MID-ATLANTIC HISTORIC BUILDINGS AND LANDSCAPES SURVEY

Phase II Architectural Investigations for the Fish Passage at the Lower Brandywine River Dams, 2, 3, 4, 5, and 6

University of Delaware | Center for Historic Architecture + Design

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Phase II Architectural Investigations for the Fish Passage at the Lower Brandywine River Dams 2, 3, 4, 5, and 6

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Prepared For

Brandywine Shad 2020

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Cover Image: Thomas Doughty's *View on the Brandywine River: Gilpin's Paper Mill, 1825-1830.*

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ABSTRACT

The purpose of this report is to identify and evaluate historic resources along the Lower Brandywine River north of the City of Wilmington, in New Castle County, Delaware as part of a project to restore native fish passage to the Brandywine River. The project, undertaken at the request of Brandywine Shad 2020, is seeking a federal permit for in-water work and is in part federally funded, therefore it constitutes a "federal undertaking" and is subject to review under Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, and its implementing regulations, under 36 CFR Part 800. The Army Corp of Engineers will serve as the lead federal agency for this fish passage project. The proposed in-water work has the potential to cause effects to historic properties if any such properties exist in the project area. The Center for Historic Architecture and Design (CHAD) is completing this assessment of potential historic properties in the identified project area, on behalf of Brandywine Shad 2020, in order to be in compliance with Section 106.

A total of thirteen (13) properties greater than 50 years old were initially identified within the project area. Only two (2) of these resources had previously been identified, both of which were already established as contributing resources to historic districts listed in the National Register of Historic Places (NRHP). One of them, Upper Dam (Dam 2), is listed as a contributing resource to the Brandywine Park and Kentmere Parkway Historic District, while the other, Rockford Dam (Dam 5), is listed as a contributing resource to the Bancroft and Sons Cotton Mills Historic District. Of the newly identified properties evaluated, three (3) were found eligible for listing in the National Register—Augustine Mill Dam (Dam 3), Kentmere Dam (Dam 4), and Lower Hagley Yard Dam (Dam 6). Four (4) of the other eight (8) resources, including two stone wall culverts, a metal platform footbridge, and a USGS water monitoring tower, are all recommended as ineligible. The four (4) remaining resources, being industrial buildings located within the DuPont Experimental Station complex, were not evaluated for eligibility as part of the scope of this project.

The current report is an independent effort meeting the DE SHPO standards outlined in *Architectural Survey in Delaware* (February 2015). The first architectural field surveys were conducted by qualified CHAD staff in September 2020, with additional fieldwork conducted in March, October, and November

of 2021. Written efforts began in February 2021 and were completed in December 2021. All forms and original information pertaining to these property evaluations can be found at the Center for Historic Architecture and Design at the University of Delaware.

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INTRODUCTION AND PROJECT DESCRIPTION

The Center for Historic Architecture and Design (CHAD) at the University of Delaware conducted National Register of Historic Places eligibility evaluations (Phase II architectural evaluations) in the Area of Potential Effects (APE) for the provision of fish passage at Dams 2, 3, 4, 5, and 6 located on the Brandywine River. The project is being conducted on behalf of Brandywine Shad 2020. The project's goal is to restore passage of anadromous fish along the Brandywine River throughout its course in New Castle County, Delaware. In order to accommodate fish passage, human-made obstacles will need to be removed or bypassed. While the initial goal of Brandywine Shad 2020 was to restore the Brandywine River "to its free-flowing, pre-colonial state," Brandywine Dams 2, 4, 5, and 6 will at minimum require some sort of modification to allow fish passage.[1] Modification solutions for each dam will likely be different and include dam removals, partial removals (notching), or the creation of fish passage structures where full or partial dam removal is not possible.

As part of this effort, CHAD has identified historic properties already listed in the National Register of Historic Places, as well as other properties that would be considered eligible for listing, that are located within the geographic Area of Potential Effects of the proposed project (figures 1 and 2). Dams 4 and 6 have proposed and accepted APEs, while the APEs have not been finalized for Dams 2 and 5. However, a working APE has been created for both Dams 2 and 5 for this report.

Documentation and research for this project was conducted in accordance with relevant state and federal guidelines as part of the compliance process established in Section 106 of the National Historic Preservation act of 1966, as amended (36 CFR 800). CHAD architectural historians Catherine Morrissey and Michael J. Emmons, Jr., with historic preservation specialist Kimberley Showell, performed the work for this project, with Catherine Morrissey serving as Principal Investigator. Morrissey, Emmons, and Showell all meet and exceed the standards established for Architectural Historian and / or Historian by the Secretary of the Interior (SOI).

[1] Dam 3 has been naturally breached. Due to the extent of the breach, Brandywine Shad 2020 currently believes that no additional modifications will be required at Dam 3 to allow fish passage.

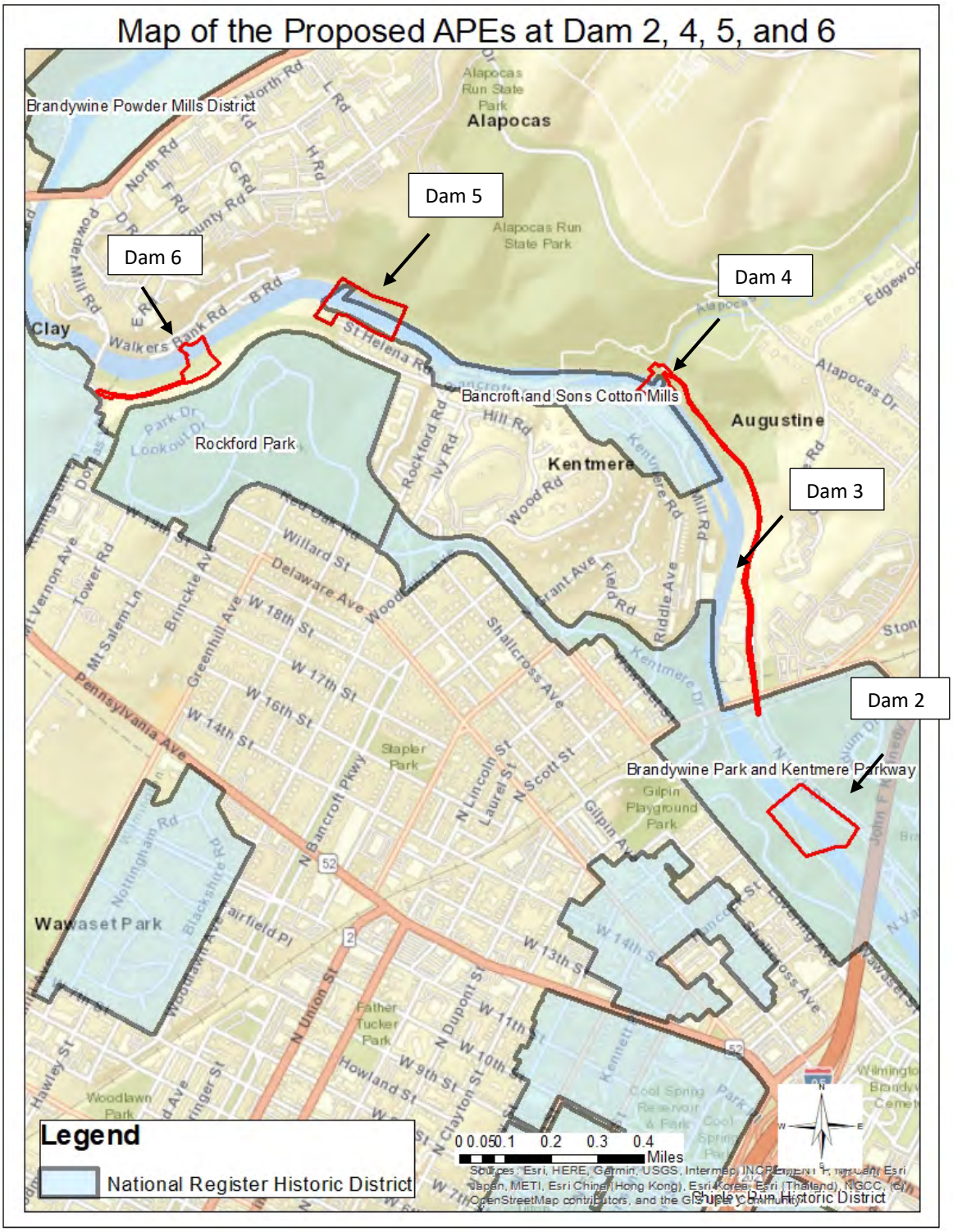

Figure 1. Map showing the location of Dams 2-6, as well as the location of the proposed APEs for Dams 2, 4, 5, and 6. (Center for Historic Architecture and Design)

Figure 2. Map of the APE at Dam 4, showing the surveyed resources. (Center for Historic Architecture and Design)

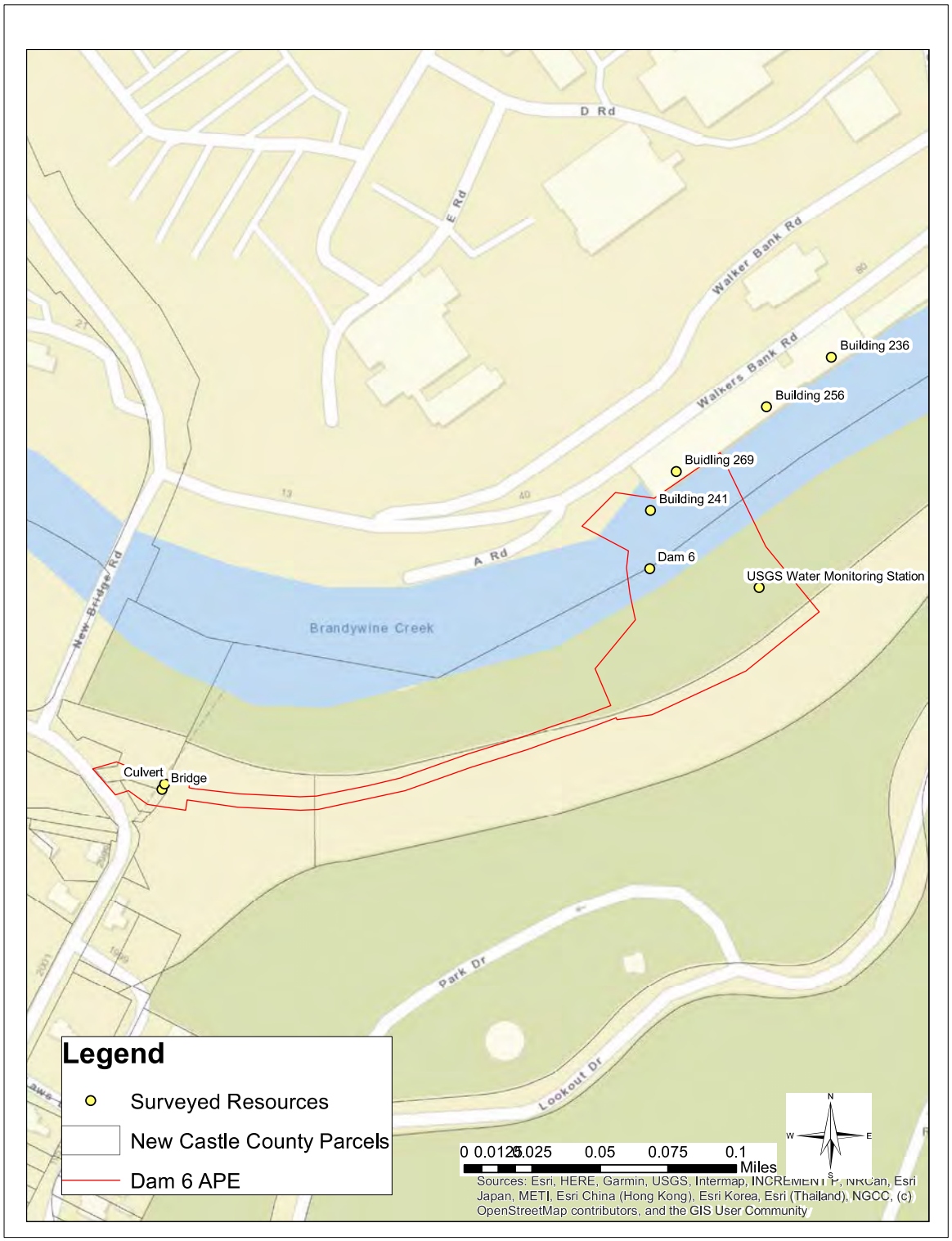

Figure 3. Map of the APE at Dam 6, showing surveyed resources. (Center for Historic Architecture and Design)

Description of Area and Context

During the eighteenth, nineteenth, and early twentieth centuries, this stretch of the Brandywine River was heavily characterized by water-powdered industry. Today, the Lower Brandywine is now mainly comprised of city and state parks, as well as recent residential developments (mainly condominiums) located on the sites of formal industrial complexes. During the twenty-first century, the dams spanning the Brandywine River, and a few associated features including mill races and head gates, often serve as the only remnants of the industrial past. In the vicinity of the Lower Brandywine River are several National Register of Historic Places historic districts as well as individually listed resources, recognizing industrial history as well as park creation.

Area of Potential Effect

The Area of Potential Effects is the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist. The APE is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking (ACHP 1966).

Due to the fact that the five dams studied in this report (including the four dams that may be impacted by the proposed fish passages) are dispersed along a long stretch of the Brandywine River totaling a couple of miles, each dam and its surrounding resources represent a distinct study area, spatially distinct from the other study areas. The proposed APE for Dam 2 encompasses 8.13 acres, the APE for Dam 4 encompasses 1.34 acres (and a 3,290-foot-long access route), the APE for Dam 5 encompasses 4.65 acres, and the APE for Dam 6 encompasses 2.05 acres and an access route measuring 657 feet long (see figure 1).[2]

[2] The descriptions for the APEs were summarized by Richard P. Adamczyk (Richard Grubb and Associates) in their report "Phase IA Archaeological Survey: Fish Passage at Brandywine Creek Dams 2, 4, 5, and 6, City of Wilmington, Brandywine and Christiana Hundreds, New Castle County, Delaware," December 2021.

Project Plans

The proposed project activities for Dam 4 include the removal of a portion of the 1896 and c. 1940 dam through demolition of the crest from an elevation of approximately 45’ above sea level to the natural riverbed elevations prior to dam construction; filling the area around the dam with the materials from the dam removal to create a more uniform slope (that simulates natural river features) to aid passage of American shad. The project will also demolish the majority of a decommissioned, poured-concrete, technical fishway (c. 1970; no longer maintained) to restore this portion of the river. These activities will largely be confined to work in the water of the Brandywine River, with a limited, small upland area used only for staging equipment (minimal to no earth disturbance is anticipated). The proposed work includes leaving at least the first 10 feet of each abutment in place to mark the historic location of the dam along the Brandywine. The upland areas will be replanted to the existing condition (with trees or grass) once the in-water work is completed. This dam is prioritized for removal as it is damaged and deteriorating and may now pose a public safety risk.

For Dam 6, the proposed project activities include the removal of the c. 1839 dam through demolition of the crest from an elevation of 79.4’ above sea level to an elevation of approximately 72’ above sea level, as well as filling the area around the dam with the materials from the dam removal to create a more uniform slope (that simulates natural river features) to aid passage of American shad. The first 25 feet of the dam from each abutment will remain on either side of the river to mark the historic location of this dam. Boulders and stone from the dam removal will be placed to stabilize the stream banks on the north and south sides of the river in the vicinity of the dam removal. These activities will largely be confined to work in the water of the Brandywine River, with a small upland area used only for staging equipment (minimal to no earth disturbance is anticipated). The upland areas will be replanted to the existing condition (with trees or grass) once the in-water work is completed.

Project plans for Dams 2 and 5 have not been formalized or submitted to date.

RESEARCH DESIGN

Goals and Methods

The goal of this study was to review previously identified architectural resources, identify unrecorded properties in the APE that are 50 years of age or older, and evaluate the eligibility of these properties for the National Register of Historic Places (NRHP) according to applicable historic contexts.

A search for previously identified properties was conducted using the Delaware Division of Historical and Cultural Affairs online Cultural and Historical Resources Information System (CHRIS), and relevant cultural resource survey (CRS) forms were gathered and reviewed for past recommendations, relevance to the current project scope and area, accuracy, and comprehensive quality. Architectural history and archaeology reports were also found on the DelDOT Archaeology website database, as well as in the Center for Historic Architecture and Design's archives at the University of Delaware.

A cartographic study of the project impact areas and surrounding areas was conducted to confirm the locations of previously identified properties, flag additional properties for study through field investigations, and confirm property boundaries. Historic atlases (e.g., Rea and Price, Beers, Hopkins), historic and contemporary United State Geological Survey (USGS) topographic maps, and aerial photographs aided in the understanding of the development of the area throughout the twentieth century, and the accuracy of information in previous reports. A specialty map delineated in 1816 by Fairlamb & Read for the Brandywine Seats Company (available at the Hagley Museum and Library) provided the most useful information for the early-nineteenth century. The map depicts the location of all the dams on the Brandywine River in Delaware, as well as the location of mills, mill races, bridges, roadways, and the owners of properties. Additionally, the Dallin Aerial Surveys (also available at the Hagley Museum and Library) provided many views of the dams and their associated industrial complexes in the 1920s, 30s, and 40s.

Documentary research was conducted to further understand the general history and development of the area, dates of construction for various structures, and property evolution so that an evaluation of NRHP eligibility for each identified property could be developed. Property research was conducted online

through the New Castle County Recorder of Deeds. Other digital repositories searched for relevant property and context information included Delaware Public Archives, Delaware Historical Society, and collections at the Hagley Museum and Library. Most of the historical images, paintings, maps, etc. are located at Hagley. Additionally, the archives for the DuPont Company as well as the Bancroft Company are housed at Hagley—providing especially in-depth information on Dams 4, 5, and 6.

Intensive level survey was conducted on September 9, 2020, March 9, 2021, October 29, 2021, and November 14, 2021, for identified properties within the project area, including previously documented properties and new properties. Permission to access the properties was obtained from the property owners, or the sites were accessible from public land. For all historic properties identified in the APEs cultural resource survey forms were produced and submitted via CHRIS. The forms created for this project include CRS 1 Property Identification Form, CRS 2 Main Building Form (when applicable), CRS 6 Structure (Land Feature) Form (when applicable), CRS 9 Map Form, CRS 12 Photo Inventory Form, and CRS 13 Digital Photo Form.

Expected Results

Based on preliminary research and a review of previous architectural surveys in the project and surrounding area, it was expected that properties along the corridor would be industrial in nature. It is expected that identified properties would fit within the **Early Industrialization (1770-1830 +/-), Industrialization and Early Urbanization (1830-1880 +/-)** or **Urbanization and Early Suburbanization (1880-1940+/-)** chronological periods, as well as more recent time periods as defined in the *Delaware Comprehensive Historic Preservation Plan* and the *Historic Context Master Reference Summary*. Property types would most likely be associated with the following historic themes: **Manufacturing; Settlement patterns and demographic changes; Architecture, engineering, and decorative arts;** and **Major families, individuals, and events.**

HISTORIC BACKGROUND & CONTEXT

The series of dams spanning the lower Brandywine River, from Wilmington to Rockland, represent key components of a nationally recognized, water-powered industrial landscape created during the eighteenth and nineteenth centuries. Beginning with small-scale, local milling—especially the processing of lumber and grains during the late-seventeenth and early-eighteenth centuries—early industrialists on the Brandywine River quickly diversified and scaled up their operations, so that by the turn of the nineteenth century, the mills of the lower Brandywine valley led the United States in the production of flour and gunpowder, and within a couple of decades, innovated in papermaking and made early advances in textile production. "In terms of game-changing innovation," notes one prominent historian of the region, "the Brandywine Valley at Wilmington was effectively the Silicon Valley of its day," a reference to the world-famous concentration of technology companies in California at the turn of the twenty-first century.[3]

Central to this industrial revolution was the series of dams constructed on the lower stretches of the Brandywine, taking advantage of the precipitous fall of the river between Pennsylvania and the Delaware River as it descended from the rocky Piedmont to the coastal plain. Dams, and the waterpower they helped generate, were critical to American industrial power before the rise of steam and electricity. Damming a river, especially along a descent, increased the height of the headwater upstream, while creating a reservoir of water for mill power, which was then channeled into mill races that ran alongside the river at an elevated height after the river itself dropped. The diverted water in the mill race, due to both gravity (weight) and its kinetic energy (flow), then turned the waterwheels of a single mill or a series of mills, powering their industrial machinery inside, before the water was returned to the river downstream from the dam.

[3] W. Barksdale Maynard, *The Brandywine: An Intimate Portrait* (Philadelphia: University of Pennsylvania Press, 2015), 75.

Dam-Related Legislation in Delaware

Early on, the Delaware Assembly enacted laws that delegated the power of eminent domain to entrepreneurs who wished to flood land with dams, or who needed adjacent land for mill infrastructures.[4] By 1719, the Delaware Assembly passed "An act to encourage the building of good mills," establishing a condemnation procedure for anyone owning or building a gristmill but whom might require "some other small share of adjacent land, which at the time may happen to be another man's property."[5] The law applied to all "creeks, rivers, or runs" in Delaware. This new legal instrument would, in part, ensure that the owner of a small wing dam, extending only from one side of a creek and terminating at the middle of the waterway, could now extend their dam across the entire course of the stream, to the other bank—thus raising the water level and producing more waterpower. It might also allow more extensive mill races and other mill infrastructure to be developed upstream or downstream from an existing mill building or mill seat. The amount of additional land that could be condemned for such improvements could total up to six acres in New Castle County—a substantial amount of property.[6] This act of legislature essentially established, in both law and in principle, that milling grain was a public good that was greater in importance than private property rights—and served as an early facilitator of dam construction on Delaware's waterways, including the Brandywine River.

Forty years later, as dams and mills proliferated on the Brandywine River and other Delaware waterways, another important legislative action, the Act of 1760, addressed overcrowding of mills along Delaware's rivers, streams, and creeks. It altered the previously established condemnation procedures—including for the construction of new dams, mill races, or millponds—to consider the impact that the proposed action would have on already-existing mills, both downstream and upstream. Under the new process, a jury would consider possible "damage or loss" to mills already operating should the new applicant begin "taking the water out of the river, creek or run, above the mill of such person or persons, and bringing it past the same in a race, or by any obstruction or impediment caused by the backwater" of

[4] John F. Hart, "Property Rights, Costs, and Welfare: Delaware Water Mill Legislation, 1719-1859," *The Journal of Legal Studies*, Vol. 27, No. 2 (June 1998), [pp. 455-471], 455.
[5] Hart, 456.
[6] Hart, 456. The limit for condemned land was only two acres in Kent and Sussex Counties.

the new dam, mill race, or related infrastructure.[7] A judge would then weigh any potential impacts and decide whether it was "proper a mill should be built," based on its potential to operate "without doing too great [an] injury to the mills already built."[8] This legislation may not have solved the overcrowding caused by new dams and mills, since just thirteen years later, in 1773, the entire condemnation process for creating mills was repealed. Subsequent, more limited acts later authorized condemnation of land for other mills sites, but they were typically in less-developed areas—and none of them affected existing waterpower and milling on the Brandywine River, which was already "the most intensively developed waterway in the state."[9]

Impact on Native Americans

The colonial-era construction of dams to provide industrial power for European-Americans often had an adverse effect on American Indian groups who had long relied on the same rivers. In 1725, the Brandywine Lenape petitioned the Pennsylvania Commissioners of Property, complaining that, "to our great Injury the Brandy-wine Creek is so obstructed with Dams, that the Fish cannot come up to our Habitation," a settlement that had by that time already been moved from a bend of the river at the Pennsylvania-Delaware border to a site further north on the West Branch of the river.[10] Previously, in a 1683 agreement between William Penn and Lenape sachems, including Seketarius, the Lenape had granted to Penn the land between Upland (Chester) and the Christina creeks, including the length of the Brandywine River and its tributaries in New Castle County. Within this territory, on the Brandywine River near the Big Bend on the Delaware-Pennsylvania border, was a Lenape village called Queonemysing, which was a seasonal fishing village occupied during summers, when the Lenape also probably raised corn and other produce there. The name Queonemysing translated as "place where there are long fish."[11] In 1684, an additional agreement between Penn and the Lenape "identified an area of land encompassing the length of the Brandywine Creek and extending one mile on either side of which

[7] Hart, 460.
[8] Hart, 461.
[9] Hart, 461. See Hart's footnote 34.
[10] Paula S. Reed and Edith B. Wallace, *A Historic Saga of Settlement and Nation Building: First State National Historical Park—Historic Resource Study* (New Castle, Delaware: National Park Service—U.S. Department of the Interior, 2019), 28.
[11] Reed and Wallace, 26. After the Swedes began settling along the Brandywine River during the 1630s, they had called the river Fiskekylen, or Fish Creek.

the Brandywine Lenape retained exclusive use"—providing for the Lenape's continued seasonal occupation of Queonemysing and the riparian land to the south.[12] In 1706, after disputes over ownership rights to land in the valley (George Harlan was granted the property on which Queonemysing stood in 1701, after claiming the Lenape had "vacated" it—though in 1705, the Lenape reasserted their rights under the 1684 agreement), the Commissioners of Property purchased from the Lenape all the land from the mouth of the Brandywine up to a point on the West Branch of the river in Pennsylvania. In their 1725 petition, in which they complained of the loss of fishing due to the Brandywine dams, the Lenape asserted that they had never relinquished their rights from the 1684 agreement to access the Brandywine River and a mile of land on either side—but the Commission nevertheless ruled that they had forfeited all such reservations in 1706.[13] With their land and fishing rights thus significantly removed, by the 1730s the majority of Brandywine Lenape had moved west to the Susquehanna River and even further west to the Ohio River Valley.

The Height of Water-Powered Milling on the Brandywine

The water-powered industries along the banks of the Brandywine River were remarkably diverse even during the late-eighteenth century. During the years after the American Revolution, there was "a dizzying explosion of industry" on the Brandywine in Delaware, and by 1793, there were fifty merchant mills grinding and exporting 91,500 barrels of flour per year, fifty sawmills cutting one thousand feet per day of plank and boards, eight forges creating about 600 tons of iron annually, seven fulling mills producing cloth, four gristmills producing local flour, four paper mills, three oil mills, two slitting mills creating rods of iron for nails and other metal products, one snuff mill processing tobacco, and a tilt hammer.[14] By 1816, the lower Brandywine between Rockland and Wilmington could boast of at least 13 dams, powering no less than 86 mill buildings—many of substantial size and output.[15]

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[12] Reed and Wallace, 27.
[13] Reed and Wallace, 28.
[14] Maynard, 73 and Canby, 81 (citing a letter from "Pennsylvania Farmer" in the *Delaware Gazette* on January 26, 1793).
[15] Fairlamb & Read, "Mill Seats on the Brandywine River," 1816, Group 9, Series C, Map Drawer 5, The Longwood Manuscripts (Accession LMSS), Manuscripts and Archives Department, Hagley Museum and Library, Wilmington, Delaware 19807.

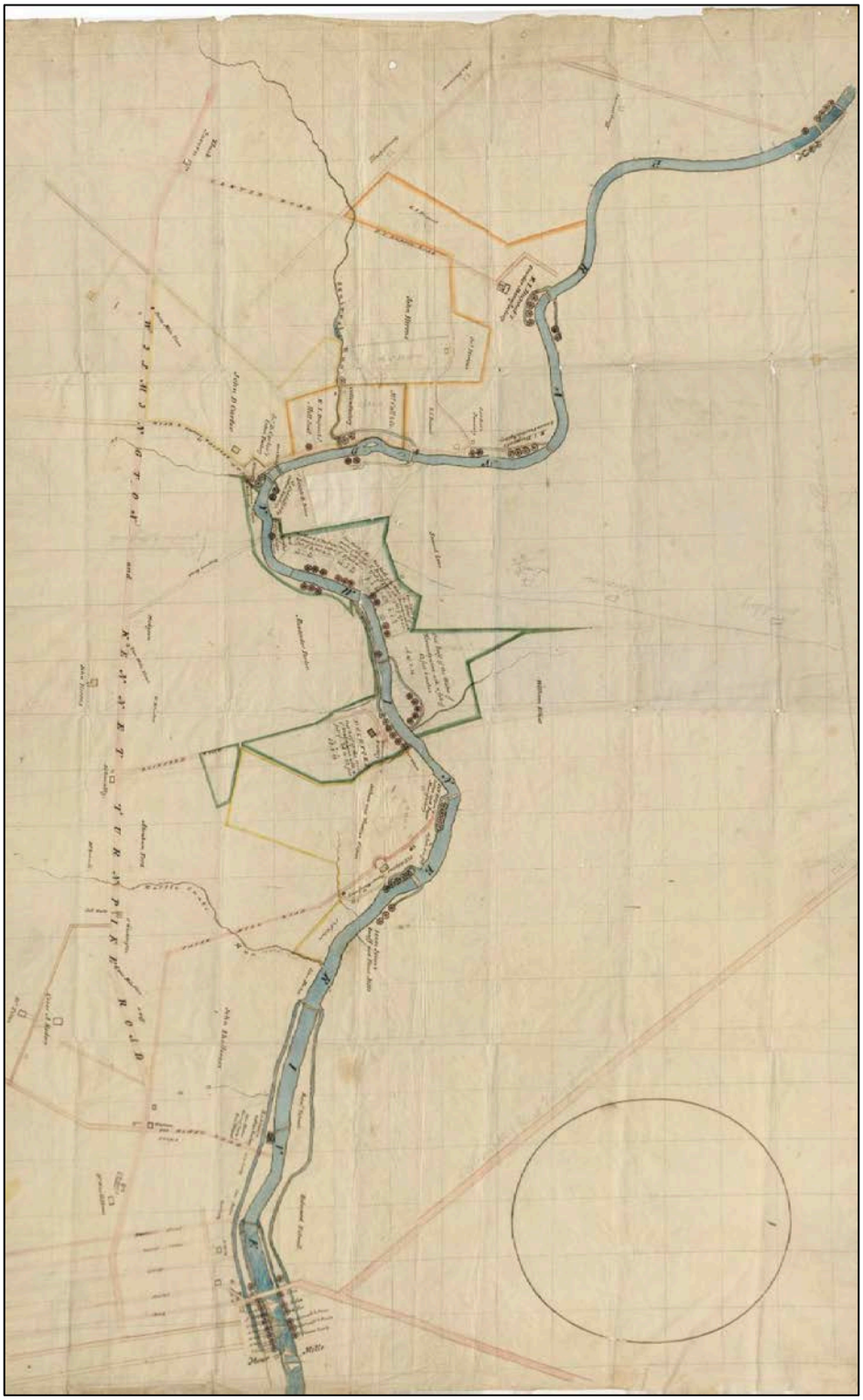

Figure 4. ***Mill Seats on the Brandywine*****, showing the large number of mills and dams along the Brandywine, 1816. (Hagley Museum and Library)**

By 1840, around the height of water-powered industry in the United States, almost every river in the country had at least one dam, and many featured dozens, for a total of around 65,000 dams in the twenty-six states at that time—equal to a dam for every 261 people.[16] The Lower Brandywine River, where it dropped from the rocky Piedmont hills towards the coastal plain at Wilmington, featured more than its fair share of dams. Entrepreneurs here constructed a large concentration of dams within a fairly short span of the river to better harness, direct, and exploit the productive power of its falling water. On a short stretch of the Brandywine called "the gorge," spanning from Rockland to Wilmington's Market Street bridge, the river's water drops 120 feet in elevation over just four miles, and featured at least 11 dams during the mid-nineteenth century. One historian of the region observed that, "Nowhere in the colonies was there more waterpower, more conveniently located, than on the Brandywine."[17] This span of the river, and its large collection of dams and mill races, formed the heart of the Brandywine's renowned industries in the eighteenth and nineteenth centuries. Though most famous for its flour production by the end of the eighteenth century, the lower Brandywine River had, by the middle of the nineteenth century, become a national player in at least four industries: flour, textiles, paper, and gunpowder.

Flour (associated with Dams 1, 2, 3, 5, 7, 8, and 11)

As on many American rivers, gristmills—along with sawmills to aid in construction—were among the first industries built on the banks of the Brandywine River, to grind grain into flour for local consumption. Already by 1725, the Lenape had petitioned the government for redress because multiple dams on the Brandywine had blocked the runs of fish they relied upon, and presumably these early dams were constructed to power smaller-scale saw and gristmills (often called "custom mills").

By the end of the eighteenth century, the Brandywine could also boast of many merchant mills—large-scale gristmills that processed greater quantities of grain to export flour to broader markets. By the 1760s, it became clear that a particular spot on the Lower Brandywine River, where the descending river met navigable tidewater at Wilmington, was a major strategic location for both processing grain and

[16] Martin Doyle, *The Source: How Rivers Made America and America Remade its Rivers* (New York: W.W. Norton & Company, 2018), 220.
[17] Henry Seidel Canby, *The Brandywine, (*New York: Farrar & Rinehart, 1941), 80.

shipping flour—and soon, a merchant mill consortium at Brandywine Village was trading with markets around the world. By the 1730s, regional settlement and increased agriculture in the Pennsylvania interior, including the establishment of Lancaster, had created conditions favorable to developing a grain center at Wilmington. With only primitive roads, the cost of wagon transport from those western settlements to Philadelphia was high, but shipment to Wilmington and the Christina River provided a more economical outlet. Wilmington thus emerged first as a port for shipping, then quickly into a grain processing center. By 1742, Oliver Canby had constructed the first merchant mill on the Brandywine to process and export flour. In 1762, Thomas Shipley, Canby's nephew who had inherited the gristmill, constructed a new and larger mill near the foot of present-day French Street on the south side of the Brandywine.[18] Soon, the vicinity of Shipley's mill became the nexus of flour milling on the Brandywine, with a cluster of flour mills, collectively known as the Brandywine Merchant Mills, established at Brandywine Village. By the early 1790s, the Brandywine millers—among them, prominent Quakers and merchants Joseph Tatnall and Thomas Lea—had adopted local inventor and engineer Oliver Evans' revolutionary machinery that allowed for the automation of flour milling. Production of highly-quality Brandywine "superfine" flour soared, with between 300,000 and 500,000 bushels of wheat ground annually and thousands of barrels shipped around the world.[19] With such advances and increased scale, the Brandywine mills reached the peak of their importance during the several decades after the Revolutionary War, as the Brandywine millers purchased grain from a wide-ranging area that included Pennsylvania, Delaware, southern New Jersey, Maryland, and beyond. Brandywine superfine flour carried a strong reputation for quality nationwide, and it was the most sought-after in the American market.[20]

[18] Peter C. Welsh, "Brandywine: An Early Flour Milling Center," from the *Smithsonian Report for 1959*, 677-686 (Washington, D.C.: Smithsonian, 1960), 679.
[19] Walter J. Heacock, "Oliver Evans, Ingenious Magician," white paper published July 1955, Hagley Museum and Library (https://digital.hagley.org/islandora/object/islandora%3A2304780/datastream/OBJ/download), 6; Peter C. Welsh, "The Brandywine Mills: A Chronicle of an Industry, 1762-1816," *Delaware History* VII (March 1956), no. 1, 19.
[20] Hoffecker, *Brandywine Village: The Story of A Mill Community*, 29.

Figure 5. *Brandywine Mills*, Bass Otis, c. 1820. (Delaware Historical Society)

The position of grain processors in Wilmington began to decline significantly after 1840, as transportation advances in larger cities, like Philadelphia, consolidated their own economic positions at the expense of smaller markets like Wilmington. Soon, "Wilmington's old economy based upon grain processing and shipping was severely curtailed by the Philadelphia-Columbia Railroad, which diverted much of the town's grain supply from southeastern Pennsylvania to Philadelphia."[21] Nevertheless, several flour mills remained in operation at Brandywine Village into the latter part of the nineteenth century, with William Lea & Sons Co.—successor to the Tatnall and Lea family mills—being the longest lived, continuing until the early-twentieth century.

[21] Carol Hoffecker, *Wilmington, Delaware: Portrait of an Industrial City, 1830-1910* (Charlottesville, VA: University Press of Virginia, 1974), 15-17.

Though flour milling on the Brandywine is most prominently linked with Brandywine Village due to the dense cluster of flour mills (powered by Dams 1 and 2) that operated there from the late-eighteenth century, Dams 3, 5, 7, 8, and 11 are also associated with flour milling. Jacob Vandever first built a grist mill c. 1682 on the northern bank of the Brandywine in the vicinity of Dam 3.[22] In the late-eighteenth and early-nineteenth centuries, Wilmington farmer John Shallcross also operated a gristmill near Dam 3. During the same period of time, Isaac Jones operated a flour mill in the same vicinity.[23] At Rockford, in the vicinity of Dam 5, Job Harvey operated a gristmill on the southern bank during the mid-to-late-eighteenth century.[24] In the late-eighteenth and early-nineteenth centuries, Vincent Gilpin operated a flour mill powered by Dam 7.[25] Brothers Abijah and Rumford Dawes constructed a gristmill c. 1784 near Dam 8 (Hagley) and may have continued operations into the first decade of the nineteenth century.[26] Adam Kirk also built and operated a gristmill on the western bank of the Brandywine at Rockland (powered by Dam 11) during the mid- to late-eighteenth century.[27] Additionally, the Smith, Twaddell, and Talley families milled flour in the area of Smith's Bridge, near the Delaware-Pennsylvania border, until about 1900, though the mill was powered via a long race without a mill dam.[28]

Paper (associated with Dams 3, 4, and 11)

In 1787, the same year the United States Constitution was written, papermaking commenced on the Brandywine River—and over the next half century, Brandywine papermakers would thrive, expanding their operations and innovating for the American papermaking industry. The first, largest, and most important paper mill in Delaware, Thomas and Joshua Gilpin's operation on the Brandywine, was

[22] "Vandever Mill," Delaware's Industrial Brandywine Digital Exhibit, Hagley Museum and Library, https://www.hagley.org/research/digital-exhibits/vandever-mill.
[23] "Isaac Jones's Snuff Mill," Delaware's Industrial Brandywine Digital Exhibit, Hagley Museum and Library, https://www.hagley.org/research/digital-exhibits/isaac-joness-snuff-mill; "John Shallcross," Delaware's Industrial Brandywine Digital Exhibit, Hagley Museum and Library, https://www.hagley.org/research/digital-exhibits/john-shallcross.
[24] "Job Harvey," Delaware's Industrial Brandywine Digital Exhibit, Hagley Museum and Library, https://www.hagley.org/research/digital-exhibits/job-harvey.
[25] "Vincent Gilpin," Delaware's Industrial Brandywine Digital Exhibit, Hagley Museum and Library, https://www.hagley.org/research/digital-exhibits/vincent-gilpin.
[26] "Rumford & Abijah Dawes," Delaware's Industrial Brandywine Digital Exhibit, Hagley Museum and Library, https://www.hagley.org/research/digital-exhibits/rumford-abijah-dawes.
[27] "Heshbon Factory," Delaware's Industrial Brandywine Digital Exhibit, Hagley Museum and Library, https://www.hagley.org/research/digital-exhibits/heshbon-factory.
[28] Frank R. Zebley, *Along the Brandywine* (Wilmington, DE: William Cann, Inc., 1940), 95.

founded in June 1787 below Dam 4. At that time, paper was still essentially handmade, producing individual sheets of various sizes using "wove molds" that were rectangular in shape.[29] Joshua Gilpin is credited with purchasing the first wove molds manufactured in the United States, from the firm of Nathan Sellers in Philadelphia in 1789, and the mill likely was the first to incorporate the first papermaking-related patent in the US, involving "an improvement in the moulds," registered by John Carnes of Delaware in 1793. Already by 1790, the mill employed twenty workers and produced sixteen reams of paper each day.[30] While the vellum paper produced here was neither "so white nor so well moulded" as the finest European vellum papers, it was nonetheless described as "a beautiful and good paper" by a Frenchman who toured the operation in 1797.[31] By the War of 1812, the Gilpin paper mills were specializing in banknote paper, sold to financial institutions throughout the country.[32]

Yet the most innovative development at the Gilpin mills occurred in December 1816, when Thomas Gilpin patented the first "endless paper" machine in America, inspired by similar machines first patented in France in 1798 and successfully constructed in England in 1803. These new machines collectively "revolutionized the technique of papermaking."[33] Rather than forming individual sheets of paper from rectangular molds, the new machines rotated a cylinder of wire mesh (which Thomas Gilpin called an "endless mould") through pulp in a vat, which then transferred the continuous, wet sheet of pulp through rollers that squeezed out excess water, by passing the damp sheet between cylinders.[34] In 1816 and 1817, the Gilpins reconstructed their Brandywine Paper Mills to accommodate such new machinery and processes, which reduced the number of workers they required, while at the same time producing paper more quickly and efficiently.[35] In October 1817, a relative of the Gilpins described sitting at a large table that was about 15 feet long and "covered with White Paper of the new machine," which he mistook for "a fine damask cloth," and the following month, a local newspaper editor gushed that the paper was "perfectly smooth and even" and "not excelled by any made by hand."[36]

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[29] Harold B. Hancock, "Delaware Papermakers and Papermaking, 1787-1840," August 1955, p. xi, 1.
[30] Hancock, 9-11.
[31] Hancock, 11-12.
[32] Hancock, 14.
[33] Hancock, 15.
[34] Hancock, 25.
[35] Hancock, 23-24.
[36] Hancock, 29-30.

Figure 6. ***Gilpin's Mill on the Brandywine*****, Thomas Doughty, 1830–37.**

Despite Thomas Gilpin's patent, imitators and competitors emerged within a few years. Further, the financial depression after the Panic of 1819, a freshet on the Brandywine in 1822, and a calamitous fire in the original paper mill in 1825 all dealt devastating blows to the Gilpin papermaking enterprise.[37] In 1828, the Gilpins sold their holdings along the Brandywine River to a group of investors who planned to expand the manufacturing enterprises there to include iron, wool, flax, cotton, and other products. Thomas Gilpin continued to manage the papermaking enterprise for the Brandywine Manufacturing Company until June of 1837, when the operation ceased after almost exactly fifty years of production.[38]

[37] Hancock, 34-35.
[38] Hancock, 37-40.

Figure 7. ***View on the Brandywine River: Gilpin's Paper Mill*****, Thomas Doughty, 1825-1830.**

The Gilpin brothers were not the only paper manufacturers on the lower Brandywine River. William Young founded Delaware Paper Mills along the Brandywine in 1795, which he moved to Rockland in 1801 (Dam 11), and he was providing paper to the United States Treasury by 1800. However, his Rockland paper mill suffered a devastating fire in 1814, a blow from which he never recovered. After operating intermittently until 1822, he finally closed his papermaking mill after a quarter of a century.[39] In 1860, Jessup and Moore began paper manufacturing at the same location, expanding on their existing operations further south on Brandywine River, at Dam 3, where they had begun the Jessup & Moore Paper Company in 1845. That company produced paper products below Dam 3 for nearly 150 years, first as the Jessup & Moore Paper Company (1845-1934), then as Delaware Paper Mills (1934-1939),

[39] Hancock, 44.

and finally, as the Container Corporation of America (1939-1984). At Rockland (Dam 11), the New York-based San-Nap-Pak Manufacturing Company, later named Doeskin Products, began operations in the 1940s at the paper mill site formerly of Jessup & Moore, first producing feminine hygiene products and from the 1950s into the 1970s producing facial tissue.[40]

A couple of smaller papermakers, more elusive in the historical record, also operated along the Brandywine during the nineteenth century. Among them was the Sunnydale Paper Mill of John and Daniel Farra, near the Delaware-Pennsylvania border, which produced paper (including "tissue manilla") from the 1810s until at least 1901. By 1927, that mill had been purchased by an official of the Curtis Paper Company in Newark and was called Beaver Valley Paper Company.[41]

Textiles (associated with Dams, 1, 2, 4, 5, 7, 8, and 11)

In 1795, Jacob Broom, a signer of the US Constitution and a man of several enterprises, was the first to establish a machine-spun cotton mill on the Brandywine River—just two years after Samuel Slater established his now famous mill (the first in the United States) in Pawtucket, Rhode Island. Broom's mill was initially established in the center of Wilmington but soon relocated to his country estate, a part of which would later become Eleutherian Mills. It was a sizable structure, measuring 40 feet by 50 feet and standing three stories high. He equipped the building with water-powered carding machines and Arkwright water frames for spinning cotton, all driven by Brandywine water.[42] It is unclear whether Broom installed looms in his mill or outsourced the weaving, but he advertised finished cotton goods at his Market Street store including jaconet, muslins, chintzes, calicoes, jeans, royal ribs, and satinettes.[43] During its first year of operation, Thomas Rodney visited "Brooms Cotton factory" and noted that "very few Such excellent Cotton Stuffs are imported as those made here."[44] However, less than two years after establishing this textile factory, Broom's mill burned down in February 1797, and he was unable to raise

[40] "Doeskin Products," Delaware's Industrial Brandywine Digital Exhibit, Hagley Museum and Library, https://www.hagley.org/research/digital-exhibits/doeskin-products.
[41] Hancock, 53.
[42] Roy M. Boatman, "Brandywine Cotton Industry, 1795-1865," Box 1, Eleutherian Mills-Hagley Foundation research reports (Accession 1645), Manuscripts and Archives Department, Hagley Museum and Library, Wilmington, DE 19807, 11.
[43] Boatman, 11.
[44] Boatman, 11-12.

the funds to rebuild.[45] A few years later, he sold his mill site—which still included the dam and working mill race—to E.I. du Pont, who established there the gunpowder works that would become the DuPont Company.

The War of 1812, and related embargoes and protective tariffs before and after the war, all served to stimulate American manufacturing. By 1810, there were 226 cotton mills in the United States, and at least two were operating on the Brandywine River. One was Thomas Massey's cotton yarn factory in Rumford Dawes' old gristmill, and the other was Samuel and Caleb Kirk's mill in Rockland, where they were processing cotton and wool.[46] In 1813, the mill now called Breck's Mill was first constructed by Louis McLane and George B. Milligan at Dam 7, where they established a "cotton factory." Between the new building and a converted old gristmill at the site, forming a complex called Rokeby, McLane and Milligan (or their corporate tenants, Little & Company) had installed around 1,500 spindles.[47] During the same time, and just across the river from Breck's Mill, John Siddall & Co., began cotton spinning operations in what is known as Walker's Mill, having installed 3,000 spindles and making cotton yarns in addition to check, muslin, and plaid fabrics.[48] Cotton milling operations continued at the site, intermittently with different owners and lessees, well into the early-twentieth century. Around the same time that Breck's and Walker's Mills were established, Duplanty, McCall & Co. also constructed its cotton factory, later called the Henry Clay Mill, just upstream (powered by Dam 8) on a portion of land E. I du Pont had purchased from Rumford Dawes in 1812.[49] The "highpoint of the Brandywine cotton industry," based on the number of mills, "was reached just after the War of 1812," according to one authority on the subject.[50] Yet, the gains in cotton manufacturing in the U.S. during the war were rolled back to some degree after the war, when the British were somewhat successful in their attempts to flood the American market with cheap textiles and stifle the viability of new American enterprises.

[45] Boatman, 12.
[46] Boatman, 12-13.
[47] Boatman, 13.
[48] Boatman, 59; "John Siddall & Co.," Delaware's Industrial Brandywine Digital Exhibit, Hagley Museum and Library, https://www.hagley.org/research/digital-exhibits/john-siddall-co.
[49] Boatman, 20-25.
[50] Boatman, 103.

Still, other cotton factories—some relatively short lived—sprung up in the years following the War of 1812, all along the Lower Brandywine. A handful of cotton mills were established at Brandywine Village (powered by Dams 1 and 2), including Bancroft Flannel Mill, operating between 1822-1832; Rodgers & Reeves, established in 1828 and closed by 1832; Arlington Cotton Mills, operating from c. 1830-1860; and Wilmington Cotton Factory, established in 1831 and closing by 1837. In the vicinity of Dam 4 at Kentmere, Thomas Jr. and Joshua Gilpin also briefly operated a woolen mill, known as the Brandywine Woolen Mill, between 1812 and 1814, and for a short time in the early 1820s they were processing cotton, in additional to paper manufacturing.[51] In 1845, James Riddle, later James Riddle, Son & Co., established a cotton manufactory at the site, building a weaving mill in 1850 and "running 12,000 spindles to produce approximately 70,000 yards of fancy ticking per week."[52]

In 1814, upstream at Rockland (Dam 11), William Young also established a textile mill, first as a woolen manufactory producing merino, cassimere, satinet, and fancy cord for markets in Wilmington, Philadelphia, and Baltimore. In 1822, after a flood severely damaged several mill buildings, Young constructed a new cotton mill which he called the Wallace Cotton Factory, named for his son William Wallace. By 1832, after Young's death and then part of Rockland Manufacturing Company, the mill utilized 3,000 spindles and employed 66 laborers, with another weaving operation utilizing 30 looms to produce muslin and other finer fabrics. Young's sons, William and Evan, continued textile productions at Rockland until the late 1840s.[53]

Joseph Bancroft & Sons Co., established in the vicinity of Dam 5 in 1831 as Rockford Cotton Mill, would go on to be the most significant and longest lasting textiles company on the Lower Brandywine. In the 1840s, Bancroft's mill introduced possibly the first "self-acting mules and fly frames in America."[54] By the 1860s, the company became known for its window shades fabric and increasingly supplied cloth to shade manufacturers who could no longer import it from England as a result of the

[51] Boatman, 75; "T&J Gilpin," Delaware's Industrial Brandywine Digital Exhibit, Hagley Museum and Library, https://www.hagley.org/research/digital-exhibits/tj-gilpin.
[52] Boatman, 77; "Messrs. James Riddle, Son & Co.," Delaware's Industrial Brandywine Digital Exhibit, Hagley Museum and Library, https://www.hagley.org/research/digital-exhibits/messrs-james-riddle-son-co.
[53] "Rockland Manufacturing Company," Delaware's Industrial Brandywine Digital Exhibit, Hagley Museum and Library, https://www.hagley.org/research/digital-exhibits/rockland-manufacturing-company.
[54] Boatman, 80.

Civil War.[55] The company continued to grow through the late-nineteenth century, expanding downstream to Kentmere (Dam 4) in 1895, and became innovators in the early-twentieth century in the development of synthetic yarns.[56] By 1930, Bancroft & Sons Co. had become the world's largest single cotton dyeing and finishing operation—and by the mid-twentieth century was the only-remaining textiles company on the Brandywine.[57]

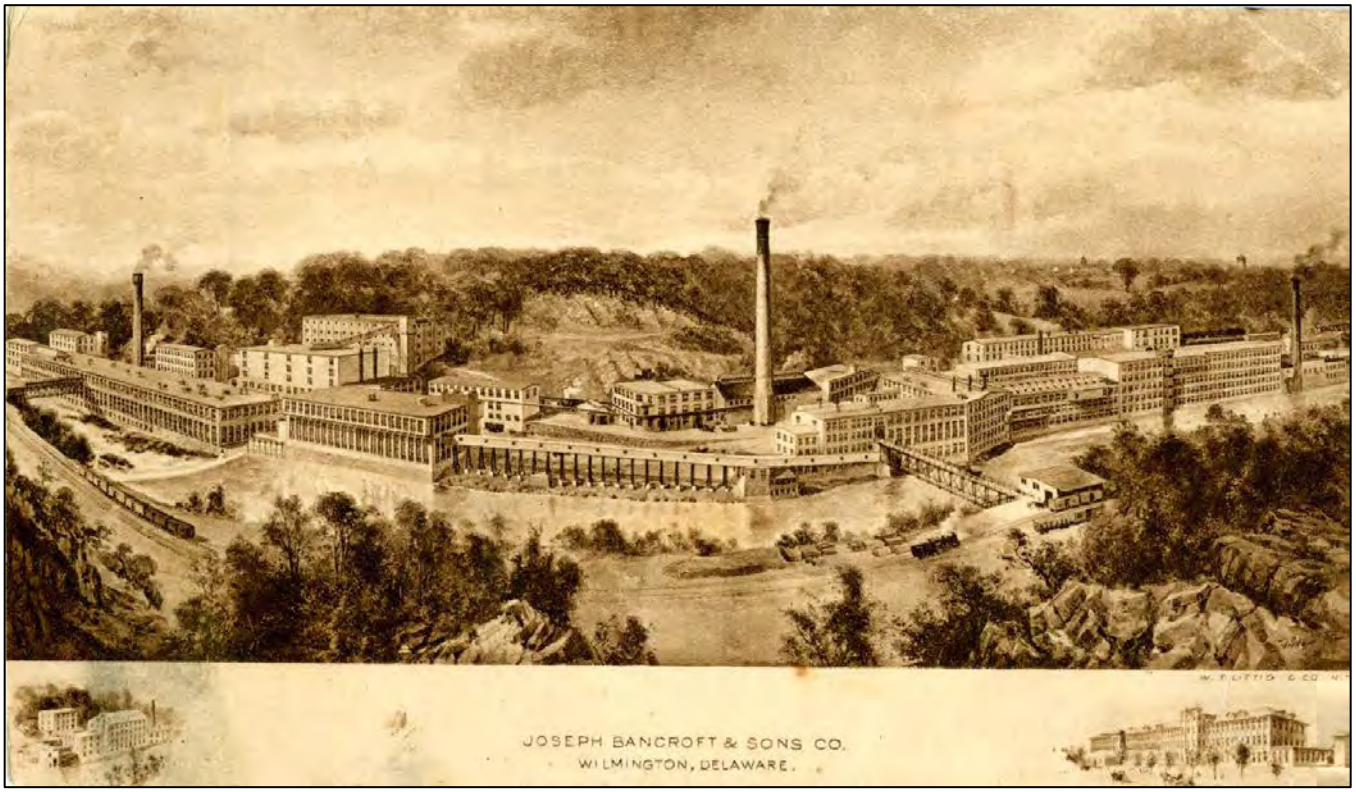

Figure 8. ***Joseph Bancroft & Sons, Co.,*** **undated. (Delaware Public Archives)**

Gunpowder (and Chemicals) (associated with Dams 6, 8, 9, and 10)

The manufacturing of gunpowder on the Brandywine River, and later the United States, is mostly the story of a single company, the E. I. du Pont de Nemours Company, now known as the DuPont Company. During the eighteenth century, prior to the establishment of the du Pont de Nemours

[55] Boatman, 82.
[56] "Joseph Bancroft & Sons Company miscellany on Bancroft Mills 2448," Manuscripts and Archives Repository, Hagley Museum and Library, https://hagley-aspace-pdf.s3.amazonaws.com/2448.pdf.
[57] Boatman, "The Brandywine Cotton Industry, 1795-1865," 82.

Company, there were few significant gunpowder producers in America. While the first known powder mill was established in Massachusetts in 1639, the colonial mills largely fell into disrepair after the French and Indian War (1754-1763), leaving the colonists with little ability to produce their own gunpowder.[58] The strong trade network between Great Britain and the American colonies made it cheaper to import powder from England than to build local manufactories in the colonies; however, this reliance on British powder quickly became a problem in 1775 with the outbreak of hostilities with the mother country.[59] Due to the lack of American gunpowder available during the American Revolution (1775-1783), the Continental Congress raided or traded with European allies to obtain much of the powder used during the war—including with the French, who under the direction of Antoine Lavoisier (head of France's Gunpowder Commission) had brought the production of gunpowder and saltpeter back into production on French soil in 1774.[60]

In France, Éleuthère Irénée (E.I.) du Pont studied gunpowder manufacturing under Antoine Lavoisier—and by 1802, he would import similar processes to the United States on the Brandywine River, including new ideas for the design of mill structures, the arrangement of the buildings, and the process used to create the gunpowder.[61]In the aftermath of the French Revolution (1789-1799), the du Pont de Nemours family emigrated from France in 1800 and soon began scouting locations to build a gunpowder manufactory. In 1802, after visiting Wilmington, Delaware, E. I. du Pont decided to site his manufactory north of the city along the Brandywine River. For $6,740, he purchased 95 acres from Jacob Broom, which included a dam and race (Dam 10), plus a cotton and sawmill.[62] Du Pont then began constructing his first powder yard on the Brandywine, which is known today as the Upper Eleutherian Mills or the Upper Yard.

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[58] Jimmy Dick, "The Gunpowder Shortage," *The Journal of the American Revolution,* September 9, 2013, https://allthingsliberty.com/2013/09/the-gunpowder-shortage/ ; David L. Salay, "The Production of Gunpowder in Pennsylvania During the American Revolution," *The Pennsylvania Magazine of History and Biography,* Vol. 99, No. 4 (Oct. 1975), 423.
[59] Dick, "The Gunpowder Shortage."
[60] Dick, "The Gunpowder Shortage."
[61] Robert A. Howard, "Black Powder Manufacture," *The Journal of the Society for Industrial Archeology*, Vol. 1, no. 1, pp. 13-28, 1975, 13, and B.G. du Pont, *E. I. du Pont Nemours and Company* (New York: Houghton Mifflin Company, 1920), 12.
[62] Robert A. Howard, "Brandywine Powder Mills," National Register of Historic Places Inventory/Nomination Form, Hagley Museum and Library, Greenville, Delaware, December 1983, Section 8, no page #.

Figure 9. *Eleutherian Mills*, Charles Dalmas, 1806. (Courtesy of Hagley Museum and Library)

In 1810, just eight years after constructing his first gunpowder works, E. I. du Pont was operating the largest black powder plant in America (powered by Dams 8-10).[63] As such, the powder yards were expanded several times along the Brandywine River to keep up with demand. The first expansion, to keep up with the demands for gunpowder by the United States government during the War of 1812, included the purchase of the adjacent 62-acre mill property just downstream of the Eleutherian Yard, called "Hagley," from Rumford Dawes in 1813.[64] In 1821, adjacent to the Hagley Yard again to the south, E. I. du Pont and his brother Victor also purchased the Henry Clay Mill (though they did not utilize this site for gunpowder manufacturing until 1884, when they converted the old mill into a keg mill for the shipment of gunpowder).[65] By 1832, as peacetime demands for gunpowder continued to

[63] Roger Lowenstein, "It Began With Gunpowder: The history of DuPont speaks volumes about the history of modern corporation," *The Wall Street Journal*, January 11, 1999.
[64] Howard, "Brandywine Powder Mills," Section 8, 1, and "Company Chronology: 1801-1834," The *DuPont Company on the Brandywine* Digital Exhibit, Hagley Museum and Library, https://www.hagley.org/research/digital-exhibits/company-chronology-1801-1834.
[65] Thompson, "Henry Clay Village Historic District," Section 8, 4.

grow for hunting and for engineering purposes as Americans moved west, one-seventh of all U.S. gunpowder was made by the DuPont Company.[66] In 1839, Lammot du Pont expanded the gunpowder manufactory once more to the south (and east) of the Eleutherian and Hagley Yards, through the purchase of land from the defunct Brandywine Seats Company on the northern banks of the Brandywine River (Dam 6 vicinity). In creating this additional yard, the du Ponts sought to separate the creation of gunpowder into two distinctly separate places.

By 1903, the DuPont Company was again expanding, this time into the production of chemicals and other consumer goods—prompting the conversion of the Lower Hagley Yards into an experimental station. When created, the DuPont Experimental Station was one of the first industrial research laboratories in the United States.[67] DuPont established its Chemical Department in 1911, the forerunner of DuPont Central Research & Development. After a formal program of research in physics and chemical engineering was initiated in 1927, it had reaped "spectacular results" by the early 1930s, including discoveries that would directly lead to nylon, neoprene (the first general-purpose synthetic rubber), rayon (the first high-tenacity rayon tire cord), and Teflon.

The powder mills continued in operation along the banks of the Brandywine until 1921, when the DuPont Company closed them due to dwindling demand for black powder. The explosives produced by the DuPont Company contributed to every American war effort from the War of 1812 through World War I, and to peacetime projects such as the building of the Erie Canal and opening of the coal fields. While at the height of its gunpowder production, the DuPont Company was the nation's largest producer of black powder.

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[66] Maynard, 98.
[67] DuPont Company, "DuPont Science & Technology: R & D History at the DuPont Experimental Station," October 2010, accessed December 1, 2010, https://sites.lafayette.edu/aiche/files/2013/09/RD-History-at-the-DuPont-Experimental-Station.pdf.

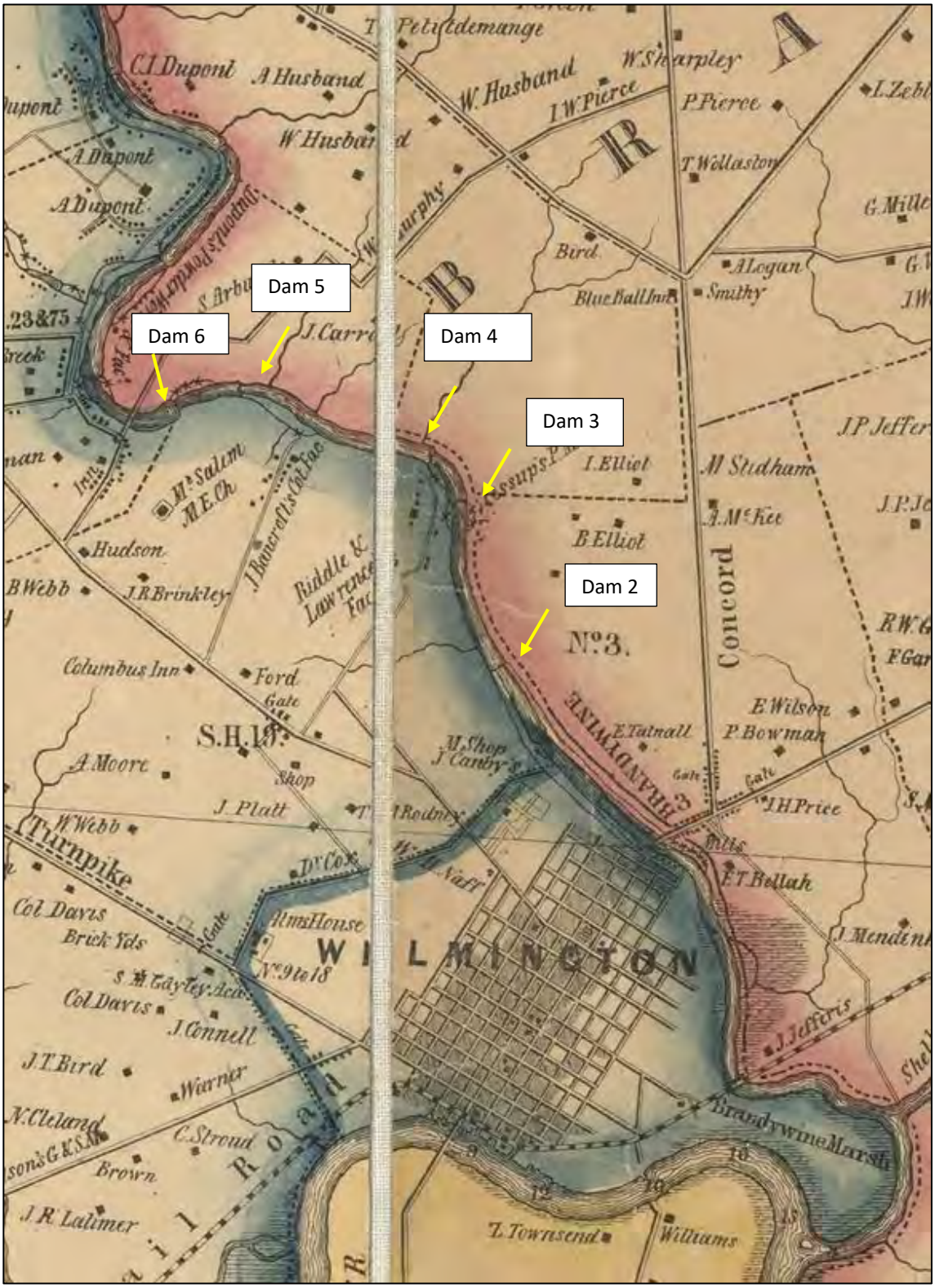


Figure 10. Detail of *Rea and Price Map*, 1849.

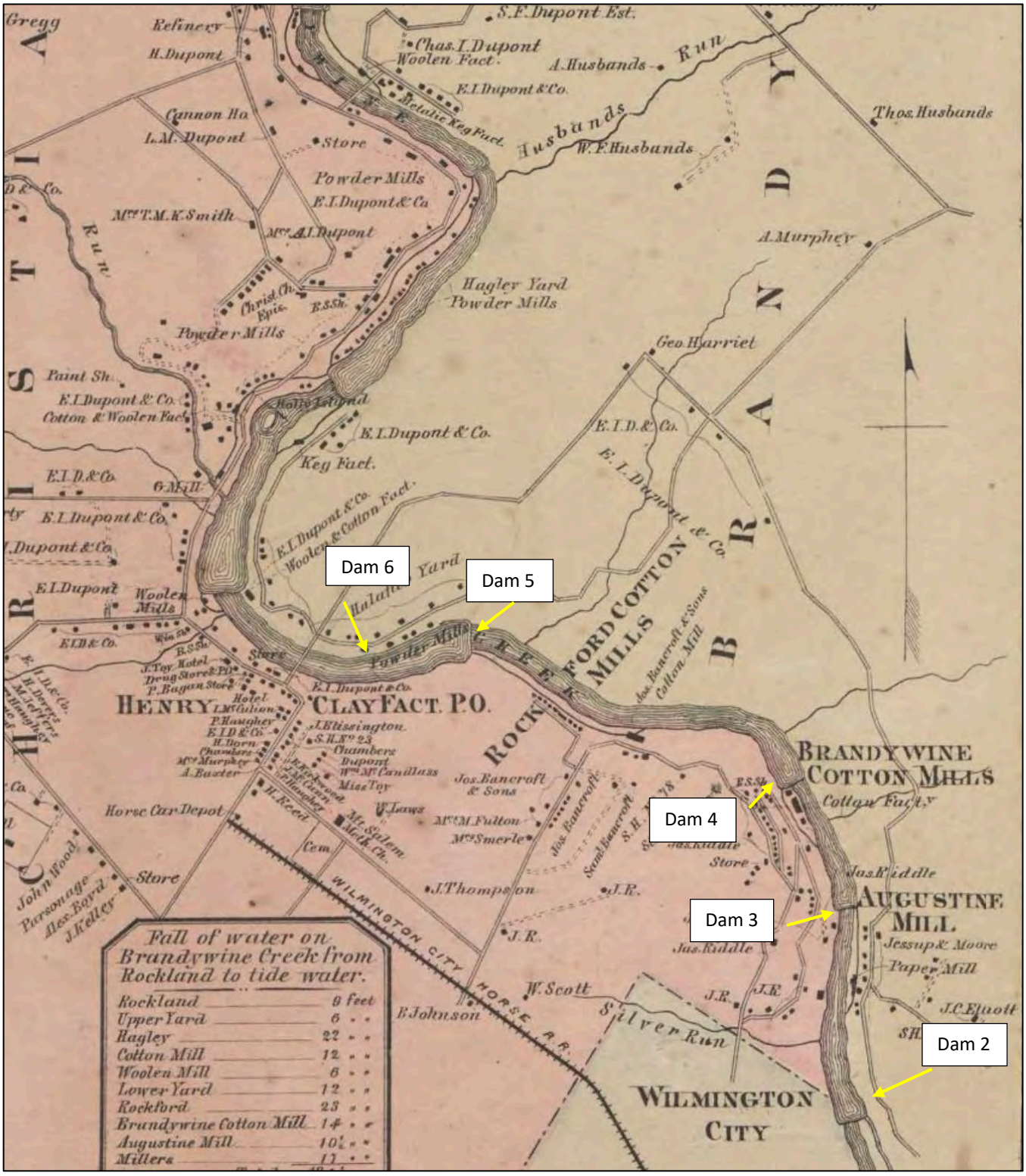


Figure 11. Detail of Beers Atlas *Brandywine Banks,* 1868.

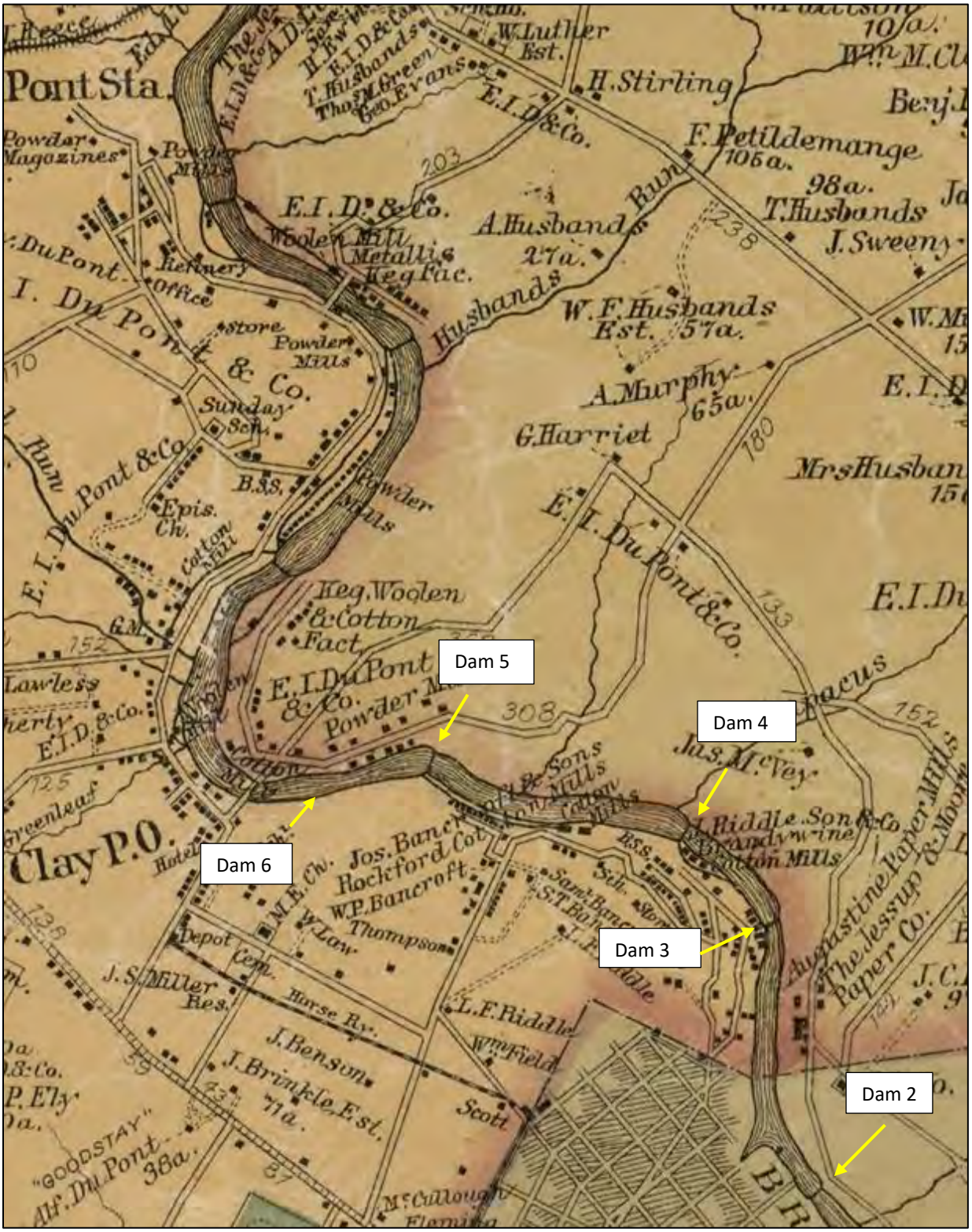


Figure 12. Detail of the G.M. Hopkins & Co. *Map of New Castle County, Delaware*, 1881.

PROPERTY TYPES

The National Historic Preservation Act of 1966, 80 Stat. 915, 16 U.S.C. 470, as amended, established the National Register of Historic Places (NRHP), and authorized the Secretary of the Interior to expand and maintain it, as an official list of resources composed of districts, sites, buildings, structures and objects significant in American history, architecture, engineering, archeology, and culture. The National Register is maintained by the Sectary of the Interior and administered by the National Park Service (NPS). The Department of the Interior has developed regulations defining the procedures for listing properties in the National Register (36 CFR Part 60).

The National Park Service developed criteria used to evaluate historic properties to assist in the evaluation of properties eligible for listing in the National Register of Historic Places. The National Park Service's publication *National Register Bulletin 15: How to Apply the National Register Criteria for Evaluation* provides detailed guidance on how to apply to the four criteria, levels of significance, as well as aspects of integrity properties need to retain to be eligible. According to the NPS, properties may be significant under one (or more) criteria, within local, state, or national historic trends and contexts.

The National Register Criteria for Evaluation are:

> Criterion A: Properties determined eligible for listing are associated with events that have made a significant contribution to the broad patterns of our history. Properties can be significant under Criterion A that are associated with single events, or historic trends.
>
> Criterion B: Properties determined eligible for listing are associated with the lives of significant persons in our past. This criterion is generally limited in use, only applying to a place that illustrates a person's important achievements and is not commemorative.
>
> Criterion C: Properties determined eligible for listing embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess

high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction. This criterion generally applies to properties significant for their physical design, style, or construction.

Criterion D: Properties determined eligible for listing under Criterion D have yielded, or may be likely to yield, information important in prehistory or history. This criterion is often associated with archaeology. [68]

In addition to being determined to be significant based on one (or more) of the above criteria, eligible properties must also retain their integrity. "Integrity" is defined by the NPS as the "ability of a property to convey its significance."[69] In order for a historic property to retain integrity NPS has defined seven aspects or qualities that define integrity. The seven aspects of integrity are location, design, setting, materials, workmanship, feeling, and association. These aspects are further defined below:

1. Location is the place where the historic property was constructed or the place where the historic event occurred.
2. Design is the combination of elements that create the form, plan, space, structure, and style of a property.
3. Setting is the physical environment of a historic property.
4. Materials are the physical elements that were combined or deposited during a particular period of time and in a particular pattern or configuration to form a historic property.
5. Workmanship is the physical evidence of the crafts of a particular culture or people during any given period in history or prehistory.
6. Feeling is a property's expression of the aesthetic or historic sense of a particular period of time.
7. Association is the direct link between an important historic event or person and a historic property.[70]

[68] National Park Service (NPS), *National Register Bulletin: How to Apply the National Register Criteria for Evaluation*, Washington, DC: United States Department of the Interior, 2002. https://www.nps.gov/nr/publications/bulletins/nrb15/.
[69] NPS, *National Register Bulletin: How to Apply the National Register Criteria for Evaluation*, 40.
[70] NPS, *National Register Bulletin: How to Apply the National Register Criteria for Evaluation*, 44.

In accordance with National Park Service guidelines, assessing integrity requires several steps. Identifying the character-defining features that must be present to represent significance; determining whether these features are visible enough to convey significance; determining whether the property needs to be compared with similar properties; and determining which aspects of integrity are particularly vital to the property and if they are present.

Character-defining features are considered to be those that define why and when a property was significant. Specifically, under Criteria A and B, a property is considered eligible if it retains the essential "features that made up its character or appearance during the period of its association with the important event, historical pattern, or person(s)." Under Criterion C, a property that is important for illustrating a particular architectural style or construction technique must retain most of its physical features that represent that style or technique. Under Criterion D, archeological sites in particular do not exist as they were formed, and cultural and natural processes continue to alter the deposited materials. Therefore, for Criterion D, integrity is based on the property's potential to yield information that addresses research questions.

The architectural resources within the defined project area consist mainly of mill dams and associated features (mill races, head gates, etc.). This section defines this resource type more specifically and details their character-defining features. Properties qualifying for the NRHP must retain the majority of their character-defining features, and thus their integrity in order to establish their significance and, thus, provide justification for their eligibility.

Mill Dams

The main function of mill dams was to raise and divert water to create industrial power. Damming a river, especially along a descent, increased the height of the headwater upstream, while creating a reservoir of water for mill power, which was then channeled into mill races that ran alongside the river at an elevated height after the river itself dropped. There were almost countless engineering approaches to creating mill dams on rivers, some very basic and others highly engineered, and in a wide variety of materials, ranging from compacted dirt or gathered brush at the most rudimentary end of the spectrum, and complex, interlocked timber and masonry designs on the other.

The majority of historic mill dams built prior to the turn of the twentieth century were of vernacular forms, utilizing varied construction techniques and readily available materials, depending on the geology of the region and natural resources of any given locale. Nineteenth-century millwright William Hughes rightly explained, "There are as many opinions on the proper way to build [mill dams] as there are mill-dams in use. Some prefer stone, some clay, and others brush, logs, and every conceivable material of such nature."[71] Indeed, the dams on the Brandywine before the twentieth century seem to have drawn on several different construction techniques and design solutions, often resulting in unique subtypes or hybrid types of dams. Many dams on the Brandywine River feature a mixture of materials and components, sometimes dating to different construction campaigns. One approach to categorizing dam construction is by primary building materials, for which at least four general types emerge—including earthen/dirt, timber/plank, stone/rock, and later, concrete dams. The dams on the Lower Brandywine are predominantly of stone construction, though often featuring combinations of timber, plank, and concrete elements as important parts of their designs.

Despite the wide-ranging historical approaches to dam building, several publications from the second half of the nineteenth century shed important light on general types of dam construction and, equally important, they illustrate those individual design components or techniques that dam builders utilized in their solutions for vernacular or hybrid dams. During the latter part of the nineteenth century, millwrights like William Hughes and James Leffel were at the forefront of dam engineering and technology, publishing books discussing well-tested construction techniques for the most effective and functional structures. Among the important publications were Hughes' *The American Miller, and Millwright's Assistant* (1862) and Leffel's *The Construction of Mill Dams* (1874). An evaluation of these period books, though featuring a wide range of design solutions and individual examples, helps to establish some general types, subtypes, and design tendencies that are reflected in the Lower Brandywine dams. The following sections highlight both design tendencies and construction subtypes that are found among the subject dams on the Brandywine River.

[71] William Carter Hughes, *The American Miller, and Millwright's Assistant* (Philadelphia, PA: Henry Carey Baird, 1862). 117.

Design Tendencies of the Lower Brandywine

Stone as Primary Building Material

On the superiority of stone construction for mill dams, Leffel said, "Whatever may be said in favor of other descriptions of dams, whether they be frame, crib, log, pile, earth, brush or iron dams, it must still be admitted that stone is on many accounts the most suitable material for a barrier against the pressure of water." He continued, "Stone possesses more of the qualities which are valuable in a dam than any other substance."[72] If available, and not too costly to construct, stone was the preferred dam material suggested by Leffel. Dam builders on the Lower Brandywine River typically used stone as their primary structural element, even if they incorporated other materials in their designs. With the abundance of stone available in the Piedmont region of Delaware, it is not surprising that most of the surviving dams on the Brandywine River feature primarily masonry construction, expressed in various forms and through different techniques. However, little information is available regarding any previous iterations of these dams, or any components of the extant dams that may survive under the present structures (and not presently observable), which may have utilized other materials or construction techniques. It should also be noted here that different types of riverbed—whether mud, sand, rubble, gravel, or bedrock—could have significant implications for the type of dam construction, and anchoring required, to form a stable structure than would not easily wash out. In the case of the Lower Brandywine dams, the riverbed was almost exclusively bedrock, providing a solid foundation for dam construction.

Ramping / "A Gentle Slope from the Crest"

A great many of the dam designs recommended during the nineteenth century contained some form of ramping or gradual slope—often for the upstream side, but also sometimes for the downslope. This ramping or slope creation helped direct water, buttressed dams to create structural stability, and helped prevent erosion. Leffel pointed out that good masonry dams could be built, in profile or cross-section, with "a gentle slope from the crest both up and down the stream" (both on the upstream (approach) side

[72] James Leffel & Co., *Construction of Mill Dams: And Bookwalter's Millwright and Mechanic* (Springfield, OH: James Leffel & Co., 1881), 55.

and the downstream (descent) side) to reduce the destructive force of the water against the dam structure and below it. Examples of ramping, whether upstream or downstream, are present at almost every subject dam on the Lower Brandywine.

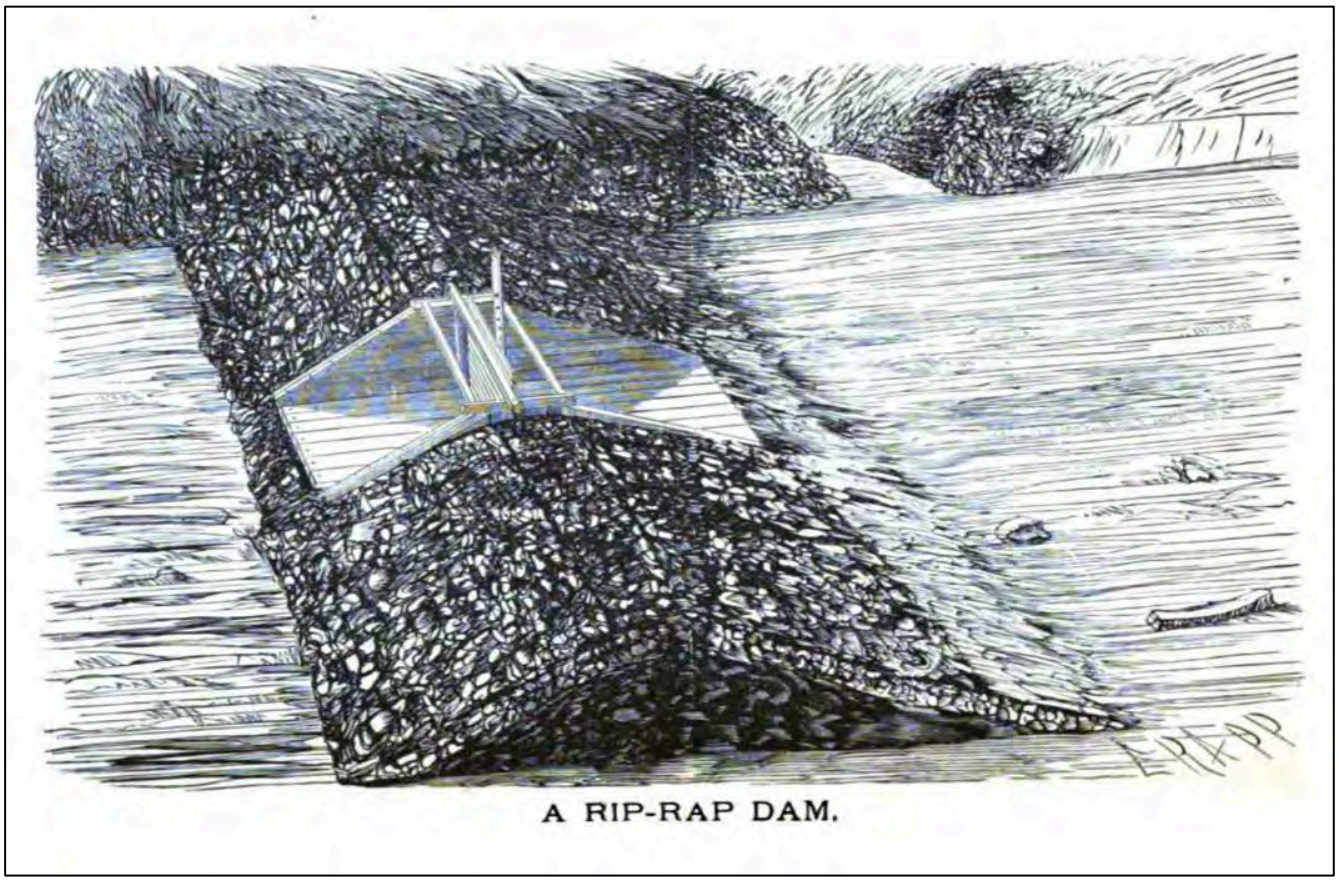


Figure 13. Example of dam with both ascending and descending ramps. ("A Rip-Rap Dam," James Leffel & Co. *The Construction of Mill Dams,* 1874, page 42)

Bows or Bow-Like Shapes

For any dam of a "more solid structure," one of Leffel's first recommendations was that dams be "substantially built of stone, and stretched across the river in the form of a bow, the curve being against the current—the middle of the dam, in other words, being higher up the stream than the two ends."[73] If anchored at the banks by "massive stone abutments," the dam would feature "firm resistance to the onset

[73] James Leffel & Co., *The Construction of Mill Dams: Comprising Also the Building of Race and Reservoir Embankments and Head Gates* (Springfield, OH: James Leffel & Co., 1874), 9.

of a flood," proving more stable, reliable, and requiring less repairs.[74] A bow shape, which essentially employed the structural strength of the arch, but horizontally against the powerful current of a river's flow, making it less likely to wash out or require timely and expensive repairs. A bow shape, or similar arrangement where the middle of the dam was further upstream, also had the effect of channeling water towards the edges of the rivers—providing increased flow towards the mouths of mill races. The design of several of the dams on the Lower Brandywine employed some form of this general design principle, whether bows or half-hexagons, including Dams 2, 3, 4, and 6.

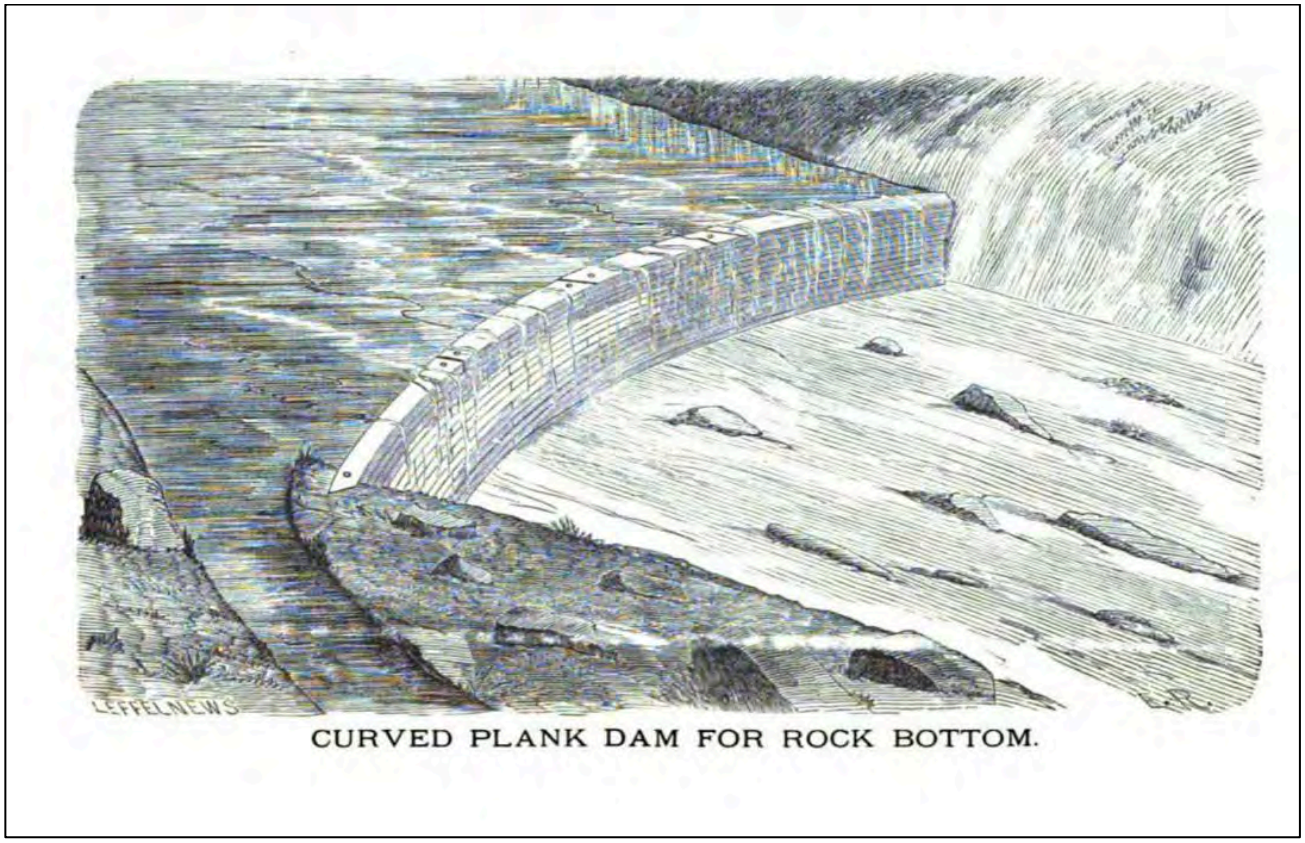


Figure 14. Example of a curved bow. ("Curved Plank Dam for Rock Bottom," James Leffel & Co. *The Construction of Mill Dams,* 1874, page 95)

[74] Leffel, *The Construction of Mill Dams: Comprising Also the Building of Race and Reservoir Embankments and Head Gates*, 9.

Stone Abutments & Bank Walls—Manmade & Natural

Abutments are critical components of most dams, essentially anchoring the dam against either side of a riverbank and often holding the primary span of the dam in place. Leffel notes in describing one abutment type that it had "the effect to hold the dam in its place and prevent it from being lifted or moved forward by the force to the current."[75] Most of the dams in the study area feature either natural stone abutments, or stone wall abutments. The 1902 iteration of Dam 2 is constructed with concrete abutments, or wing walls, on both sides of the River, with portions of stone walls visible from its earlier 1885 iteration. Dam 3 is constructed with stone walls on both sides of the river, while Dams 4, 5, and 6 feature a combination of both natural and stone walls.

"Low Head" Dams

The "head" of a dam is the height differential between the top of the reservoir of water above the dam to the surface of the river below the dam. The Lower Brandywine dams, like most of those built before the twentieth century, tend to be "low head" dams, rising only a few feet in height, with water typically flowing over the full length of the crest. Nearly all historical dams used for small-scale industry were low-head dams, and "high head" dams, which are usually greater than 10 feet high and often formed of concrete, are often used for storing water or for generating electricity.[76]

[75] Leffel, *The Construction of Mill Dams: Comprising Also the Building of Race and Reservoir Embankments and Head Gates*, 27.
[76] Sigrid Arnott, Douglas A. Birk, and David Maki, *Evaluating Minnesota's Historic Dams: A Framework for Management* (Minneapolis, MN: Archaeo-Physics LLC, 2013), 3.

Typology of Lower Brandywine Dams

Field study of the Lower Brandywine dams reveals that most of them feature unique designs, often incorporating some or all of the design tendencies described above. However, several sub-types of stone dams are present, and a single concrete dam type, distinguished primarily by their overall form.

Ascending Ramp Dam

The character-defining feature of this dam is a ramp located upstream of the dam itself, rising gradually to the crest of the dam wall. The ramps themselves could be constructed of many different materials, including stone, planks, logs, rubble, or a combination of these elements. The ramping for dams in the study area is not typically fully visible, but stone appears to have been the primary construction material, often with plank facing boards to create the ramp surface on top. The shape of upstream ramp dams can be bowed or straight. The 1885 iteration of Dam 2 as well as Dam 6 are examples of bowed Ascending Ramp dams, while Dam 5 is an example of a straight Ascending Ramp dam.

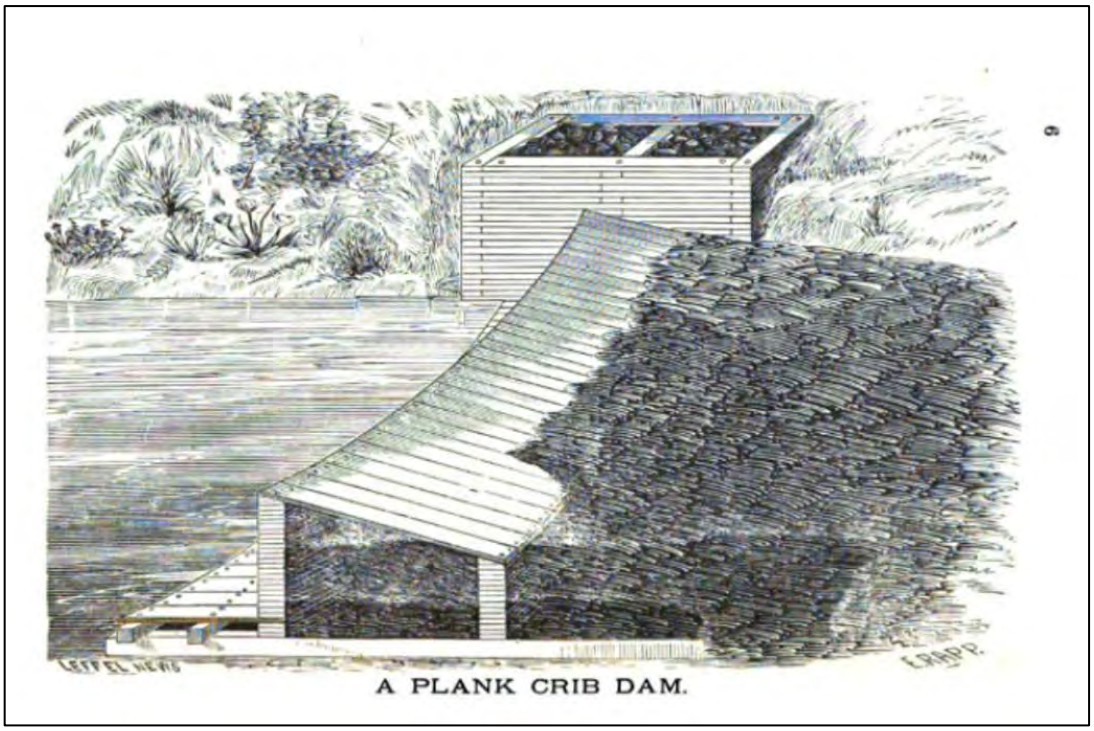


Figure 15. Example of an ascending ramp dam constructed of plank. ("A Plank Crib Dam," James Leffel & Co. *The Construction of Mill Dams,* 1874, page 73)

Descending Ramp (Apron) Dam

The character-defining feature of a Descending Ramp (Apron) Dam is a ramp ("apron") located on the downstream side of the dam. These descending ramps could be constructed of many different materials, including stone, planks, logs, rubble, or a combination of these elements. The ramping for dams in the study area is not typically fully visible, but stone appears to have been the primary construction material in the Lower Brandywine dams built in this type. The shape of the dam can be curved or bowed. Dam 3 and the 1896 portion of Dam 4 are both examples of bowed stone apron Descending Ramp dams.

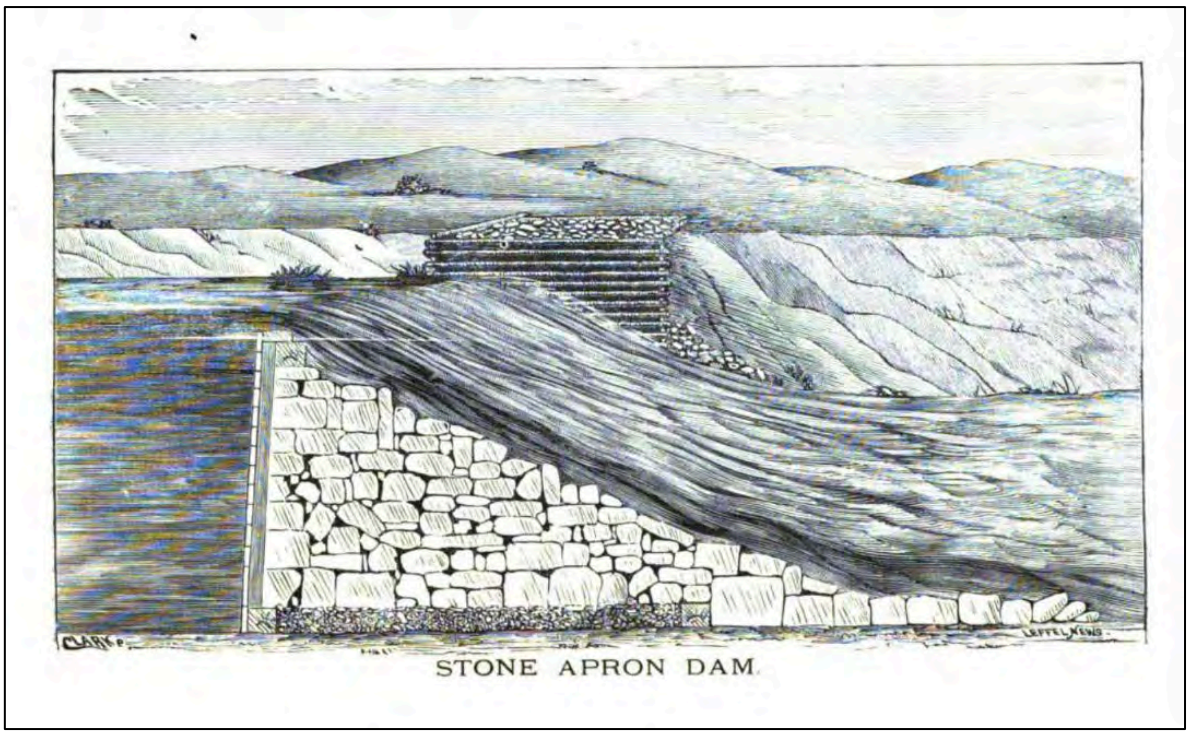
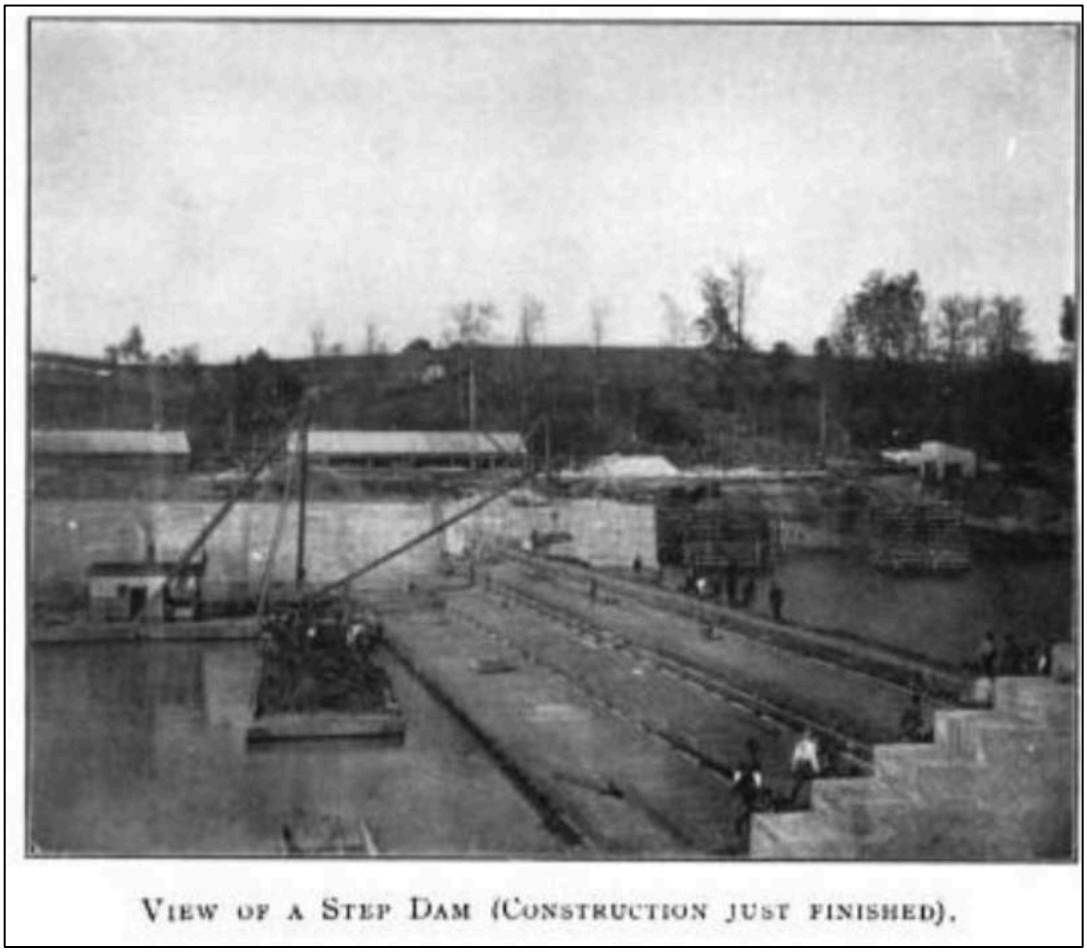


Figure 16. Example of a descending (apron) ramp dam constructed of plank. ("Stone Apron Dam," James Leffel & Co. *The Construction of Mill Dams*, 1874, page 229)

Stepped Dam

The character-defining feature of a stepped dam is a stair-stepped form that can be located upstream, downstream, or both upstream and downstream of the dam, acting as either a ramp or an apron. The stepped profile acts to either raise the water level gradually, or prevent washouts, or both. The 1902 iteration of Dam 2 is an excellent example of a stepped concrete dam.



VIEW OF A STEP DAM (CONSTRUCTION JUST FINISHED).

Figure 17. Example of a stepped dam. ("View of a Step Dam," B.F. Thomas, *Improvement of Rivers,* page 201)

Integrity Requirements for Mill Dams Along the Brandywine

In order to be determined as eligible for listing in the National Register of Historic Places, the dams of the Lower Brandywine River must retain several aspects of integrity as defined by the National Park Service. All dams must retain at least four of the seven aspects of integrity, including location, design, materials, and workmanship. Additionally, various types of ancillary structures and features are typically associated with mill dams, such as mill races, head and sluice gates, abutments (natural or created), retaining walls, buildings connected to milling operations, etc. Though distinct from the dam itself, when retained, these structures and features enhance the integrity of the dam site, more properly situating it within its historical setting.

Location: Over the course of centuries, the exact locations of some of the dams along the Brandywine have shifted slightly during rebuilding campaigns. Of the extant dams, many exhibit evidence of multiple construction periods, sometimes with multiple dam structures from different periods built directly adjacent to one another, or atop one another, resulting in essentially a single structure embodying multiple historical periods. To retain integrity of location, a dam must retain its location from its last significant construction campaign.

Setting: To retain integrity of setting, the physical environment of a dam must remain relatively unchanged or be sufficiently similar or compatible to that of its historic period. For example, the dam is located on its original waterway, and the topography and current land use has not changed so significantly that it compromises the historic sense of the dam site or its ability to convey historic associations. While the particular setting of each dam will vary, there will always be evidence of alterations to the natural environment. The integrity of setting for the dams will be enhanced by the retention of buildings or structures—other milling property types—that directly relate to each or were present during its historic period, such as mill races, head gates, abutments (natural or created), retaining walls, buildings connected to milling operations, etc.

Design: For the above-described dam types, strong evidence of its original design must still be legible on the landscape today. While some dams have been repaired or modified over time in order to remain

operable, the features discussed above that provide key shape, form, and structural unification to the dams—including ramps, bows, and abutments—must still be reflected in the extant remains of the subject dam.

Materials: The primary construction material must be present and not replaced by modern materials. The presence of other later material layers and components, such as concrete encasement (especially when used for stabilization), does not constitute a loss of material integrity. Instead, it displays adaptation over time and material evidence of continued use.

Workmanship: Where stone is the primary structural material, dams along the Brandywine must retain evidence of stone coursing or laying of the stones. Evidence of coursing, from thrown stone to ashlar masonry, must be visible—essentially, the purposeful placement of the masonry must still be visible whatever the method. Poured concrete dams retain integrity of workmanship if they still retain their original, poured concrete shape, and the material (concrete) is still evident today. Other elements that may be present and show surviving evidence of workmanship include wood planking affixed with stakes, stones joined with iron staples or strapping, and quarry marks to shape stone before construction.

Feeling: In order to retain integrity of feeling, a dam property should maintain enough of its physical components of integrity to sufficiently convey its historic context to the period of building and use. Feeling reflects a historic sense of place and function. With sufficient physical integrity, one with a basic understanding of mill dams should be able to "read" the landscape and infer the dam property's historic use.

Association: All the dams along the Brandywine River were originally constructed to power mills, with the exception of the 1902 portion of Dam 2, and thus associated with the industrial history in the Brandywine River corridor. Evidence, whether archival, photographic, pictorial, or physical (i.e., through extant structures) must exist to establish this primary function for each individual dam. Due to development pressures and the obsolescence of these industries, many of the associated industrial structures do not survive. However, if the association between the dam and the industry can be documented through newspapers, photographs, and historic maps, this provides enough integrity of

association to understand the dam's relationship to industry. For dams that are not associated with an industrial function (i.e., Dam 2, which provides municipal water supply for the City of Wilmington), archival and pictorial documentation of another significant historical use (as well as continued use) provides adequate evidence of integrity of association.

Resources Related to Mill Dams

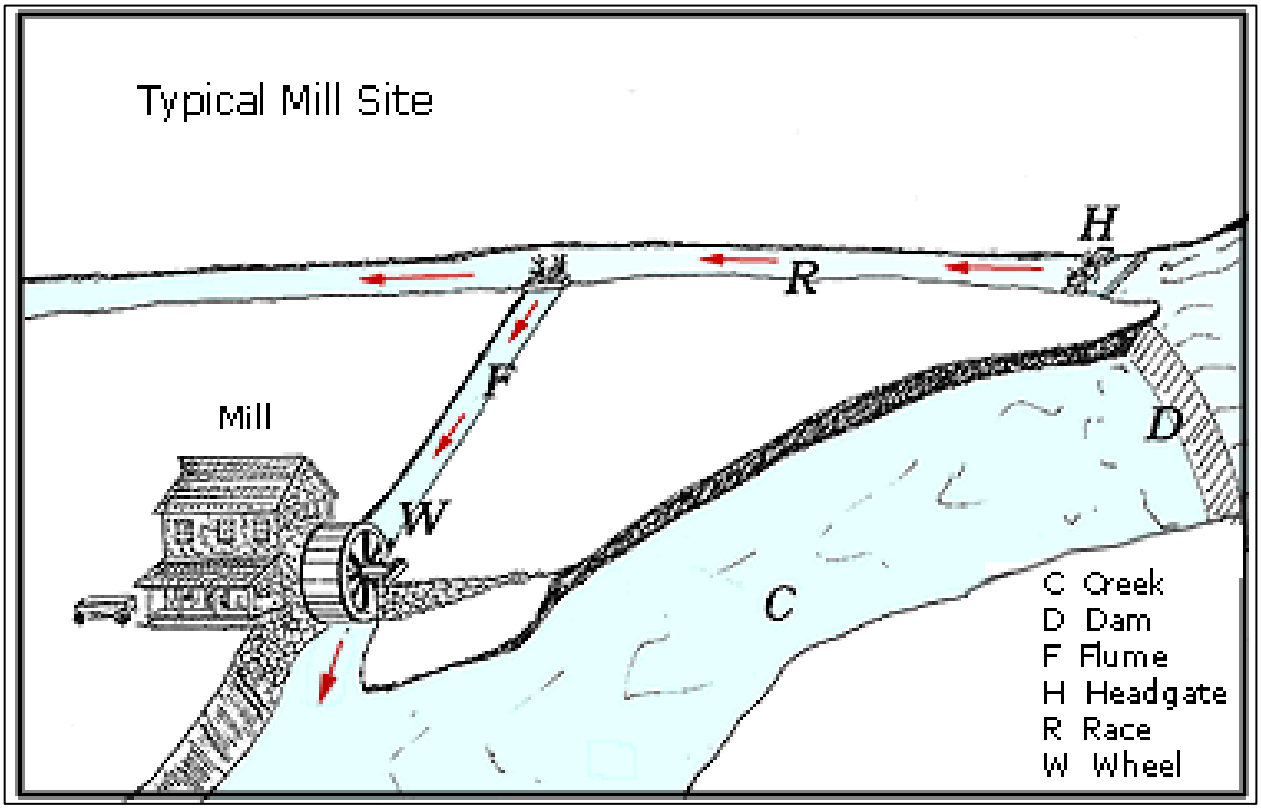


Figure 18. Diagram of a Typical Mill Seat, by Robert A. Howard in "Waterpower: How it Works." (Hagley Museum and Library)

Mill Race

A mill race is a man-made water channel that conveys water from a river to a mill site. The mouth of a mill race usually originated above a dam, and the mill race terminated below the mill site where it returned water to the river. Mill races were often constructed informally as a simple earthen ditch or trench, though sometimes they were designed more formally and in stone, especially directly adjacent to the mill works. A mill race could be as short as a few feet, or as long as several miles. Mill races were often used to power only a single mill, but if enough waterpower was available, they were sometimes

utilized by multiple mills that drew from a single mill race (with each mill having an individual flume or sluiceway drawing water from the shared mill race). The portion of a mill race above the mill was called a head race, while the portion below the mill was called the tailrace.

Head Gates

At the head or mouth of the mill race, above the dam, a head gate was often constructed to control the amount of water entering the mill race. Adjacent to the head gate, a trash rack or debris screen was frequently constructed to prevent logs, sticks, and other debris from entering and clogging the mill race and damaging the mill's waterwheel.

Control Gate/Sluice Gate

Further down the mill race, directly adjacent to the mill or its flume, a second gate called a control gate or sluice gate regulated the water flowing into the mill and waterwheel. This control gate could be opened to power the waterwheel and mill by allowing it to flow through the mill flume, or the gate could be closed to allow the water to bypass the mill and remain flowing in the mill race and returned to the river.

Sluice/Sluiceway/Flume

Though terminology varied from region to region, and evolved over time, a channel drawing water from a mill race was often called a sluiceway or flume. On the Brandywine River, where mill races often provided water for multiple mills, these individual channels drew a portion of the water from the mill race, fed by opening an individual sluice gate at the main race. Sluices or flumes were sometimes more formally constructed than mill races, through the use of masonry, for example, in order to better control water flow and provide structural stability. A "flume" almost always referred to the highly controlled water flow directed to the water wheel or turbine, and usually implies a more rapid, directed water flow. A "penstock" refers to a pipe that acts as a flume.

PROPERTY AND EVALUATIONS

Dam 2 Complex: Upper Dam and Race (N01566.024)

Tax ID: East bank: 2601410006 (City of Wilmington) / West bank: 201340075 (City of Wilmington)
Geographic Coordinates: 39.75868, -75.55502
Date of Construction: 1902, with partial 1885 dam structure
Eligibility Recommendation: Eligible

Description:

Dam 2, known as Upper Dam and City Dam, was completed in November 1902 by the City of Wilmington Water Department, under the direction of New York consulting engineer Charles A. Hague.[77] Hague advised that the dam should be "built up to the ends of the present dam," which had been reconstructed in 1885 and determined to be in poor repair and at imminent risk of failure.[78] Daniel Dohl, keeper of the city reservoirs, was in charge of the project to construct the new dam.[79] Documentation from that time describes the construction of a "stone and concrete dam directly below the present dam straight across the stream, with wing walls at each end of the new work to protect the present shoulders and confine ordinary floods to the crest of the dam and prevent the continual wash which takes place at and under the shoulders."[80] The stone to be used in the construction was to be "Brandywine granite" (Brandywine Blue Gneiss) collected from the immediate vicinity, and the dam was designed in the shape of steps and of solid masonry. The design indicated a base of 16 feet with a run of four feet, with the steps rising two feet high and being a half foot wide.[81] As a result of the stepped dam design, Hague explained that "water would be carried over the dam with less destructive effects than with the present form."[82]

[77] "New Dam Finished," *Morning News*, November 24, 1902.
[78] "New City Dam," *Every Evening*, August 27, 1902; "Local Points," *Morning News*, September 18, 1885.
[79] "The New Dam," *Every Evening*, August 28, 1902.
[80] "Engineer Says Dam is Unsafe," *Evening Republican*, September 10, 1902.
[81] "Work on New Dam," *Morning News*, August 29, 1902; "Engineer Says Dam is Unsafe," *Evening Republican*, September 10, 1902.
[82] "Engineer Says Dam is Unsafe," *Evening Republican*, September 10, 1902.

Visual inspection in November 2021 evidences a straight, stepped concrete dam with concrete wing walls. (Stone is not readily visible as part of the dam's construction, though it is presumably part of the structure, as documented during its construction, and covered in concrete.) The dam extends approximately 154 feet across the river with a fall of six to seven feet. An arched concrete cap runs along the full length of the crest, set atop the first and highest step, with metal I-beams abutting and reinforcing the cap. Historic as well as more modern photographs of Dam 2, during periods of particularly low water levels in the Brandywine, document three concrete steps on the downstream (southeast) side of the dam, with a bedrock of Brandywine Blue Gneiss (figures 20-22). A photograph from 2002 also evidences that the year 1902 is stamped in concrete on the downstream face of the first step, towards its western end.

As described in documentary evidence from 1902, the present dam appears to have been built immediately in front (to the southeast) of the previous dam, which was reconstructed at the site in 1885 by the William Lea & Sons Company.[83] This earlier iteration of the dam was constructed as a type of ascending ramp, bowed, timber-braced stone dam, seemingly fixed along its crest with a light covering of cement. The extant portion of the ascending ramp, stone dam arcs across the river forming a half hexagonal shape or type of "bow," which may have served to channel water toward the northern and southern mill races. The photographs from 2002 show apparently loose stones resting within the shallow cavity or reservoir formed between the ascending ramp, stone dam and 1902 stepped concrete dam. During planning for the 1902 dam, the 1885 dam was described by Hague as being "built with a top spring piece and a vertical plank front at the downstream face of the dam. Back of this face there is a rough filling, paved as far as I could see, and perhaps entirely formed of stone speels. This filling is probably loosely put in place and is in some places open…."[84] In describing its condition, he noted that the "string piece and planking at the front is slowing rotting away and the braces of timber as well; one or two of these timber braces have disappeared entirely…."[85] A November 1885 photograph (figure 24) shows the dam just after its rebuilding by William Lea & Sons company, illustrating its half hexagonal shape and timber bracing.

[83] "Local Points," *Morning News*, September 18, 1885.
[84] "Engineer Says Dam is Unsafe," *Evening Republican*, September 10, 1902.
[85] "Engineer Says Dam is Unsafe," *Evening Republican*, September 10, 1902.

The northeastern wing wall measures approximately 75 feet in length and reflects several periods of concrete construction or repair. The wall appears to at least partially incorporate an earlier stone wing wall associated with the ascending ramp, stone dam built in 1885, with some stones visible at the northwestern end of the concrete wing wall. The southeastern end of the wing wall terminates with three concrete steps, leading down into a now boulder-strewn area along the bank.

Extending northeast from the northern concrete wing wall of the dam is a rubble concrete wall that formerly housed the head gate for the now filled in northern mill race, with the space for the head gate closed in with a concrete patch. Long iron straps with bolts secure coursed rubble stones that survive as part of the earlier walls of the infilled northern mill race. Loose rubble stones and boulders are strewn immediately below (southeast of) the rubble concrete wall that housed the head gate. Extending further northeast of the concrete head gate wall is an earlier low concrete retaining wall, measuring about 27 feet long and two feet and five inches wide.

The remnant of a concrete fish ladder, constructed in 1969, is located on the northeastern side of the dam, comprising a partially ruinous rubble concrete wall with visible slots or tracks for wooden baffles. It is constructed against and parallel to the dam's concrete wing wall, with an imbedded metal I-beam running along its southern top edge and rebar protruding from its partially deteriorated northwestern end. The fish ladder was later partially dismantled with the removal of its southwestern concrete wall, prior to 2007, due to trash becoming caught in it.[86] Its concrete ramp remains extant and is clearly visible. The fish ladder was originally designed with two 24-foot runs, with a resting pool at its halfway point.[87]

On the southwestern bank of the dam is a poured concrete wing wall incorporating a three-tiered, poured concrete platform with metal rails associated with the City of Wilmington's water filtration plant, measuring roughly 60 feet long by 20 feet wide. The modern metal and concrete head gate for the dam's

[86] Molly Murray, "Plan to Restore Natural Habits," *News Journal*, January 24, 2007.
[87] "Shad Ladder Construction Started," *Morning News*, May 7, 1969.

southern race is housed between the northwestern end of the wing wall and a poured concrete abutment and retaining wall running along the southwestern bank. A trash rack, or debris screen, rests on the surface of the water and extends from the northwestern end of the wing wall to the adjacent bank, guarding the head gate. A poured concrete catwalk spans the head gate and is also guarded by modern metal rails and a gate to limit unauthorized access. The wing wall and platform incorporate an earlier stone wing wall, evidenced by photographs from 2014-2015 during renovations of the head gate and mill race conducted by the City of Wilmington Department of Public Works. At the southeastern end of the wing wall and platform are six poured concrete steps leading to a poured concrete spillway spanning approximately 35 feet, with rubble stones below it and along the edge of the river. Located approximately 50 feet to the southeast of this spillway is the Combined Sewer overflow (CSO), which is covered by another large, poured concrete platform guarded with modern metal rails. The CSO is about 33 feet wide with one foot wide rubble concrete sidewalls.

The walls of the southern mill race are constructed of rubble stone capped with later layers of high macadam and rubble concrete. These walls are approximately two feet wide, while the raceway spans about 16 to 17 feet. Beginning approximately one foot below the capped stone walls of the race (not visible with typical water levels in the race) is a poured concrete lining, which was installed in 2014-2015 during the City of Wilmington Department of Public Works' restoration project for the water filtration plant and raceway (figures 29 and 30).[88] From the head gate, the southern race extends southeastward for approximately one mile to the water filtration plant.

[88] The Delaware State Historic Preservation Office holds photographs of this restoration project, available through the Cultural and Historic Resources Information System: https://chris-users.delaware.gov/.

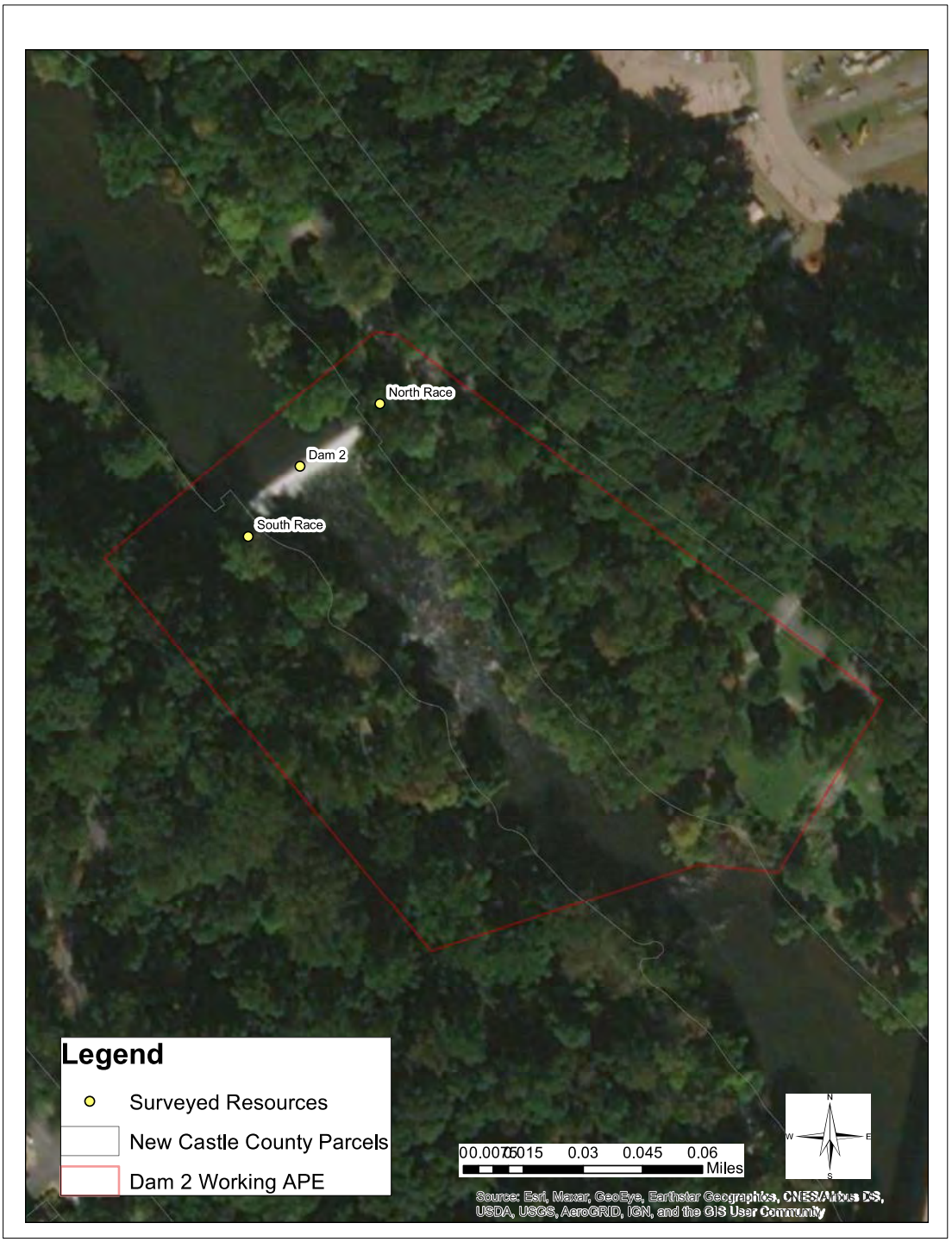
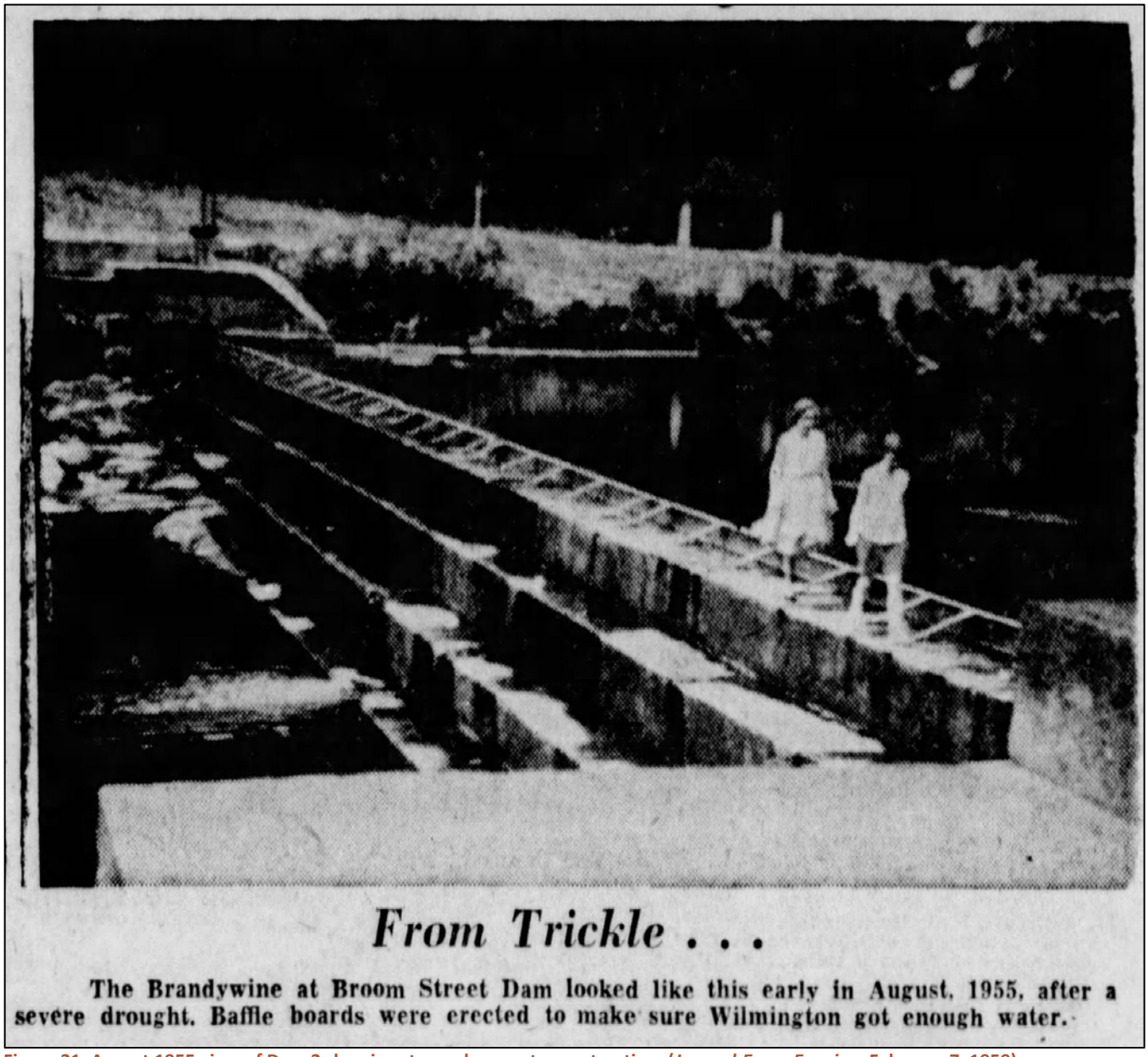


Figure 19. Location map of working APE at Dam 2. (Center for Historic Architecture and Design)

Figure 20. View of stepped concrete construction of Dam 2 in 1904, looking north with B&O Railroad bridge in distance. (Frank R. Zebley photograph albums, Hagley Museum and Library)



From Trickle . . .

The Brandywine at Broom Street Dam looked like this early in August, 1955, after a severe drought. Baffle boards were erected to make sure Wilmington got enough water.

Figure 21. August 1955 view of Dam 2 showing stepped concrete construction. (*Journal-Every Evening,* February 7, 1959)

Figure 22. View of Dam 2 during low water flow, showing stepped concrete construction, looking north, 2002. (Water Resources Center, University of Delaware)

Figure 23. View of half-hexagon bow construction of the c. 1885 dam behind the current Dam 2, 2002. (Water Resources Center, University of Delaware)

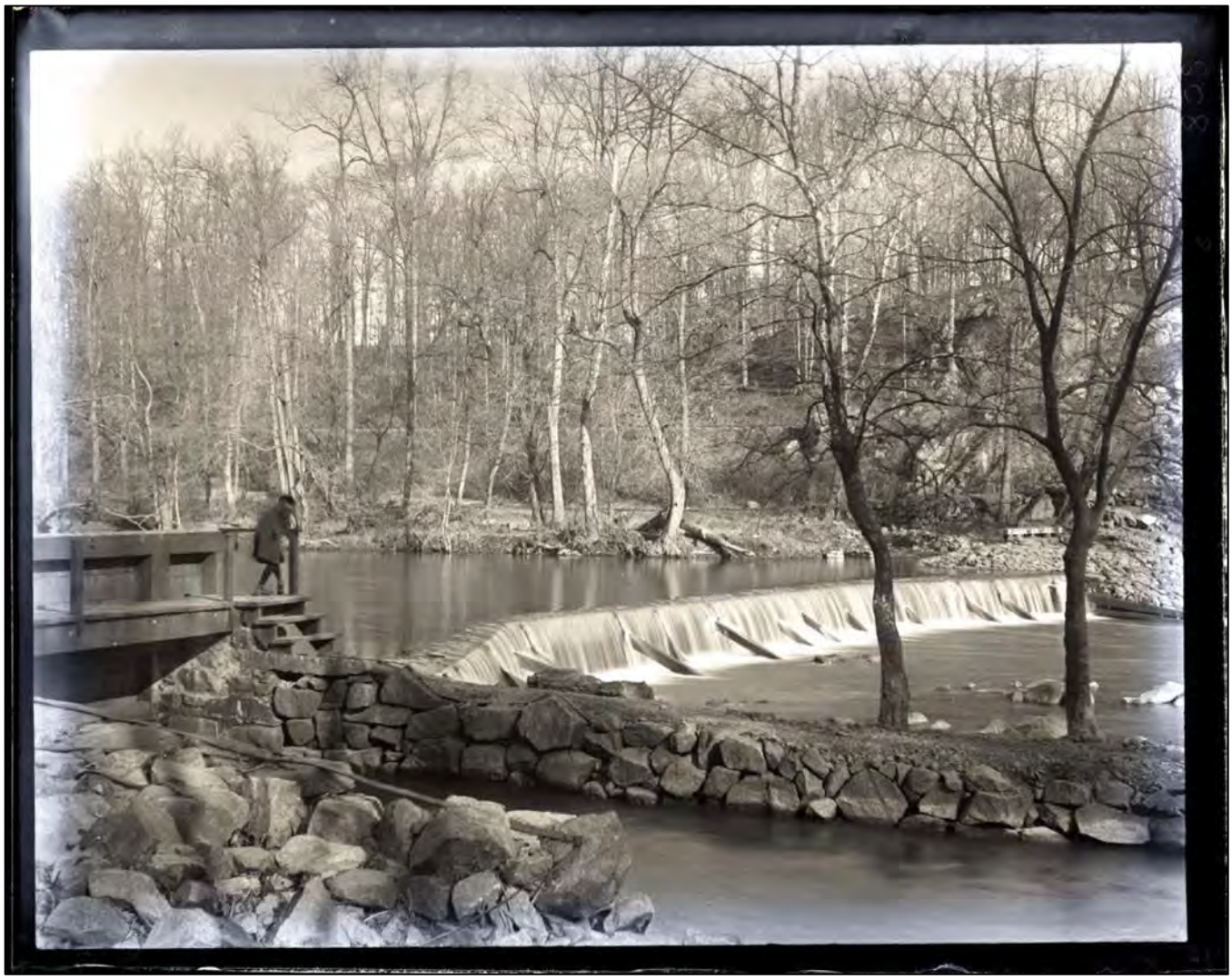


Figure 24. View of Dam 2 on November 26, 1885, soon after its reconstruction by the William Lea & Sons Co., photograph by Marriott Canby Morris. (Library Company of Philadelphia)

Figure 25. View of Dam 2 (Upper Dam), looking northwest, 2021. (Center for Historic Architecture and Design)

Figure 26. View of Dam 2, showing the southern mill race in the foreground, looking north, 2021. (Center for Historic Architecture and Design)

Figure 27. View of Dam 2, looking north across to northern banks and filled in northern race, 2021. (Center for Historic Architecture and Design)

Figure 28. View of the southern mill race, looking southeast, 2021. (Center for Historic Architecture and Design)

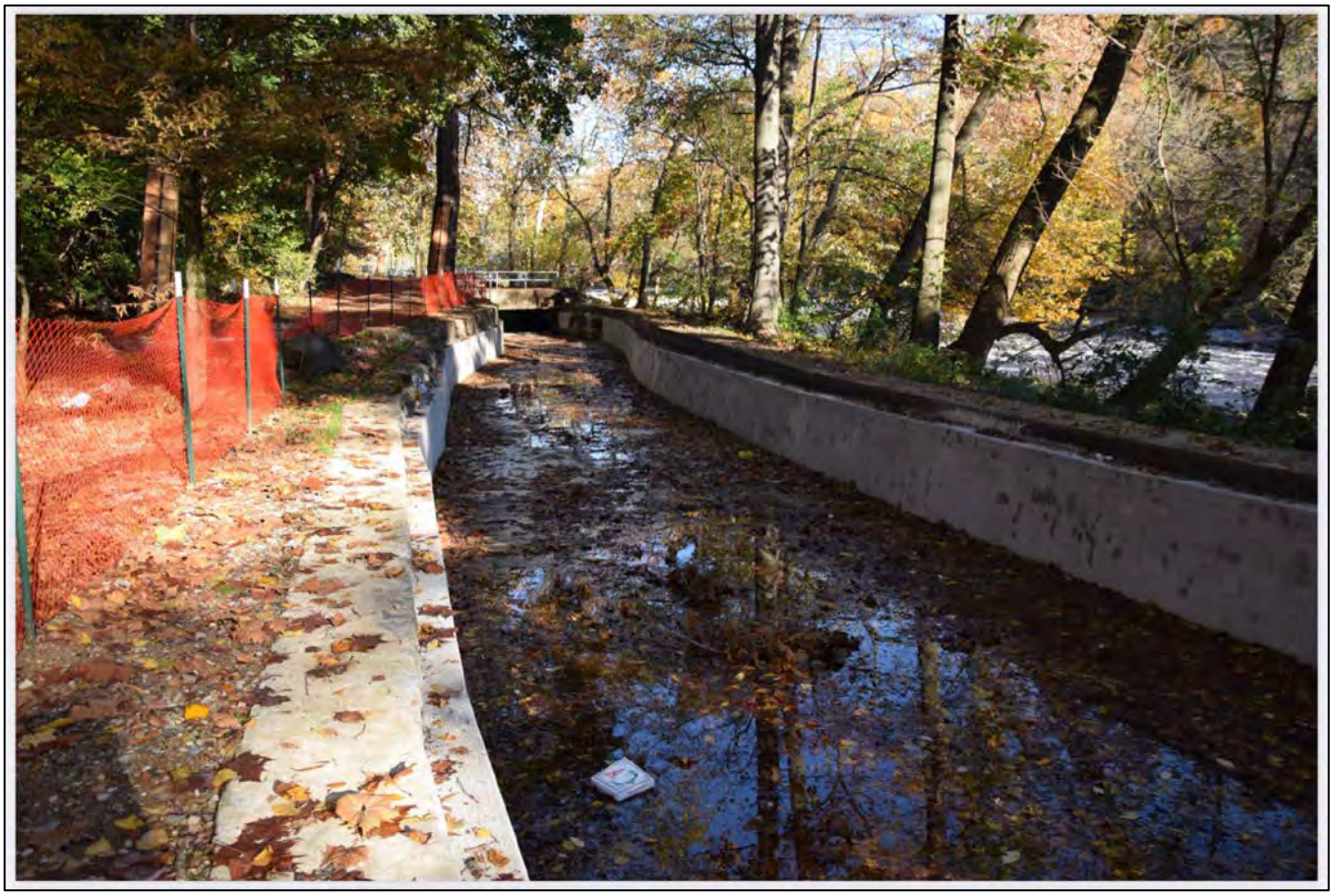


Figure 29. View of the southern mill race, south of Dam 2, looking northest, 2015. (John Milner and Associates, "Mitigation for Proposed Upgrades at the Brandywine Filtration Plant and Raceway")

Figure 30. View of the southern mill race, south of Dam 2, looking west, 2015. (John Milner and Associates, "Mitigation for Proposed Upgrades at the Brandywine Filtration Plant and Raceway")

Figure 31. View of infilled northern mill race, with quarried stone and bolted iron straps still visible, 2021. (Center for Historic Architecture and Design)

WILMINGTON, DELAWARE, WEDNESDAY, MAY 7, 1969

Staff Photo by Frank Fahey

Shad ladder construction started

Workmen drill and pound for foundations of a fish ladder in the Brandywine at Broom Street. The dam here will provide a reservoir for the Wilmington water department. It will have a 6-foot rise. The plan is for a 24-foot run, to a resting pool halfway up, then another 24-foot run for the shad to the top of the dam. This run will parallel the dam. This project is twinned with a dam at West Street. Both are to be completed Sept. 1. Low bidder was Eastern States Construction Co., Elsmere, at $98,884. Ten more dams are to be built sequentially upstream on the Brandywine into Pennsylvania.

Figure 32. View of Dam 2 in 1969 with fish ladder under construction. (*Morning News,* May 7, 1969)

Historic Context:

Hundred: Wilmington; *Quadrant:* Wilmington North; *Geographic Zone:* Piedmont; *Time Period:* Urbanization and Early Suburbanization, 1880-1940+/-; *Historic Period Themes:* Manufacturing; Settlement Patterns and Demographic Changes; Architecture, Engineering and Decorative Arts

History:

Dam 2, known as Upper Dam and City Dam, is located in Brandywine Park, with the earliest dam at this site dating to 1762.[89] It is associated with two long mill races, one on each side of the Brandywine River, which initially powered merchant flour mills further downstream near tidewater, just east of Market Street Bridge. In 1760, millers Daniel Byrne and William Moore planned for the construction of a mill near the foot of modern day French Street, "the first to be built downstream from the rapids in the navigable portion of the river."[90] Powering the mill, which would utilize an overshot wheel, necessitated a long mill race in order to "raise the elevation of the race water to a height sufficient to turn" the wheel.[91] Miller Thomas Shipley was also preparing to construct an overshot mill at tidewater and paid some of the costs associated with building and maintaining the race. Landowners along the south bank of the Brandywine, including Timothy Stidham and the Vandever family, were also compensated for the use of the property in the construction of the race. Another miller, William Marshall, constructed a new dam (Dam 2) for the race to the south of Rattlesnake Run, at the foot of modern-day Broome Street, and upstream from the dam formerly located at West Street (historically known as Lower Dam, which also powered the merchant mills at tidewater). By the end of 1762, the southern race was complete, and construction was underway for four overshot mills.[92] During this same period, a bridge was also constructed at tidewater, crossing at modern day North Market Street, to better connect Wilmington to farms northeast of the city as well as Philadelphia.[93]

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[89] Historically, this dam was the third dam upstream from tidewater and was often also referred to as such.
[90] Carol E. Hoffecker, *Brandywine Village: The Story of a Milling Community* (Wilmington, DE: Old Brandywine Village Inc., 1974), 22.
[91] Hoffecker, *Brandywine Village*, 22.
[92] Hoffecker, *Brandywine Village*, 22.
[93] Hoffecker, *Brandywine Village*, 23-24.

Following the construction of the south race, and after the construction of the bridge spanning the Brandywine, William and James Marshall initiated the construction of another long race along the northern bank, which was rockier and proved a greater engineering challenge. A 1769 indenture evidences the Marshalls' plans, with an agreement to compensate landowner Tobias Vandever and others, and indicates the intent to construct said race in order to provide power to turn four overshot mills at tidewater, as well as building two for themselves.[94] However, the Marshalls realized that, given the difficulties in digging a long race along the north bank, they were financially under resourced to see it to completion. As a result, in 1770, miller Joseph Tatnall, "a relative with more considerable means who was destined to be one of the most important millers ever to operate along the Brandywine," took over the project.[95] In order to finance the completion of the north race, he sold shares in mills on the south bank. Within two years, there were four tidewater mills powered on the north bank, two of which Tatnall owned, with interest held in a third. Brandywine Village, a residential milling community, formed along the north bank of the Brandywine adjacent to the bridge crossing. Tatnall and James Marshall were among the first to build homes there, with dwellings located at 1801 and 1803 N. Market Street, respectively, each constructed of Brandywine Blue Gneiss, which was likely sourced from excavations from the north mill race.[96]

Between about 1772 and 1816, the tidewater mills, which became collectively known as the Brandywine Mills, grew from eight (with four on either side of the river) to 14.[97] Along with Joseph Tatnall, who partnered with his son-in-law Thomas Lea, other early owners of the mills are recorded as Cheney Broom, John Buckley, William Canby, George Evans, Joshua Gilpin, John Morton, William Poole, and John Welsh.[98] In addition to flour milling, Jacob Derickson also operated a saw mill at Brandywine Village from the late-eighteenth century, though exactly when it was established and for how long it

[94] Hoffecker, *Brandywine Village*, 25.
[95] Hoffecker, *Brandywine Village*, 26.
[96] Hoffecker, *Brandywine Village*, 26.
[97] Welsh, "The Brandywine Mills," 19.
[98] Henry C. Conrad, *History of the State of Delaware: From the Earliest Settlements to the Year 1907* (Lancaster, PA: Wickersham Company, 1908), 418; Peter C. Welsh, "The Brandywine Mills, 1742-1815," Master's Thesis, (University of Delaware, 1956), 17.

remained are unclear.[99] There were also a number of cotton mills, including Thomas Garrett and Jacob Pusey's Wilmington Cotton Works the south side of the Brandywine, in operation during the 1830s.[100] Prior to that and for a brief time, the firm Rodgers & Reeves also operated a cotton spinning business.[101] Another, Arlington Cotton Mills, also known as Eagle Mills, operated on the north side of the Brandywine from around 1830 into the late-nineteenth century.[102]

In the late 1780s, local inventor and engineer Oliver Evans developed the automation of flour milling machinery, a revolutionary industrial innovation of which the Brandywine Mills were early adopters.[103] Production soared, with the mills annually grinding between 300,000 and 500,000 bushels of wheat by the 1790s, shipping "thousands of barrels of Brandywine flour to the four corners of the earth.[104] Surveyors Fairlamb & Read's 1816 *Mill Seats on the Brandywine River* shows the dense cluster of flour mills (figure 34), with owners at that time listed as James Canby, J. Cummings, Thomas Lea, Tatnall & Price, and William Poole & Co.[105] Descendants of these families and others would continue operations until the late-nineteenth century on the south bank and through the early-twentieth century on the north bank.[106] The longest running was the William Lea & Sons Company mills, on the north side, formed after the death of Joseph Tatnall (1811) and later Thomas Lea (1824), which remained in operation until about 1920, selling its water rights to the City of Wilmington in April 1923.[107] On the south side, the last mill company in operation was a joint venture of John Price and Joseph Phillips, running from about the time of the Civil War until 1890, by which time the City of Wilmington had acquired the remainder of

[99] Hagley Museum and Library, *Delaware's Industrial Brandywine*, "Derickson's Mills on the Brandywine," https://www.hagley.org/research/digital-exhibits/dericksons-mills-brandywine.
[100] Hagley Museum and Library, *Delaware's Industrial Brandywine*, "Wilmington Cotton Factory," https://www.hagley.org/research/digital-exhibits/wilmington-cotton-factory.
[101] Hagley Museum and Library, *Delaware's Industrial Brandywine*, "Rodgers and Reeves," https://www.hagley.org/research/digital-exhibits/rodgers-reeves.
[102] Hagley Museum and Library, *Delaware's Industrial Brandywine*, "Arlington Cotton Mills," https://www.hagley.org/research/digital-exhibits/arlington-cotton-mills.
[103] Walter J. Heacock, "Oliver Evans, Ingenious Magician," white paper published July 1955, Hagley Museum and Library (https://digital.hagley.org/islandora/object/islandora%3A2304780/datastream/OBJ/download), 6.
[104] Welsh, "The Brandywine Mills: A Chronicle of an Industry, 1762-1816," 19.
[105] Fairlamb & Read, "Mill Seats on the Brandywine River."
[106] Welsh, Smithsonian report, 683; Douglas C. McVarish, Timothy J. Mancl, and Richard Meyer, "From Creek to Tap: The Story of Wilmington's Public Water System," John Milner Associates, Inc., for City of Wilmington, Delaware (Reading, PA: The Standard Group, 2014).
[107] Zebley, *Along the Brandywine*, 183; Hagley Museum and Library, *Delaware's Industrial Brandywine*, "Thomas Lea's Mills," https://www.hagley.org/research/digital-exhibits/thomas-leas-mills; Hagley Museum and Library, *Delaware's Industrial Brandywine*, "William Lea & Sons Co.," https://www.hagley.org/research/digital-exhibits/william-lea-sons-co.

mill properties on the south side to use the sites as water pumping and filtration stations for the city waterworks.[108]

The City of Wilmington had first begun to acquire property along the Brandywine to use for its waterworks in June 1827. With increasing need for a public water supply and determining that a sufficient amount could only be realized through the diversion of water from the Brandywine, the city purchased the Old Shipley Mill on the south side of the river from then owner John Cummings for $28,000, retrofitting it for use as a pumping station.[109] This had earlier been the site, in the late-seventeenth century, of Swedish immigrant Tyman Stidham's gristmill and then in the early-eighteenth century, the site of Oliver Canby's gristmill, Wilmington's first large gristmill.[110] Utilizing the long southern mill race established in 1762, water was directed to the pumping station, which used an overshot waterwheel to drive a double-acting pump.[111] The city waterworks continued to develop and expand through the nineteenth century, with new and better equipment to meet ever increasing city water supply needs. There were also growing concerns about water contaminants from industry, and in 1870, the city purchased additional land that would eventually become Brandywine Park, following recommendations to create a buffer to prevent pollutants from entering the raceway.[112] In 1872, a new pumping station was constructed on the site of the former one, in order to house a new and larger steam pump.[113] William Lea & Sons Company rebuilt the Upper Dam in late 1885.[114]

In November 1902, the Upper Dam was again rebuilt, under the direction of New York City engineer Charles A. Hague, after the dam was determined unsafe and in need of immediate replacement. Hague recommended to Wilmington's Board of Water Commissioners the construction of "a stone and

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[108] Zebley, *Along the Brandywine*, 179; Hagley Museum and Library, *Delaware's Industrial Brandywine*, "Price and Phillips Mill," https://www.hagley.org/research/digital-exhibits/price-and-phillips-mill.
[109] Zebley, *Along the Brandywine*, 178; Hagley Museum and Library, *Delaware's Industrial Brandywine*, "Shipley Mills," https://www.hagley.org/research/digital-exhibits/shipley-mills; Hagley Museum and Library, *Delaware's Industrial Brandywine*, "Rodgers and Reeves," https://www.hagley.org/research/digital-exhibits/rodgers-reeves; McVarish, Mancl, and Meyer, 25. John Cummings appears in documents with his surname spelled both as Cummings and Cummins.
[110] McVarish, Mancl, and Meyer, 23.
[111] McVarish, Mancl, and Meyer, 27.
[112] McVarish, Mancl, and Meyer, 25.
[113] McVarish, Mancl, and Meyer, 31.
[114] "Local Points," *Morning News*, September 18, 1885.

concrete dam directly below the present dam across the stream, with wing walls at each end of the new work to protect the present shoulders and confine ordinary floods to the crest of the dam and prevent the continual wash which takes place at or under the shoulders."[115] Plans indicated that the dam would be "built of Brandywine granite and cement" and likely "all the stone necessary [would] be found in the immediate vicinity."[116] The dam was to be designed "in the shape of steps" with a base 16 feet wide with a run of four feet.[117]

At the turn of the century and with ever-increasing water supply needs due to continued population and industrial growth, Wilmington's Water Commission planned a large scale expansion of the waterworks, called the Brandywine Water Plant. This complex, first constructed between 1906 and 1910 and in the general footprint of the former south side merchant mills, consisted of a series of neoclassical style buildings including a new pumping station with a boiler room, office, and plumbing shop, along with a filtration plant.[118] The long southern race, fed by the Upper Dam, or City Dam, continues to be utilized today to draw water from the Brandywine into the current Brandywine Pumping Station complex.[119] After the city acquired water rights for the north long mill race in the 1920s, the race carried sewage and surface waters from commercial and industrial properties located upstream, including the Joseph Bancroft & Sons Company and DuPont Experimental Station. In the 1950s, the city implemented a new sewage disposal, treatment, and interceptor system—installing a 48-inch concrete reinforced pipe to redirect the race waters, and subsequently burying the line and infilling the northern race.[120] In 1933, a fire destroyed a large portion of the former Lea Mills buildings on the north side of the Brandywine.[121] The site was ultimately redeveloped into condominiums in the 1980s, built on the stone foundations of the former mill buildings.[122]

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[115] "Says Dam is Unsafe," *The Morning News*, September 10, 1902.
[116] "Work on New Dam," *The Morning News*, August 29, 1902.
[117] "Work on New Dam," *The Morning News*, August 29, 1902.
[118] McVarish, Mancl, and Meyer, 38-39.
[119] McVarish, Mancl, and Meyer, 25.
[120] "Waters of Lea Race Diverted in Start of New Sewer System," *Journal-Every Evening*, March 26, 1951.
[121] "25 Years Ago Today," *Journal-Every Evening*, May 20, 1958.
[122] Maureen Milford, "Chalfonts Defend 'Proud Name,'" *News Journal*, March 13, 1994.

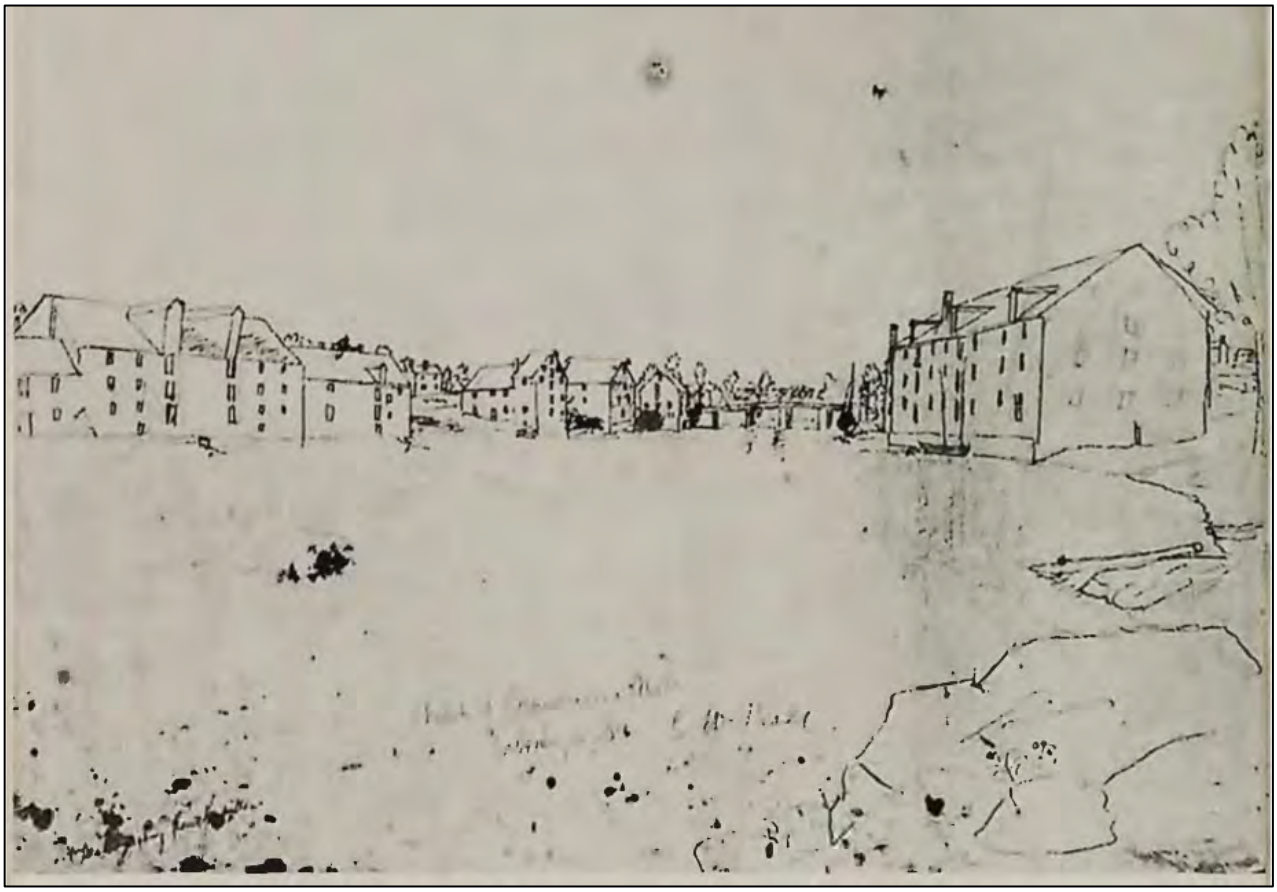

Figure 33. Sketch of Brandywine Mills by Charles Willson Peale, October 23, 1789 (American Philosophical Society via *Brandywine Village: The Story of a Milling Community*, by Carol E. Hoffecker, 1974)

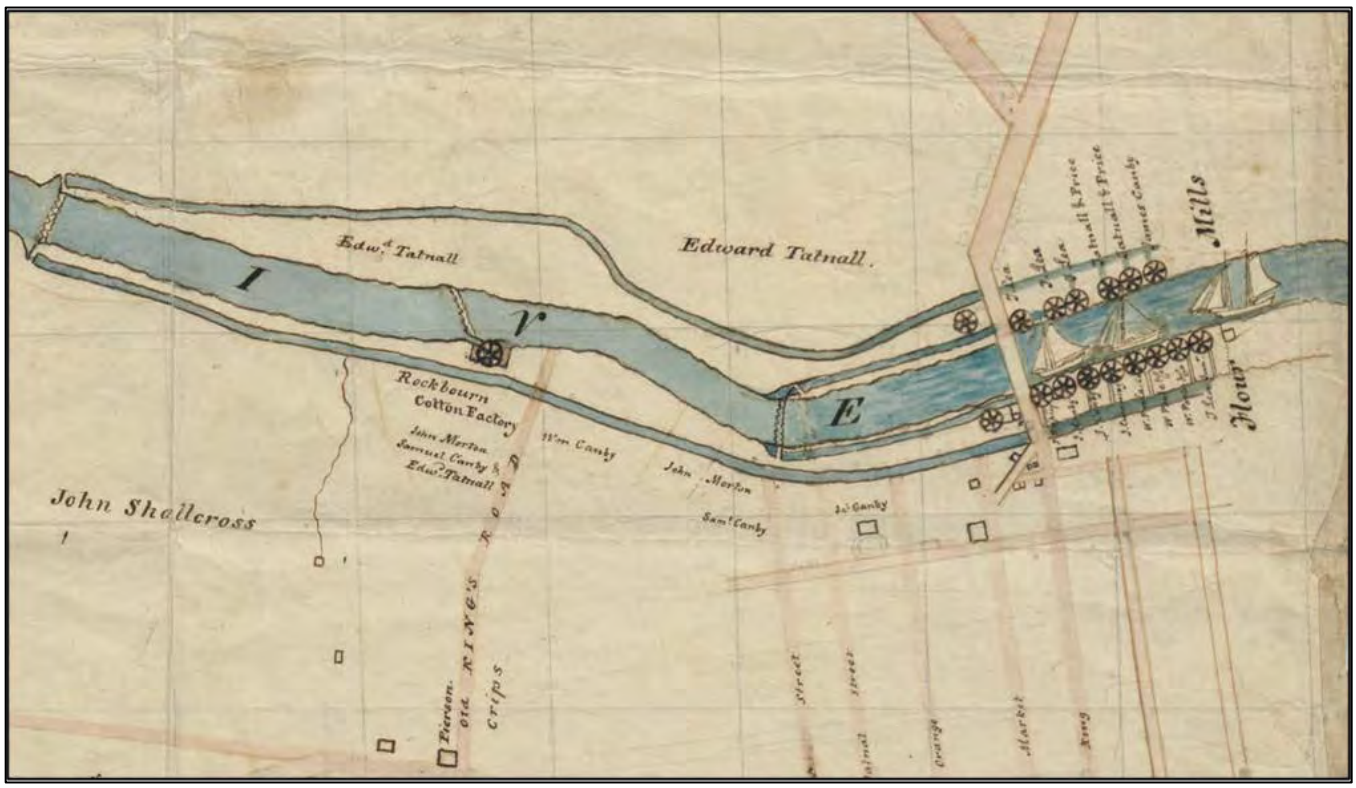

Figure 34. Fairlamb & Read's 1816 *Mill Seats on the Brandywine River* (cropped for detail), showing the dense cluster of flour mills at Brandywine Village, as well as Upper Dam (Dam 2) at the far left and its northern and southern long races, powering the mills downstream.

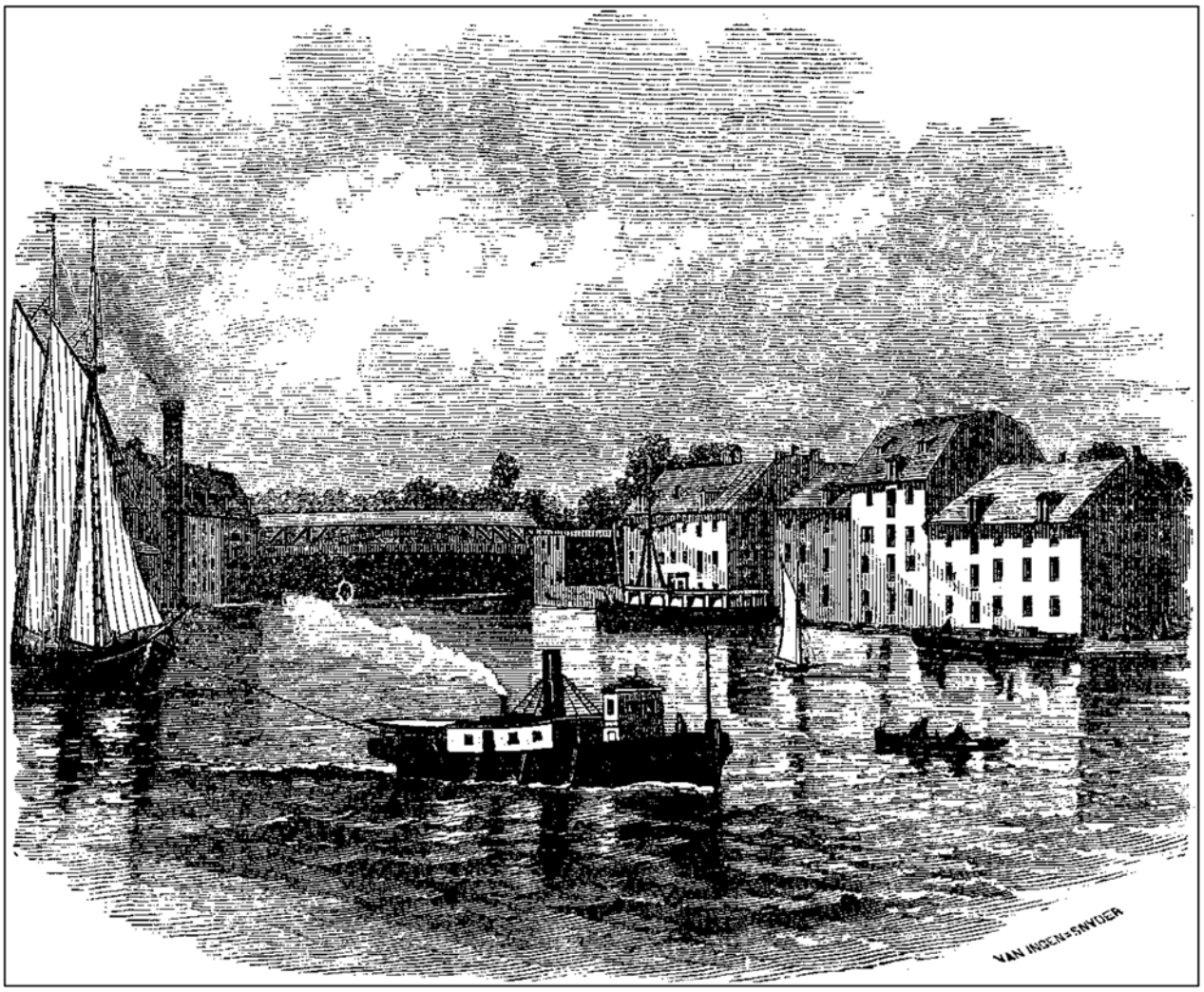

Figure 35. Wood cut of the "Brandywine merchant mills," April 1873. (Lippincott's Magazine of Popular Literature and Science XI)

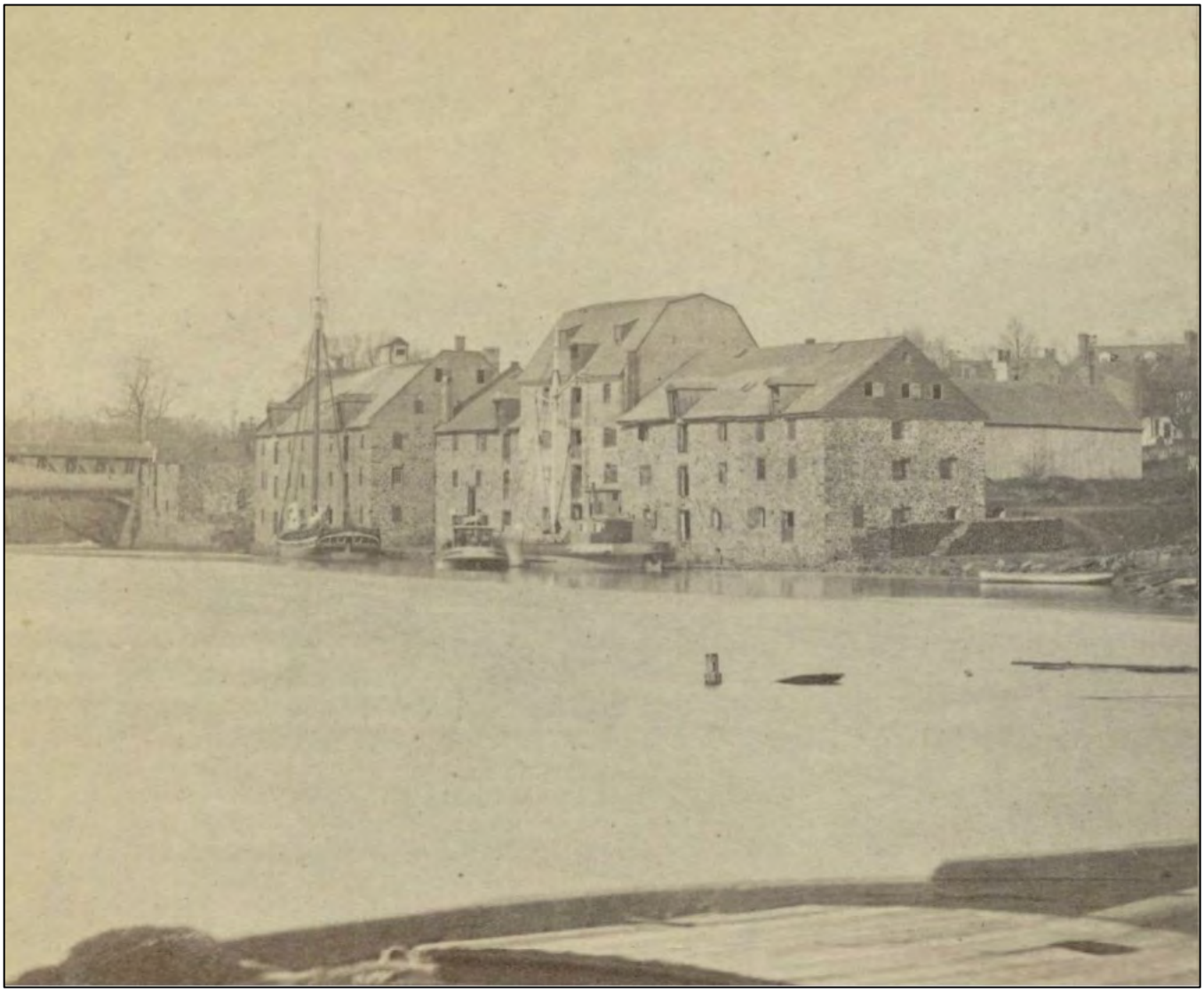

Figure 36. Stereograph (cropped for detail) of the William Lea & Sons flour mills on the northern banks at Brandywine Village, c. 1868 (Lammot du Pont, Sr. prints and photographs, Hagley Museum and Library)

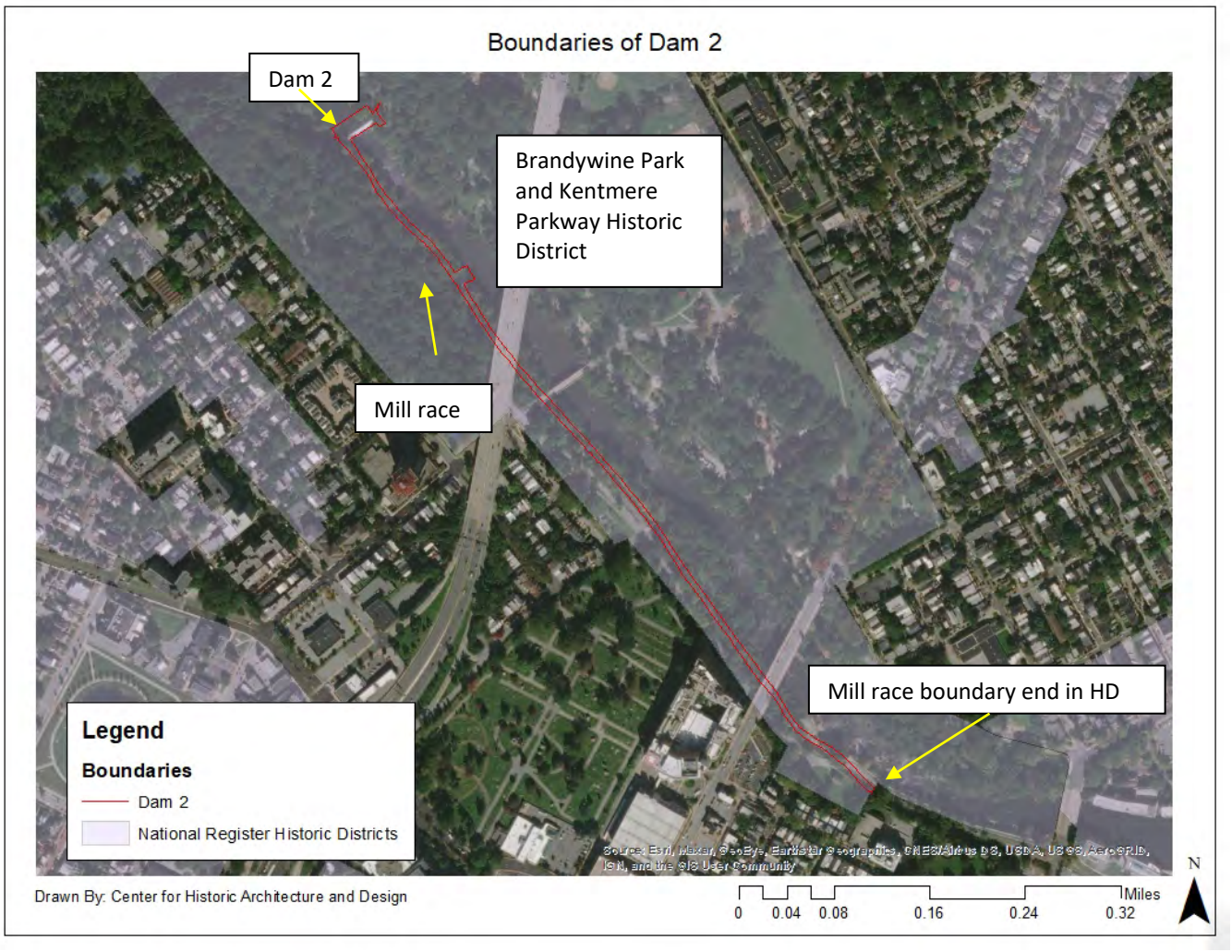

Figure 37. Boundary map for Dam 2, showing extent of mill race boundary.

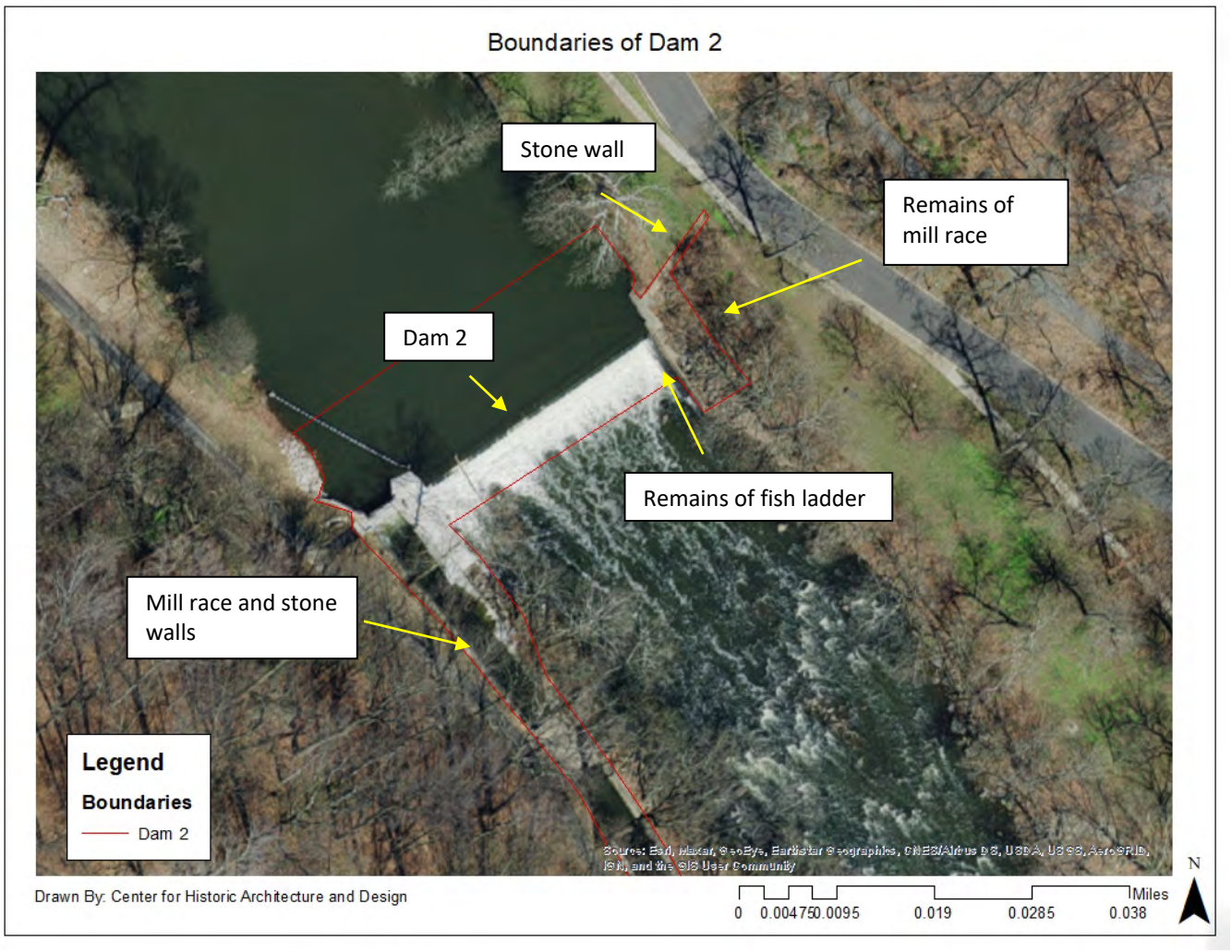

Figure 38. Detail boundary map for Dam 2.

Evaluation:

Dam 2, known as Upper Dam and City Dam, is recommended as eligible for listing in the National Register of Historic Places under Criteria A and C with significance at the local level. It is significant under Criterion A for its association with the industrial development along the Brandywine, specifically the flour milling industry of the Brandywine Merchant Mills, formerly clustered downstream of the Market Street Bridge (and powered by both Dams 1 (Lower) and 2 (Upper)), as well as its association with the City of Wilmington's water filtration complex. It is also significant under Criterion C as an engineered, stepped concrete dam (built 1902) with an extant earlier vernacular timber-braced, ascending ramp, bowed stone dam (reconstructed 1885). Research on this resource has not revealed any

associations with the lives of persons significant to our local, state, or national history, for whom this resource is the best representative associated property; therefore, it ineligible for listing under Criterion B. This resource has not been evaluated for eligibility under Criterion D.

Dam 2, built in 1902, retains relatively high levels of historic integrity for all seven aspects under consideration: location, design, setting, materials, workmanship, feeling, and association. Dam 2 has remained in its original location since its construction in 1902 and is built at the site of earlier mill dams dating to c. 1762. Constructed as a stepped concrete dam, it exhibits high levels of integrity of design, materials, and workmanship, with minimal alterations being apparent concrete repairs and reinforcements at its wings. Its setting has remained relatively unchanged since the turn of the century, located within Brandywine Park and generally set apart from the clustered industrial activities that occurred further upstream and downstream of it. It also retains its historic southern mill race, originally dating to c. 1762, which further enhances the integrity of design and setting. While its historic northern mill race was in-filled in the 1950s, the retention of the sub-structures related to the mill race, including the in-filled concrete wall that housed the head gate, and extant iron straps and bolts that helped secure the earlier stone wing walls of the dam and race, enhance the overall historic integrity of Dam 2. Because of relatively high levels of integrity for location, design, setting, materials, and workmanship, Dam 2 continues to relate the feeling and association of a turn-of-the-century engineered, stepped concrete dam built within City of Wilmington parklands.

Additionally, the extant earlier iteration of Dam 2, constructed in 1885 as a vernacular timber-braced, ascending ramp, bowed stone dam maintains its integrity of location as well as some integrity of design, setting, materials, and workmanship, and enhances the overall integrity of Dam 2 and the dam site, demonstrating continuity of use. While the 1885 dam was significantly altered by the construction of the 1902 stepped concrete dam, its original bowed, half-hexagonal design is still clearly legible, with stone masonry evident under light concrete reinforcement.

Dam 3 Complex: Augustine Dam

Tax ID: East bank: 0614300001 (Augustine Mill Associates) / West bank: 2600640050 (2/3 Mill Road LLC)
Geographic Coordinates: 39.76491, -75.55695
Date of Construction: c. 1850, race rebuilt c. 1932
Eligibility Recommendation: Eligible

Description:

Dam 3, known as Augustine Mill Dam, was constructed c. 1850 as a descending ramp, bowed, stone apron dam. Dry-laid, roughly-coursed stone retaining walls extend along the eastern and western banks of the dam, with the dam abutting the wall to the west; the eastern third of the dam has been breached. An extant, abandoned mill race, rebuilt c. 1932, flows along the eastern bank, adjacent to the eastern stone retaining wall, which serves as a structural wall to the mill race. The extant crest of the dam forms a partial half hexagonal shape, or "bow," and is comprised of cut, quarried stone with visible feather and plug holes, held together with iron pins or staples (figures 42 and 43). A rubble stone apron extends downstream (south), held together in several places with long iron straps and bolts (figure 44).

The extant portion of the crest of the dam extends from the western bank 39 feet northeast to an approximately 60-degree angle or turn in the crest, then extends another 61 feet to the east, for a total of 100 feet. The dam is breached to the east beyond these sections and indiscernible. The cut, quarried stones forming the crest range in length from approximately three feet and four inches to three feet and nine inches and measure between eight and 10 inches in width. Timbers measuring approximately seven inches wide are visible underwater to the north of the crest of the dam, running parallel to and helping to reinforce it. In between the timbers and the cut, quarried stone of the crest is a span of small rubble stone and cement infill measuring approximately three feet and seven inches, to additionally bolster the cut stone line of the crest (see figure 41). The timbers remain visible, running parallel to the crest of the dam, to a point approximately seven feet beyond the breached eastern portion of the dam.

The rubble stone apron downstream of the dam appears to be comprised of two sections with a channel dividing it. The first section of the apron extends from the crest of the dam approximately 28 feet and six

inches to the channel, which is approximately two feet and nine inches wide. The second section of the apron extends approximately 17 feet and nine inches, with the total span of the apron, including the channel, measuring approximately 48 feet. It is probable that timbers like those used on the upstream (north) side of the dam were once situated within the channel to help reinforce the rubble stone apron and prevent its shifting but have since deteriorated.

Figure 39. Map showing the location of Dam 3. There is no proposed fish passage work at this dam due to the breach.

Figure 40. Historic view of Dam 3, showing the descending stone ramp, east bank wall, and head gate, undated. (Hagley Museum and Library)

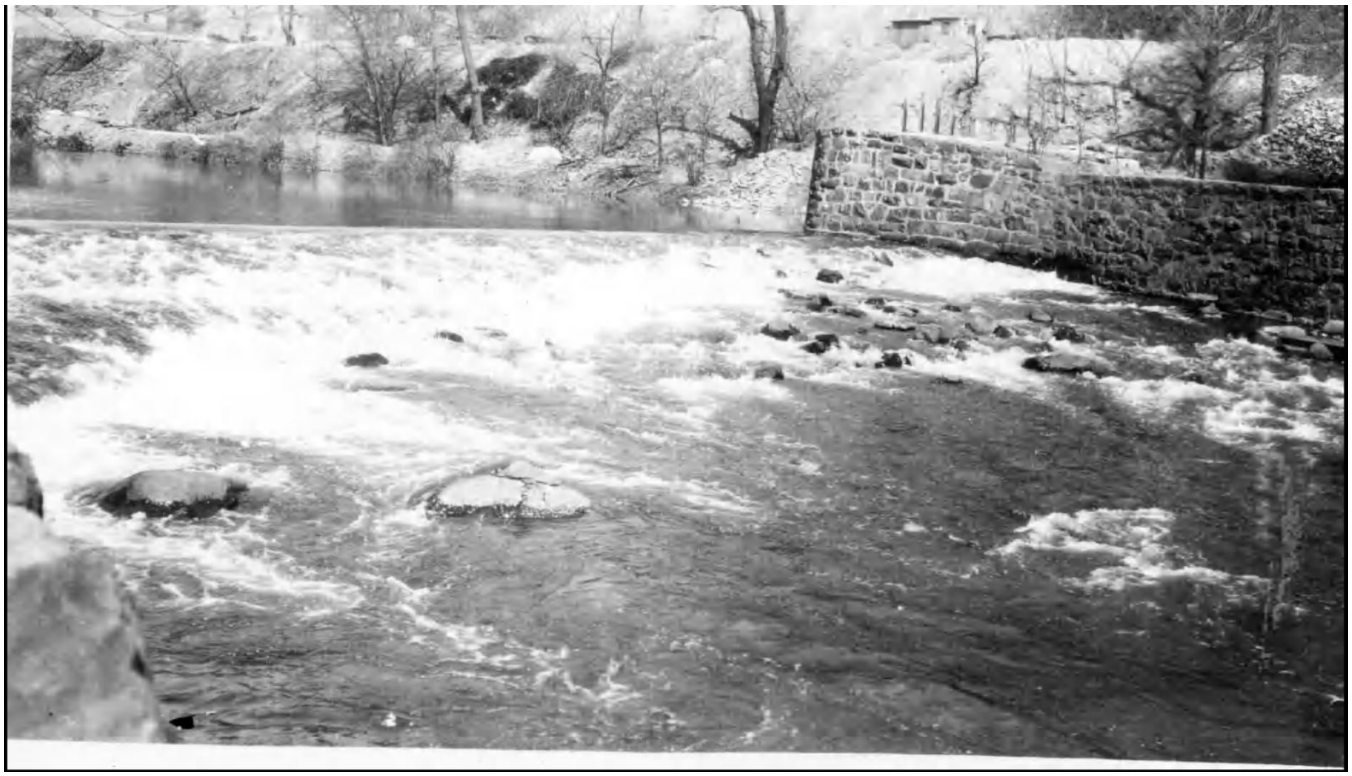

Figure 41. View of Dam 3, looking upstream, 1932. (Zebley Photo Collection, Delaware Public Archives)

Figure 42.View of Dam 3 from the west banks, looking east, 2021. (Center for Historic Architecture and Design)

Figure 43.View of Dam 3 from the west banks, looking east, 2021. (Center for Historic Architecture and Design)

Figure 44. Detail view of Dam 3, showing the fill in front of the quarried stone dam, 2021. (Center for Historic Architecture and Design)

Figure 45. Detail view of the iron staples at the crest of Dam 3, 2021. (Center for Historic Architecture and Design)

Figure 46. Detail view of stone slab at Dam 3 in 2021, exhibiting plug-and-feather holes used with wedges during the quarrying process. (Center for Historic Architecture and Design)

Figure 47. View of metal straps, securing the stone apron at Dam 3. (Center for Historic Architecture and Design)

Figure 48. View of the east bank wall, looking east, 2021. (Center for Historic Architecture and Design)

Figure 49. View of the west bank walls, showing Dam 5 descending stone dam, 2021. (Center for Architecture and Design)

Historic Context:

Hundred: Wilmington; Brandywine; *Quadrant:* Wilmington North; *Geographic Zone:* Piedmont; *Time Period:* Industrialization and Early Urbanization 1830-1880; *Historic Period Themes:* Manufacturing; Settlement Patterns and Demographic Changes; Architecture, Engineering and Decorative Arts

History:

Dam 3, known as Augustine Dam, is most significantly associated with the paper-making industry on the Brandywine. The earliest milling operations thought to be associated with this mill seat are that of Jacob Vandever, who built a grist mill around 1682 on the northern bank. It is unclear for how long this mill, known as the "old high roof mill," was in operation, but it is thought that around 1757, Thomas

Lea built a mill on the site. A saw mill was also built there in 1770.[123] In the 1790s, Isaac Jones was operating a flour mill at the property as well as a snuff mill.[124] Fairlamb & Read's 1816 survey *Mill Seats on the Brandywine River* shows a northern mill race powering several mill stones for "Isaac Jones's Snuff and Flour Mills."[125] The snuff and flour mills were in operation until about 1820 and were then vacant for many years.[126] During the 1820s, brothers Benjamin and Ziba Ferris reportedly also had a cotton mill and weaving factory, along with a blacksmith shop, on the south bank of the Brandywine in the vicinity of Dam 3, though operations were abandoned by 1832.[127]

The 1816 Fairlamb & Read survey also illustrates a short southern race running from Dam 3 powering multiple mill stones associated with "J. & T. Gilpin's Paper Manufactory" (see figure 47). Brothers Joshua and Thomas Gilpin owned property along the southern banks of the Brandywine in the vicinity of both Dams 3 and Dam 4 (Kentmere Dam), and established a paper manufactory along the Brandywine banks in 1787. Earlier, Thomas Gilpin I, a Quaker from Philadelphia, had purchased 42 acres of land along the Brandywine and by 1751 had constructed a dam, race, grist mill and sawmill on his property (though the exact site of this initial mill complex is unknown).[128] That same year, Gilpin deeded one-quarter of the mill operations to his nephew of the same name, Thomas Gilpin II. Upon Thomas Gilpin I's death in 1766, Thomas Gilpin II inherited the entirety of the mill operations, as well as his uncle's estate.[129] Thomas Gilpin II's father-in-law, Joshua Fisher, purchased additional land along the Brandywine in 1766 and constructed the Gilpin and Fisher Snuff Mill.[130] During the same year, Gilpin purchased the water rights for the snuff mill for £500 from William and Elizabeth Elliot.[131] An

[123] "Vandever Mill," Delaware's Industrial Brandywine Digital Exhibit, Hagley Museum and Library, https://www.hagley.org/research/digital-exhibits/vandever-mill.
[124] "Isaac Jones's Snuff Mill," Delaware's Industrial Brandywine Digital Exhibit, Hagley Museum and Library, https://www.hagley.org/research/digital-exhibits/isaac-joness-snuff-mill.
[125] Fairlamb & Read Survey, "Mill seats on the Brandywine River."
[126] "Isaac Jones's Snuff Mill," Delaware's Industrial Brandywine Digital Exhibit, Hagley Museum and Library, https://www.hagley.org/research/digital-exhibits/isaac-joness-snuff-mill.
[127] Boatman, 69; "Benjamin & Ziba Ferris," Delaware's Industrial Brandywine Digital Exhibit, Hagley Museum and Library, https://www.hagley.org/research/digital-exhibits/benjamin-ziba-ferris.
[128] Hancock, 4.
[129] Hancock, 5.
[130] Hancock, vi; 5.
[131] Hancock, 9.

advertisement placed in *Pennsylvania Gazette* on January 5, 1769, provides additional information about the first grist mill and saw mill complex:

> To be LETT for a term of years, and may be entered on in the Fourth Month (April) next, A GRIST MILL, and SAW MILL, on Brandywine creek, a never failing stream of water, and within two miles of Wilmington; the grist mill has a pair of burr, and a pair of Cologne millstones of the best kind, with screens, fanns and boulting mills compleat, for manufacturing superfine flour. About 40 acres of land will be lett with the mills, whereon are an orchard, two dwelling houses, stables, coppershop, and other conveniences. For terms apply to JOSHUA FISHER and SONS, or THOMAS GILPIN.[132]

During the American Revolution, Gilpin was suspected of "disloyal tendencies" and was exiled from Philadelphia and Wilmington to Winchester, Virginia, where he died in 1778. His estate was divided between his living heirs, sons Thomas Gilpin III and Joseph Gilpin.[133]

[132] *The Pennsylvania Gazette*, Philadelphia, Pennsylvania, January 5, 1769.
[133] Hancock, 5; Thomas Gilpin Will, *Wills of New Castle County, Delaware, 1682-1854; Index to Wills, 1682-1885;* Probate Place: *New Castle, Delaware.*

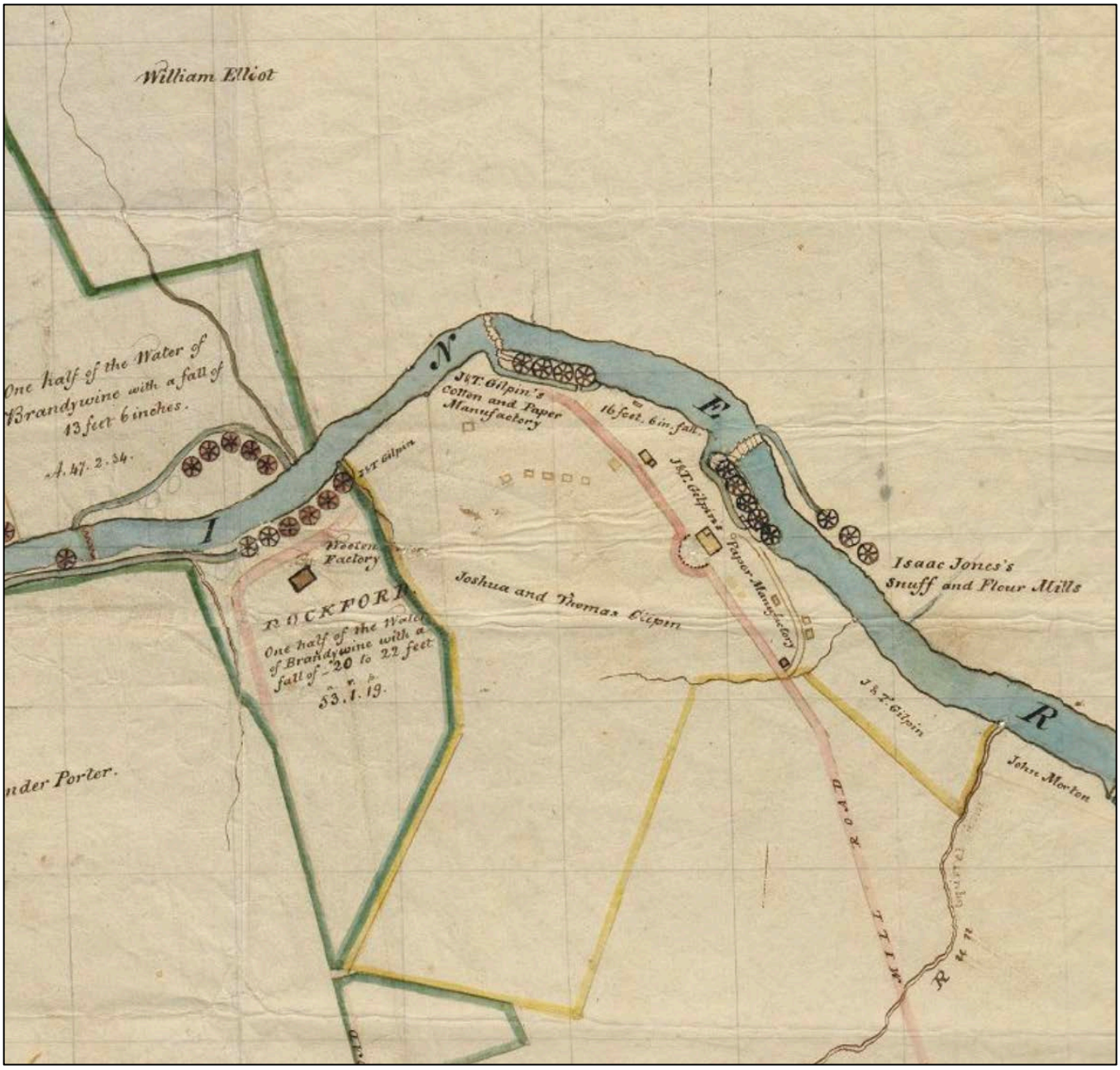

Figure 50. Fairlamb & Read map, showing the short race at Dam 3 on the west banks powering "J. & T. Gilpin's Paper Manufactory," 1816. (Hagley Museum and Library)

In 1787, Thomas III and Joseph converted the snuff mill into a paper mill, the first in the state of Delaware. Initially, it retained the name Gilpin and Fisher, but the paper mill was ultimately operated under a variety of names including Joshua Gilpin and Company, Thomas Gilpin and Company, Gilpin

and Company, and was also known as the Brandywine Paper Mills.[134] The first recorded purchase of paper molds was from the Philadelphia dealer Nathan Sellers in 1788. Like other contemporary paper mills, they produced one sheet of paper at a time. Numerous examples of Gilpin-manufactured paper dated from 1788 are held in the Rodney Collection at the Delaware Historical Society.[135] A *Delaware Gazette* article published in 1790 notes that two paper mills had been founded in the state—Gilpin and Fisher as well as Meeter Mill in Newark. The Gilpin and Fisher mill employed 20 people and made 16 reams of paper daily.[136]

Significantly, on December 24, 1816, Thomas Gilpin III patented the first endless paper making machine in America. This machine, its successors, and similar machines imported from England revolutionized the paper making industry, drastically increasing the amount of paper produced at any single mill. In 1817, the paper mills were rebuilt and enlarged, and new paper making machinery was installed.[137] However, a large fire badly damaged the paper mill in 1825, effectively putting it out of business. In an effort to transfer some of their debt, the Gilpins sold the Brandywine Paper Mills including all “buildings, mills, mill dams, races, etc. for $50.”[138] The State Legislature granted a charter in 1825 to the Brandywine Manufacturing Company to take over the Gilpin property. This venture did not succeed, and in 1829 John B. Newman, John Hemphill, Nathan Bunker, Jacob B. Clement and Thomas Fisher were authorized to carry on the manufacture of "cotton, woollen, paper, flax, iron or any other material which they may from time to time adopt or substitute" under the name Brandywine and Christiana Manufacturing Company.[139] The Brandywine and Christiana Manufacturing Company operated at the project site until 1845, when it was sold at sheriff sale for $15,500 to John B. Newman.[140] However, it is unclear for how long these associated operations continued to utilize Dam 3;

[134] Hancock, 9.
[135] Hancock, 10.
[136] Hancock, 10.
[137] Hancock, 24.
[138] Boatman, 75
[139] Hancock, 37.
[140] Boatman, 77.

by the publishing of the 1849 Rea & Price *Map of New Castle County, Delaware*, the southern mill race was no longer extant.[141]

In 1843, Augustus Jessup and his son-in-law Bloomfield Moore of Philadelphia formed a partnership for the manufacturing paper, establishing themselves in that city. In 1845, they set up on the Brandywine with the purchase of Isaac Jones' former snuff and flour mills, downstream from Dam 3.[142] Jessup and Moore soon expanded Augustine Mills, as the site had come to be known (after Augustus Jessup), and built "one of the largest and most complete paper mills to be found in the United States, where the finest lithograph, map and plate paper" was manufactured.[143] By 1860, Jessup and Moore acquired another mill at Rockland, several miles upstream on the Brandywine, further expanding their paper milling operations.[144] In 1863, the company constructed a straw warehouse near the shipyard at Brandywine Village, downstream of the Augustine Mills, described in a newspaper article as a "large stone building of four hundred and seventy-five feet in length, and one hundred and four feet wide" and illustrated in the 1868 Beers *Atlas of the State of Delaware* and 1881 Hopkins *Map of New Castle County, Delaware*.[145] The Jessup & Moore Paper Company formally incorporated in 1878, and by 1886, Augustine Mills employed about 120 workers, producing "fine book paper, beautifully calendered" at the rate of approximately 16 tons daily, with one of its most high-profile clients being the journal *Scientific American*.[146] The company continued producing highly-quality book and magazine paper into the early 1930s.[147]

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[141] Rea, Samuel M, and Jacob Price, *Map of New Castle County, Delaware: from original surveys* (Philadelphia: Smith & Wistar, 1849), https://www.loc.gov/item/2013593084/.
[142] "Jessup & Moore," Delaware's Industrial Brandywine Digital Exhibit, Hagley Museum and Library, https://www.hagley.org/research/digital-exhibits/jessup-moore; Scharf, 794.
[143] Scharf, 794.
[144] Scharf, 793.
[145] "Large Building," *Delaware State Journal*, July 28, 1863; D.G. Beers Atlas of the State of Delaware, *Brandywine Banks*, 1868; Hopkins & Co., *Map of New Castle County, Delaware*, 1881.
[146] "A Local Industry," *Weekly Times* (Wilmington, DE), October 16, 1886; "Jessup & Moore," Delaware's Industrial Brandywine Digital Exhibit, Hagley Museum and Library, https://www.hagley.org/research/digital-exhibits/jessup-moore; Zebley, *Along the Brandywine*, 164.
[147] "Jessup & Moore," Delaware's Industrial Brandywine Digital Exhibit, Hagley Museum and Library, https://www.hagley.org/research/digital-exhibits/jessup-moore; Zebley, *Along the Brandywine*, 164.

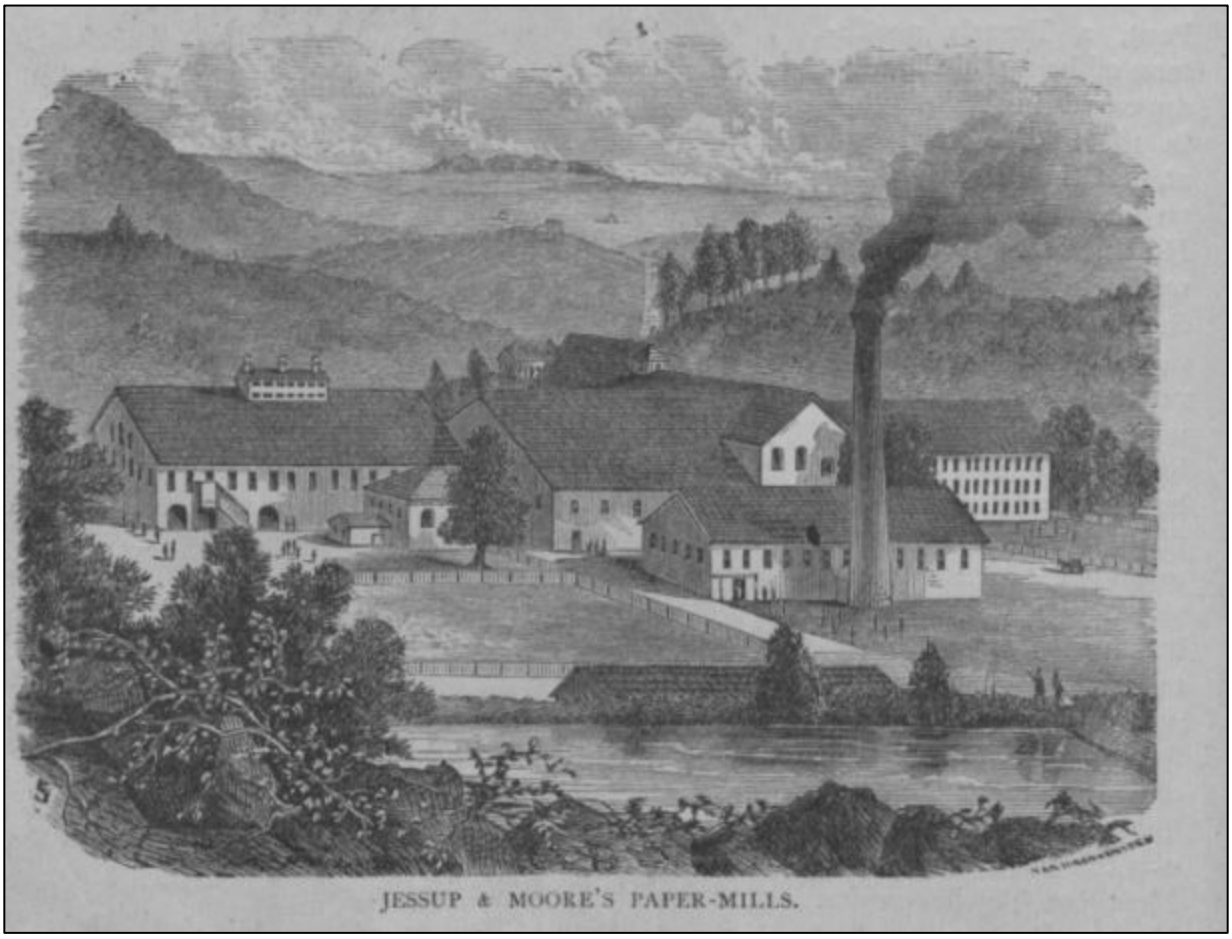

Figure 51. Jessup & Moore Paper Mills, undated. (Harkers Magazine)

The Delaware Paper Mills, Inc., purchased Augustine Mills in 1934 and produced "chip paper" as well as other types, to be used in the manufacturing of paper box containers.[148] In 1939, the Container Corporation of America took over the site and continued paper manufacturing until the early 1980s. Augustine Mill Associates purchased the property in 1984 and subsequently redeveloped the site into Brandywine Park Condominiums.[149] The only mill building to survive the redevelopment is the earliest building, originally constructed before 1845, that Jessup & Moore purchased and converted into their

[148] "Extensive Repairs at Augustine Mills," *Journal-Every Evening*, August 3, 1935; Container Corporation of America," Delaware's Industrial Brandywine Digital Exhibit, Hagley Museum and Library, https://www.hagley.org/research/digital-exhibits/container-corporation-america.
[149] "Container Corporation of America," Delaware's Industrial Brandywine Digital Exhibit, Hagley Museum and Library, https://www.hagley.org/research/digital-exhibits/container-corporation-america.

paper mill, rebuilding it in 1849.[150] It stands three stories in height and is constructed of quarried stone from the vicinity.

Figure 52. Jessup & Moore Paper Company at Augustine Mills, c. 1900 (Hagley Museum and Library)

[150] Hexamer General Surveys indicate that the main building was rebuilt in 1849 by Jessup & Moore. Ernest Hexamer, Hexamer General Surveys, Volume 2 (plate 159), 1866; Volume 6 (plate 552), year unknown; Volume 9 (plate 759), 1874. Philadelphia Free Library, Map Collection: https://libwww.freelibrary.org/locations/departments/map-collection.

Figure 53. Aerial view of the Jessup & Moore Paper Company, showing Dam 3, 1931. (Hagley Museum and Library)

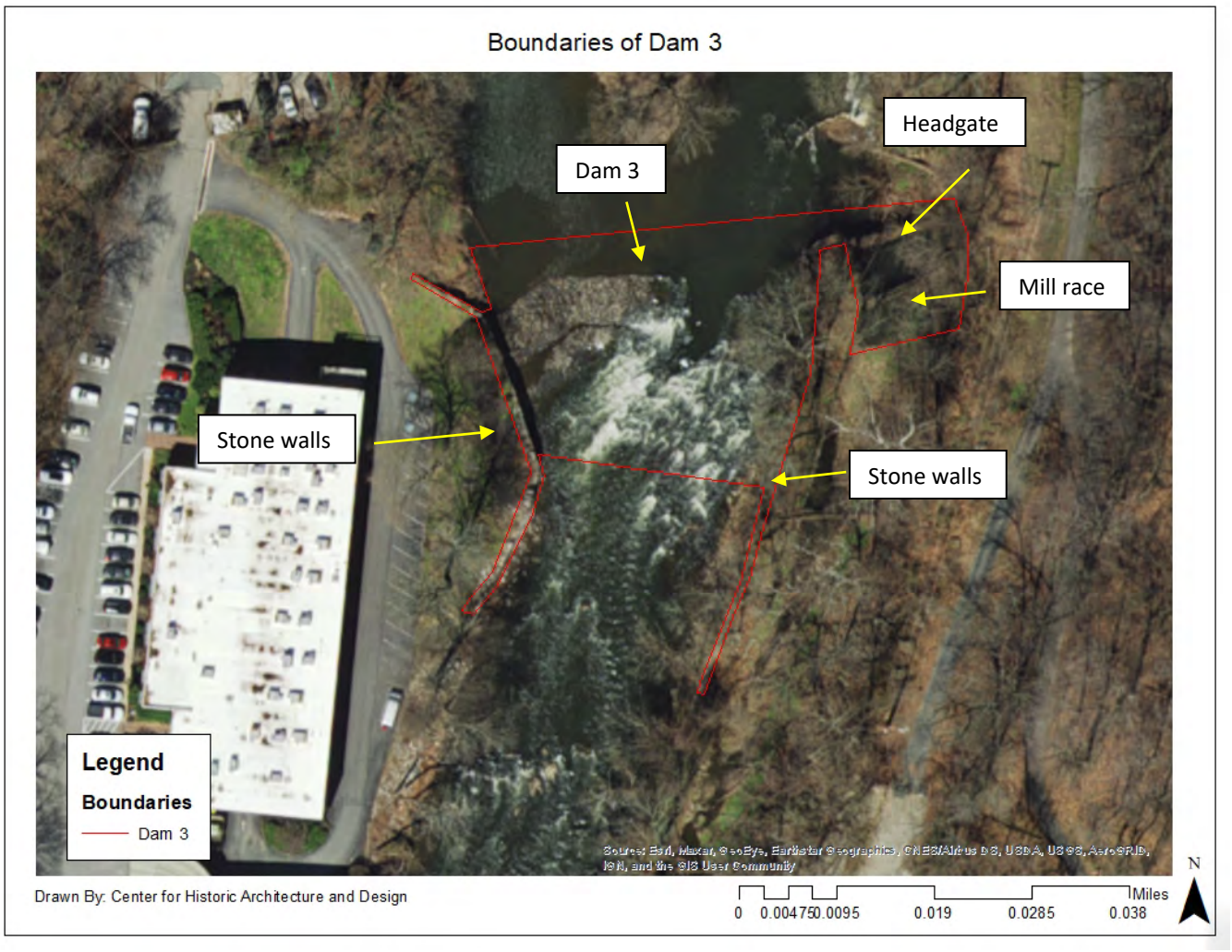

Figure 54. Boundary map of the Dam 3 complex.

Evaluation:

Dam 3, known as Augustine Dam, is recommended as eligible for listing in the National Register of Historic Places under Criteria A and C with significance at the local level. It is significant under Criterion A for its association with the industrial development along the Brandywine, specifically the paper milling industry. It was constructed in the mid-nineteenth century and supplied water to the Jessup & Moore Paper Company at Augustine Mills (also operating at Dam 11), a premiere paper manufactory operating between the mid-nineteenth and early-twentieth centuries specializing in high-quality book and magazine papers. Dam 3 is also significant under Criterion C for its vernacular construction of a descending ramp, bowed, stone apron dam. Research on this resource has not revealed any associations with the lives of persons significant to our local, state, or national history, for whom this resource is the best representative associated property; therefore, it ineligible for listing under Criterion B. This resource has not been evaluated for eligibility under Criterion D.

Dam 3 retains relatively high levels of historic integrity for location, design, materials, and workmanship. It has remained in its original location since its construction c. 1850. Despite being breached on its eastern third, its design as a vernacular type of descending ramp, bowed, stone apron dam is clearly legible, with a majority of material fabric surviving to sufficiently convey its significance. Its workmanship is apparent through its construction, with a careful arrangement of cut and quarried stone laid in a half hexagonal shape forming its crest, secured with iron pins, and rubble stones forming a long apron, secured with iron straps and bolts. The integrity of setting as well as feeling and association are compromised due to the loss of adjacent industry, which the dam powered, and changes in land use from industrial to commercial and residential with the construction of office buildings and condominiums, including the adaptive reuse of the sole surviving building at the Augustine Mills site associated with the Jessup & Moore Paper Company. Despite this, some integrity of setting, feeling, and association is retained and design integrity is enhanced through the survival of the dam’s historic mill race and associated stone retaining wall on the northern bank.

Dam 4 Complex: Kentmere / Bancroft II Dam

Tax ID: East bank: 0612700002 (State of Delaware) / West bank: 2600620083 (State of Delaware)
Geographic Coordinates: 39.76861, -75.55922
Date of Construction: 1896; c. 1940
Eligibility Recommendation: Eligible

Description:

Dam 4, known as Kentmere Dam and Bancroft Dam, is a descending ramp, bowed, stone apron dam augmented by a later straight stone and concrete dam. Construction of the descending ramp, stone dam was completed in 1896 by the Joseph Bancroft & Sons Company, shortly after the company purchased the mill seat property. Bancroft & Sons added a straight stone and concrete dam c. 1940, immediately downstream of the curved dam.[151] The extant dam structure today has the appearance of a double crest, with one created by the earlier 1896 descending ramp, stone dam and another running straight-across created by the straight stone and concrete dam. The overall dam structure extends across the Brandywine approximately 180 feet and has a fall of about 10 feet. A concrete fish ladder was built at the northern abutment of the dam c. 1970, the structure of which remains fairly intact.

The 1896 descending ramp, stone dam arcs across the Brandywine, with an angled notch or carved channel on its northern side that is likely related to the dam's positioning at the mouth of Alapocas Run. Historical aerial photographs from the early-twentieth century show evidence of a rubble stone apron extending downstream from the 1896 dam (see figures 54 and 64). The c. 1940 straight stone and concrete dam sits a foot or two lower than the 1896 dam, with a reservoir created between their crests. Some large stones visibly protrude through the fall of water along the downstream face of the dam. There is also a large breach in the downstream face of the dam towards its southern end. The overall dam structure is supported on the southern bank at the point of an approximately 60-degree angle in a cut and quarried stone retaining wall. The retaining wall extends along the riverbank approximately 250 feet to the northwest and nearly 500 feet to the southeast and were the foundational walls for two large,

[151] This date was inferred from historic aerial photographs from the Dallin Aerial Survey Company (Hagley Museum and Library) and those available through the State of Delaware's Cultural and Historical Resources Information System (https://chris-users.delaware.gov/#/).

non-extant mill buildings built c. 1895 by the Joseph Bancroft & Sons Company. The extant metal head gate for the southern mill race is situated immediately upstream (west) of the dam, though the mill race is no longer extant. The overall dam structure is buttressed on the northern bank by the natural bedrock of Brandywine Blue Gneiss. A poured concrete sanitary sewer line runs southeast from the northern side of the dam, with a poured concrete access hatch and metal cover, situated just east of the dam.

The fish ladder added to Dam 4 is a type of baffle fishway called a Denil fishway and constructed of poured rubble concrete with exterior walls measuring approximately nine-and-a-half inches in width. The distance from the outer edge of one exterior wall to the other is five feet and seven inches in width, making the interior runs of the ladder about four feet across. The fish ladder was designed with two runs, with a 45-foot long lower run accessed by two entrance gates, rising southeast to a resting pool, followed by a second run in two sections, the first measuring 62.5 feet and rising to the northwest, then turning about 45 degrees and extending another 40 feet west-northwest to the top of the dam. Metal grating covers the runs between the ladder's concrete side walls, though some sections of grating are damaged or missing. The fish ladder was designed with wooden baffles that could be removed for repair or replacement, though none presently remain. The side slots or tracks into which the baffles were inserted are clearly visible. The wooden baffles were utilized to control water flow, turning the water back upon itself and slowing down the rate of flow to between about two and four feet per second, which is a manageable rate for shad to pass. The shad would swim in a stream created above the baffles in order to pass through the ladder. Housing for a sluice gate is located at the top of the ladder so that, outside of the period of the shad run, it could be closed to restore full water flow to the river; however, the sluice gate is no longer in place. The fish ladder is no longer in active use and shows signs of disrepair.

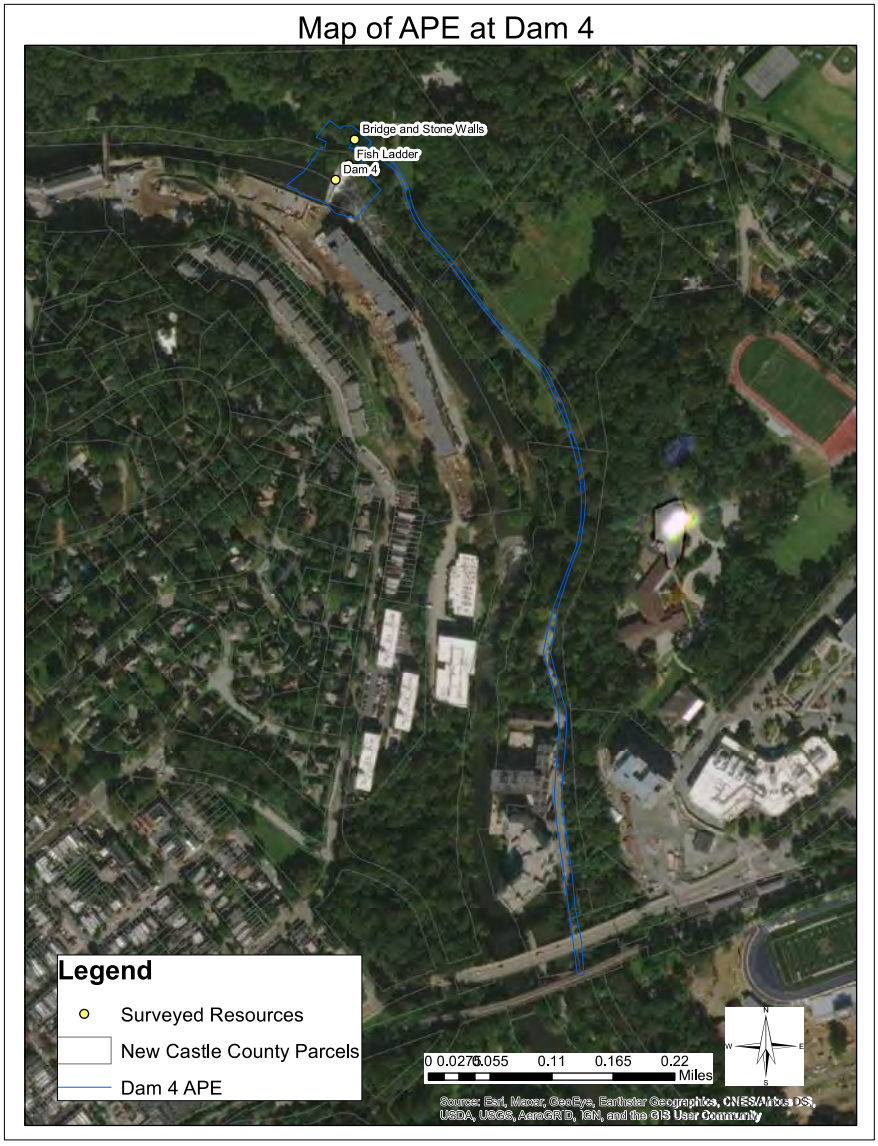

Figure 55. Location map of Dam 4, showing the entire APE. (Center for Historic Architecture and Design)

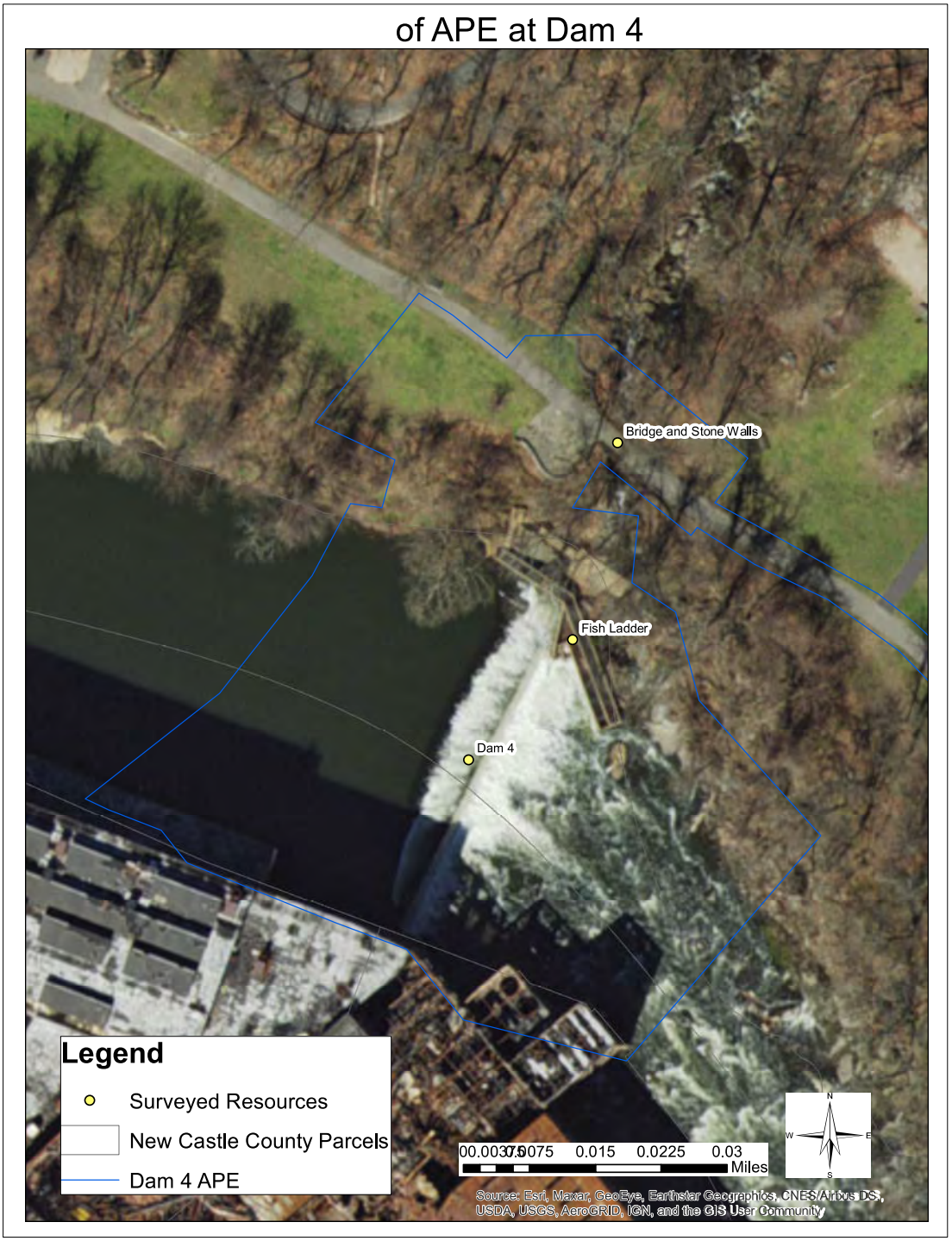

Figure 56. Detail location map of Dam 4. (Center for Historic Architecture and Design)

Figure 57. "Riddle's Dam on the Brandywine," showing a descending stone dam, c. 1870. This dam was replaced in 1896 by the Joseph Bancroft & Sons Company. (Hagley Museum and Library)

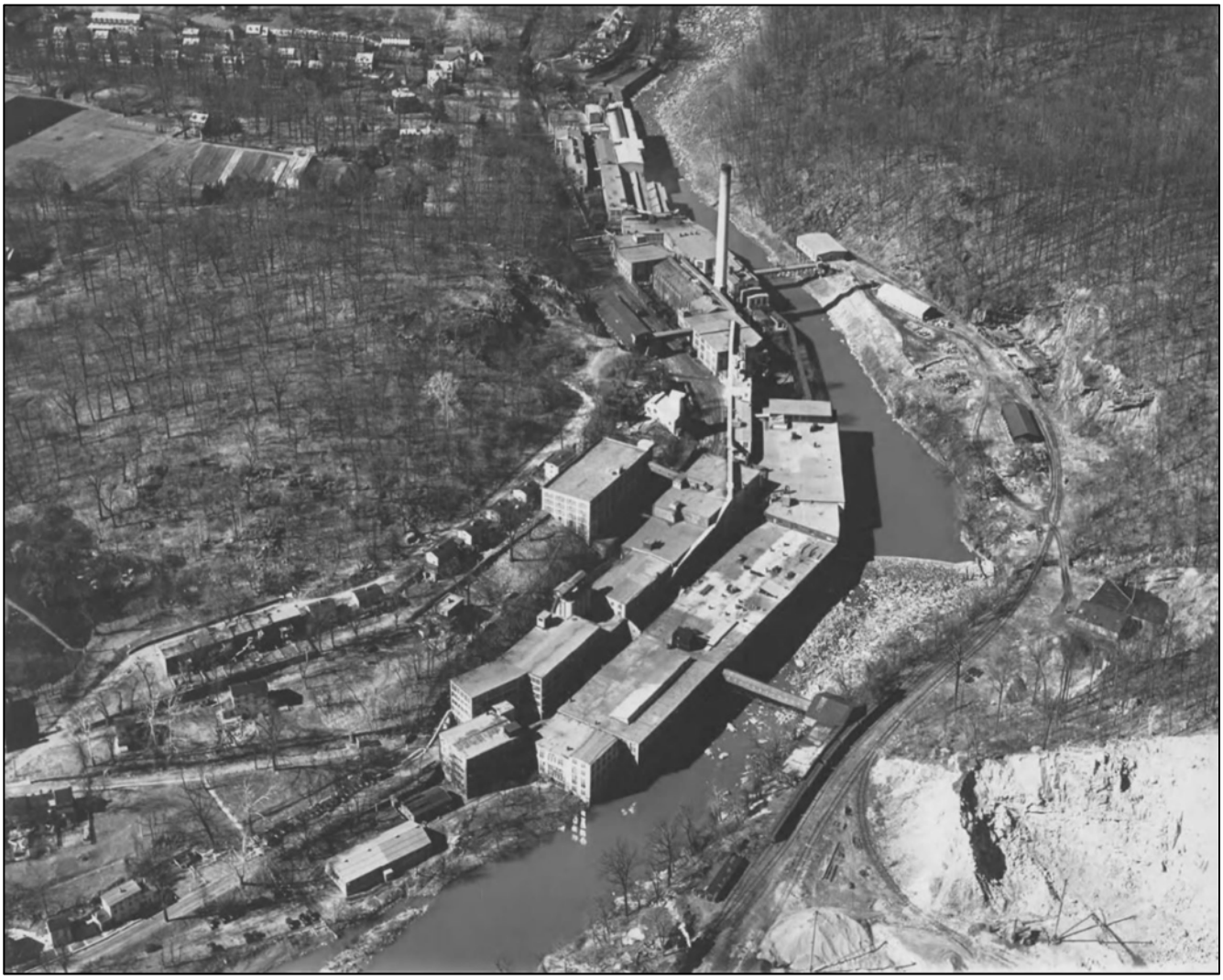

Figure 58. View of the 1896 iteration of Dam 4, showing the descending ramp stone apron dam, 1930. (Dallin Aerial Image Collection, Hagley Museum and Library)

Figure 59. View of Dam 4, looking upstream (west), 2021. (Center for Historic Architecture and Design)

Figure 60. View of Dam 4, showing both the 1896 dam and the c. 1940 dam with the c. 1970 fish ladder addition, looking downstream (east), 2021. (Center for Historic Architecture and Design)

Figure 57. View of the fish ladder addition to Dam 4, looking south, 2021. (Center for Historic Architecture and Design)

Figure 58. Detail view of the 1896 dam behind the c. 1940 dam, looking south, 2021. (Center for Historic Architecture and Design)

Figure 59. Detail view of the headgate and stone river walls on the south banks, 2021. (Center for Historic Architecture and Design)

Historic Context:

Hundred: Wilmington; Brandywine; *Quadrant:* Wilmington North; *Geographic Zone:* Piedmont; *Time Period:* Urbanization and Early Suburbanization, 1880-1940+/-; Suburbanization and Early Ex-Urbanization 1940-1960 +/-; Historic *Period Themes:* Manufacturing; Settlement Patterns and Demographic Changes; Architecture, Engineering and Decorative Arts

History:

Little is known about the mill seat associated with Kentmere Dam, prior to the establishment of the Gilpin Mills in 1787. Thomas Gilpin I, a Quaker from Philadelphia, purchased 42 acres of land along the Brandywine, and by 1751, he had constructed a dam, race, grist mill and sawmill on his property (the

site of this initial mill complex is unknown).[152] That same year, Gilpin deeded one-quarter of the mill operations to his nephew of the same name, Thomas Gilpin II. Upon Thomas Gilpin I's death in 1766, Thomas Gilpin II inherited the entirety of the mill operations, as well as his uncle's estate.[153] Thomas Gilpin II's father-in-law, Joshua Fisher, purchased additional land along the Brandywine in 1766 and constructed the Gilpin and Fisher Snuff Mill.[154] During the same year, Gilpin purchased the water rights for the snuff mill for £500 from William and Elizabeth Elliot.[155] An advertisement placed in *Pennsylvania Gazette* on January 5, 1769, provides additional information about the first grist mill and saw mill complex:

> To be LETT for a term of years, and may be entered on in the Fourth Month (April) next, A GRIST MILL, and SAW MILL, on Brandywine creek, a never failing stream of water, and within two miles of Wilmington; the grist mill has a pair of burr, and a pair of Cologne millstones of the best kind, with screens, fanns and boulting mills compleat, for manufacturing superfine flour. About 40 acres of land will be lett with the mills, whereon are an orchard, two dwelling houses, stables, coppershop, and other conveniences. For terms apply to JOSHUA FISHER and SONS, or THOMAS GILPIN.[156]

During the American Revolution, Gilpin was suspected of "disloyal tendencies" and was exiled from Philadelphia and Wilmington to Winchester, Virginia, where he died in 1778. His estate was divided between his living heirs, sons Thomas Gilpin III and Joseph Gilpin.[157]

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[152] Hancock, 4.
[153] Hancock, 5.
[154] Hancock, vi; 5.
[155] Hancock, 9.
[156] *Pennsylvania Gazette*, Philadelphia, Pennsylvania, January 5, 1769.
[157] Hancock, 5; Thomas Gilpin Will, *Wills of New Castle County, Delaware, 1682-1854; Index to Wills, 1682-1885;* Probate Place: *New Castle, Delaware.*

Figure 60. *The Gilpin Paper Mills,* unknown artist, undated. (Hagley Museum and Library)

In 1787, Thomas III and Joseph converted the snuff mill into a paper mill, the first in the state of Delaware. Initially, it retained the name Gilpin and Fisher, but the paper mill was ultimately operated under a variety of names including Joshua Gilpin and Company, Thomas Gilpin and Company, Gilpin and Company, and was also known as the Brandywine Paper Mill.[158] The first recorded purchase of paper molds was from the Philadelphia dealer Nathan Sellers in 1788. Like other contemporary paper mills, they produced one sheet of paper at a time. Numerous examples of Gilpin-manufactured paper dated from 1788 are held in the Rodney Collection at the Delaware Historical Society.[159] A *Delaware Gazette* article published in 1790 notes that two paper mills had been founded in the state—Gilpin and Fisher as well as Meeter Mill in Newark. The Gilpin and Fisher mill employed 20 people and made 16

[158] Hancock, 9.
[159] Hancock, 10.

reams of paper daily.[160] For a brief period, between about 1812 and 1814, the Gilpins also operated the Brandywine Woolen Mill, just north above the site of the paper mill.[161] Financial difficulties cut the endeavor short, but they introduced cotton milling in late 1821.[162]

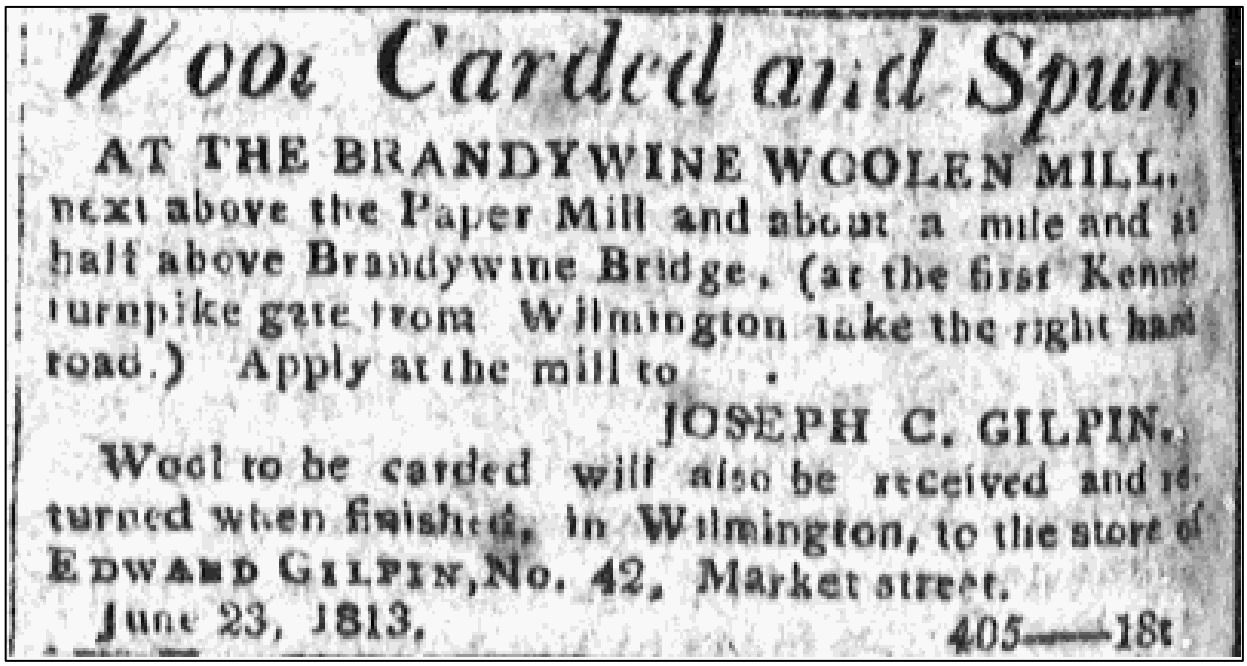
Wool Carded and Spun,
AT THE BRANDYWINE WOOLEN MILL,
next above the Paper Mill and about a mile and a
half above Brandywine Bridge, (at the first Kennet
turnpike gate from Wilmington take the right hand
road.) Apply at the mill to
JOSEPH C. GILPIN.
Wool to be carded will also be received and re-
turned when finished, in Wilmington, to the store of
EDWARD GILPIN, No. 42, Market street.
June 23, 1813. 405——18t

Figure 61. Advertisement for the short-lived Brandywine Woolen Mill, *American Watchman*, July 3, 1813.

Significantly, on December 24, 1816, Thomas Gilpin III patented the first endless paper making machine in America. This machine, its successors, and similar machines imported from England revolutionized the paper making industry, drastically increasing the amount of paper produced at any single mill. In 1817, the paper mills were rebuilt and enlarged, and new paper making machinery was installed at the mill.[163] However, a large fire badly damaged the paper mill in 1825, effectively putting it out of business. In an effort to transfer some of their debt, the Gilpins sold the Brandywine Paper Mills including all "buildings, mills, mill dams, races, etc. for $50."[164] The State Legislature granted a charter in 1825 to the Brandywine Manufacturing Company to take over the Gilpin property. This venture did not succeed, and in 1829 John B. Newman, John Hemphill, Nathan Bunker, Jacob B. Clement and

[160] Hancock, 10.
[161] "Wool Carded and Spun" *American Watchman*, Wilmington, Delaware, July 3, 1813.
[162] Boatman, 75.
[163] Hancock, 24.
[164] Boatman, 75

Thomas Fisher were authorized to carry on the manufacture of "cotton, woollen, paper, flax, iron or any other material which they may from time to time adopt or substitute" under the name Brandywine and Christiana Manufacturing Company.[165]

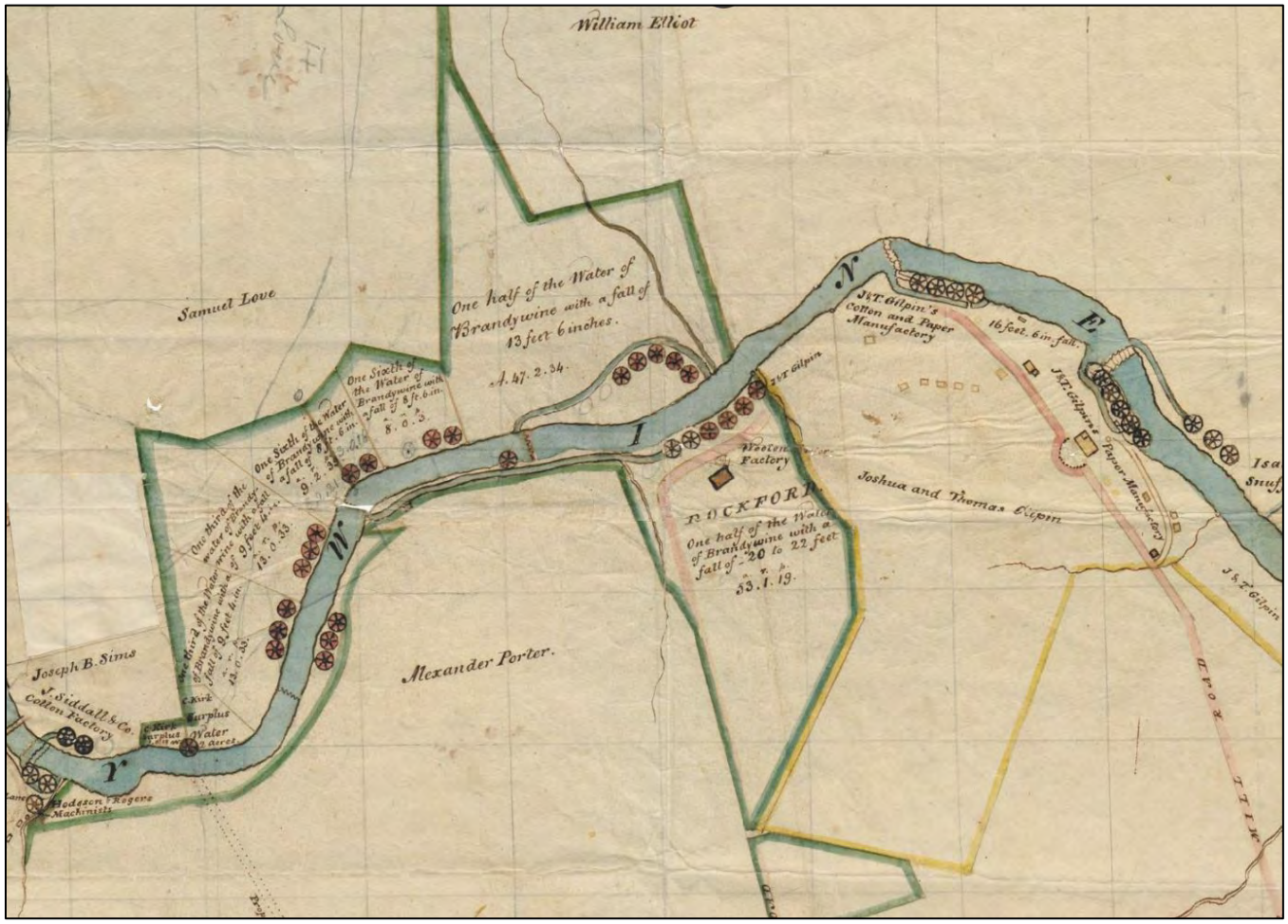

Figure 62. Fairlamb & Read, *Mill Seats on the Brandywine,* 1816. Note the "Joshua and Thomas Gilpin" property outlined in yellow. (Hagley Museum and Library)

The Brandywine and Christiana Manufacturing Company operated at the project site until 1845, when it was sold at sheriff sale for $15,500 to John B. Newman.[166] Newman sold the property later that same year to Henry Lawrence and James Riddle for $34,000.[167] However, Lawrence did not remain a partner

[165] Hancock, 37.
[166] Boatman, 77.
[167] Boatman, 77.

in the company for very long. James Riddle, under the company name James Riddle & Sons, constructed a five-story weaving mill in 1850, eventually employing 12,000 spindles with an average of 68,400 yards of fancy ticking woven fabric produced per week.[168] By 1869, the company was renamed the Brandywine Cotton Mills. James Riddle died in 1872 and left the property to his son Leander Riddle and son-in-law William M. Field.[169] Field remained proprietor of the mills and in some years leased the operation to C. J. Milne & Sons, until the latter vacated the site in the early 1890s.[170]

Cotton milling operation Joseph Bancroft & Sons Co., located just to the west at Rockford, greatly expanded its holdings and manufacturing capabilities with the purchase of the Brandywine Cotton Mills property in 1895.[171] In addition to the old Riddle mill site at the adjacent property downstream, the Bancroft company also acquired the quarry located on the property, then operated by the Brandywine Granite Company and thereafter operated by Bancroft.[172] After purchasing the property, Bancroft heavily renovated the old mill site. In May 1896, a news brief announced:

> Great improvements are being made at Bancroft's Banks. A sewer is being built from a point opposite to the Jessup and Moore paper mill to the upper factory of the Bancroft company. The old Riddle mill has been almost demolished and next week work will begin on the new mill. A new dam is being built at the site of the old Riddle mill, and seventy-five men are now at work on it. The new mill will be four stories in height and 100 feet by 250 feet.[173]

Another news brief from June 1896 announces the granting of a building permit for an additional two-story factory at the old Riddle mill site.[174]

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[168] Boatman, 77.
[169] "Messrs. James Riddle, Son & Co.," Hagley Museum and Library., October 09, 2017, accessed June 9, 2021, https://www.hagley.org/research/digital-exhibits/messrs-james-riddle-son-co.
[170] "Brandywine Cotton Mills Leased to a Philadelphia Firm," *Every Evening*, April 7, 1887; "Riddle Estate Reported Sold," *Delaware Gazette and State Journal*, August 22, 1895.
[171] "Riddle Estate Reported Sold," *Delaware Gazette and State Journal*, August 22, 1895.
[172] "Riddle Mills Sold," *Evening Journal*, August 16, 1895.
[173] "Improvements at Bancroft's Banks," *Morning News*, May 28, 1896.
[174] "To Build a Factory," *Morning News*, June 4, 1896.

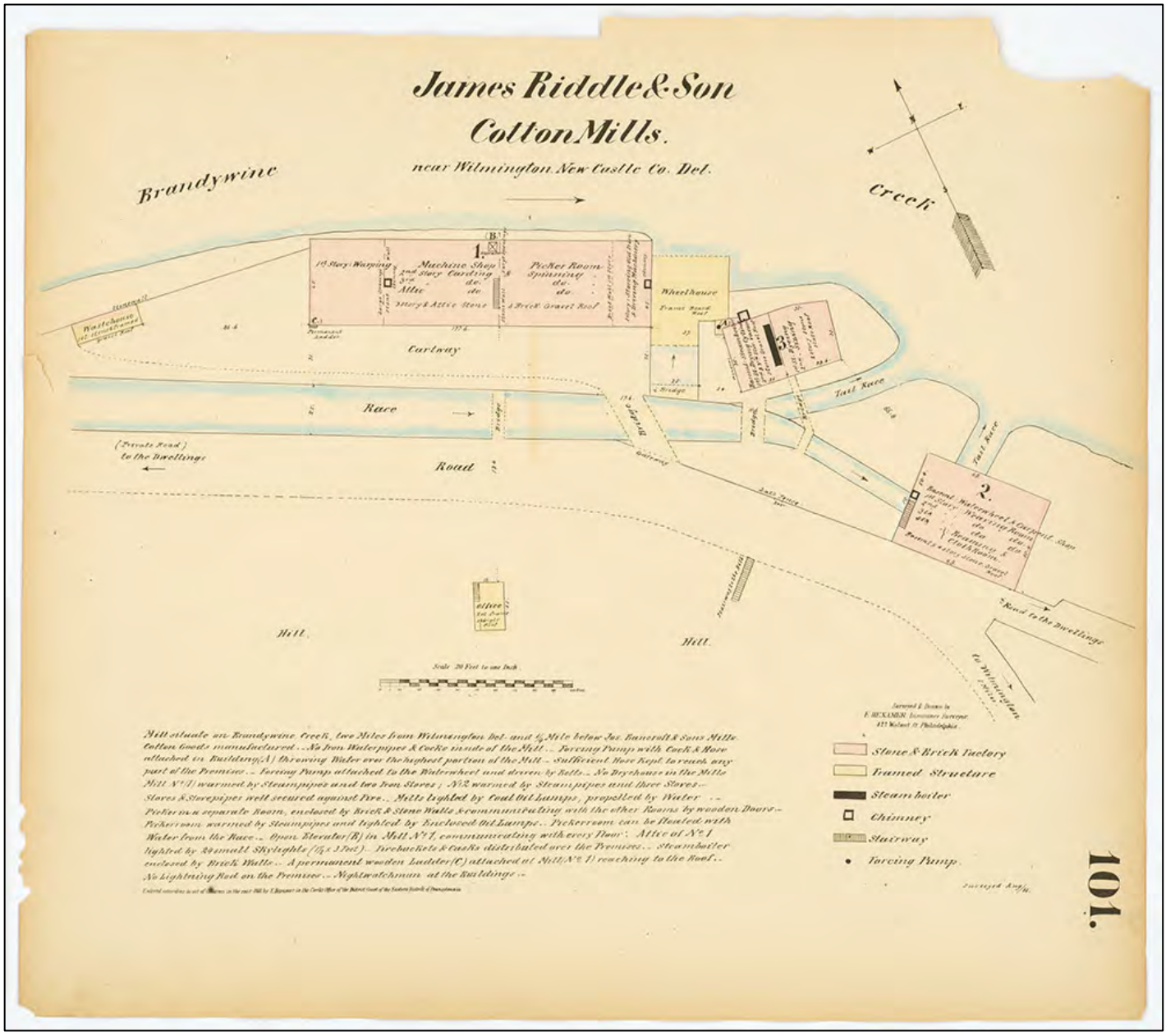


Figure 63. "James Riddle & Sons Cotton Mills," 1866. (Hexamer General Survey Vol. 2, Plate 101, Free Library of Philadelphia)

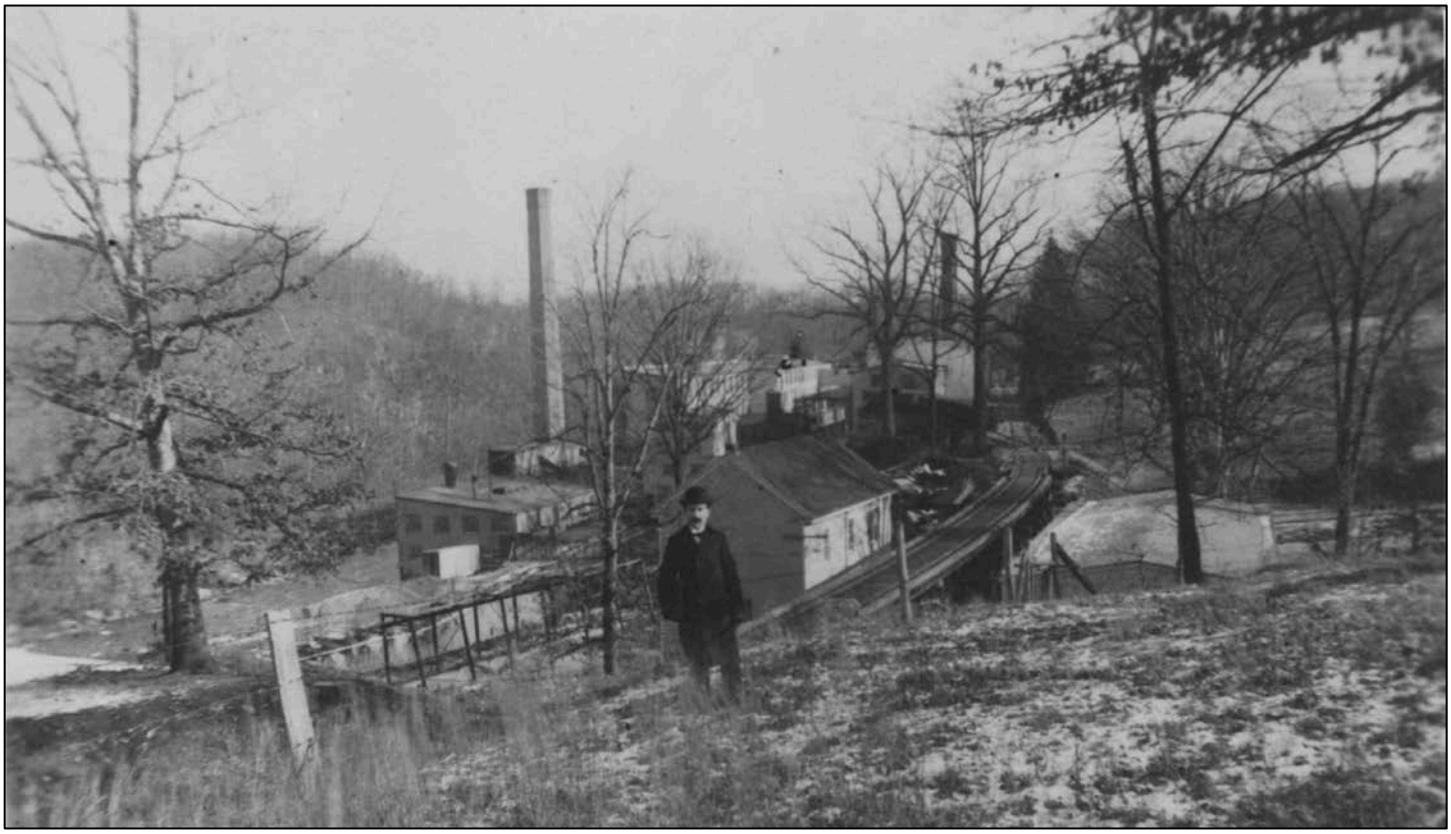


Figure 64. “Bancroft Mills in Kentmere on the Brandywine Creek,” c. 1895. (Hagley Museum and Library)

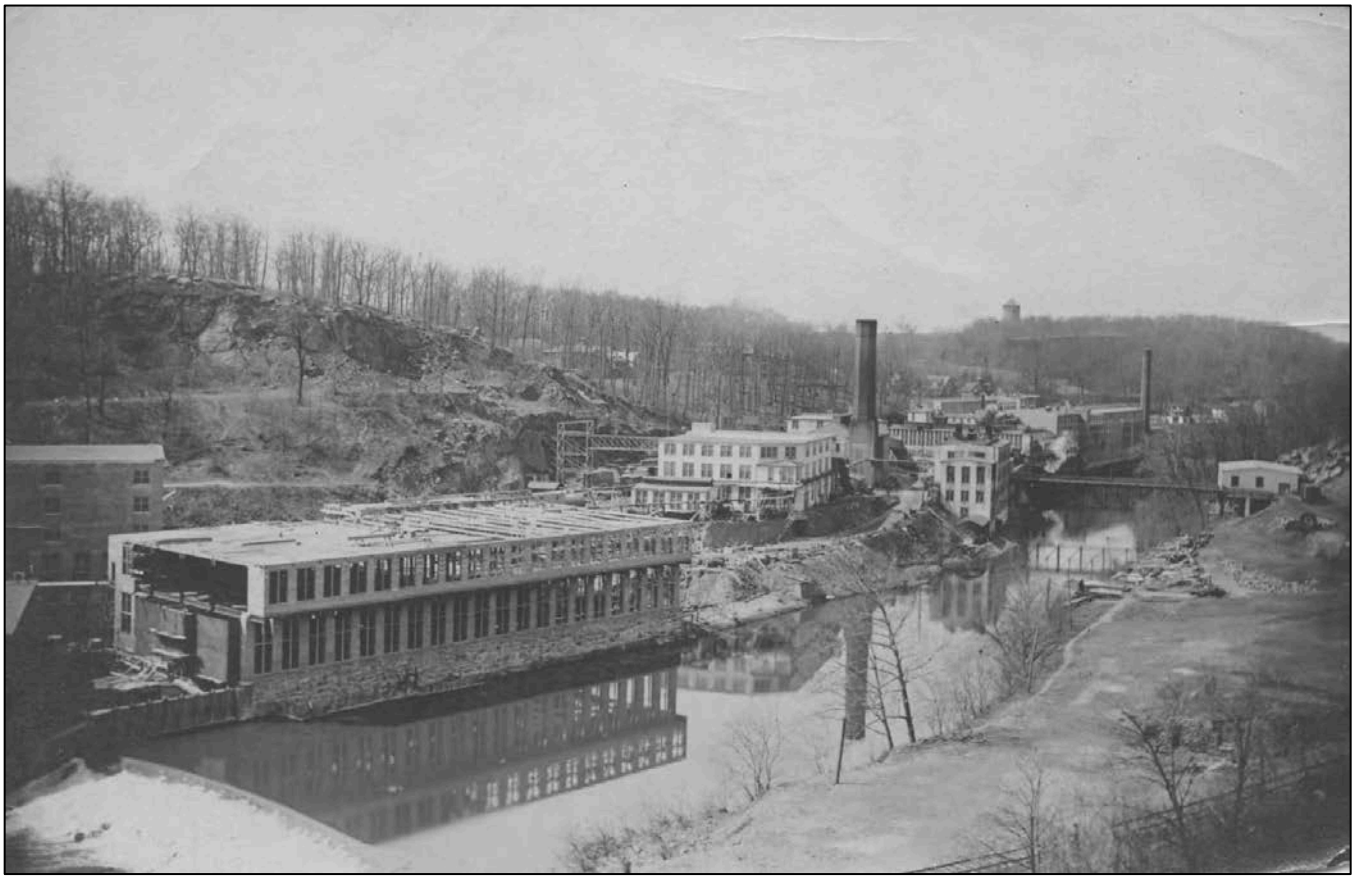


Figure 65. Construction at the Bancroft Mill buildings at the new Kentmere site; note the dam in the extreme left corner, undated. (Hagley Museum and Library)

In 1905, the Bancroft company purchased water rights and 13.7 acres of land on the northern bank of the Brandywine from E.I. du Pont de Nemours & Co.[175] Then, in 1910, the company purchased another property in Reading, Pennsylvania, subsequently moving all manufacturing operations to the Pennsylvania site and utilizing the Wilmington facilities for bleaching, dyeing, and finishing. As synthetic yarns increasingly came into use in the 1930s and beyond, the company devoted research and development to those fields, with "Ban-Lon" and "Everglaze" becoming company staples into the mid-twentieth century.[176] By 1930, Bancroft & Sons Co. had become one of the world's largest single cotton

[175] Boatman, 82.
[176] "Joseph Bancroft & Sons Company miscellany on Bancroft Mills 2448," Manuscripts and Archives Repository, Hagley Museum and Library, https://hagley-aspace-pdf.s3.amazonaws.com/2448.pdf.

dyeing and finishing operations and by the mid-twentieth was the only-remaining textile manufactory on the Brandywine.[177]

Figure 66. Aerial image of Bancroft Mill, 1922. (Dallin Aerial Survey, Hagley Museum and Library)

[177] Boatman, 82.

Figure 67. Aerial image Bancroft Mill, 1927. (Dallin Aerial Image Collection, Hagley Museum and Library)

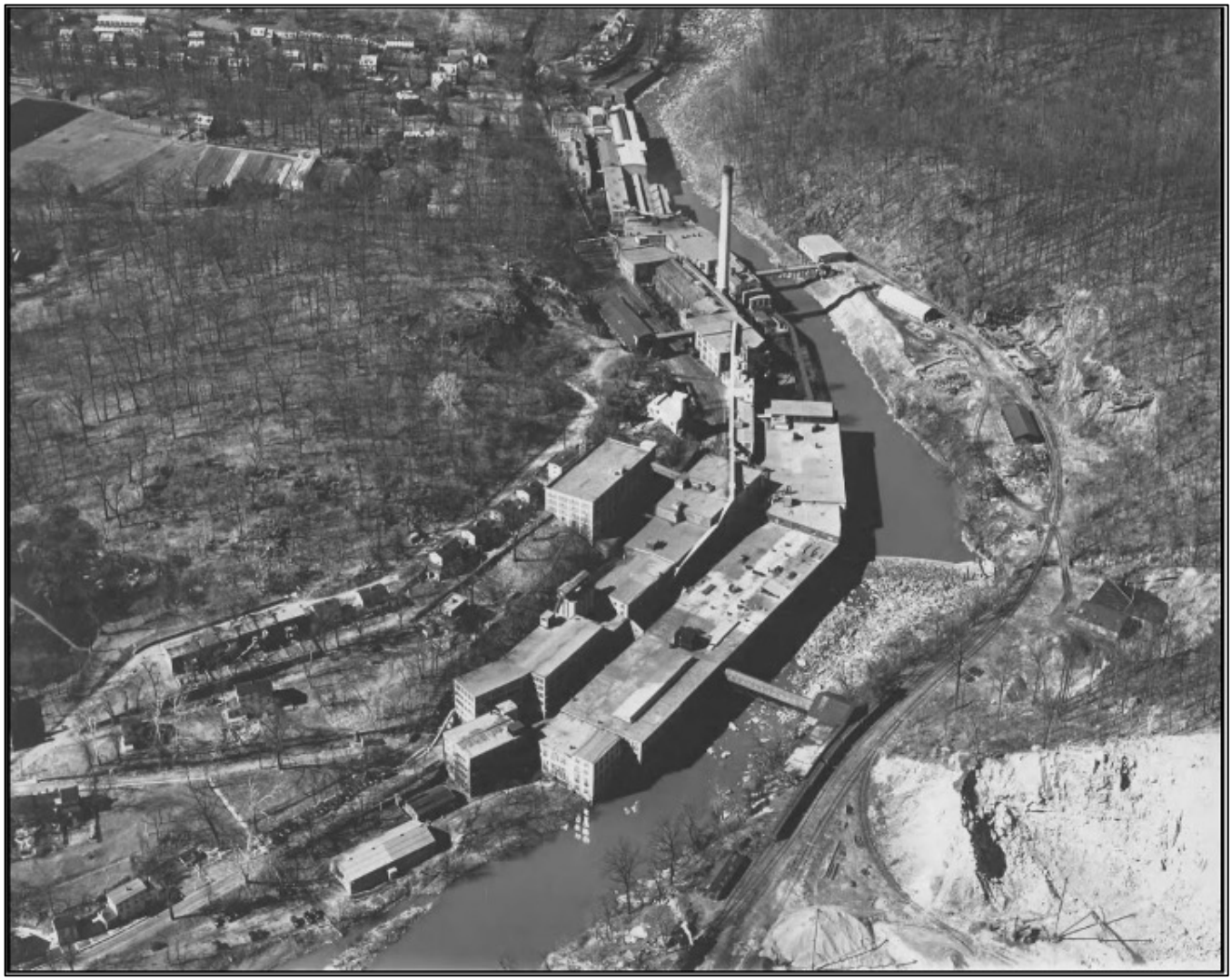


Figure 68. Aerial image Bancroft Mill, 1930. (Dallin Aerial Image Collection, Hagley Museum and Library)

Figure 69. View of the Bancroft Mill complex, showing the northern riverbanks and Dam 4 with fish ladder addition, 1975. (Woodlawn Trustees Archives)

Several other groups took over the Bancroft mills site in the late-twentieth century. In 1961, Bancroft became a subsidiary of textiles manufacturer Indian Head Mills, Inc., and in 1972, the finishing plant was purchased by the Wilmington Finishing Company, a group of department heads from Bancroft. In 1975, the company was sold to the Beaunit Corporation. Wilmington Piece Dye Company purchased the plant in 1981 and operated the site until its bankruptcy in 2003.[178] In the years to follow, a section of the former mills (two buildings) were renovated into condominiums, just east of Rockford Road. Earlier, in 1967, a 70-acre section of the property had also been purchased by the Krapf family, which developed

[178] "Joseph Bancroft & Sons," Delaware's Industrial Brandywine Digital Exhibit, Hagley Museum and Library, https://www.hagley.org/research/digital-exhibits/joseph-bancroft-sons.

portions of it for housing including the Brandywine Falls community (the site of earlier Bancroft company housing on what was St. Helena Road), situated just east of the Rockford Dam.[179] A large portion of the remaining buildings of the former Bancroft property were severely damaged by fire in November 2016 and subsequently razed. The site is undergoing residential redevelopment.[180]

WILLIAM BRETZGER/THE NEWS JOURNAL

A large portion of the abandoned Bancroft Mills complex burns out of control along the Brandywine in Wilmington after a fire there was reported shortly after 2 a.m. Nov. 9.

Figure 70. View of the remaining large buildings associated with Bancroft Mills, severely damaged by fire in late 2016. They were subsequently razed. (The News Journal)

[179] Maureen Milford, "Bancroft Saved North Delaware from Sprawl," *The News Journal*, September 6, 1994.
[180] William Bretzger and Brittany Horn, "Abandoned Bancroft Mills in Wilmington Burns, *The News Journal*, November 10, 2016; Xerxes Wilson, "Builder to Raze State Landmark for Rentals," *The News Journal*, March 24, 2017.

The Denil fish ladder or fishway constructed at the northern abutment of Dam 4 c. 1970 is the third of three that were constructed on the Lower Brandywine through the Delaware State Game and Fish Commission, with state and federal funding, in an effort to restore American shad to the river. Fish ladders are designed to allow different species of migratory fish to pass dams, spillways, and other barriers. Unlike salmon, American shad are not able to "jump" and therefore require specific types of fishways to bypass obstructions. The first two Brandywine fish ladders were built in 1969 at Dam 1 (formerly located at West Street) and Dam 2 (located at Broom Street).

A Denil fish ladder is a standard type of chute fishway designed with wooden baffles to control water flow. The entrance to the fishway would be situated near the bottom or "toe" of a dam, which creates high water velocity drawing fish into the chute or channel (which is typically three to four feet in width). The channel, ramping up in segments or runs and often with resting pools between the runs, gradually transports the fish up and over the dam. The channel contains regularly-spaced internal slots or tracks, usually set at a 45-degree angle, to house wooden baffles that slow the velocity of water flow.[181]

[181] Brandywine Conservancy, "The Restoration of American Shad to the Brandywine River: A Feasibility Study," January 2005 (https://www.wrc.udel.edu/wp-content/uploads/2018/01/RestorationofAmericanShadtotheBrandywineRiverFeasibilityStudyJan2005.pdf, accessed March 7, 2022), 12-14.

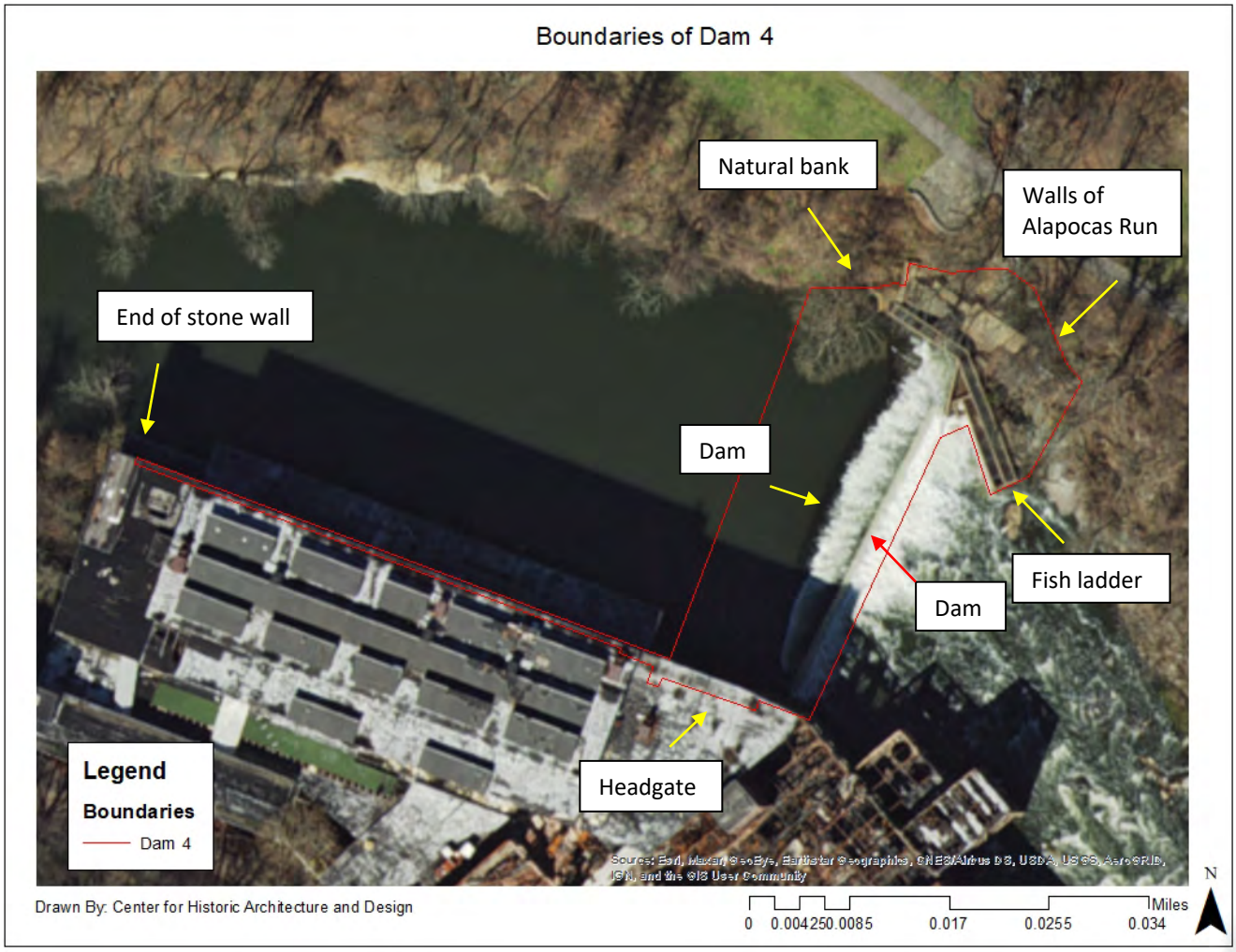


Figure 71. Boundary map of the Dam 4 complex.

Evaluation:

Dam 4, known as Kentmere Dam, is recommended as eligible for listing in the National Register of Historic Places under Criteria A and C with significance at the local level. It is significant under Criterion A for its association with the industrial development along the Brandywine, specifically the textiles industry. Dam 4 was initially constructed in 1896 by the Joseph Bancroft & Sons Company (also operating at Dam 5), which by the early-twentieth century had become one of the world's largest textile finishers and introduced various innovative processes and synthetic materials to the market. Dam 4 is also significant under Criterion C for its vernacular construction of a descending ramp, bowed, stone apron dam (built 1896), which was later augmented by a straight stone and concrete dam (built c. 1940). Research on this resource has not revealed any associations with the lives of persons significant to our local, state, or national history, for whom this resource is the best representative associated property; therefore, it ineligible for listing under Criterion B. This resource has not been evaluated for eligibility under Criterion D.

Dam 4 retains relatively high levels of historic integrity for location, design, materials, and workmanship. It has remained in its original location since its initial construction in 1896, and its augmentation by the c. 1940 stone and concrete dam demonstrates continuity of use at this dam site. Its design, materials, and workmanship are expressed through the vernacular construction of the 1896 descending ramp, bowed, stone apron dam, augmented by the c. 1940 straight stone and concrete dam. Its material fabric survives relatively intact without significant alteration, though the stone apron portion of the 1896 structure has been incorporated into the c. 1940 augmentation. Its design for the impoundment of water to power an adjacent mill is evident through the survival of the mill race head gate, though the race itself and mill buildings are non-extant. The integrity of setting as well as feeling and association are compromised due to the loss of adjacent industry, which the dam powered, and changes in land use from industrial to recreational and residential. The acreage on the northern banks of the dam was in the early-twenty-first century converted to state park lands, and the majority of the remaining Bancroft mill buildings, located along the southern banks and abandoned since c. 2002, suffered extensive fire damage in 2016 and were subsequently demolished. Two extant mill buildings had been previously adaptively reused for condominiums, while the lands on which the recently razed buildings formerly stood is currently under residential redevelopment. However, some integrity of

setting is retained and design integrity is enhanced through the survival of the dam's historic mill race head gate, though the race is non-extant, as well as the survival of the long stone retaining wall along the southern banks, which buttresses the dam and served as foundational walls to non-extant mill buildings.

Bridge and Stone Wall Culvert

Tax ID: 0612700002 (State of Delaware)
Geographic Coordinates: 39.768984, -75.558974
Date of Construction: Stone walls, c. 1885; bridge, c. 2000
Eligibility Recommendation: Ineligible

Description:

On the northern bank of the Brandywine, just northeast of Kentmere Dam, is a dry-laid, stone wall culvert, constructed c. 1885, through which Alapocas Run flows into the river. The stones used in its construction are largely cut and quarried, with some rubble fieldstone. A metal I-beam platform bridge, installed c. 2000, spans the culvert and is covered by modern asphalt. The bridge, measuring about 11 feet and seven inches wide and 20 feet long, is part of a recreational trail for Alapocas Run State Park.

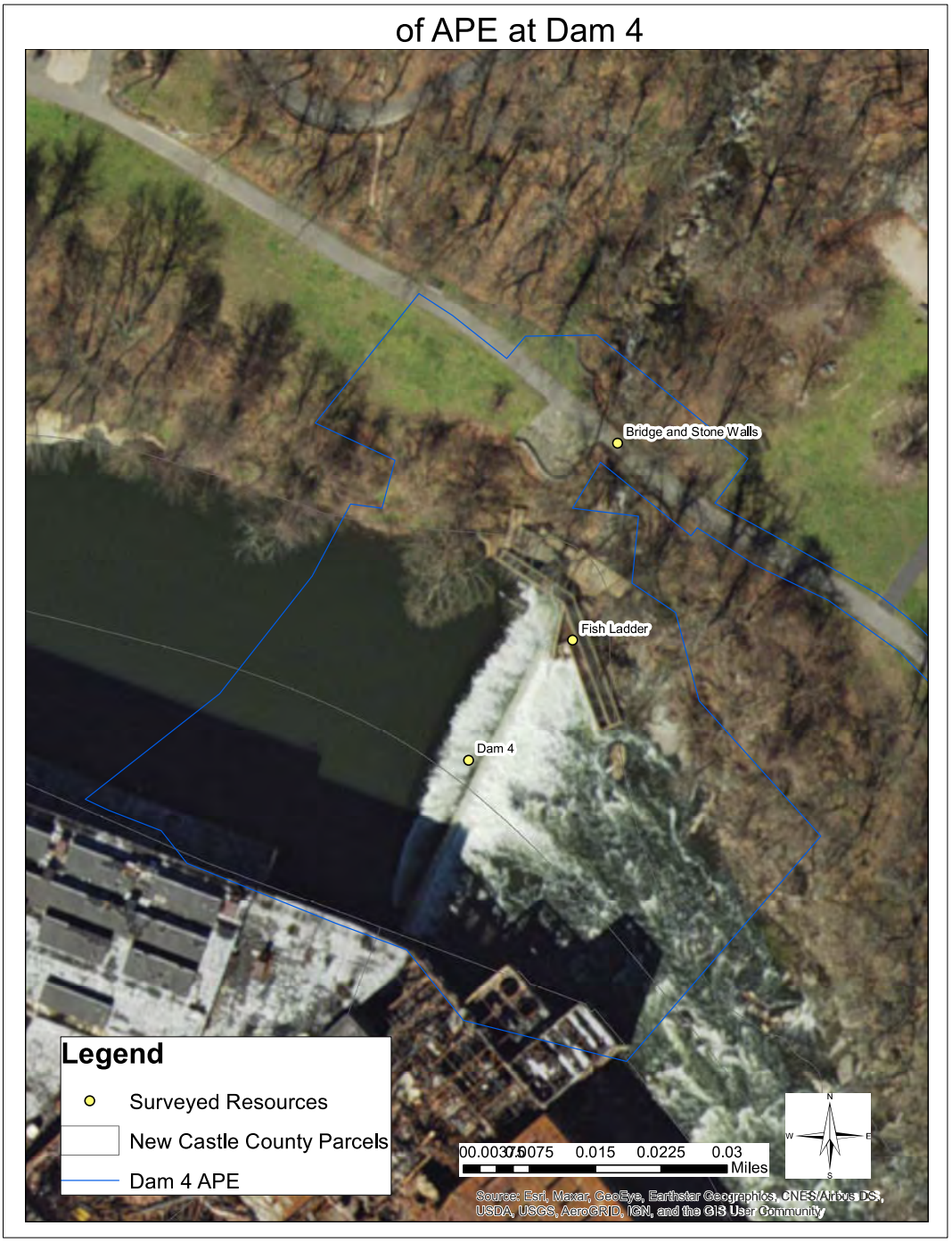


Figure 72. Location map of the bridge and stone walls within the boundaries of the APE. (Center for Historic Architecture and Design)

Figure 73. View of the c. 2000 pedestrian bridge and stone walls, looking northwest, 2021. (Center for Historic Architecture and Design)

Figure 74. View of the c. 2000 pedestrian bridge, looking northwest, 2021. (Center for Historic Architecture and Design)

Figure 75. View of Alapocas Run, showing the c. 1885 stone wall culvert and bridge substructure, looking northeast, 2021. (Center for Historic Architecture and Design)

Figure 76. View of Alapocas Run, showing the c. 1885 stone wall culvert, looking north 2021. (Center for Historic Architecture and Design)

Historic Context:

Hundred: Brandywine; *Quadrant:* Wilmington North; *Geographic Zone:* Piedmont; *Time Period:* Urbanization and Early Suburbanization, 1880-1940+/-; Suburbanization and Early Ex-Urbanization 1940-1960 +/-; Historic *Period Themes:* Settlement Patterns and Demographic Changes; Architecture, Engineering and Decorative Arts

History:

The stone culvert likely dates to c. 1885 and is associated with a railway for quarrying operations of Locke & Company, Brandywine Granite Company, and others. In the late-nineteenth and early-twentieth centuries, quarries on the northern banks above Dam 4 supplied Brandywine Blue Gneiss for many local and regional projects, including in the construction of the B&O Railroad Bridge (CRS# N01566.008, included in NR# 81000192) that crosses the Brandywine between Dams 2 and 3;

Wilmington's Rockford Water Tower (CRS# N03661, included in NR# 78000912); and the National Harbor of Refuge and Delaware Breakwater Harbor in Lewes (CRS# S00186, NR# 76000586).[182] A c. 1912 photograph (figure 79) shows the tracks for the railway crossing Alapocas Run.[183] The current metal bridge is not depicted in the 1912 image, and the crossing is obscured from view in a 1975 photograph of the site (figure 80). The current metal bridge as well as a flagstone patio just west of the bridge and curving, mortared, low stone walls on the eastern and western approaches to the bridge date to c. 2000. These features were constructed after the state acquired additional acreage on the northern banks for Alapocas Run State Park.[184] It is possible that this bridge was repurposed from another location.

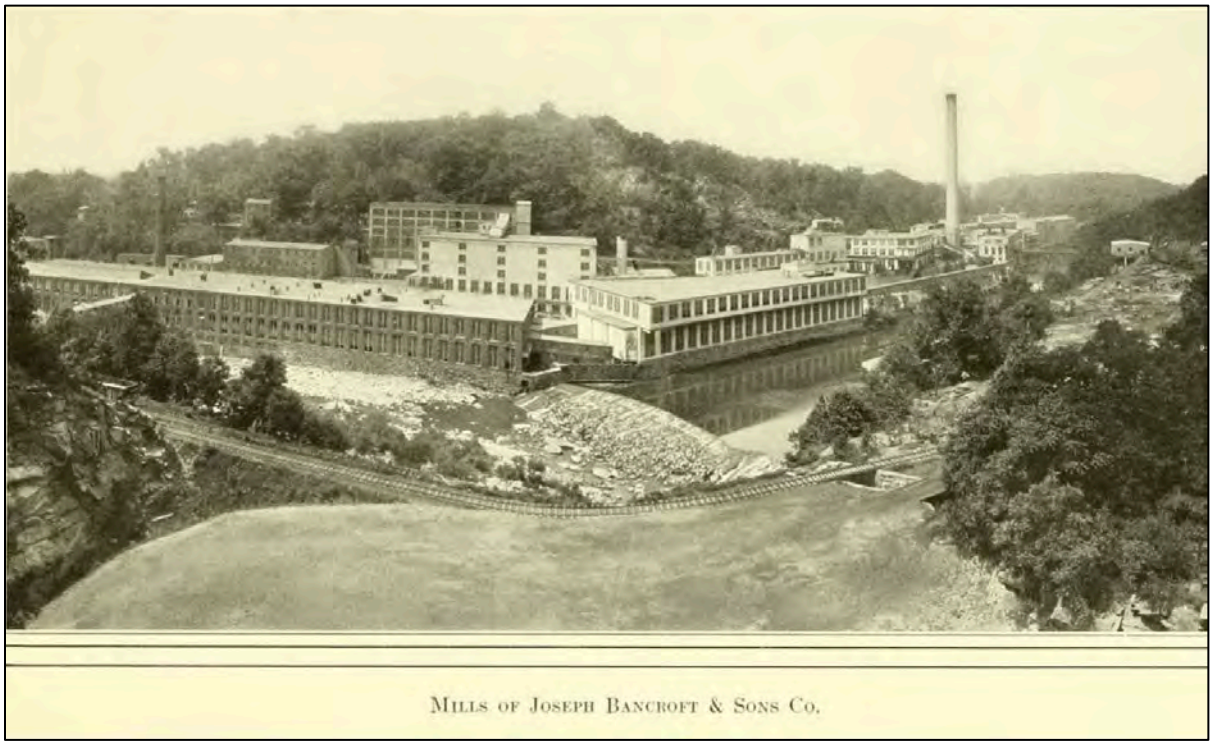


Figure 77. A c. 1912 view of the Kentmere portion of Bancroft Mills, showing Dam 4 and the tracks of the railroad (foreground), related to quarrying, running along the northern bank, and crossing Alapocas Run. (Wilmer W. MacElree, Along the Western Brandywine)

[182] Zebley, *Along the Brandywine*, 162, 164; "Alapocas Woods," Delaware's Industrial Brandywine Digital Exhibit, Hagley Museum and Library, https://www.hagley.org/industrial-brandywine-categories/alapocas-woods.
[183] Bancroft mills is pictured on page 189 of Wilmer W. MacElree's *Along the Western Brandywine*, published in 1912.
[184] Action Photo, for J. Krapf & Sons, untitled aerial images, contact sheets, April 1975, From Woodlawn Trustees Inc. Archive, Wilmington, Delaware; Gary Soulsman, "Delaware's Forgotten Emerald," *News Journal*, July 18, 1998.

Figure 78. View of the Bancroft Mill complex, showing the northern riverbank (Woodlawn Trustees Archives)

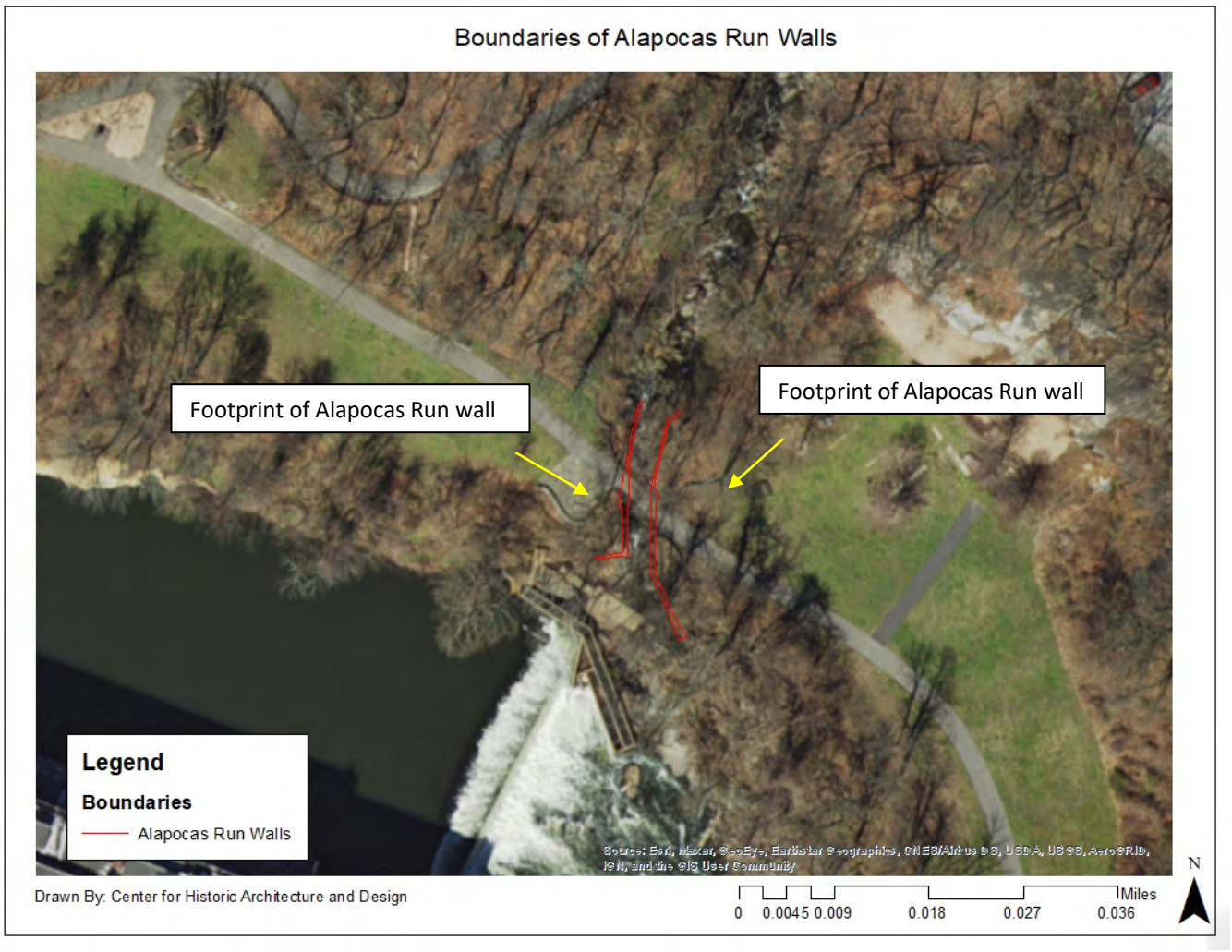


Figure 79. Boundary map for the culvert walls at Alapocas Run.

Evaluation:

This resource is recommended as ineligible for listing in the National Register of Historic Places. Under the Delaware Department of Transportation (DelDOT) *Historic Bridge Criteria for Determining Significance*, which differentiates between history that is common to like features and distinguishable events that made a significant contribution to historical development, concerning Criterion A, a bridge (or culvert) must meet a higher standard in order to represent local, state, or national level trends and broad patterns. This resource is ineligible for listing under Criterion A as it represents a common type of stone wall culvert with no distinctive or historical background or setting; while it is associated with late-nineteenth and early-twentieth century quarrying operations at the site, which supplied Brandywine Blue Gneiss for use in construction throughout the region, this resource alone does not represent the significance of the site. Research on this resource has not revealed any associations with the lives of persons significant to our local, state, or national history, for whom this resource is the best representative associated property; therefore, it ineligible for listing under Criterion B. Concerning Criterion C, under the DelDOT *Historic Bridge Criteria for Determining Significance*, eligible bridges (or culverts) must be significant in the development of bridge (or culvert) technology. Examples of eligible bridges or culverts could include those with unusual construction details or rare survivors of a significant type; those that are the work of significant engineers or engineering firms; or those that are especially good examples of their type. This resource is ineligible under Criterion C as it represents an extant example of a common or vernacular type of culvert, comprised of two cut and quarried stone abutments, constructed during the nineteenth and early-twentieth centuries in the Piedmont of Delaware using native Brandywine Blue Gneiss. It is neither unusual nor especially noteworthy. This resource has not been evaluated for eligibility under Criterion D.

Dam 5 Complex: Rockford / Bancroft I (N03646.048)

Tax ID: East bank: 0612700002 (State of Delaware) / West bank: 2600230001(Brandywine Falls Condo Association)
Geographic Coordinates: 39.77078, -75.56919
Date of Construction: 1878
Eligibility Recommendation: Eligible

Description:

Dam 5, known as the Rockford Dam, was constructed in 1878 by the Joseph Bancroft & Sons Company as an ascending ramp, straight, timber-braced stone dam. The dam retains its head gate as well as mill race extending along the southern bank of the Brandywine. The dam spans approximately 200 feet and has a fall of about eight to 10 feet. A news article published in September 1878 describes the completion of the dam, noting the employment of stonemasons in its construction and highlights it as a "very substantial piece of workmanship."[185] The article additionally notes the stonemasons' construction of a new head gate, "said to be the finest on the Brandywine."[186] The previous dam, described as having been located about 30 yards above the new dam, is confirmed to have been "torn away," as it was "incapable of furnishing enough water to run the mills," and that the new dam would "supply all deficiencies."[187]

The downstream vertical face of the dam is constructed of stone, with some stone protrusions visible through the falls. A c. 1912 photograph of Rockford Dam during low water levels shows the face of the dam covered in horizontal wooden planking, or lagging, with regularly-spaced vertical timber braces (akin to soldier beams or piles) tied in and reinforcing the dam (figure 82).[188] The face of the dam was not visible during field observations in November 2021, though some of the planking or timber braces may have partially deteriorated given the visibility of some protruding stone fill. Wooden planks laid perpendicular to the crest of the dam form a ramp on its upstream side. The planks, measuring five to six

[185] "Dam Completed," *Morning Herald*, September 21, 1878.
[186] "Dam Completed," *Morning Herald*, September 21, 1878.
[187] "Dam Completed," *Morning Herald*, September 21, 1878.
[188] Rockford Dam is pictured on page 183 of Wilmer W. MacElree's *Along the Western Brandywine*, published in 1912.

inches in width, abut one another and evidence deterioration at the crest of the dam from over wash. The northern extent of the dam is constructed against flat outcroppings of native Brandywine Blue Gneiss, while its southern end is tied into the stone abutment wall housing the head gate. Just west of the dam is the inlet for the head gate and mill race.

The dry-laid stone abutment housing the head gate measures 33 feet long and 14 inches wide and is comprised of a mix of cut and quarried (with visible feather and plug holes) and rubble stones. The year 1878 is engraved into a cut corner stone on the interior (race side) of the abutment. The large metal head gate has six chains. Wood plank decking spans the distance of the head gate for pedestrian access. The eastern side of the stone abutment continues to the east, sloping down and gradually leveling with a contiguous stone retaining river wall running along the river. The stone abutment is topped with cut, quarried stone and reinforced with a long iron strap and bolts, while the retaining river wall is capped with concrete. The path along the abutment and river wall is guarded by metal rails. Loose stones and smaller rocks comprise the southern bank of the river. The stone retaining river wall, capped with high macadam concrete, continues to the east for approximately 200 feet.

The mill race is generally concrete lined with high macadam on its northern edge, with natural earthen walls along its southern edge. On the northern side are occasional “flares” or ramps for moving machinery in and out of the race, measuring approximately three feet six inches to four inches in width. Approximately 400 feet from the head gate is a metal bridge control gate, or sluice gate, set into a low, rubble concrete wall, perpendicular to the race, measuring about two feet wide. Two rubble concrete channels, measuring about three feet wide, open to the north onto the river. A wooden and metal pedestrian bridge spans the race just east of the gate. East along the race about 700 feet from the bridge gate is another similar metal gate, set into a low, flared, poured concrete wall measuring about two-and-a-half-feet wide at the apex, guarded by metal rails. The race continues another few hundred feet east towards the former site of the Bancroft mills.

Figure 80. Location map of Dam 5 and the headgate and race, as well as the boundaries of the working APE. (Center for Historic Architecture and Design)

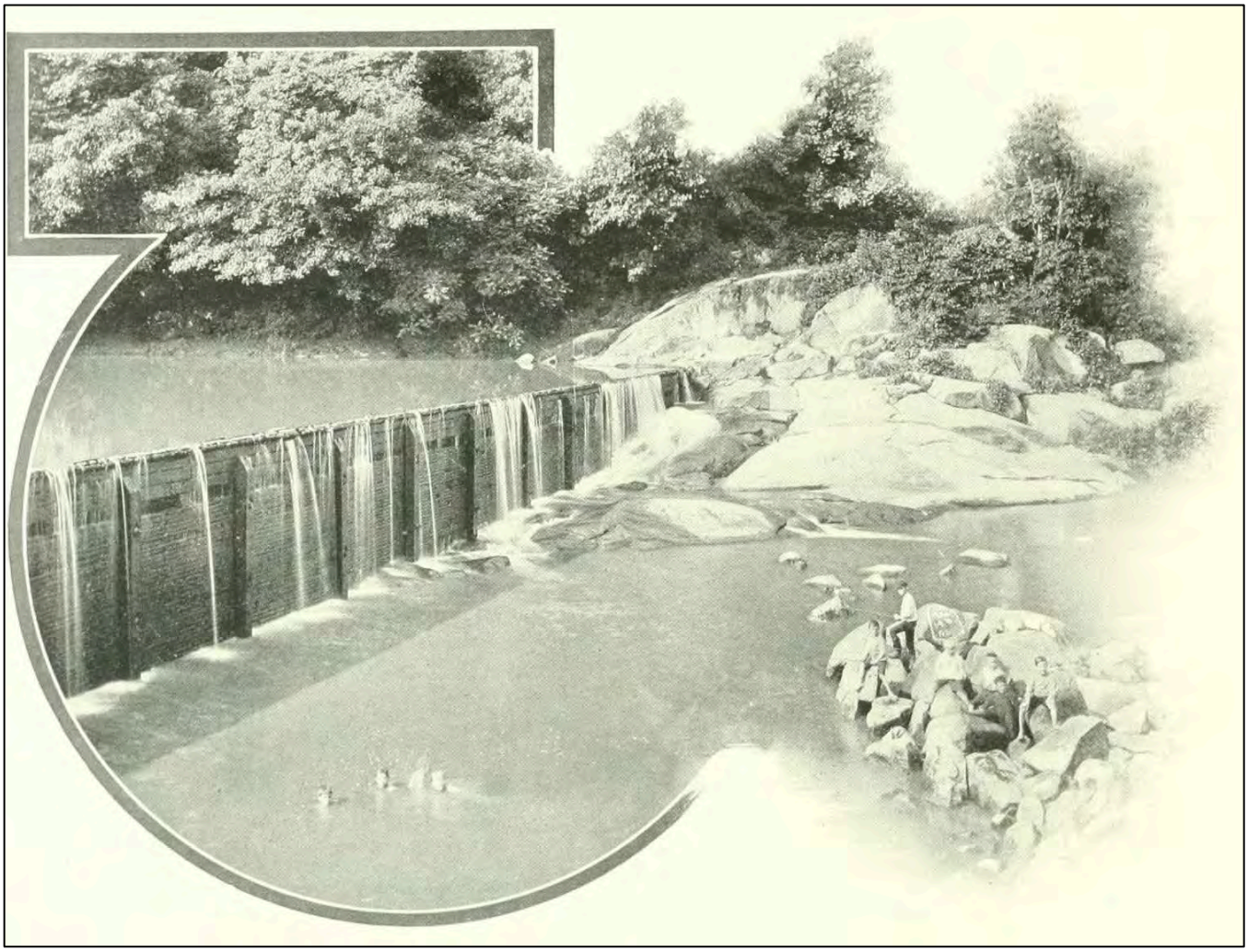


Figure 81. A c. 1909 view of Dam 5 during low water levels, showing its timber-braced framing. (Wilmer W. MacElree, Along the Western Brandywine)

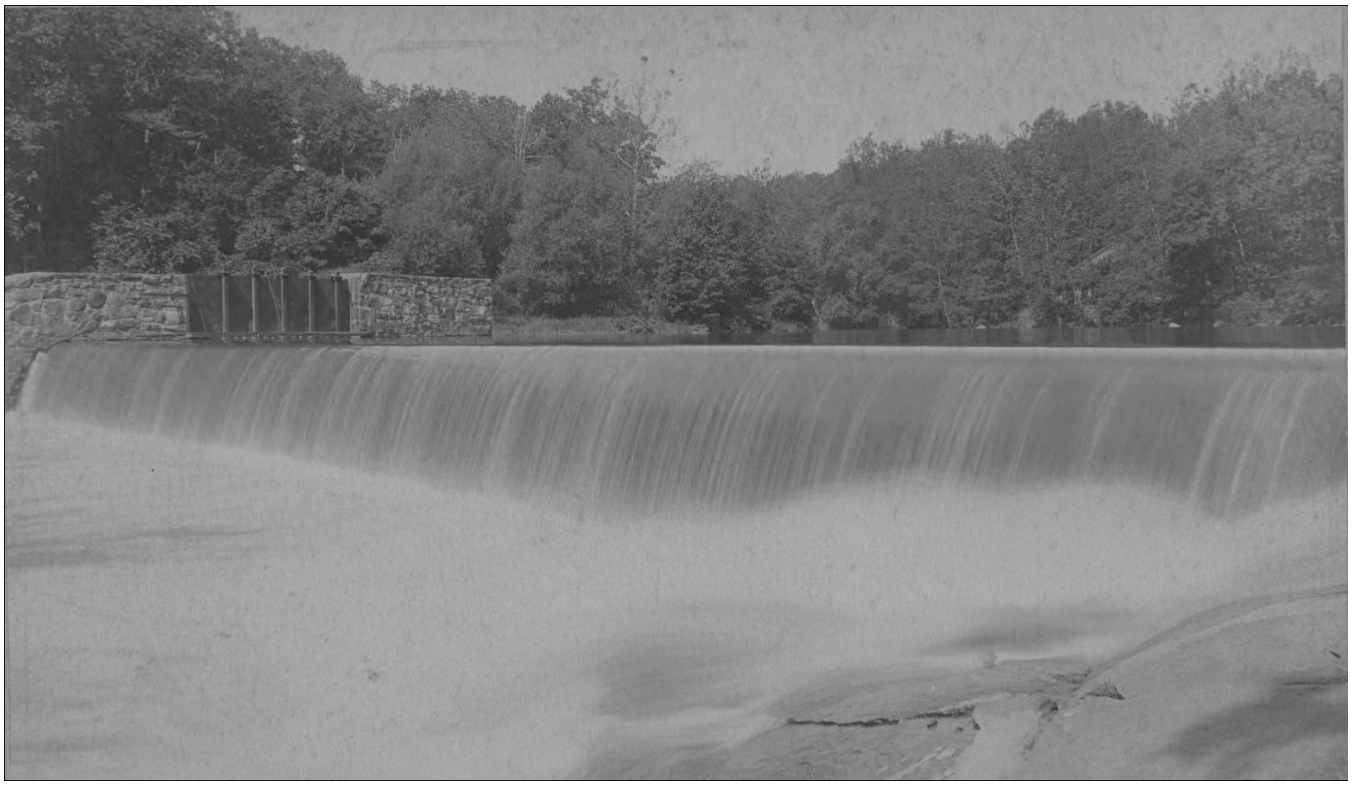


Figure 82. View of Dam 5, showing the headgate and the stone south river wall, undated. (Hagley Museum and Library)

Figure 83. View of Dam 5, showing the north banks, 1932. (Frank Zebley Photo Collection, Hagley Museum and Library)

Figure 84. View of Dam 5, looking upstream (northwest), 2021. (Center for Historic Architecture and Design)

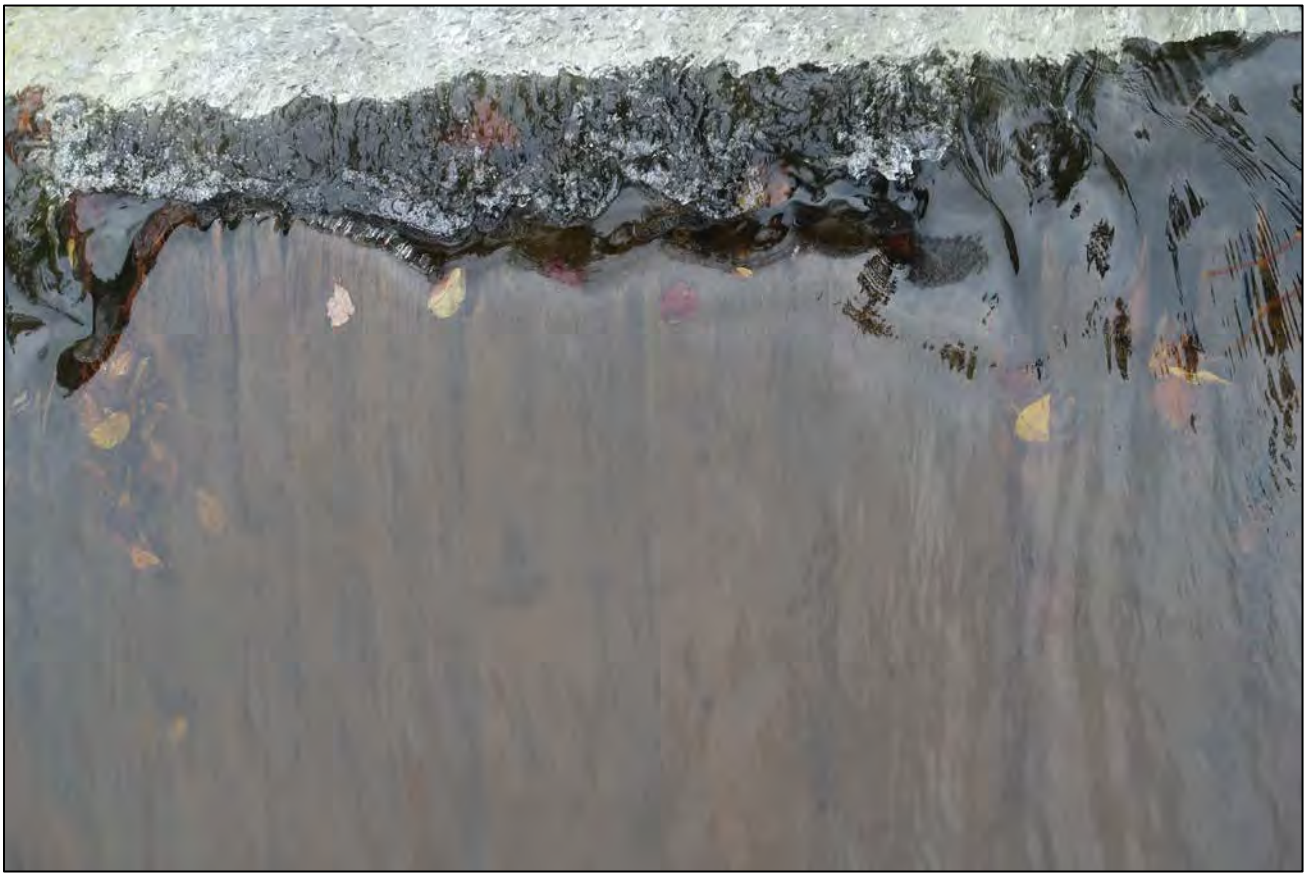


Figure 85. Detail view of the upstream plank-covered ascending ramp, 2021. (Center for Historic Architecture and Design)

Figure 86. View of head gate, race, and stone river walls, looking northeast, 2021. (Center for Historic Architecture and Design)

Figure 87. Detail view of the 1878 date stone on the race side of the river wall, 2021. (Center for Historic Architecture and Design)

Figure 88. View of the mill race, looking southeast, 2021. (Center for Historic Architecture and Design)

Figure 89. View of the mill race in relation to Dam 5, looking northwest, 2021. (Center for Historic Architecture and Design)

Historic Context:

Hundred: Wilmington; Brandywine; *Quadrant:* Wilmington North; *Geographic Zone:* Piedmont; *Time Period:* Urbanization and Early Suburbanization, 1880-1940+/-; Historic *Period Themes:* Manufacturing; Settlement Patterns and Demographic Changes; Architecture, Engineering and Decorative Arts

History:

The earliest known milling activity in the area of the Rockford Dam is said to be that of Job Harvey, who operated a gristmill at Rockford in the late-eighteenth and early-nineteenth centuries.[189] In 1813, the Brandywine Mill Seats Company formed to speculate in mill properties along the Brandywine, with E.I. du Pont, Caleb Kirk, and John Torbert among its founders. The company purchased several mill

[189] Conrad, 420.

seats, including that of Job Harvey at Rockford.[190] The firm Fairlamb & Read produced two surveys for the company, one in 1813 and another in 1816, showing the Rockford area. The 1813 *Lands and Premises of the Brandywine Company* includes the area on both sides of the Brandywine at Rockford, and the 1816 *Mill Seats on the Brandywine River* shows a woolen factory labeled on the southern bank (figures 91 and 92). It also illustrates two dams in the vicinity, one located at the approximate location of the modern Rockford Dam, at a bend in the creek, supplying waterpower to the woolen factory via a southern race; and another just to the east, with a short northern race supplying water power to several unlabeled mills on the northern bank.

Figure 90. Fairlamb & Read map, Lands and Premises of the Brandywine Company, showing the land holdings of the Brandywine Seats Company, 1813. (Hagley Museum and Library)

[190] Boatman, 109.

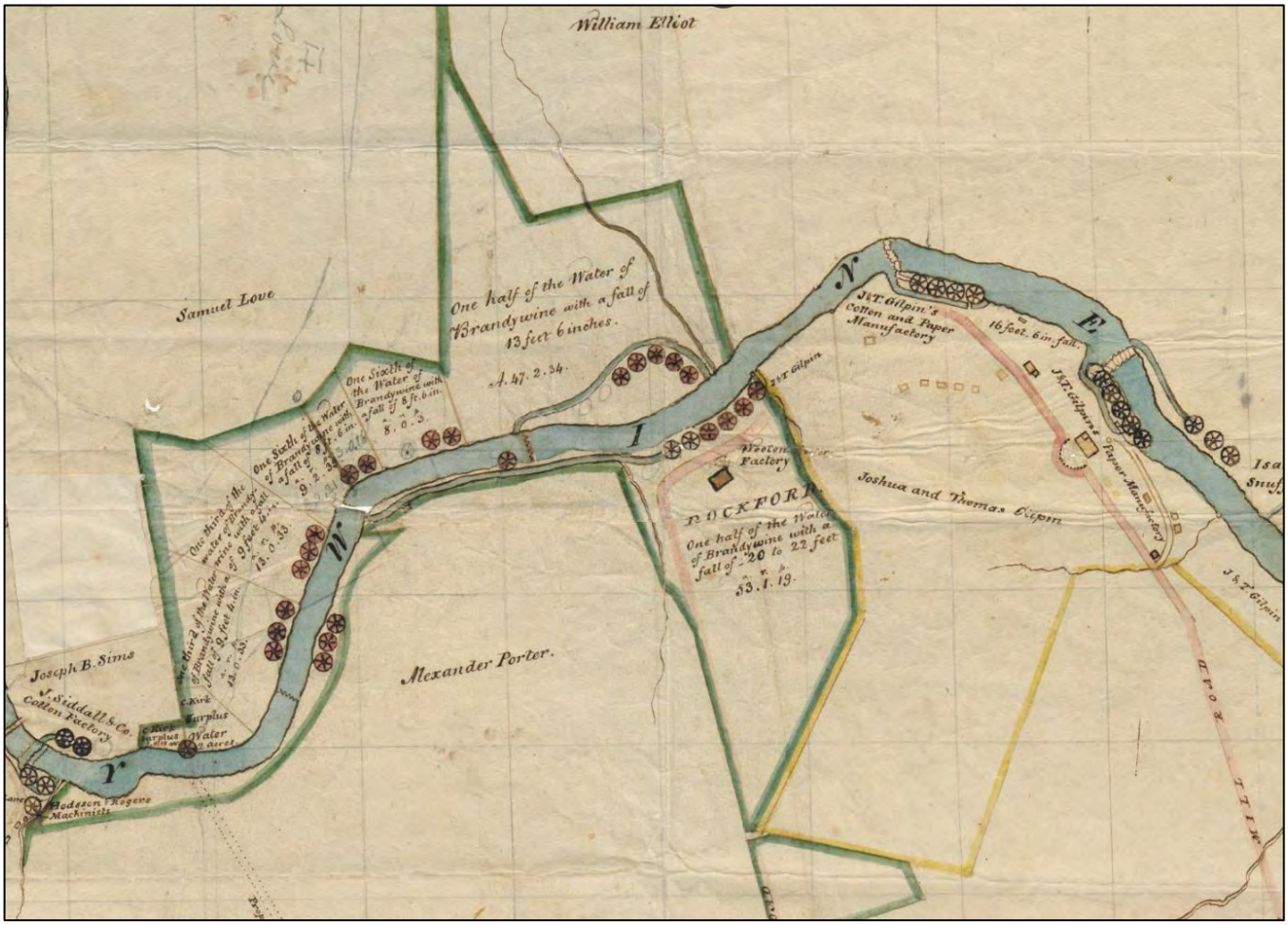


Figure 91. Fairlamb & Read map, showing Dam 5 near the "W" on the map. This dam powered the "Rockford" site downstream which contained a "woolen factory," 1816. (Hagley Museum and Library)

The most significant and longest lasting enterprise associated with the Rockford mill seat is that of Joseph Bancroft, who established what was initially known as Rockford Bleaching and Dye Works (as well as Bancroft's Cotton Mill and Rockford Cotton Mill) and later as Joseph Bancroft & Sons.[191] English native and Quaker Joseph Bancroft immigrated in 1824 to Wilmington, Delaware, after apprenticing for a period of seven years in his uncle Jacob Bright's cotton mill in England. His father, John Bancroft, and brothers had arrived at Wilmington several years before him and were operating a flannel manufactory near the Market Street bridge (Bancroft Flannel Mill), where Joseph joined them at work between 1824 and 1827.[192] From 1827 to 1831, he worked as plant superintendent for the Wallace

[191] Conrad, 419.
[192] Boatman, 78.

Cotton Manufactory at Rockland, about four miles upstream and operated by the Young family, developing further knowledge of the American cotton industry. In 1831, Bancroft purchased a vacant mill site on the south bank at Rockford, about two miles downstream from Rockland, with the financial backing of Thomas Janvier, part owner of the "Union Line" of steamboats between New Castle and Philadelphia and the New Castle & Frenchtown Turnpike. The mill property included 25.35 acres and one-fourth water rights from William W. and Julia Young along with the same acreage and water rights from John and Ellen Torbert (totaling 50.7 acres and one-half water rights), all being part of the earlier Brandywine Mill Seats Company, which had been parceled out in 1829 among the partners in that firm. On the property that Bancroft purchased stood a two- and-a-half-story mill, two-story boiler house, stone dwelling, stone barn, smaller dwelling, and two cottages as well as the mill dam and mill race.[193]

Bancroft's intent was to establish a cotton manufactory that could spin cambric muslin at a rate of 150,000 yards annually, with markets in Philadelphia, New York, and Baltimore.[194] The mill employed 67 men, women, and children to operate the "preparatory machinery, 1,760 spindles, and 30 power looms."[195] Little information is known about the cloth-making factory until a severe flood, or freshet, in January 1839, when water rose 22 feet above average levels, during which the mill dam and boiler house (used to heat the mill) were destroyed, and much of the factory's machinery and looms were significantly damaged. Following this, and with additional financial support from Janvier, Bancroft rebuilt the milldam and constructed a larger building on the site of the boiler house, measuring about 70 feet in length, with J. Morton Poole operating a machine shop for a time from the second story.[196]

[193] Boatman, 79.
[194] Boatman, 80.
[195] Boatman, 80.
[196] Boatman, 80; Wilmer W. MacElree, *Along the Western Brandywine* (F.S. Hickman, printer, 1912), 187.

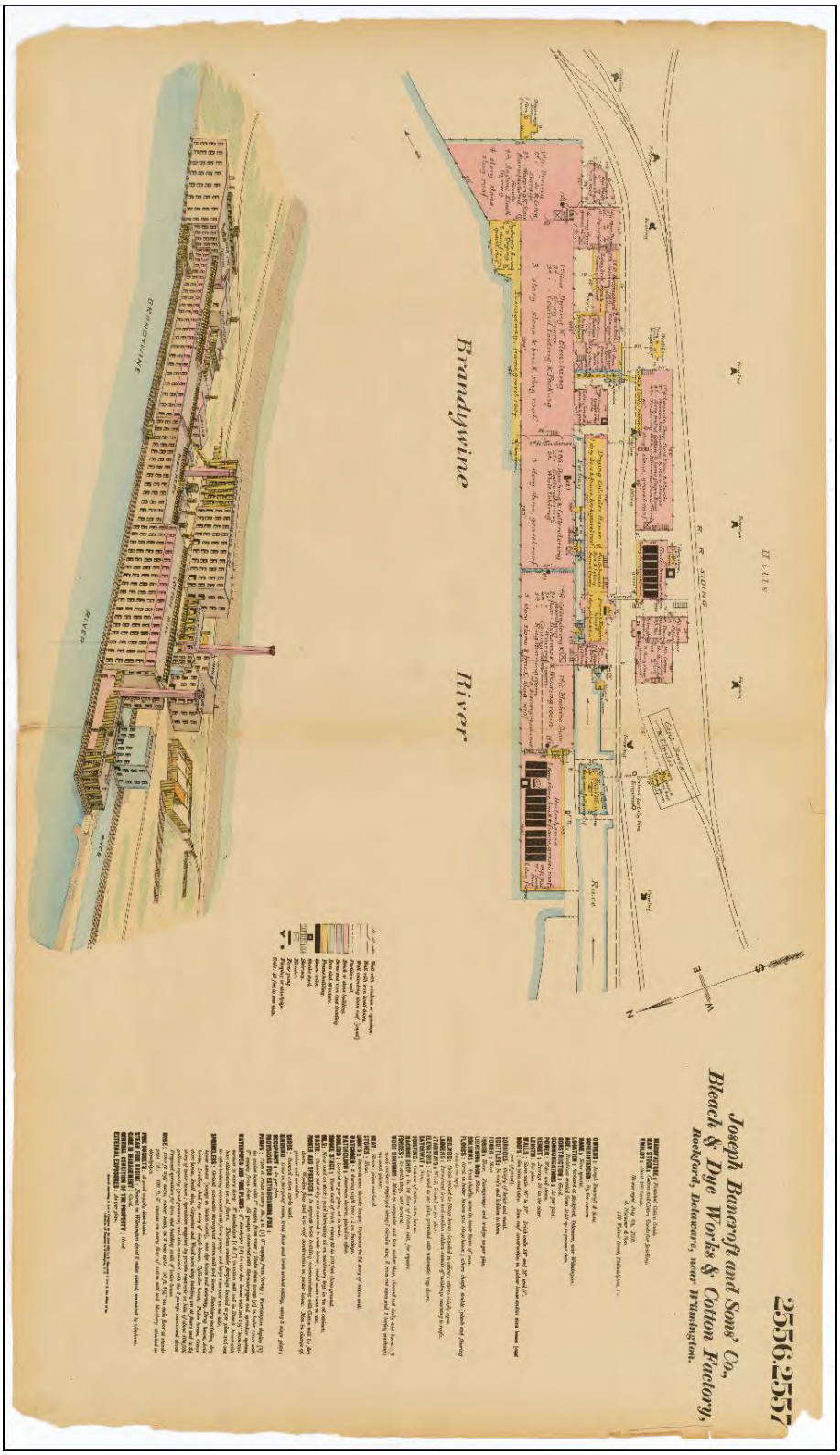
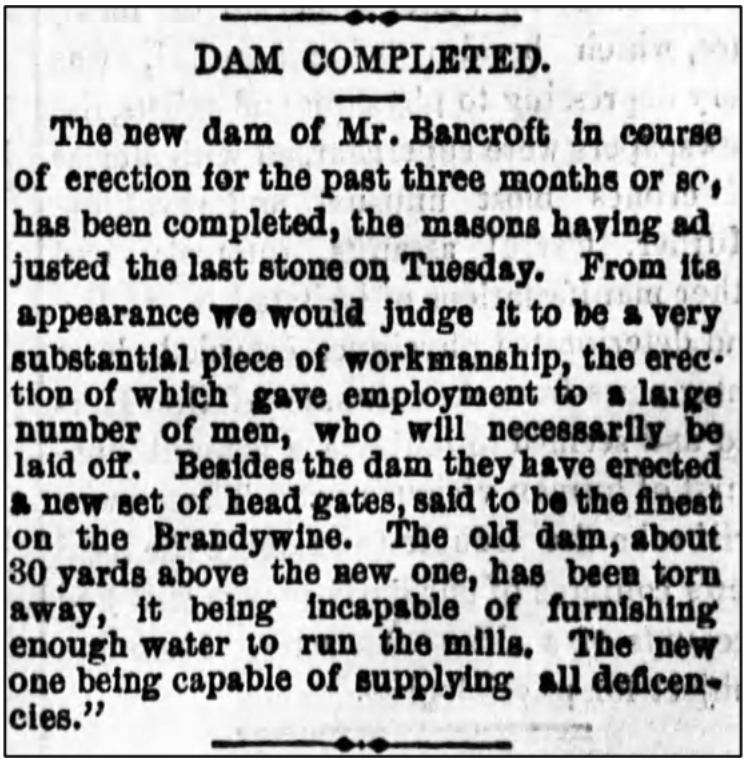


Figure 92. "Joseph Bancroft and Sons Co.," Hexamer Map, 1892. (Hagley Museum and Library)

In the following decades, Bancroft continued expanding his operations and improving machinery. In the 1840s, Bancroft's mill introduced what are said to be among the first "self-acting mules and fly frames in America."[197] During the 1850s, Bancroft studied English finishing processes with the goal of producing "Hollands," a plain-woven type of linen used commonly for window shades, in order to further expand his enterprises.[198] By the 1860s, having refined the finishing process, the Bancroft mill increasingly supplied cloth to shade manufacturers who could no longer import it from England as a result of the Civil War.[199] With this success, all earlier debts were paid, and Bancroft's sons William and Samuel came on as official partners in the business in 1866, as Joseph Bancroft & Sons. The pair carried on operations after the death of Joseph in 1874 and incorporated as Joseph Bancroft & Sons Company in 1889.[200] In 1878, the company constructed the mill dam and head gate extant today.[201] News articles from the period describe the construction, one describing a stone dam, a "substantial piece of workmanship," as well as head gates "said to be the finest on the Brandywine."[202] It is also noted that the old dam was located about 30 yards upstream from the new dam, which was removed and replaced as it was "incapable of furnishing enough water to run the mills."[203]

[197] Boatman, 80.
[198] Boatman, 81.
[199] Boatman, 82.
[200] Boatman, 82.
[201] "Local Breveties," *Every Evening and Commercial*, August 27, 1878; "Dam Completed," *Morning Herald*, September 21, 1878.
[202] "Dam Completed," *Morning Herald*, September 21, 1878.
[203] "Dam Completed," *Morning Herald*, September 21, 1878.



DAM COMPLETED.

The new dam of Mr. Bancroft in course of erection for the past three months or so, has been completed, the masons having adjusted the last stone on Tuesday. From its appearance we would judge it to be a very substantial piece of workmanship, the erection of which gave employment to a large number of men, who will necessarily be laid off. Besides the dam they have erected a new set of head gates, said to be the finest on the Brandywine. The old dam, about 30 yards above the new one, has been torn away, it being incapable of furnishing enough water to run the mills. The new one being capable of supplying all deficencies."

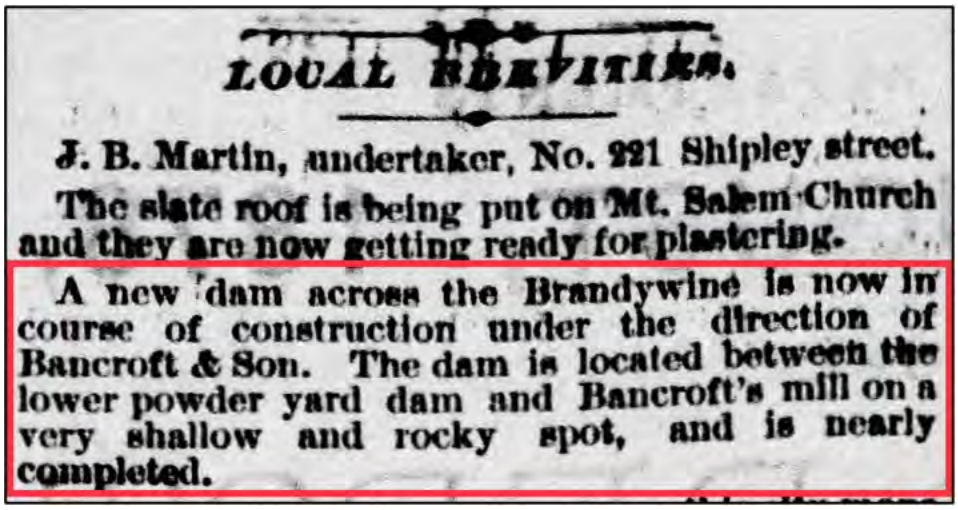
Figure 93. Every Evening and Commercial, August 27, 1878.

Joseph Bancroft & Sons Co. continued expanding into the late-nineteenth century, with the purchase in 1895 of the adjacent mill property at Kentmere, formerly the site of the Gilpin and Riddle mills, also called the Brandywine Cotton Mills. [204] In addition to the old Riddle mill site, the Bancroft company also acquired the quarry located on the property, then operated by the Brandywine Granite Company and thereafter operated by Bancroft.[205] After purchasing the property, Bancroft heavily renovated the old mill site. In May 1896, a news brief announced:

> Great improvements are being made at Bancroft's Banks. A sewer is being built from a point opposite to the Jessup and Moore paper mill to the upper factory of the Bancroft company. The old Riddle mill has been almost demolished and next week work will begin on the new mill. A new dam is being built at the site of the old Riddle mill, and seventy-five men are now at work on it. The new mill will be four stories in height and 100 feet by 250 feet.[206]

[204] "Riddle Estate Reported Sold," *Delaware Gazette and State Journal*, August 22, 1895.
[205] "Riddle Mills Sold," *Evening Journal*, August 16, 1895.
[206] "Improvements at Bancroft's Banks," *Morning News*, May 28, 1896.

Another news brief from June 1896 announced the granting of a building permit for an additional two-story factory at the old Riddle mill site.[207]



LOCAL BREVITIES.

J. B. Martin, undertaker, No. 221 Shipley street.

The slate roof is being put on Mt. Salem Church and they are now getting ready for plastering.

A new dam across the Brandywine is now in course of construction under the direction of Bancroft & Son. The dam is located between the lower powder yard dam and Bancroft's mill on a very shallow and rocky spot, and is nearly completed.

Figure 94. Morning Herald, September 21, 1878.

In 1905, the Bancroft company purchased water rights and 13.7 acres of land on the northern bank of the Brandywine from E.I. du Pont de Nemours & Co.[208] Then, in 1910, the company purchased another property in Reading, Pennsylvania, subsequently moving all manufacturing operations to the Pennsylvania site and utilizing the Wilmington facilities for bleaching, dyeing, and finishing. As synthetic yarns increasingly came into use in the 1930s and beyond, the company devoted research and development to those fields, with "Ban-Lon" and "Everglaze" becoming company staples into the mid-twentieth century.[209] By 1930, Bancroft & Sons Co. had become the world's largest single cotton dyeing and finishing operation and by the mid-twentieth was the only-remaining textile manufactory on the Brandywine.[210]

[207] "To Build a Factory," *Morning News*, June 4, 1896.
[208] Boatman, "The Brandywine Cotton Industry, 1795-1865," 82.
[209] "Joseph Bancroft & Sons Company miscellany on Bancroft Mills 2448," Manuscripts and Archives Repository, Hagley Museum and Library, https://hagley-aspace-pdf.s3.amazonaws.com/2448.pdf.
[210] Boatman, "The Brandywine Cotton Industry, 1795-1865," 82.

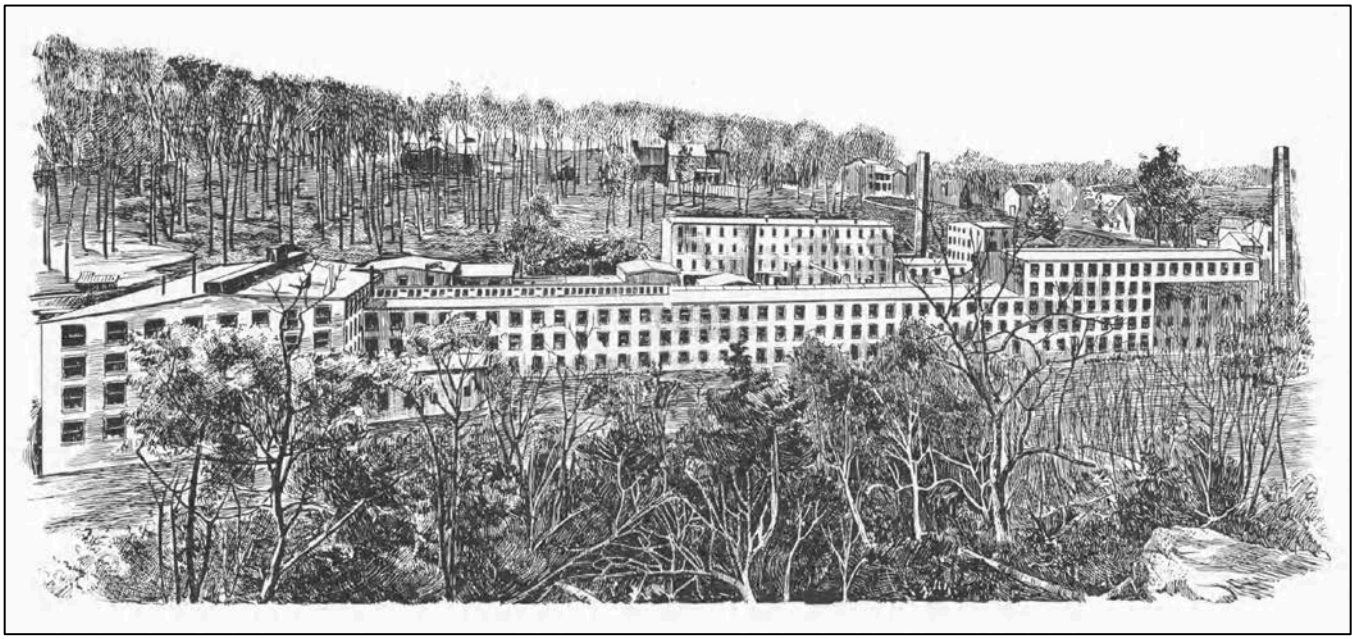


Figure 95. Woodcut showing Bancroft Mills at Rockford, 1880. (Joseph Bancroft & Sons Co. photographs, Hagley Museum and Library)

Figure 96. View of Bancroft Mills at Rockford, 1888, photographed by Albert C. Philips. (Joseph Bancroft & Sons Co. photographs, Hagley Museum and Library)

Several other groups took over the Bancroft mills site in the late-twentieth century. In 1961, Bancroft became a subsidiary of textiles manufacturer Indian Head Mills, Inc., and in 1972, the finishing plant

was purchased by the Wilmington Finishing Company, a group of department heads from Bancroft. In 1975, the company was sold to the Beaunit Corporation. Wilmington Piece Dye Company purchased the plant in 1981 and operated the site until its bankruptcy in 2003.[211] In the years to follow, a section of the former mills (two buildings) were renovated into condominiums, just east of Rockford Road. Earlier, in 1967, a 70-acre section of the property had also been purchased by the Krapf family, which developed portions of it for housing including the Brandywine Falls community (the site of earlier Bancroft company housing on what was St. Helena Road), situated just east of the Rockford Dam.[212] A large portion of the remaining buildings of the former Bancroft property were severely damaged by fire in November 2016 and subsequently razed. The site is undergoing residential redevelopment.[213]

[211] "Joseph Bancroft & Sons," Delaware's Industrial Brandywine Digital Exhibit, Hagley Museum and Library, https://www.hagley.org/research/digital-exhibits/joseph-bancroft-sons.
[212] Maureen Milford, "Bancroft Saved North Delaware from Sprawl," *The News Journal*, September 6, 1994.
[213] William Bretzger and Brittany Horn, "Abandoned Bancroft Mills in Wilmington Burns, *The News Journal*, November 10, 2016; Xerxes Wilson, "Builder to Raze State Landmark for Rentals," *The News Journal*, March 24, 2017.

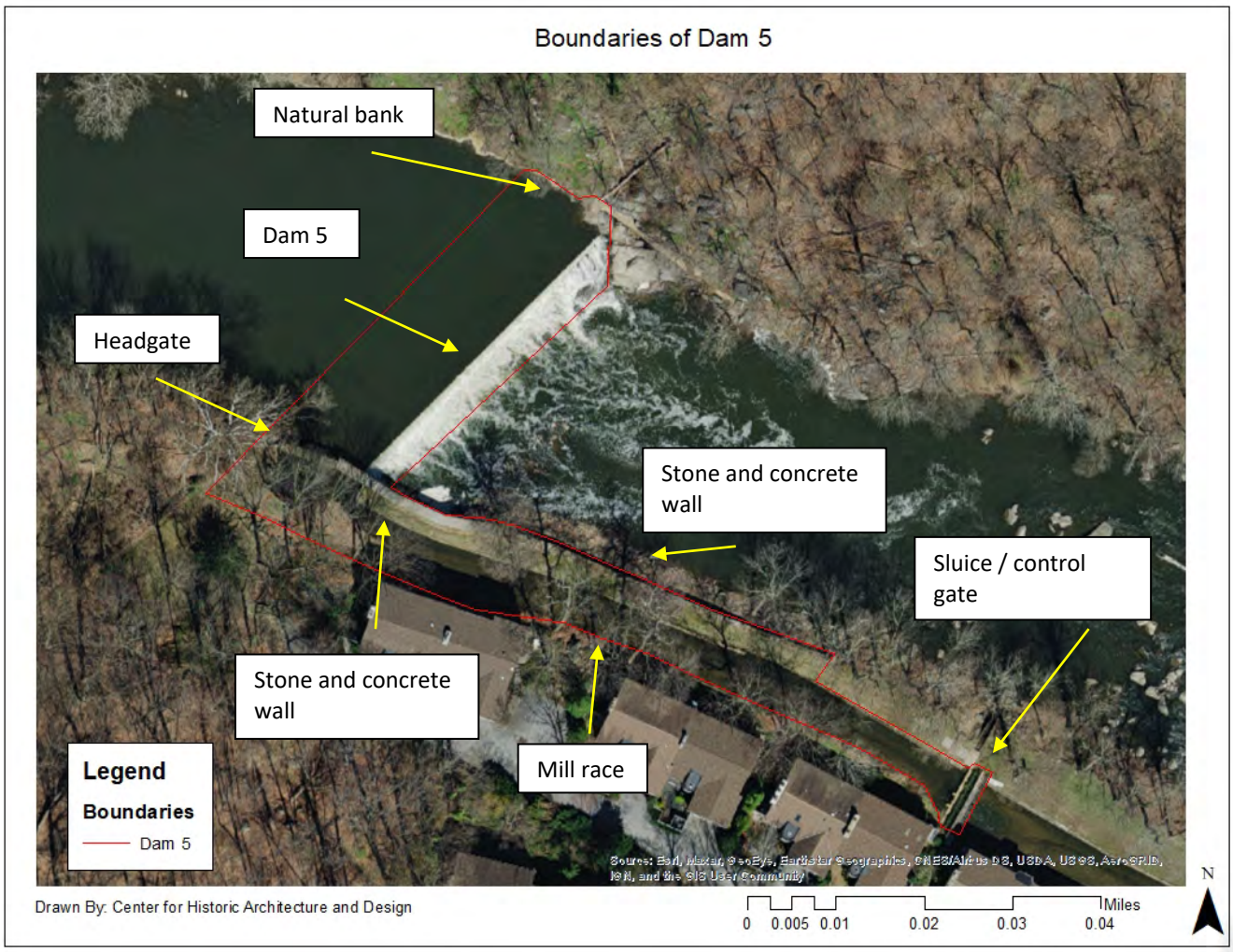


Figure 97. Boundaries of the Dam 5 complex.

Evaluation:

Dam 5, known as Rockford Dam, is recommended as eligible for listing in the National Register of Historic Places under Criteria A and C with significance at the local level. It is significant under Criterion A for its association with the industrial development along the Brandywine, specifically textile manufacturing. Dam 5 was constructed in 1878 by the Joseph Bancroft & Sons Company (also operating at Dam 4), which by the early-twentieth century had become one of the world's largest textile finishers and introduced various innovative processes and synthetic materials to the market. Dam 5 is also significant under Criterion C for its vernacular construction of an ascending ramp, straight, timber-braced stone dam. Research on this resource has not revealed any associations with the lives of persons significant to our local, state, or national history, for whom this resource is the best representative associated property; therefore, it ineligible for listing under Criterion B. This resource has not been evaluated for eligibility under Criterion D.

Dam 5 retains relatively high levels of historic integrity for location, design, materials, and workmanship. It has remained in its original location since its initial construction in 1878. Its design, materials, and workmanship is expressed through its vernacular construction as an ascending ramp, straight, timber-braced stone dam. Its material fabric largely survives intact without significant alteration, and its design for the impoundment of water to power nearby mills is evident through the survival of its mill race and head gate, though the mill buildings are non-extant. The integrity of setting as well as feeling and association are somewhat compromised due to the loss of industry downstream of the dam, as well as adjacent millworker housing that once stood on the southern banks along St. Helena Road, now Brandywine Falls Road, on which townhouses of the 1970s Brandywine Falls community were built. However, land use in the immediate vicinity of the dam has remained residential until present day. The acreage on the northern banks of the dam also remains wooded and undeveloped, now part of state park lands. Significantly, the integrity of setting, feeling, and association is enhanced through the survival of the dam's mill race as well as its metal head gate and stone abutment.

Dam 6 Complex: Lower Hagley Yard Mill Dam

Tax ID: East Bank: 0612600002 (DuPont Specialty Products USA LLC) /West bank: 2600540002 (City of Wilmington)
Geographic Coordinates: 39.769437, -75.573876
Date of Construction: c. 1839
Eligibility Recommendation: Eligible

Description:

Dam 6, known as the Lower Hagley Yard Dam, is the earliest extant dam on the lower Brandywine. It was constructed c. 1839 as an ascending ramp, curved, stone dam. The dam arcs across the Brandywine approximately 180 feet and has a fall of approximately five feet. It is supported on the southern bank by the natural bedrock of Rockford Park Gneiss, with scattered large boulders and rubble stones along the bank. The north side of the dam is tied into a mortared stone and poured concrete retaining wall. Just north of the stone retaining wall is an extant mill race, which runs under Buildings 269, 256 and 236 of the DuPont Experimental Station. The space formerly housing the mill race's head gate is filled in with concrete. The retaining wall continues running northeast of the dam. A sanitary sewer line crosses the Brandywine approximately 140 feet east of the crest of the dam, running from the southern bank to the northern bank. The line is buttressed at regular intervals by poured concrete and continues running northeast along the northern bank.

The dam features a wooden plank ramp on its upstream side, with wooden planking, or lagging, covering its downstream face, and is constructed or back-filled with stone. The upstream ramp, which begins about 20 feet and six inches from the southern bank, is comprised of wooden planks laid perpendicular (west to east) to the crest of the dam. The planks, measuring about six to eight inches in width, abut one another and evidence some deterioration towards the crest of the dam. A string piece (a long piece of timber creating a margin or edge of construction) appears to run along the eastern edge of the plank ramp. An approximately six-foot-wide concrete cap is visible between the eastern edge of the plank ramp/string piece and the crest of the dam, with metal I-beams abutting and reinforcing it. Some of the central planks situated along the apex of the dam's upstream curve are shorter than those towards the northern and southern sides of the ramp, with what appears to be concrete in-filling this area, which may have served to better reinforce the overall structure of the dam. Some small stones are also visible

along the crest of the dam. It is unknown when the concrete additions and/or repairs were completed but may date to the early-twentieth century when the DuPont Experimental Station was under initial development.

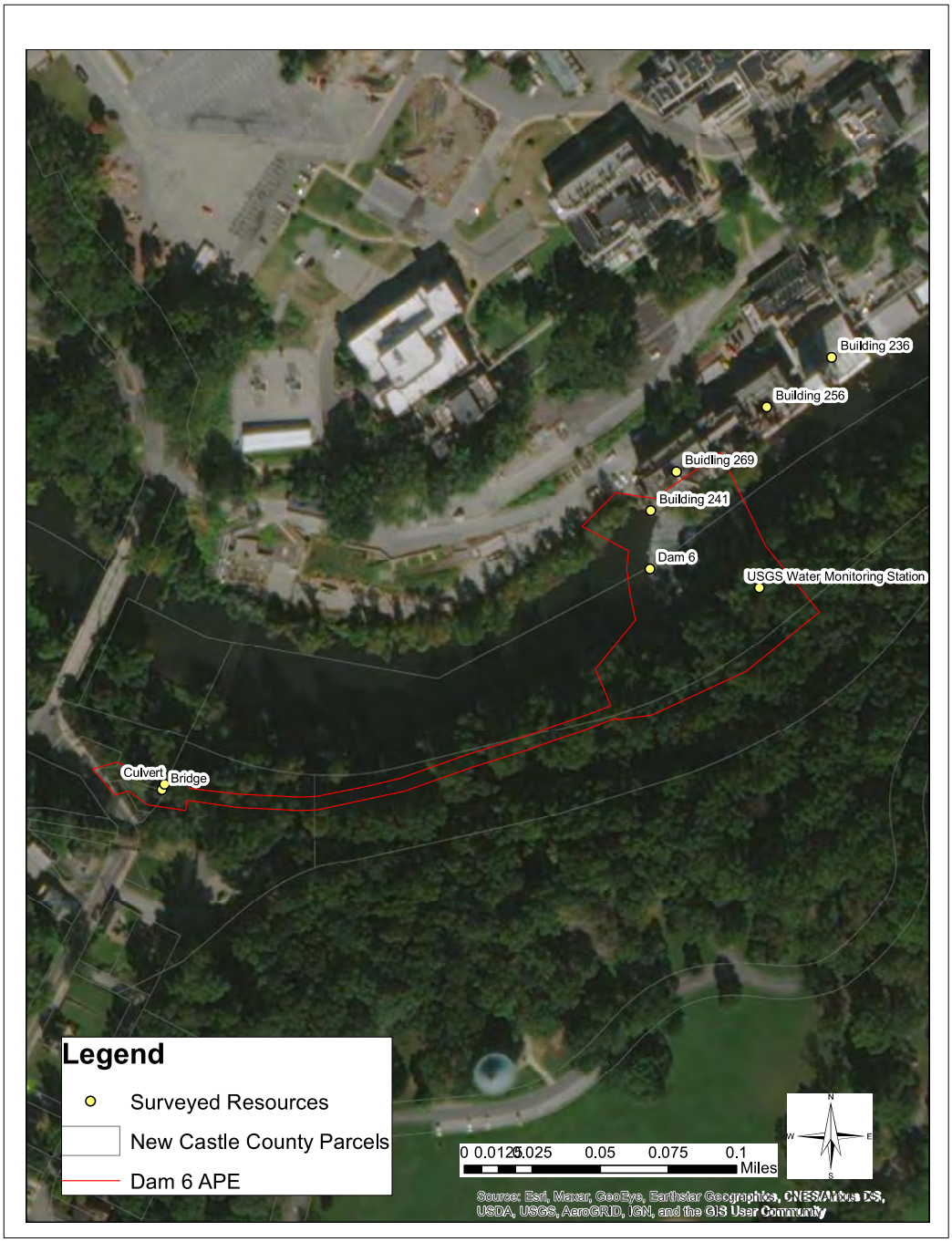


Figure 98. Location map of Dam 6, showing the APE, and the other surveyed resources. (Center for Historic Architecture and Design)

Figure 99. View of Dam 6, looking upstream (west) at the dam, 2021. (Center for Historic Architecture and Design)

Figure 100. View of Dam 6, showing the bow, looking north, 2021. (Center for Historic Architecture and Design)

Figure 101. Detail of plank facing on the ascending ramp (upstream), 2021. (Center for Historic Architecture and Design)

Figure 102. Detail of plank facing on the ascending ramp (upstream), 2021. (Center for Historic Architecture and Design)

Figure 103. Detail of stone face of Dam 6, with plank covered ramp upstream, 2021. (Center for Historic Architecture and Design)

Historic Context:

Hundred: Wilmington; Brandywine; *Quadrant:* Wilmington North; *Geographic Zone:* Piedmont; *Time Period:* 1830-1880 Industrialization and Early Urbanization 1830-1880 +/-; Historic *Period Themes:* Manufacturing; Settlement Patterns and Demographic Changes; Architecture, Engineering and Decorative Arts

History:

Dam 6, known as the Lower Hagley Yard Dam, is located at the edge of Rockford Park and originally dates to the early-nineteenth century. The earliest known milling activity in the vicinity of Dam 6 is associated with Caleb Kirk; however, the specific type of milling Kirk undertook is unknown. Prior to establishing a mill seat at this location, Kirk and his brothers operated the Rockland Mills (Dam 11),

further upstream. By the early-nineteenth century, Kirk purchased property to the east and adjacent to J. Siddall's & Co. Cotton Factory (present day Walker's Mill vicinity), and to the west of the Rockford Woolen Factory.

In 1813, the Brandywine Mill Seats Company formed to speculate in mill properties along the Brandywine, with E.I. du Pont, Caleb Kirk, and John Torbert among its founders.[214] The Mill Seats Company was formed to attract new industrial manufacturers to the Brandywine following the War of 1812.[215] The company purchased several mill seats, between J. Siddall's & Co. Cotton Factory and J & T Gilpin's Cotton and Paper Manufactory. The firm Fairlamb & Read produced two surveys for the company, one in 1813 and another in 1816, showing the vicinity of Dam 6. The 1813 *Lands and Premises of the Brandywine Company* includes the area on both sides of the Brandywine at the present-day DuPont Experiential Station, and the 1816 *Mill Seats on the Brandywine River* shows Kirk's mill upstream from the vicinity of Dam 6 and nine mills downstream from it (figure 104). While the type of Kirk's mill was not identified on the map, it does state he retained the rights to the "surplus water" power created by the dams. Of the mills owned by the Mill Seats Company, six mills were located on the north banks of the Brandywine, while three were located on the south banks. Unlike other dams on the Brandywine, Dam 6 had no races associated with it at this point. The company negotiated sales of land and water rights along the Brandywine River, but little is known about this endeavor, as they disbanded in 1825. However, the collective purchase of land and water rights spread the cost out of owning a mill seat among many mills and millers and led to one dam powering more than one milling operation. Correspondence indicates that the Brandywine Mill Seat Company negotiated the construction and repair of dams further reducing the individual cost of operating a mill. This collectivism, and water right sharing, is what allowed the quantity and variety of mills to flourish on the Brandywine and kept disputes over water usage to a minimum. Unfortunately, the construction method for this original dam is unknown. Additionally, very few records survive for the short-lived Brandywine Mill Seats Company, and except for the Rockford Mill, which was labeled as a "Woolen Factory," the types of mills associated with the company are also unknown.

[214] Boatman, 109.
[215] L. Harvey Kirk III, "The Vanguard: A Review of One Family's Early Settlement & Industrial Activity on Brandywine Creek at Rockland, DE" (Nesshagg Publications: Chester, VA, 2019, updated 2021.), 58.

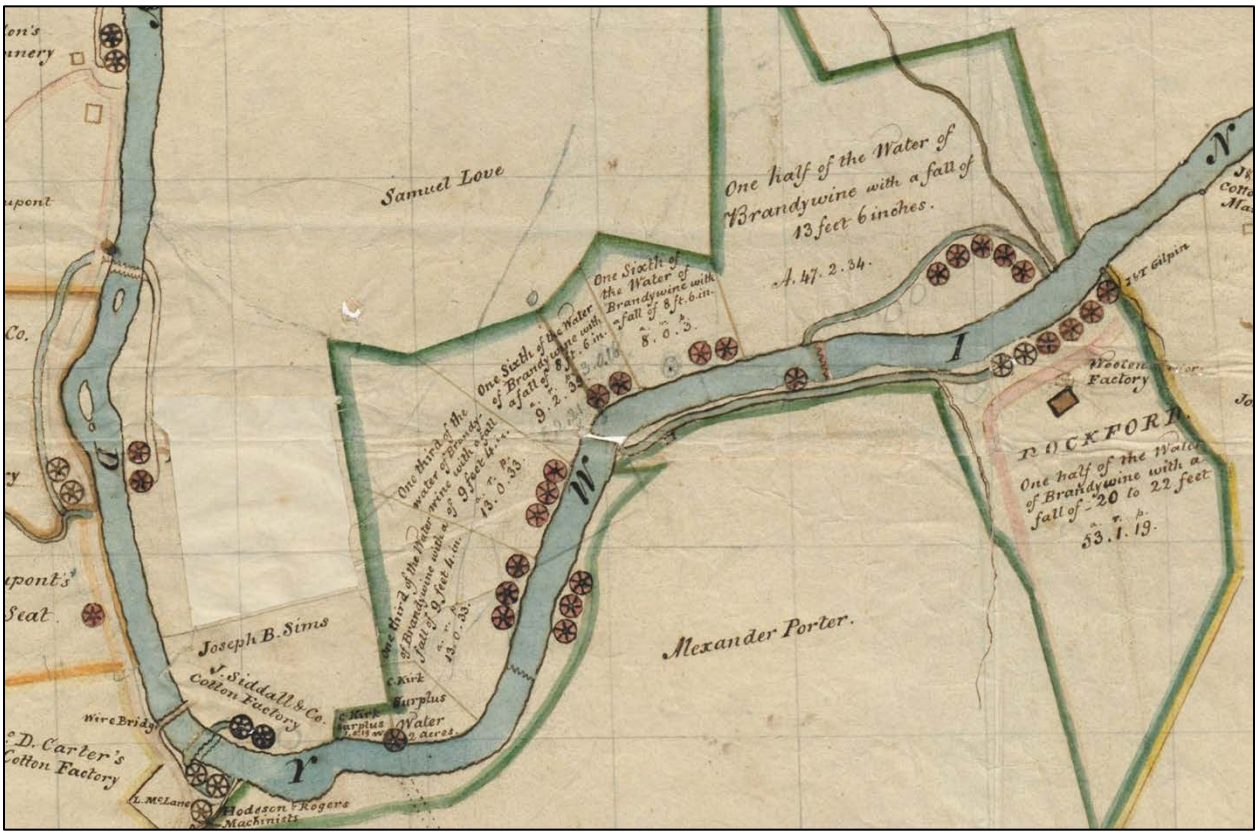


Figure 104. 1816 Fairlamb & Read Map of the Brandywine Mills Seats Company holdings outlined in Green. (Hagley Museum and Library)

After the Brandywine Mills Seats Company venture folded, E.I. du Pont began purchasing land from the defunct company, as well as other parcels of land on the north bank of the river at the site of the present-day DuPont Experimental Station. In 1830 E.I. du Pont de Nemours purchased the two tracts of land owned by Caleb Kirk on the north bank—this purchase included the surplus water rights that Kirk owned.[216] The du Ponts intended to use Kirk's land for workers housing, discontinuing use of the site as a mill.[217] The du Ponts acquired the majority of land owned by the Brandywine Mill Seats Company on the north banks of the river, purchasing 41.5 acres in total, to create a new powder yard.[218] In creating this additional yard, the du Ponts sought to separate the creation of gunpowder into two distinctly

[216] Lammot du Pont, "Map, Survey, and Remarks on Constructing the Lower Yard, 1836," Series B, Technical Papers, Box 33, Lammot du Pont, Sr., papers (Accession 0384), Manuscripts and Archives Department, Hagley Museum and Library, Wilmington, DE 19807.
[217] du Pont, "Map, Survey, and Remarks on Constructing the Lower Yard, 1836."
[218] du Pont, "Map, Survey, and Remarks on Constructing the Lower Yard, 1836."

separate places. In a series of undated papers written by Lammot du Pont about the creation of the Lower Yards states, "The principal object of the New Yard was to divide the amount of powder in fabrication at the other yards and thus to facilitate the important object in view, viz., having minimum quantities of powder in the several mills and buildings, this point has not been reached because the demand for powder has been such to force the work done in all three yards to the utmost." By May of 1839, Lower Yard, also called the Lower Hagley Powder Mill Yard, was opened. [219]

The present milldam at the Lower Yard dates to 1839. In January of that year a freshet caused significant damage along the Brandywine, especially at the Lower Hagley Yard. In the same series of undated papers by Lammot du Pont related to the construction of the Lower Yard, he recalled of that freshet:

> Note, relative to the damage caused at the New Works by the freshet of January 29, 1839—Much as all the Mills & Waterpowers, on the Brandywine, suffered by this freshet, the loss at the new work was greater than at any other places; it may be stated as follows—Both abutments of the Dam entirely washed away; part of the Dam itself destroyed; the headgates forced; the Dust Mill (the largest of the two mills then in operation) very much injured; all the race Bank carried away & the rolling mill more damaged than by half a dozen explosions. This freshet having swept off all the materials, Stone, Earth, gravel and timber, exposed to the stream (all may be said because but little was left in place and nothing of what gave way could be made of use) necessitates very expensive repairs, as for instance the New Head gates & abutment on the Brandywine Hundred side, by far the most costly of anything of the king ever constructed in the State. [220]

In the same series of papers, Lammot du Pont estimated that the reconstruction of the dam and race cost $6000.[221] What was ultimately constructed after the freshet of 1839, included a new dam, a race on the northern banks, and several buildings—including, a dust mill, a pair of rolling mills, a graining mill and a glazing mill all located between the new race and the Brandywine River. Behind the mills to the north of the race, were additional buildings including a packing house and dry tables, a dray house and stove house, and some powder houses (see figure 105).

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[219] "Company Chronology:1839-1859," The *DuPont Company on the Brandywine* Digital Exhibit, Hagley Museum and Library, https://www.hagley.org/research/digital-exhibits/company-chronology-1839-1859.
[220] du Pont, "Map, Survey, and Remarks on Constructing the Lower Yard, 1836."
[221] du Pont, "Map, Survey, and Remarks on Constructing the Lower Yard, 1836."

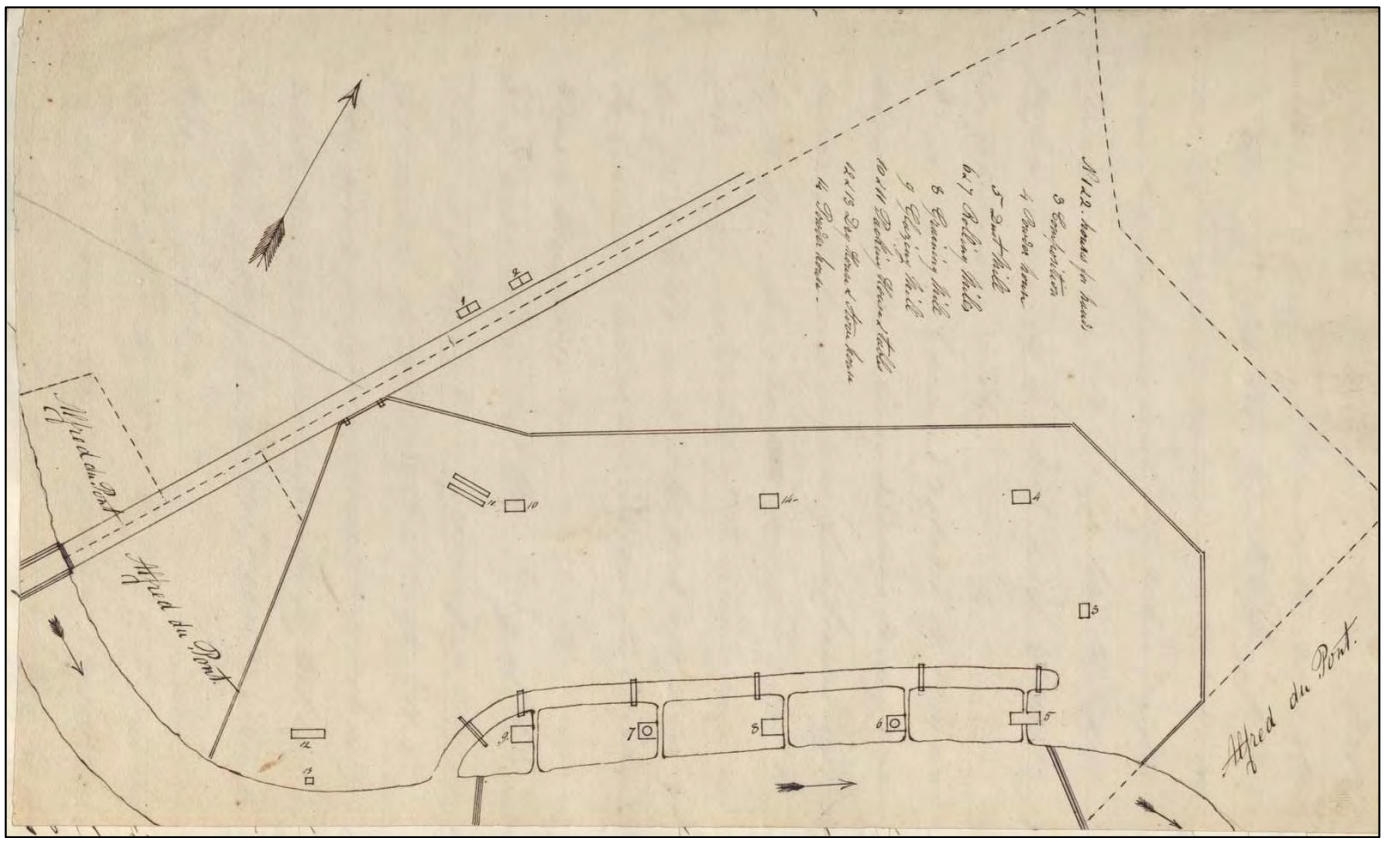

Figure 105. Undated drawing (likely late 1830s or early 1840s) of the Lower Yard, showing the new dam, race, and a series of mills related to the creation of gunpowder. (Hagley Museum and Library)

After the creation of the Lower Yard, the milldam and property served the same use through the rest of the nineteenth century. A series of historic photos, and a color illustration, depicts the dam and glazing mill during the late nineteenth century, indicating continued use, as well as little material change to the dam or site (figures 106-109).

Figure 106. Crayon sketch of the Lower Powder Yard by Pierre Gentieu, 1878, showing the dam, head gate, and mills along the Brandywine. (Hagley Museum and Library)

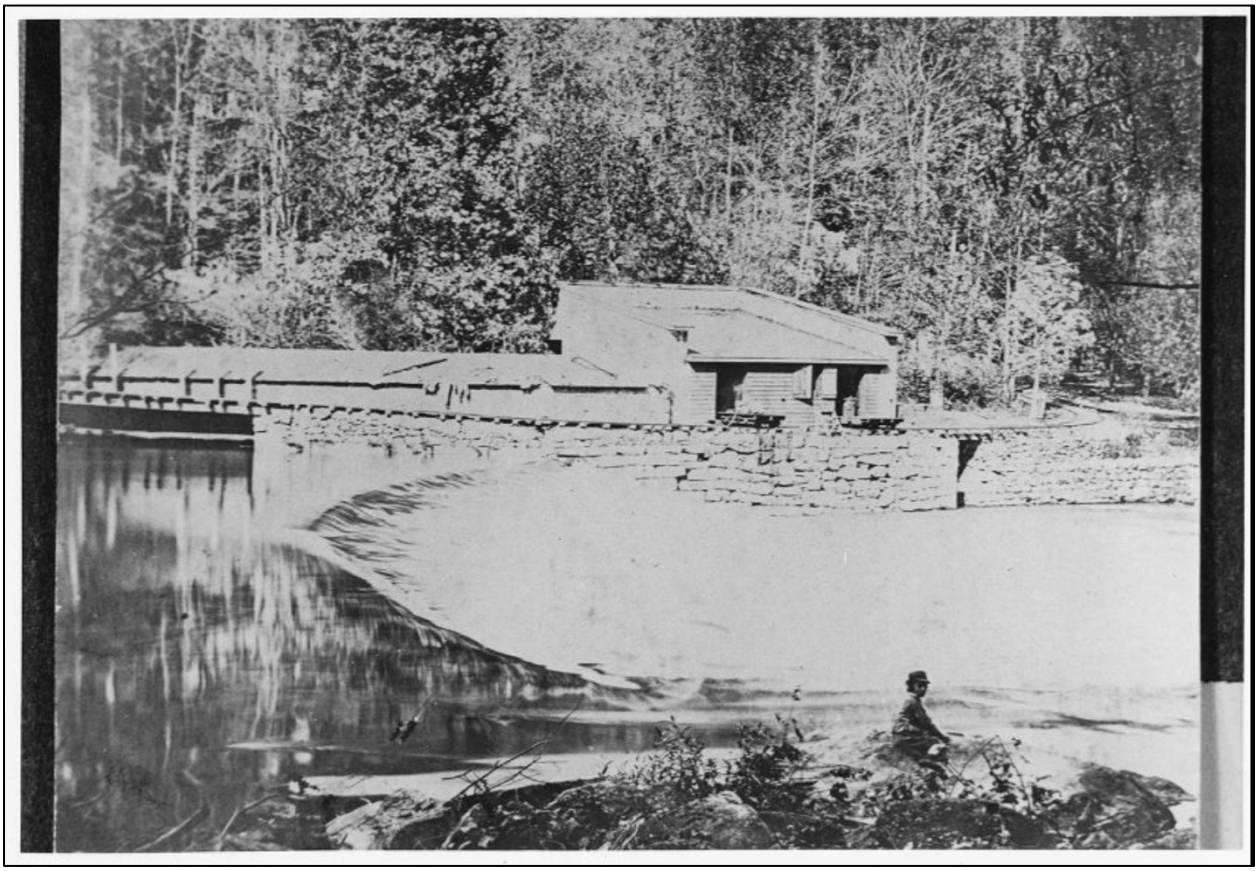

Figure 107. Photo of Dam 6, showing the head gate, stone wall, and Glaze Mill, c. 1870. (Hagley Museum and Library)

Figure 108. Photo of Dam 6, showing the stone wall, the Glaze Mill, and a rolling mill, c. 1880. (Hagley Museum and Library)

Figure 109. A group of women and girls standing in front of Dam 6, showing the head gate and Glaze Mill in the background, c. 1896. (Hagley Museum and Library)

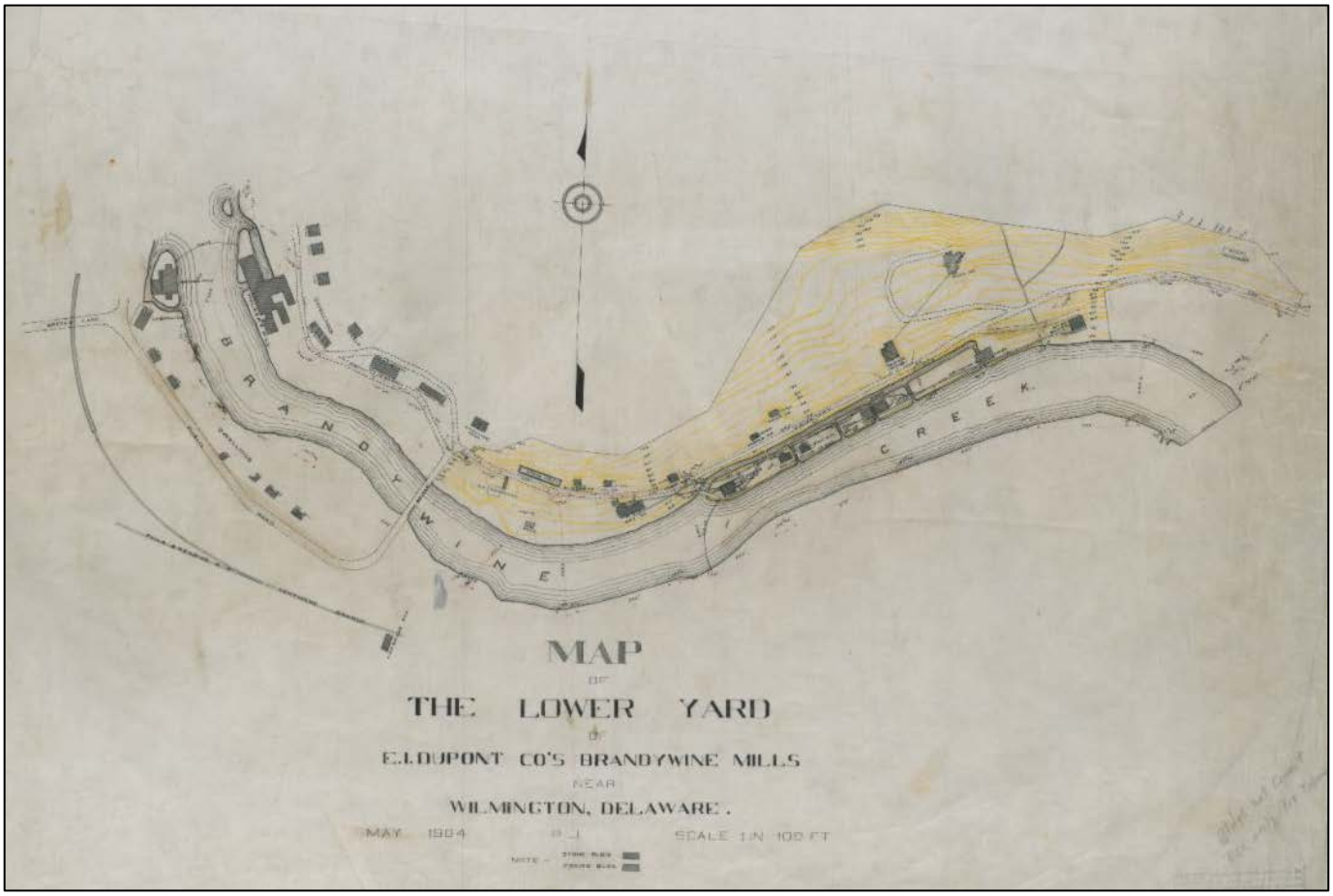

Figure 110. Map of the Lower Yard, showing the dam, race, head gates, and mill buildings, May 1904. (Hagley Museum and Library)

The DuPont Company maintained its status as the number one powder manufacturer in the United States into the twentieth century. In 1903, the DuPont Company constructed their new Experimental Station on the site of the Lower Yard (see figure 110 for map of the site in 1904). The construction of this complex ushered in a new wave of research and commercial ventures, especially in regard to the development of chemicals and consumer goods. [222] In 1921, the DuPont Company closed the powder mill yards due to the low demand for gunpowder.

After the creation of the Experimental Station, the DuPont Company still utilized the existing dam and race to power newly constructed buildings adjacent to the Brandywine. The company reportedly used

[222] Howard, "Brandywine Powder Mills," Section 8, 1.

the race and dam until the late-twentieth century. The current concrete flood wall, which infilled the headgate to the race, was constructed in 2005.[223] While the dam has likely undergone repairs and stabilization campaigns, the material fabric, construction, and design is largely reflective of its initial building campaign in 1839.

Figure 111. View of the Experimental Station, showing the dam and raceway, with new buildings lining the banks of the Brandywine, 1927. (Hagley Museum and Library)

[223] DuPont Experimental Station staff representative, email to author (Catherine Morrissey), December 7, 2021.

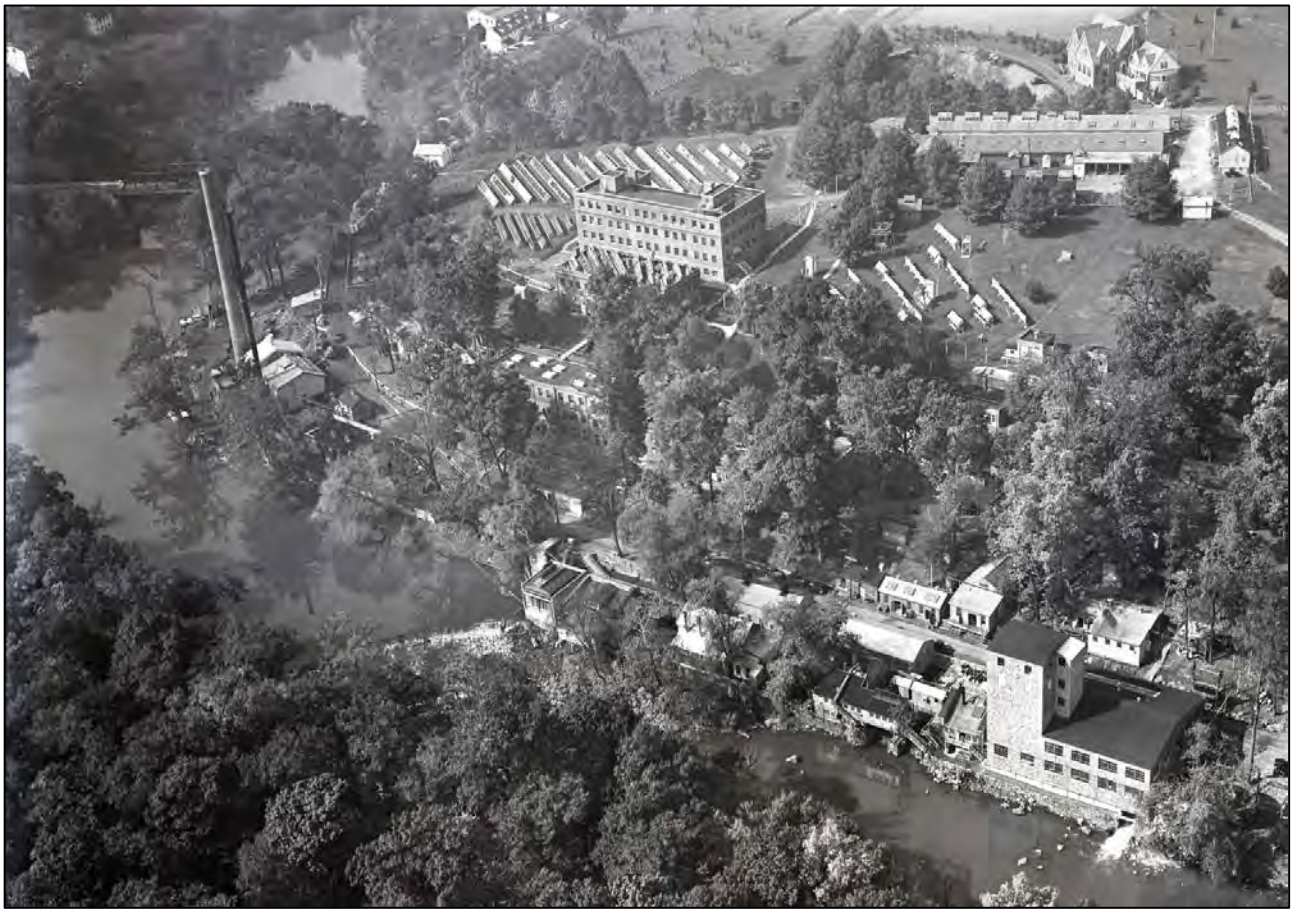

Figure 112. View of the Experimental Station, showing the milldam and raceway, with new buildings lining the banks of the Brandywine, 1927. (Hagley Museum and Library)

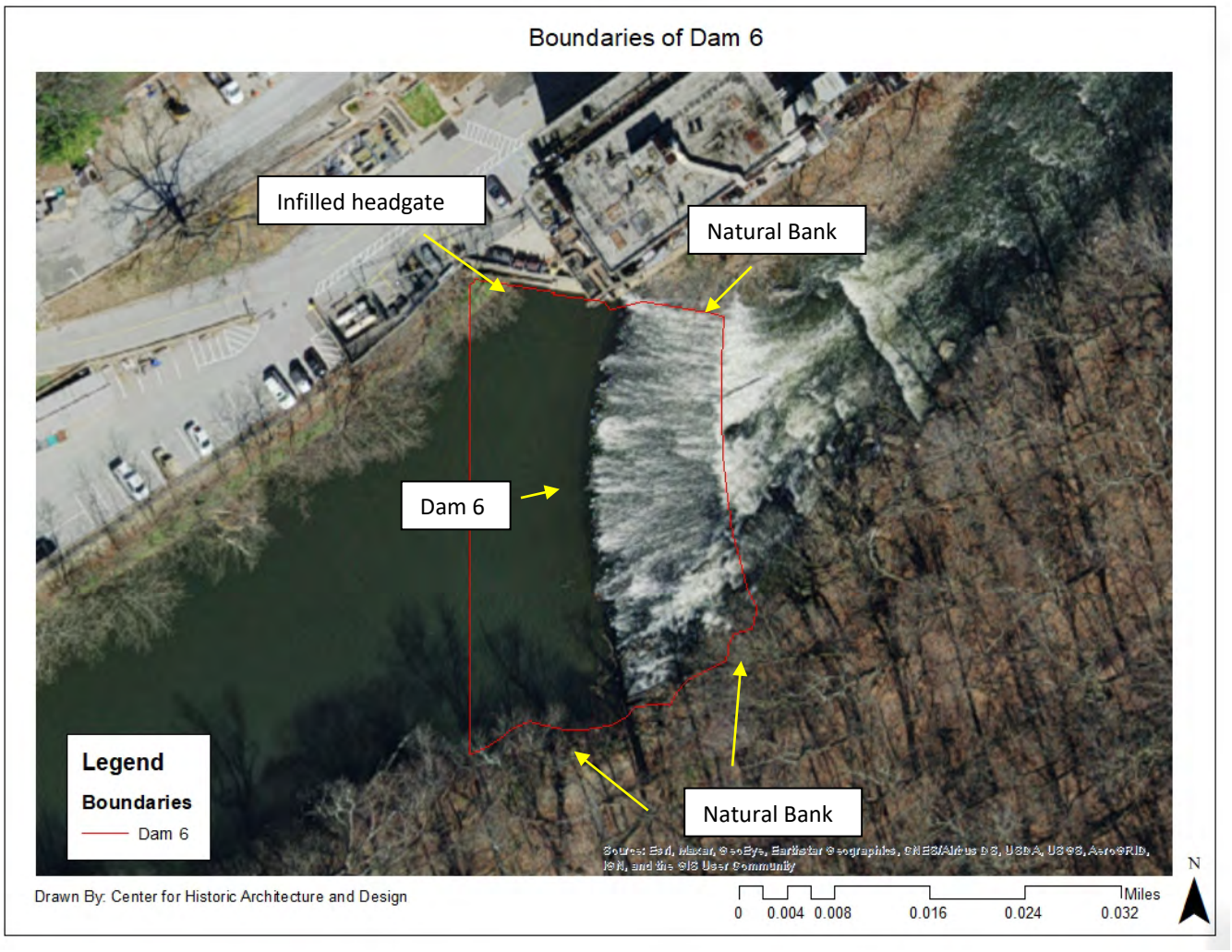

Figure 113. Boundaries for the Dam 6 complex.

Evaluation:

Dam 6, known as Lower Hagley Yard Dam, is recommended as eligible for listing in the National Register of Historic Places under Criteria A and C with significance at the local level. It is significant under Criterion A for its association with the industrial development along the Brandywine, specifically gunpowder and chemical manufacturing. Dam 6 was initially constructed in 1839 by the E. I. du Pont de Nemours Company (also operating at Dams 7-10) to power gunpowder mills along the northern banks of the Brandywine and later provided power for the DuPont Experimental Station research facility, founded at the site in 1903. Dam 6 is also significant under Criterion C for its vernacular construction of an ascending ramp, curved, stone dam. Research on this resource has not revealed any associations with the lives of persons significant to our local, state, or national history, for whom this resource is the best representative associated property; therefore, it ineligible for listing under Criterion B. This resource has not been evaluated for eligibility under Criterion D.

Dam 6 retains relatively high levels of historic integrity for all seven aspects under consideration: location, setting, design, materials, workmanship, feeling, and association. It has remained in its original location since its initial construction in 1839. Its design, materials, and workmanship are expressed through the vernacular construction of an ascending ramp, curved, stone dam. Its material fabric survives intact without significant alteration, with wooden planking visible and intact. The setting remains largely unchanged from the early-twentieth century, during which time the DuPont Experimental Station was under development. Further enhancing integrity of setting and design, as a structure meant to impound water to power adjacent mills, is the retention of its historic mill race, which now runs under multiple Experimental Station buildings, as well as the stone retaining wall along the northern banks. Because of relatively high levels of integrity for location, design, setting, materials, and workmanship, Dam 6 also maintains its historic integrity of feeling and association.

DuPont Experimental Station Buildings

Tax ID: 0612600002

Description:

The DuPont Experimental Station was founded in 1903 as one of the first and earliest industrial research laboratories in the United States, on the site of the former Lower Yard. Only four buildings in the 150-acre campus-style research complex were documented as part of this study. These four buildings are situated adjacent to the Brandywine River, and over the now defunct mill race from Dam 6. Starting from southwest (closest to Dam 6) and moving northeast, the four buildings included in this study are Building 241, Building 269, Building 256, and Building 236.

Building 241 (NXXXXX)
Geographic Coordinates: 39.769663, -75.573880
Date of Construction: c. 1930
Eligibility Recommendation: Not Evaluated

Situated adjacent to the Brandywine River, Building 241 is closest to Dam 6 and was built during the 1930s as a one-story, flat-roof, brick industrial building. The building features stretcher bond brick exterior walls and sits on a poured concrete foundation. The primary (southwest) façade has asymmetrical fenestration. This façade features three openings from the northwest—a door, a double door, and a double window. The first door is a metal, with a small, inset, full-glazed, square window, while the double doors are metal with no windows. The double windows are full glaze, fixed, metal windows. The southeast, river-facing, façade has symmetrical fenestration, with two identical window openings. The windows are both multi-light, fixed, metal windows—each now features a window air condition unit, while the northeastern most window also has a duct venting out the upper portion of the window. The northwest, Creek Road facing, façade has asymmetrical fenestration featuring only a single, multi-light, fixed, metal window. This window is identical to the two on the southeast façade. While Building 241 was originally constructed as a free-standing building, the northeast elevation has been entirely connected to Building 269.

Figure 114. Perspective view of the one-story Building 241 in front of the four-story Building 269, looking northeast, 2021. (Center for Historic Architecture and Design)

Building 269 (NXXXXX)
Geographic Coordinates: 39.769827, -75.573725
Date of Construction: 1940
Eligibility Recommendation: Not Evaluated

Building 269 is a four-story, flat-roof, brick industrial building, constructed in 1940. The building features a rowlock (shiner) stretcher bond exterior, laid in oversized bricks. The corners of the building feature stretcher bond brick quoins. The entire building sits on a poured concrete foundation. The southwest façade features a five-story, rectangular, flat-roof, stair tower, placed off-center on this elevation. The exterior cladding of the brick stair tower is identical to the rest of the building. To the southeast of the stair tower Building 241 is connected to Building 269. In front of Building 269, to the northwest of the stair tower, is an above ground metal bulkhead. This provides access to the defunct mill race which runs under several buildings, including Building 269. The southwest façade features irregular an asymmetrical fenestration. There are three windows located on the first floor, all of which are single

three-over-three, double-hung sash metal windows, with poured concrete sills. On the upper floors, the irregularly place windows are a mix of single three-over-three, double-hung sash metal windows, as well as pairs of these windows. Additionally, on the upper floor, there are infilled blind windows, as well as two-over-two, double-hung sash metal windows. The southeast, river-facing, façade has regular and symmetrical fenestration, except for the first floor—the fenestration of which is obscured by metal walling. On the upper stories, there are either two or three sets of three-over-three, double hung sash windows, which match those on the southwestern façade. The northwest, Creek Road facing, façade has regular and symmetrical fenestration. There are eight openings, all of which are pairs of three-over-three, double hung sash metal windows, with concrete sills, except the first bay from the northeast. A full glaze, metal door is in this first bay. On the northeast elevation the fenestration is irregular and asymmetrical and has four openings. From the southeast to the northwest is a pair of metal doors, a three-over-three, double hung metal sash window, a pair of three-over-three, double hung metal sash windows, and lastly a single metal door. On the second and third floors is an enclosed, brick rowlock (shiner) stretcher bond, passageway that connects Building 269 and Building 256.

Figure 115. Perspective view of Building 269, with Building 241 in the foreground, looking northeast, 2021. (Center for Historic Architecture and Design)

Figure 116. View of the northwest elevation of Building 269, showing Building 256 in the background, looking northeast, 2021. (Center for Historic Architecture and Design)

Building 256 (NXXXXX)
Geographic Coordinates: 39.770092, -75.573229
Date of Construction: 1937
Eligibility Recommendation: Not Evaluated

Building 256 is a three-story, flat-roof, brick industrial building, constructed in 1937. The building features a rowlock (shiner) stretcher bond exterior, laid in oversized bricks. The corners of the building feature stretcher bond brick quoins. The entire building sits on a poured concrete foundation, and the roof is clad in EPDM material. The southwest façade features irregular and asymmetrical fenestration. From the southeast to the northwest is a single metal door, with a glass window inset, and a single three-over-three, double hung sash metal window. On the second and third floors is an enclosed, brick rowlock (shiner) stretcher bond, passageway that connects Building 256 and Building 269. The fenestration of the southeast, river-facing, façade is now obscured by an enclosed two-story, solid metal

walling. The only windows visible are on the third story—there are five symmetrically placed pairs of three-over-three, double hung sash metal windows. The northwest, Creek Road facing, façade has regular and symmetrical fenestration. There are five bays on this façade—all identical pairs of three-over-three, double hung sash metal windows. On the northeast elevation the fenestration is irregular and asymmetrical and has three openings. From the southeast to the northwest the bays are a pair of metal double doors, with a small, inset, full glaze light, a single metal door with a small, inset, full glaze light, and a pair of three-over-three, double hung sash metal windows. On the second floor, Building 256 is attached to Building 236, by an enclosed, stretcher bond, brick bridge.

Figure 117. View of the northwest elevation of Building 256, showing Building 269 in the background, looking southwest, 2021. (Center for Historic Architecture and Design)

Building 236 (NXXXXX)
Geographic Coordinates: 39.770293, -75.572896
Date of Construction: 1930
Eligibility Recommendation: Not Evaluated

Building 236 is a brick industrial building, composed of two primary sections, contemporaneously constructed in 1930. Both sections are front gabled and joined on the longitudinal side—the portion of the building that abuts Creek Road is two-and-a-half stories, while the portion that abuts the Brandywine River is 6 stories. The building features hollow tile block exterior. The corners of the building feature stretcher bond brick quoins. The entire building sits on a poured concrete foundation, and the roof is covered in corrugated metal. The southwest façade features an eight-story, rectangular, flat-roof, stair tower, placed in the center of the gable end of the six-story section. The southwest façade has irregular and asymmetrical fenestration, with five openings on the first floor. From northwest to southeast there is a metal door, a pair of metal doors, each with an inset window, a metal door with an inset window, followed by a double fixed light window, and another double fixed light window. Also on this elevation is an enclosed, stretcher bond brick bridge that connects this building to Building 256. The fenestration of the southeast, river-facing, façade is now obscured by an enclosed two-story, solid metal walling. The northwest, Creek Road facing, façade has regular and symmetrical fenestration. There are six bays on this façade— all identical sets of three full-glazed metal windows. On the northeast elevation the fenestration is irregular and asymmetrical and has five openings. From the southeast to northwest there is a pair of full-glazed, fixed light metal windows, a pair of metal double doors each with a window, a three-over-three, double hung metal sash window, a pair of metal double doors each with a window, and a single metal door.

Figure 118. View of southwest gable end of Building 236, looking northeast, 2021. (Center for Historic Architecture and Design)

Figure 119. View of the northwest elevation of Building 236, looking southwest, 2021. (Center for Historic Architecture and Design)

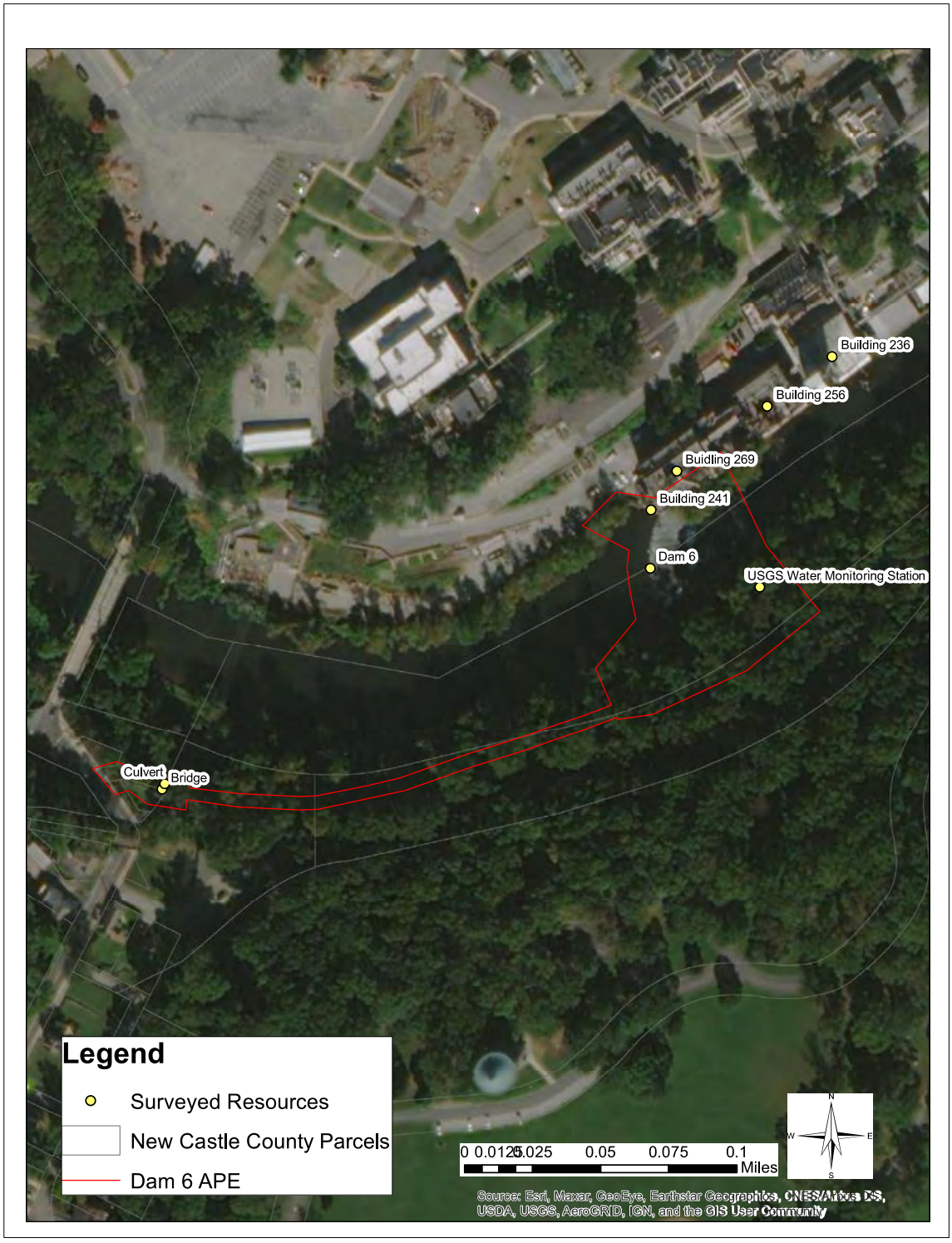

Figure 120. Location map of the DuPont Experimental Station Buildings, show in relation to the APE and the other surveyed resources. (Center for Historic Architecture and Design)

Historic Context:

Hundred: Brandywine; *Quadrant:* Wilmington North; *Geographic Zone:* Piedmont; *Time Period:* Urbanization and Early Suburbanization, 1880-1940+/-; Suburbanization and Early Ex-Urbanization 1940-1960 +/-; Historic *Period Themes:* Manufacturing; Settlement Patterns and Demographic Changes; Architecture, Engineering and Decorative Arts

History:

The DuPont Experimental Station, established in 1903, is located on the site of the former Lower Hagley Powder Yards (established in 1839). When created, the DuPont Experimental Station was one of the first industrial research laboratories in the United States.[224] DuPont established its Chemical Department in 1911, the forerunner of DuPont Central Research & Development. Soon after a formal program of research in physics and chemical engineering was initiated in 1927, it had reaped "spectacular results" by the early 1930s, including discoveries that would directly lead to nylon, neoprene (the first general-purpose synthetic rubber), rayon (the first high-tenacity rayon tire cord), and Teflon.

In 1948, the DuPont Company hired the renowned New York City architectural firm, Voorhees, Walker, Smith & Smith, to undertake a $30,000,000 expansion to the Experimental Station.[225] This project added 10 International Style new laboratory and semi-works buildings to the site, relocating several research facilities from all over the east coast to the Wilmington Campus.[226] During the Postwar period, the firm of Voorhees, Walker, Smith & Smith specialized in designing sprawling research campuses in the suburbs.[227] Voorhees, Walker, Smith & Smith designed research labs for Bell Laboratories in Murray Hill, New Jersey (1940-1945), the Argonne National Laboratory outside of Chicago, Illinois (1948-1953), and the U.S. Atomic Energy Commission's Germantown, Maryland campus (1957-1958). Additionally, they built corporate and research complexes for IBM, General Foods, the Ford Motor

[224] DuPont Company, "DuPont Science & Technology: R & D History at the DuPont Experimental Station," October 2010, accessed December 1, 2010, https://sites.lafayette.edu/aiche/files/2013/09/RD-History-at-the-DuPont-Experimental-Station.pdf.
[225] "DuPont to Spend $30,000,000 to Expand Research Facilities," *The News Journal*, April 27, 1948.
[226] "DuPont to Spend $30,000,000 to Expand Research Facilities," *The News Journal*, April 27, 1948.
[227] Ralph Walker, *Ralph Walker: Architect, of Voorhees, Gmelin & Walker, Voorhees, Walker, Foley & Smith; Voorhees, Walker, Smith & Smith*, (New York: Henahan House, 1957), 12.

Company, General Electric, and Bethlehem Steel.[228] Concurrently with the designed expansion of the Experimental Station, the DuPont Company also began planning a new bridge to provide access to the facility. DuPont approached the state highway department with its plans and offered to donate $250,000 to the construction of the bridge, as well as provide preliminary survey work.[229] In cooperation with DuPont, the state highway department hired the New York City engineering firm of Parson, Brinckerhoff, Hall & MacDonald to design the bridge. The Tyler McConnell Bridge (State Route 141) opened in December of 1952.[230]

Of the four buildings included in this survey, several important inventions are specifically associated with Building 256, most being in plastics, including Surlyn ionomeric resins (used in coating and packaging material), Teflon FEP (used in coatings and wiring), Elvax ethylene-vinyl acetate copolymers (used for sealants, footwear, and wire insulation), Elvaloy copolymers (currently used in meal packaging, asphalt paving, roofing membranes, and PVC), Nafion fluorinated ionomers (discovered in the late 1960s by Walther Grot, and used now in PEM fuel cells, batteries, and sensors), and Vespel SP polyimide parts (used mostly in aerospace, semiconductor, and transportation technologies).

[228] Walker, 12.
[229] A.G. Lichtenstein and Associates, Inc., "Delaware Department of Transportation Historic Bridge Survey SR 141 (Tyler McConnell Bridge) Over Brandywine Creek and Road 260 (Brecks Lane)," 1996, 2.
[230] A.G. Lichtenstein and Associates, Inc., 2

Figure 121. Aerial view of the DuPont Experimental Station, with Dam 6 in the lower right-hand corner, 1956. (Hagley Museum and Library)

Figure 122. Aerial image of the DuPont Experimental Station campus, 1970. (Hagley Museum and Library)

Figure 123. Suggested boundaries for a potential DuPont Experimental Station Historic District.

Evaluation:

The four buildings on the grounds of the DuPont Experimental Station (buildings 241, 269, 256, and 236) were not evaluated for individual listing in the National Register of Historic Places, as determinations of eligibility for these buildings is outside of the scope of work for this project. Together, these buildings comprise only 0.75 acres of the 150-acre complex and are four of approximately 50 buildings on the site. To fully understand these buildings and their significance, an evaluation of the entire Experimental Station should be completed. Due to the many scientific innovations at the site, it is possible that the Experimental Station could qualify for listing under Criterion A. Research on this resource has not revealed any associations with the lives of persons significant to our local, state, or national history, for whom this resource is the best representative associated property; therefore, it ineligible for listing under Criterion B. More research is needed to evaluate the Experimental Station under Criterion C; however, if the site retains enough material integrity, it is potentially eligible for listing under this criterion as well. This resource has not been evaluated for eligibility under Criterion D. An evaluation of the entire Experimental Station campus was outside of the scope of work for this project.

Platform Bridge

Tax ID: 0703020022, 703020019, 2600510001
Geographic Coordinates: 39.768449, -75.576515
Date of Construction: c. 1946
Eligibility Recommendation: Ineligible

Description:

An open grate platform bridge constructed with metal I-beams crosses a stone wall culvert east of Rising Sun Lane. The bridge is approximately 18 feet and eight inches long and 10 feet wide with has plain metal guardrails.

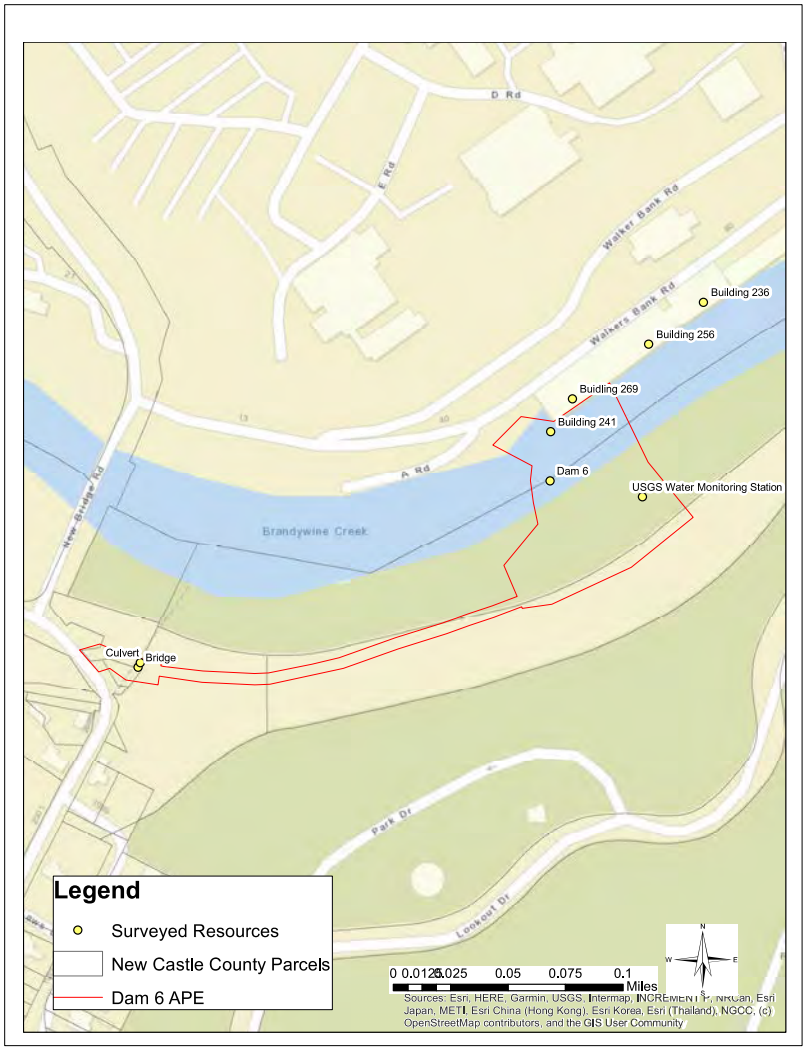

Figure 124. Map showing the location of the bridge within the boundaries of the APE. (Center for Historic Architecture and Design)

Figure 125. View of the open grate platform bridge, looking towards Rising Sun Lane, 2021. (Center for Historic Architecture and Design)

Figure 126. View of the open grate platform bridge, looking northeast, 2021. (Center for Historic Architecture and Design)

Historic Context:

Hundred: Christiana; Wilmington; *Quadrant:* Wilmington North; *Geographic Zone:* Piedmont; *Time Period:* Urbanization and Early Suburbanization, 1880-1940+/-; Suburbanization and Early Ex-Urbanization 1940-1960 +/-; Historic *Period Themes:* Settlement Patterns and Demographic Changes; Architecture, Engineering and Decorative Arts

History:

The open grate platform bridge is associated with the U.S. Geological Survey Water Monitoring State Gage House and was likely built at the same time as the gage house (1946). The form and materials of

the bridge supports a 1940s construction date.[231] The bridge is situated along an access route leading from southeast of Rising Sun Lane Bridge to the gage house and is part of a footpath within Rockford Park. A newspaper article from 1946 further suggests that the bridge was built around the same time as the gage house, stating, "The Wilmington Park Commission has provided space for the station and its approach in Rockford Park, along the Brandywine."[232] The bridge may have replaced an earlier bridge in use at the same location within the park.

[231] Dan Hartzell, "Open Grate Bridges have lost popularity: Steel once made them a value for Valley, but none built recently," *The Morning Call*, December 27, 2002.
[232] "Flow of Silt to be Studied," *Journal-Every Evening*, September 28, 1946 (Newspapers.com).

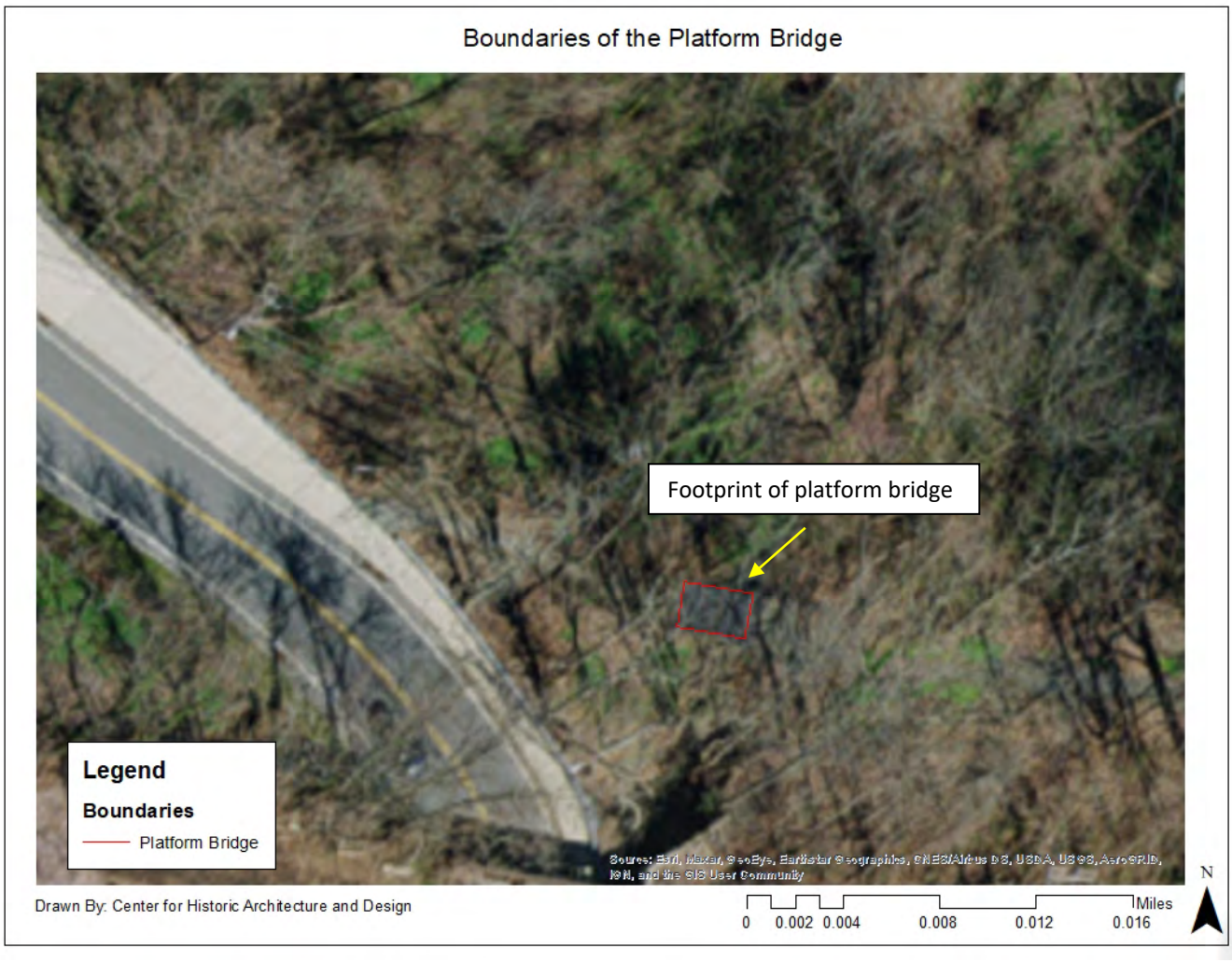

Figure 127. Boundaries of the platform bridge.

Evaluation:

This resource is recommended as ineligible for listing in the National Register of Historic Places. Under the Delaware Department of Transportation (DelDOT) *Historic Bridge Criteria for Determining Significance*, which differentiates between history that is common to like features and distinguishable events that made a significant contribution to historical development, concerning Criterion A, a bridge (or culvert) must meet a higher standard in order to represent local, state, or national level trends and broad patterns. This resource is ineligible for listing under Criterion A as it represents a common type of open grate metal bridge with no distinctive or historical background or setting. Research on this resource has not revealed any associations with the lives of persons significant to our local, state, or national history, for whom this resource is the best representative associated property; therefore, it is ineligible for listing under Criterion B. Concerning Criterion C, under the DelDOT *Historic Bridge Criteria for Determining Significance*, eligible bridges (or culverts) must be significant in the development of bridge (or culvert) technology. Examples of eligible bridges or culverts could include those with unusual construction details or rare survivors of a significant type; those that are the work of significant engineers or engineering firms; or those that are especially good examples of their type. This resource is ineligible under Criterion C as it represents an extant example of a common type of open grate metal bridge built widely during the early- to mid-twentieth century. It is neither unusual nor especially noteworthy. This resource has not been evaluated for eligibility under Criterion D.

Stone Wall Culvert

Tax ID: 0703020022
Geographic Coordinates: 39.768461, -75.576506
Date of Construction: c. Late-nineteenth century
Eligibility Recommendation: Ineligible

Description:

Two low, mortared, rubble stone abutment walls, functioning as a culvert and likely dating to the late-nineteenth century, stand to either side of a rocky watercourse, southeast of Rising Sun Lane Bridge. The watercourse runs south to north towards the Brandywine. The stone wall culvert is currently topped with a metal platform bridge (c. 1946) that provides access from Rising Sun Lane on the west, east towards the U.S. Geological Survey Water Monitoring Station Gage House. Dry-laid stones extend several feet east from the eastern stone wall, partially ramping up and supporting the path to the bridge.

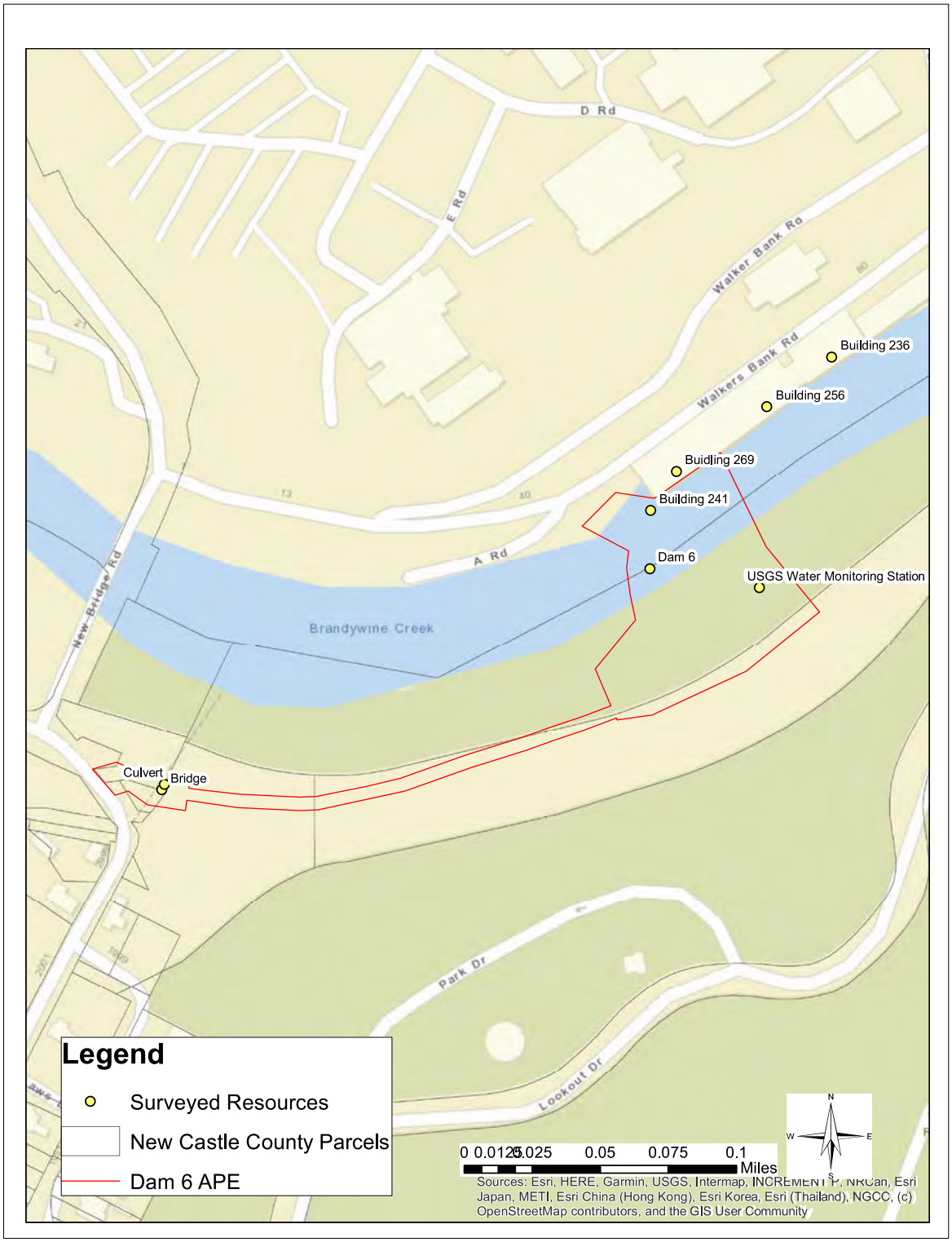

Figure 128. Map showing the location of the culvert within the boundaries of the APE. (Center for Historic Architecture and Design)

Figure 129. View of the stone walls and culvert, looking southwest, 2021. (Center for Historic Architecture and Design)

Historic Context:

Hundred: Christiana; *Quadrant:* Wilmington North; *Geographic Zone:* Piedmont; *Time Period:* Urbanization and Early Suburbanization, 1880-1940+/-; Suburbanization and Early Ex-Urbanization 1940-1960 +/-; Historic *Period Themes:* Settlement Patterns and Demographic Changes; Architecture, Engineering and Decorative Arts

History:

The stone wall culvert may be associated with the establishment of Rockford Park (1889) and was likely constructed as a substructure to a bridge, possibly to provide access between the village of Rising Sun

and the park.[233] Stone was commonly used as a building material in the Piedmont region of Delaware throughout the eighteenth and nineteenth centuries and into the twentieth due to its natural abundance. Vernacular stone structures such as these are plentiful throughout the region. The metal platform bridge (c. 1946) that the stone wall culvert currently supports likely replaced an earlier bridge at this site.

Figure 130. Boundaries of the stone culvert.

[233] Joan M. Norton, "Rockford Park," National Register of Historic Places Inventory/Nomination Form (Division of Historical & Cultural Affairs, Dover, Delaware, 1978), Section 8.

Evaluation:

This resource is recommended as ineligible for listing in the National Register of Historic Places. Under the Delaware Department of Transportation (DelDOT) *Historic Bridge Criteria for Determining Significance*, which differentiates between history that is common to like features and distinguishable events that made a significant contribution to historical development, concerning Criterion A, a bridge (or culvert) must meet a higher standard in order to represent local, state, or national level trends and broad patterns. This resource is ineligible for listing under Criterion A as it represents a common type of stone wall culvert with no distinctive or historical background or setting. Research on this resource has not revealed any associations with the lives of persons significant to our local, state, or national history, for whom this resource is the best representative associated property; therefore, it is ineligible for listing under Criterion B. Concerning Criterion C, under the DelDOT *Historic Bridge Criteria for Determining Significance*, eligible bridges (or culverts) must be significant in the development of bridge (or culvert) technology. Examples of eligible bridges or culverts could include those with unusual construction details or rare survivors of a significant type; those that are the work of significant engineers or engineering firms; or those that are especially good examples of their type. This resource is ineligible under Criterion C as it represents an extant example of a common or vernacular type of culvert, comprised of two fieldstone abutments, constructed into the early-twentieth century in the Piedmont of Delaware using native Brandywine Blue Gneiss. It is neither unusual nor especially noteworthy. This resource has not been evaluated for eligibility under Criterion D.

United States Geological Survey Water Monitoring Station Gage House

Tax ID: 2600540002
Geographic Coordinates: 39.769204, -75.573609
Date of Construction: 1946
Eligibility Recommendation: Ineligible

Description:

The United States Geological Survey Gage House, associated with water monitoring station 01481500, was built in October 1946 on the southern bank of the Brandywine, approximately 150 feet downstream from Dam 6.[234] The gage house is a utilitarian two-story, concrete block tower with a hipped roof of rubble concrete. It measures five feet and four inches square and is set on an angle with the riverbank, oriented to the northwest. Poured concrete steps with plain metal railings extend from its northwest elevation, accessing a metal door into the gage house at the second level of its northwest elevation. A vertical poured concrete pier supports the steps about halfway along its rise. A metal hatch is located at the first level on the tower's southeast elevation.

[234] This station was constructed and placed into operation in October 1946. Its construction by the U.S. Geological Survey is documented in period newspapers articles, including "Flood Gauging Station to be Installed in Park," *Journal-Every Evening*, July 13, 1946; and "Flow of Silt to be Studied," *Journal-Every Evening*, September 28, 1946 (Newspapers.com).

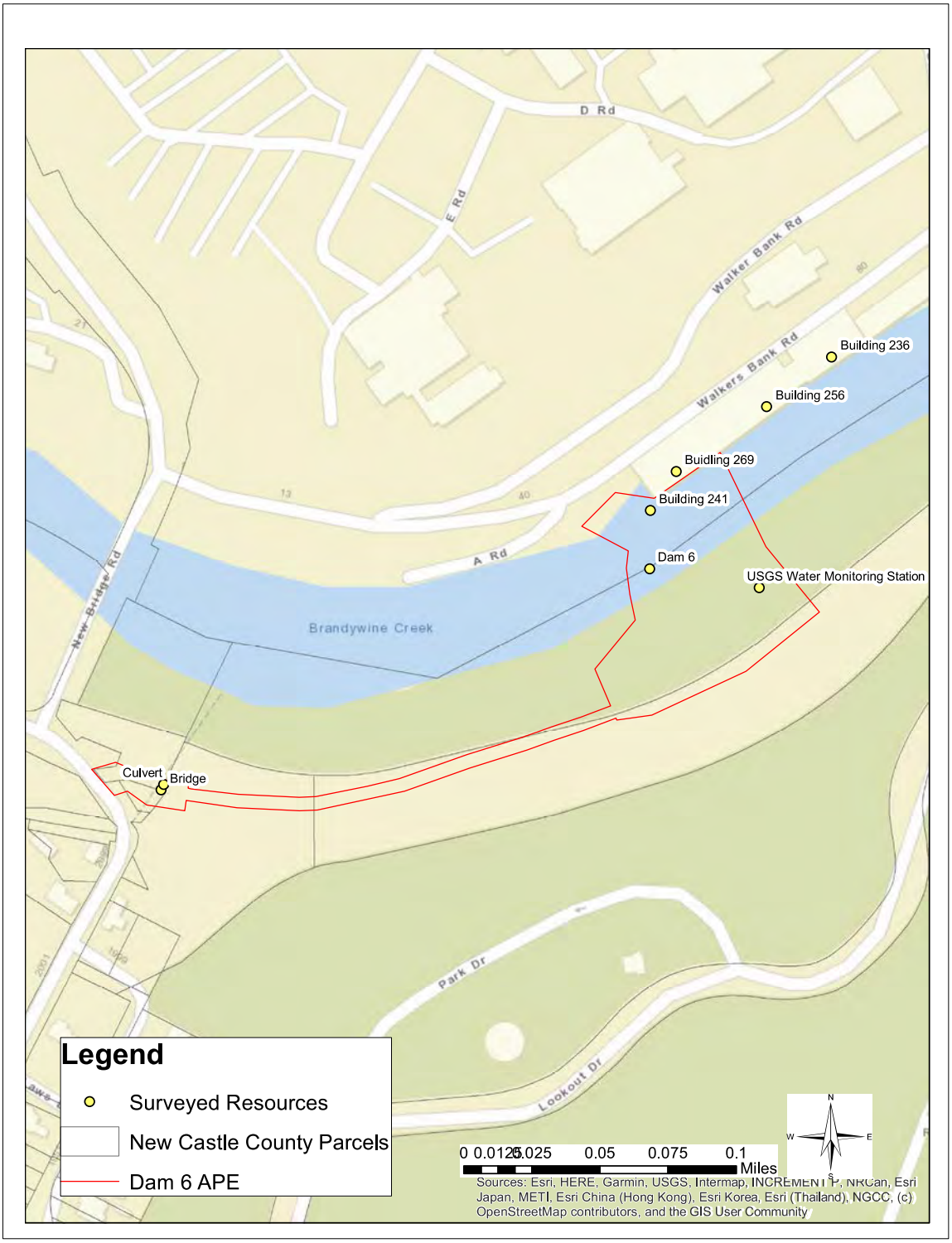

Figure 131. Map showing the location of the USGS Water Monitoring Station Gage House within the boundaries of the APE. (Center for Historic Architecture and Design)

Figure 132. View of the USGS Water Monitoring Station Gage House, looking east, 2021. (Center for Historic Architecture and Design)

Figure 133. View of the USGS Water Monitoring Station Gage House, looking northwest, 2021. (Center for Historic Architecture and Design)

Historic Context:

Hundred: Wilmington; *Quadrant:* Wilmington North; *Geographic Zone:* Piedmont; *Time Period:* Suburbanization and Early Ex-Urbanization 1940-1960 +/-; Historic *Period Themes:* Settlement Patterns and Demographic Changes; Architecture, Engineering and Decorative Arts

History:

The U.S. Geological Survey was established in 1879 by an Act of Congress and tasked with "classification of the public lands, and examination of the geological structure, mineral resources, and products of the national domain."[235] Towards the end of the nineteenth century, John Wesley Powell, who served as the second Director of the U.S. Geological Survey, "proposed gaging the flow of rivers and streams in the Western United States to evaluate the potential for irrigation," while several Eastern cities had "established primitive streamgages for use in designing water-supply systems."[236] In 1889, the first streamgage was established on the Rio Grande in New Mexico.[237] Water investigations became a more formal part of the USGS program in 1894 when an appropriation was first made for "gauging streams and determining the water supply of the United States."[238] Water studies and streamgaging technology expanded and evolved throughout the twentieth century, extending from those earliest concerns regarding irrigation to those of "waste disposal and siting of mines and plants as well as the quantity and quality of the water supply for communities."[239] According to the USGS Streamgaging Network, today "the USGS Groundwater and Streamflow Information Program supports the collection and (or) delivery of both streamflow and water-level information at approximately 8,500 sites."[240]

Gage houses were established by the U. S. Geological Survey to house streamgage recording equipment, which measures the height of the water surface (gage height or stage), and were constructed in various

[235] U. S. Geological Survey and Mary C. Rabbitt, "A Brief History of the U. S. Geological Survey," (Washington, D.C.: U.S. Government Printing Office, 1975), 2.
[236] Water Resources, "USGS Streamgaging Network,"April 27, 2021, https://www.usgs.gov/mission-areas/water-resources/science/usgs-streamgaging-network (accessed March 3, 2022).
[237] "Gages Through the Ages," United States Geological Survey, https://labs.waterdata.usgs.gov/visualizations/gages-through-the-ages/index.html#/ (accessed March 3, 2022).
[238] U. S. Geological Survey and Mary C. Rabbitt, 12.
[239] U. S. Geological Survey and Mary C. Rabbitt, 36.
[240] Water Resources, "USGS Streamgaging Network."

vernacular and utilitarian forms.[241] Streamgage data is used for many different purposes including hydrologic research; maintaining water quality; forecasting river conditions, floods, and drought; and in the design of water-storage and treatment facilities as well as that of bridges, culverts, and other structures to ensure safe-functioning during flood conditions.[242]

The U. S. Geological Survey Gage House, associated with water monitoring station 01481500, was placed into operation in October 1946. The station's primary function was to record hydrological information including water temperature, discharge, gage height, dissolved oxygen, pH, and turbidity. The gage house is no longer in use, as the station was relocated upstream to the west side of Rising Sun Lane Bridge in October 2006.[243] Several other gage house structures of similar vintage and concrete block construction are extant in Delaware, including one on White Clay Creek near Newark (associated with USGS station 01479000); another, on Christina River south of Newark near Cooch's Bridge (associated with USGS station 01478000); and a third, on Nanticoke River near Bridgeville (associated with USGS station 01487000).[244]

[241] Dakota Water Science Center, "How/Why Does the USGS Collect Streamflow Data," https://www.usgs.gov/centers/dakota-water-science-center/howwhy-does-usgs-collect-streamflow-data (accessed March 3, 2022).
[242] Dakota Water Science Center, "How/Why Does the USGS Collect Streamflow Data."
[243] Information about this station is derived from the USGS National Water Information website for station 01481500, accessed December 1, 2021: https://waterdata.usgs.gov/usa/nwis/uv?01481500.
[244] Data retrieved from the USGS National Water Dashboard, https://dashboard.waterdata.usgs.gov/app/nwd/?region=lower48 (accessed March 4, 2022).

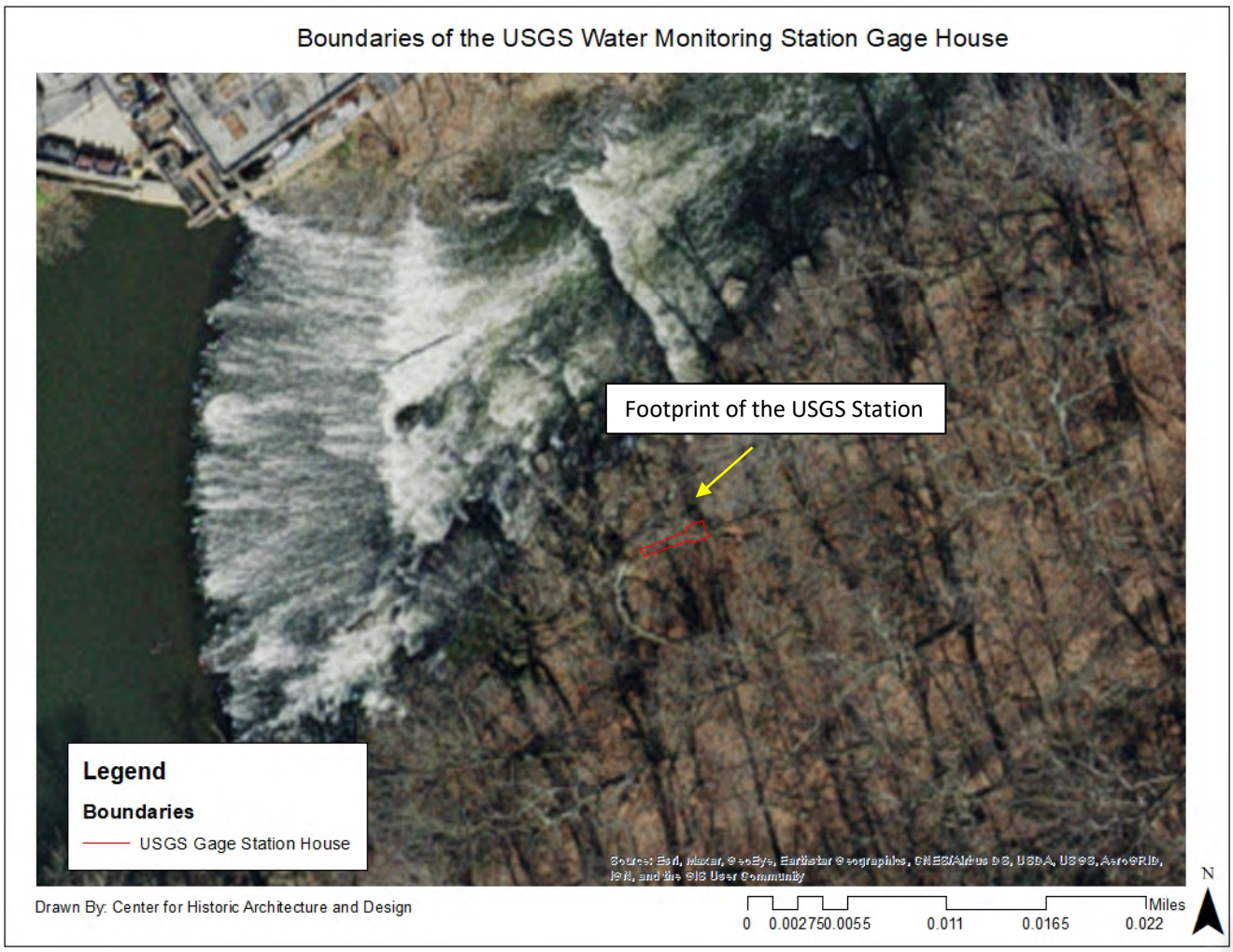

Figure 134. Boundaries of the USGS Water Monitoring Station Gage House

Evaluation:

This resource is recommended as ineligible for listing in the National Register of Historic Places. Though it is associated with the government's scientific study of streams and water flow, this resource alone does not represent the significance of those studies; therefore, it is ineligible for listing under Criterion A. Research on this resource has not revealed any associations with the lives of persons significant to our local, state, or national history, for whom this resource is the best representative associated property; therefore, it ineligible for listing under Criterion B. The resource is one of thousands of gage houses built in the early- to mid-twentieth century for holding streamgage equipment. This resource is utilitarian in nature and does not embody the distinctive characteristics of a type, period, or method of construction, or represent the work of a master, or possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction; therefore, it is ineligible for listing under Criterion C. This resource has not been evaluated for eligibility under Criterion D.

SUMMARY AND RECOMMENDATIONS

Based on the context outlined in this document, two (2) of the previously identified resources, the Upper Dam (Dam 2, CRS# N01566.024), and the Rockford Dam (Dam 5, CRS # N03646.048), were determined to be individually eligible for listing in the National Register of Historic Places. While both had previously been determined as contributing resources to larger historic districts (Dam 2 is a contributing resource to "Brandywine Park and Kentmere Parkway Historic District," and Dam 5 is a contributing resource to "Bancroft and Sons Cotton Mills Historic District"), the entire districts were not re-evaluated as part of this project. Of the eleven (11) newly identified resources surveyed within this report, three (3) have been determined to meet the criteria for historical significance at the local level and retain sufficient integrity to be listed in the National Register of Historic Places. These three resources are Augustine Dam (Dam 3), Kentmere Dam (Dam 4), and Lower Hagley Yard Dam (Dam 6). Four (4) resources were not evaluated because determinations of eligibility for those resources fall outside of the scope of work for this project. The other four (4) newly identified resources do not possess historical significance at the local, state, or national level. As a result, these resources are not recommended as eligible for the NRHP.

The Lower Brandywine dams have potential to be considered eligible for listing as a historic district. Based on guidelines established by the National Park Service, a historic district "possesses a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development."[245] Further guidance indicates that "individual resources that although linked by association or function were separated geographically during the period of significance" may comprise a district and cites an example similar in nature to the subject dams, suggesting a "canal system with manmade segments interconnected by natural bodies of water."[246] The dams and their ancillary structures, as a collection of resources separated geographically yet associated historically and interconnected with one another by the Brandywine River, are potentially eligible as a historic district and should be further evaluated as such.

[245] "Guidelines for Completing National Register of Historic Places Forms, Part A: How to Complete the National Register Registration Form," (Washington, D.C.: U.S. Department of Interior, National Park Service, 1997), 15.
[246] "Guidelines for Completing National Register of Historic Places Forms, Part A: How to Complete the National Register Registration Form."

Table 1: A summary table of the properties surveyed and recommendations for eligibility included in this report.

CHRIS Number	Property Name	Address or Location	Parcel ID	Year Built	Previous Determination	Current Recommendation
Previously Identified Properties						
N01566.024	Dam 2 / Upper Dam	39.75868, -75.55502	2601410006/ 201340075	1902, 1885 dam behind	Contributing resource to HD	Eligible
N03646.048	Dam 5 / Rockford Dam	39.77078, -75.56919	0612700002/ 2600230001	1878	Contributing resource to HD	Eligible
Newly Identified Properties						
	Dam 3 / Augustine Dam	39.76491, -75.55695	0614300001/ 2600640050	c. 1850	Undetermined	Eligible
	Dam 4 / Kentmere Dam	39.76861, -75.55922	0612700002/ 2600620083	1896, c. 1940	Undetermined	Eligible
	Stone Wall Culvert with Footbridge	39.768984, -75.558974	0612700002	c. 1885 substructure / c. 2000 bridge	Undetermined	Ineligible
	Dam 6 / Lower Hagley Yard Dam	39.769437, -75.573876	0612600002/ 2600540002	c. 1839	Undetermined	Eligible
	Dupont Experimental Station Bldg 241	39.769663, -75.573880	0612600002	c. 1930	Undetermined	Not Evaluated
	Dupont Experimental Station Bldg 269	39.769827, -75.573725	0612600002	1940	Undetermined	Not Evaluated
	Dupont Experimental Station Bldg 256	39.770092, -75.573229	0612600002	1937	Undetermined	Not Evaluated
	Dupont Experimental Station Bldg 236	39.770293, -75.572896	0612600002	1930	Undetermined	Not Evaluated

	USGS Water Monitoring Station Gage House	39.769204, -75.573609	2600540002	1946	Undetermined	Ineligible
	Metal Platform Footbridge	39.768449, -75.576515	0703020022	c. 1946	Undetermined	Ineligible
	Stone Wall Culvert	39.768461, -75.576506	0703020022	c. Late-nineteenth century	Undetermined	Ineligible

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