeat topographical information year after year, with no change or alteration. The 1906 USGS map illustrates the project area with a different configuration of embankments, showing no sign of the chevron-shaped embankment depicted in 1848 (Figure 11). There are embankments shown to the north and south of the impoundment project area and the marsh and drainage of Little St. Georges Creek is also depicted, as is the Congress Street extension to the present Lang Wildlife Management area. It is possible that the earlier dike was destroyed in one of the extreme weather events circa 1880, and no dike was in place by the beginning of the twentieth century that controlled the tide or protected the Port Penn-Delaware City Road.

The almost annual repairs necessary to maintain the dikes was a significant burden on marsh companies and private landowners, and in 1895 a bill was introduced in the state legislature to provide for the maintenance of several public roads in St. Georges and Red Lion Hundreds, notably the Port Penn-Delaware City Road, which was protected at its northern end by the St. Georges Marsh Company (Anonymous 1895a). During the period from 1879 to 1894 the cost of maintaining the Marsh Company improvements totaled $47,339 or an average of $3,155 annually. The Port Penn-Delaware City Road was constantly threatened by overwash and damage during high storm tides, and the Wilmington paper reported such damages frequently in the early decades of the twentieth century. In 1915 a November storm severely damaged the embankments of the St. Georges Marsh Company dikes, south of Delaware City and "unless repairs are made at once damage will be done to the county road." Even the stone tide walls along the river were damaged (Anonymous 1915).

A series of dike and sluice repairs along the Delaware River between Delaware City and Port Penn were undertaken in the years between 1900 and 1920. The repairs included work on the road's causeway and bridges and on the Delaware River dikes. In April of 1917 the Wilmington *Evening Journal* reported that a "small bridge on the road to Port Penn" had been damaged by the winter weather, and that breaks in the Delaware River bank included one "on the property of the Little St. Georges Marsh Company." The County Engineer, James Wilson, ordered a dredge "to go to work on the marsh lands north of Port Penn" (Anonymous 1917a). It may be that the impoundment as configured today was part of construction work completed circa 1917 on the "river banks and causeways in and adjacent to Port Penn" (Anonymous 1917b). The 1926 aerial of the project area depicts the embankment in its current configuration, indicating that the dike and sluice as we know it today were in placed by that time (Figure 12).

Road work in the 1930s and again in the mid-1950s raised the road bed on the Port Penn-Delaware City Road, affecting the two bridges at the western side of the Lang Impoundment. Aerial images and USGS maps from the middle decades of the twentieth century indicate no change in the configuration of the Lang Impoundment dike. A breach or break in the northern embankment wall is apparent in the 1937 aerial, but this is no present by 1954, and three barges were sunk at the mouth of the sluice by 1948 (Figures 13, 14, and 15).

The Lang Impoundment was acquired by the State of Delaware in 1971 from Delaware Wild Lands, Inc. At that time the parcel was 355.72 acres in extent and was the tract that Minnie J. Lang conveyed to Delaware Wild Lands, Inc. a year earlier in 1970 (State Deeds 1970-1971). The Lang's may have been occupants of the property since the early 1940s, when Paul Lang was appointed as the constable of the marshlands located between Delaware City and Port Penn (Appointments 1940). In 1970 Minnie Lang was allowed to remain on the property in a life tenancy, reside in the house and have limited use of the immediate grounds.

Figure 11. Detail of the USGS Quadrangle Map (1906). Current Lang Impoundment shown in yellow.

Figure 12. Aerial image of project area, 1926.

Figure 13. Aerial image of project area, 1937.

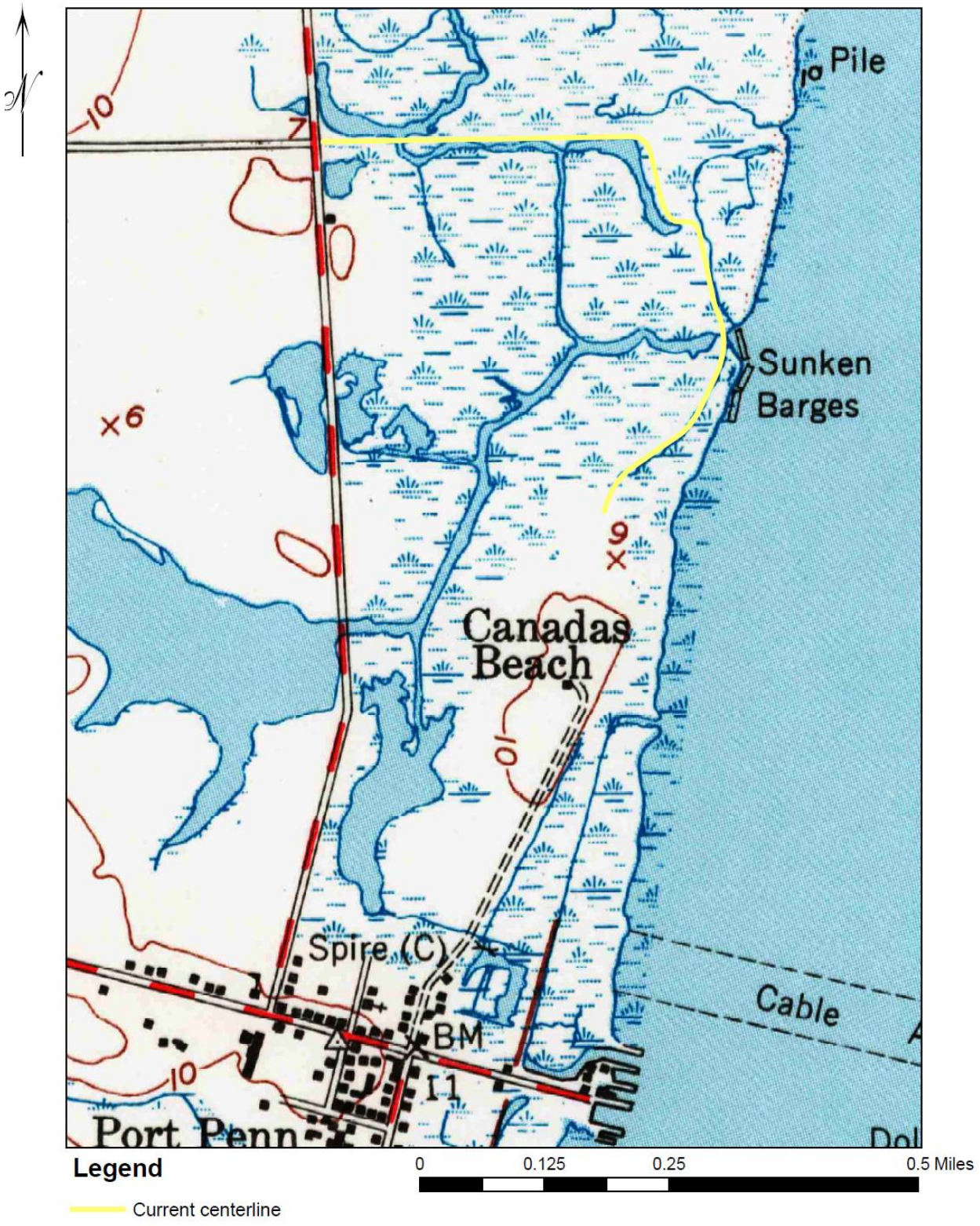

Figure 14. Detail of USGS *Delaware City* 7.5-minute quadrangle map (1948). Current configuration of Lang Impoundment shown in yellow.

Figure 15. Aerial image of project area, 1954.

Since the state acquired the dike in 1970, Delaware Fish and Wildlife has conducted minor repairs and maintenance of the embankment (Figure 16). The concrete and steel sluice has been replaced and additional soil and gravel has been applied to the surface. Riprap stone has been added along the river side of the dike; the stone used is clearly from two different and distinct episodes of riprap.

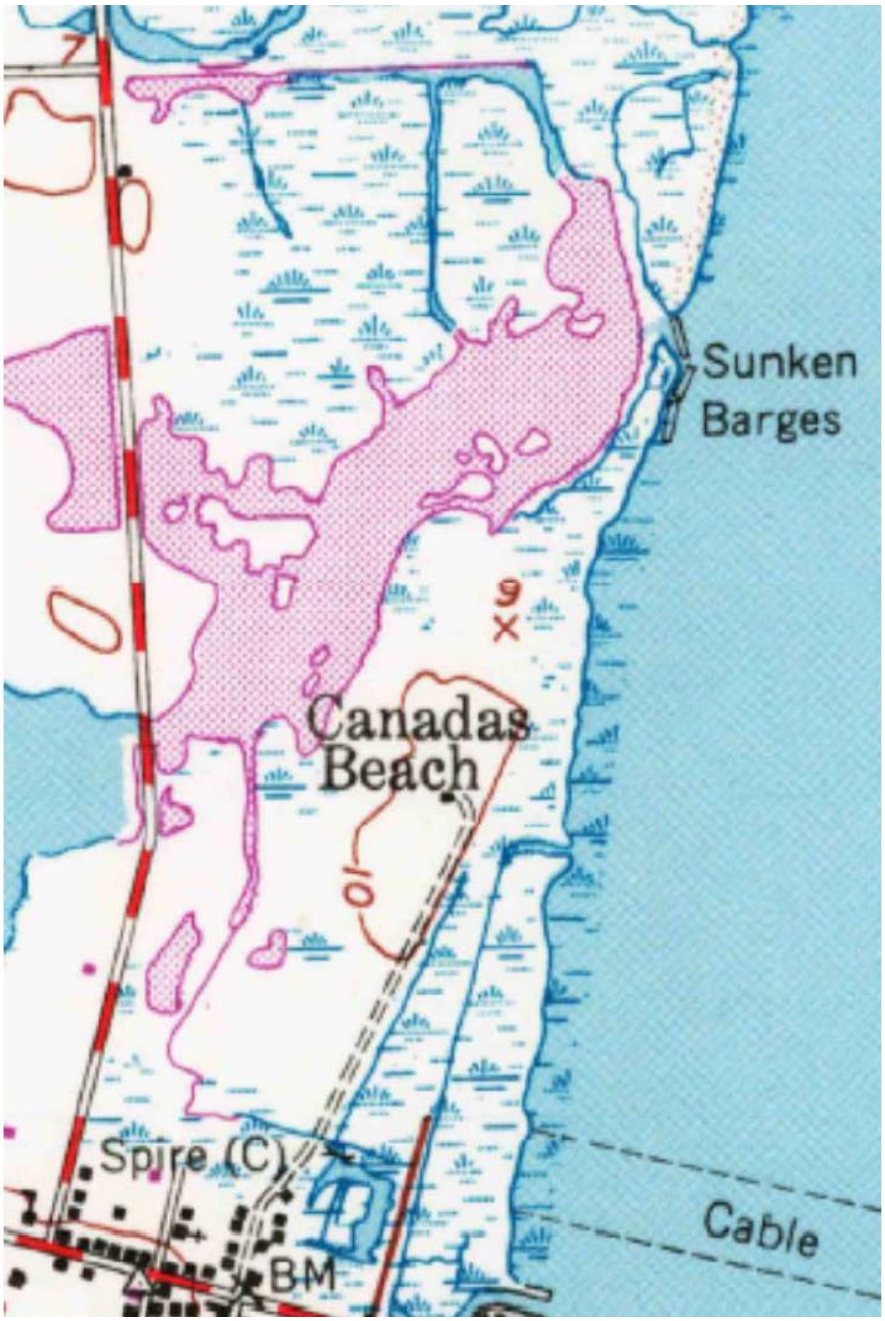

Figure 16. Detail of USGS *Delaware City* 7.5-minute quadrangle map (1970).

4.0 FIELD RECONNAISSANCE

A field reconnaissance of the Lang Impoundment project area was completed on 6 December 2016. Beginning at the intersection of Thornton Road and the Route 9, the northern embankment (termed levee on the 1993 USGS *Delaware City* 7.5 minute quadrangle map) is an earthen embankment approximately 1,750 feet long, ranging from about 30 to 50 feet in width and varying in height from 6 to 10 feet above sea level. The ground on either side of the northern embankment consists of a combination of upland, standing water, and marsh with drains situated on both the north and south sides of the embankment (Figure 17).

At the eastern end of the northern embankment, the dike makes a southern dog-leg curve over an area of about 500 feet (Figure 18). This location has a broad drain on the interior (western) side of the dike. Widths of the dike here are comparable to the northern section, and height ranges from about 8 to 9 feet asl. After the dog-leg the eastern embankment (north of the sluice) extends almost due south approximately 600 feet to the concrete and steel sluice. The height of the dike is varies from 8.3 to 7.9 feet als, and the width is ranges from 30 to 50 feet at the base, and from less than 10 feet across at the top, generally averaging about 20 feet across (Figure 19).

The portions of the embankment fronting on the Delaware River both north and south of the sluice are mantled in stone (Figure 20). Such a method of construction is in keeping with the "prescriptive" technique described in the literature dating to the last quarter of the nineteenth century. In several locations the stratigraphy of the embankment was also visible, consisting of a recent gravel overmantle above a dark earthen core (Figure 21). There is no stone mantling on the northern embankment, and in some places the dirt core is evident. Some evidence of wooden cribbing was observed on the interior of the embankment south of the sluice gate, and in at least one section is located well into the impoundment area (Figure 22 and 23).

South of the sluice the earthen embankment curves gently southwest approximately 1,500 feet. The dike height at the sluice is 7.3 feet asl, and varies from 7.9 to 6.9 feet where it encounters the fast land at the southern terminus of the dike (and the project area). The top of the dike along the southern section is generally 20 to 25 feet wide and 35 to 50 feet wide at the base (Figure 24).

The sluice gate and wing walls are concrete and steel and appear to be fairly recent in construction (likely put in as a repair in the last two decades) (Figure 25). In the river and visible from the sluice area are timbers. These timbers may represent an earlier dike configuration (possibly the dike depicted on the 1848 survey map) or they are the remnants of three barges, visible on the 1948 USGS map, that were deliberately sunk at the mouth of the sluice, apparently as a protection against tidal action and siltation. That the timbers represent the cribbing structure for an earlier dike is supported by the location of the timbers and the locations of the mapped barges - two of the three barges are significantly south of and further east from the sluice, and are not directly in the location of the visible timbers (Figure 26 and 27).

There are several small locations along the current dike where the potential exists for portions of the earlier dike system, present by at least 1848, to be extant (Figure 7). The likelihood that significant portions of the earlier dike are present is low, given the lack of obvious topographic indications and the documentary evidence (compare Figures 7 and 12, for example). However, two soil borings, LB-6 and LB-7 (mislabeled on sheets 4 and 5 of the 60% plans as LB-7 and LB-8, respectively), encountered a two-foot thick soil layer composed of gray and brown silt and sand between 6 and 8 feet below the surface of the dike. This area may represent remnants of the earlier dike, beneath later construction episodes. In both borings water was encountered below this soil horizon. While the potential for earlier earthen embankment is present, the archaeological potential is low, and the current project calls for strengthening and widening the dike, not removal of the dike.

Figure 17. View to the west along the northern embankment wall. Impoundment area to left of image.

Figure 18. View to the south along the dog-leg portion of the embankment. The Lang Impoundment is to the right, and Salem I nuclear cooling tower is in the distance. Headquarters are in right background.

Figure 19. View to the northeast from the sluice, showing the general setting of the embankment north of the sluice.

Figure 20. View to north showing Stone mantling (riprap) along river face north of the sluice. Embankment to left of image.

Figure 21. View to east of exposed section of the earthen dike, showing clay core and sandy overmantle. This section is south of the sluice.

Figure 22. View to the interior of the impoundment showing submerged cribbing. This is located along the southern embankment, south of the sluice.

Figure 23. View to the northeast of wooden cribbing on the interior of the southern embankment.

Figure 24. View to the southwest showing the southern embankment and stone riprap along the exterior (river side) of the embankment. Impoundment to the right, and the Lang Headquarters area is in the trees in the center distance.

Figure 25. View to the south of the concrete and steel sluice. River is to the left, impoundment to the right.

Figure 26. View to the east looking at the timber configuration south of the sluice entrance.

Figure 27. View to the east toward the river, showing the timber configuration north of the sluice.

5. NATIONAL REGISTER OF HISTORIC PLACES EVALUATION

5.1 CRITERIA FOR EVALUATION

Within the Delaware Comprehensive Plan (Ames et al. 1987) the time period of that the Lang Impoundment is 1880-1940 (urbanization and suburbanization). An earlier dike was present in the project area by circa 1848, but that dike is no longer extant. Historical Themes that apply include Agriculture, Landscape change, and Community Organization (Ames et al. 1987:82). The geographic zone for is the Upper Peninsula. Within the historical archeological context developed for agricultural in New Castle County the dikes would be considered agricultural structures (DeCunzo and Garcia 1992:239).

As the primary consideration for eligibility, National Register criteria require that a historic property possess integrity. As defined by the National Park Service, seven aspects of integrity must be considered: location, design, setting, materials, workmanship, feeling, and association (Townsend et al. 1993:16-21). In addition to integrity, a historic property must meet one or more of the specific criteria for evaluation (A through D) in order to be eligible to the National Register. The historic context for Delaware's marshland cultural resources (Fisher et al. 1993:132) suggests that identified cultural resources should be evaluated under Criteria A and C of the National Register of Historic Places. The dikes may also be eligible under Criterion D (Catts and Mancl 2013).

Under Criterion A, dikes may be significant for their relation to the broad patterns of marsh reclamation for agricultural use, and as structures related to transportation and conservation. Land reclamation for agricultural purposes resulted in the creation of arable land and meadows, thus altering the character of marshes along the coast of Delaware (Fisher et al. 1993:132). The precursor to the Lang Impoundment was built by the Little St. Georges Marsh Company. The earlier dike no longer exists, though some small sections of that previous embankment may still be extant.

As elements of transportation networks, dikes may be significant for different reasons. Dikes and causeways, in this instance the Port Penn-Delaware City Road (Route 9) served to ease the travel between the settlements of New Castle and Port Penn. This use has been ongoing for centuries and the responsibility for keeping the embankments in repair has been borne by both public and private entities.

Dikes are also significant today as structures that contribute to marsh (ecological) and historical resource conservation efforts. The flow of water through the sluices is controlled in such a manner as to promote a healthy ecosystem within each of the marshes. Moreover, as an element of flood control, the Lang Impoundment helps to limit the damage to Route 9 during period of excessively high water.

Dikes may also be significant as vernacular architectural elements under Criterion C. Changes over time include reinforcement and reconstruction of the banks and replacement of elements of the infrastructure. However, each of these changes are consistent with operation of dike, and therefore do not detract from its eligibility under Criterion C. In the case of the Lang Impoundment, it retains the historical course and massing dating from its last creation in the first quarter of the twentieth century. That iteration of the dike replaced an earlier dike that was present by at least the middle of the nineteenth century, but that change is a completely different configuration.

Also to be considered during assessment under Criterion C is the persistence of structural elements no longer functional or visible. Studies at other dikes have shown the potential for the persistence of earlier elements, whose presence would bolster the argument for integrity under Criterion C. For example, at both Christiana Marsh and at the confluence of Blackbird Creek, elements of a sluice way and the remains of sheet piling were documented (Kellogg and Catts 2007; personal communication with Craig Lukezic 2013). At Red Lion Dike, the remains of a sluiceway were visible at the surface, and evident from the results of a

ground-penetrating radar survey (Mancl et al. 2013). The persistence of structural elements at dikes along the Delaware River also may indicate that the dikes are significant under Criterion D. Previous archaeological and historical studies illustrate the potential for dikes along the Delaware to retain information significant to their development and maintenance (Mancl et al. 2013).

5.2 LANG IMPOUNDMENT

The Lang Impoundment as it is configured today is an earthen embankment built circa 1920 (probably 1917-1918), but its history extends back several centuries. An earlier dike was situated at the impoundment, historically known as Doctors Swamp and Little St. Georges Creek. In 1787 a marsh company, called the Little St. Georges Marsh Company, was formed by the landowners to embank and improve a 200-acre marsh. At least one version of the earlier impoundment, as shown on an 1848 map, was a chevron-shaped configuration that bears no relation to the embankment that is present today. The 1906 USGS map indicates that the chevron-shaped dike was not present in that year, suggesting that it likely fell victim to one of the major storm events that were reported nearly annually. Coupled with the embankment and sluice at the river side are causeways along Route 9, and two of these were part of the dike system at the impoundment.

While the Lang Impoundment dike meets the age criterion (over 50 years) for National Register eligibility, and retains several of the aspects of integrity, the resource is not a remarkable or historically significant. Integrity elements such as setting and location have not changed, but elements of design, feeling, association, and workmanship are not exemplary. The dike as configured today is linked to other Delaware River embankments which act as a tidal control system, but the Lang Impoundment dike and sluice are common examples. The Lang Impoundment replaced an earlier dike that had an agricultural function, creating meadow areas and controlling water levels as part of the Little St. Georges Marsh Company. That agricultural function is no longer working and that earlier dike is no longer extant. The Lang Impoundment currently functions as in an environmental conservation capacity as well as a transportation capacity, in that the sluice and embankment offer protection to Route 9. While there may be small remnants of the earlier dike buried within the existing dike (notably in the area around the northern dog-leg) the likelihood of the present of significant archaeological information being present is considered to be low. The house currently at the Lang Impoundment is a early twentieth century structure, clearly a replacement for the earlier buildings at the property known as Mt. Airy by the middle decades of the nineteenth century.

Early ownership of the dike and impoundment area is associated with the Ashton property in the Ashton National Register Historic District situated immediately to the west of Route 9. However, the boundary of the district does not include the dike or the impoundment. There is no historical linkage between the Lang Impoundment and the Port Penn National Register Historic District.

6. SUMMARY AND RECOMMENDATIONS

The Lang Impoundment project area contains an earthen and stone embankment with a steel and concrete sluice. The configuration of this human-built landscape element dates to circa 1920. The impoundment area has a long history of diking and embanking. It was originally called Doctors Swamp in the late seventeenth century, and by 1787 was the common property of the Little St. Georges Marsh Company, an entity that was still extant in 1917. An earlier dike configuration, dating to at least the late 1840s, shows a different shape to the configuration present at the Lang Impoundment today, indicating that considerable rebuilding and reconfiguration have taken place over time. Later work on the dike has included new sluice wing walls and gates, the addition of gravel and soil to the embankment, and the addition of stone riprap to the exterior, riverside of the dike.

While the Lang Impoundment has sufficient age and retains some of the aspects or qualities of integrity that would make it eligible for listing to the National Register of Historic Places, Commonwealth does not recommend the resource as National Register eligible. It is not an outstanding example of a dike from the early twentieth century since many of the dikes along the Delaware River were rebuilt and replaced at that time. The dike's original function, as part of the Little St. Georges Marsh Company, was to create arable land or meadow, and the dike no longer functions in this capacity. Today, the dike is used as a water control feature to protect Route 9 and to provide environmental conservation. While the impoundment at Little Creek Marsh Company has historical connections with the house known as Ashton, the Ashton National Register Historic District boundary does not extend east of Route 9, thus the Lang Impoundment is not within the district. Further, there is no connection, historical or otherwise, to the Port Penn Historic District.

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Appendix 1.

Delaware state historic preservation office letter 30 September 2016.