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THE SCHUYLKILL NAVIGATION AND THE GIRARD CANAL

Stuart William Wells

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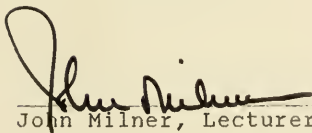
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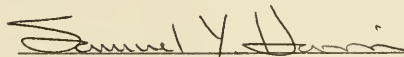
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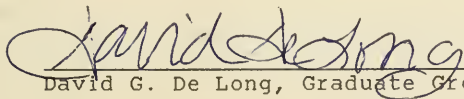
1989



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INTRODUCTION

The remaining structures and sites in and along the old Girard Canal of the Schuylkill Navigation, one of the oldest canal and slackwater navigation systems in the United States, are the subject of the following thesis.

As will become evident, the venerable "Schuylkill Navigation" system and with it the Girard Canal are almost forgotten monuments of American engineering, building skill, and ingenuity, dating back to the second decade of the nineteenth century. The continuing engineering record of maintenance, expansions, and final abandonment present a history and artifactual record that extends well into the final decades of the nineteenth century and early part of the twentieth century.

As of the writing of this thesis, the remaining structures are truly threatened and are being rapidly destroyed. Because of their historical importance and architectural and engineering merit, these early structures deserve to be called landmarks of a highly significant era in the annals of the United States and, especially, the Commonwealth of Pennsylvania. Every spring freshet, every winter freeze, and each summer's growth of trees and vines in the old masonry arches and walls take their toll, but

more destructive than these have been the activities of man. Preservation is desperately needed.

It is well known that the age of American "canaling" and its subsequent demise in competition with the newly developing railroad industry spans one of the most exciting, dynamic, and picturesque eras in Pennsylvania and in the young nation. As will be explained in Chapter I, most canal historians have focused on the economic importance of canal and lock/slackwater systems. Other historians have collected the colorful stories and material culture of the canal boats, of the mule skinnners and their teams, of the travelers' accounts of silently gliding through the nights on the canals and river segments of these old navigation systems; or they have been fascinated by the lore and ways of rough and tumble canal boat men, their fights, their songs, their whiskey and their favorite taverns. But there is no concise history and documentation of the sites and structures themselves on the Schuylkill Navigation system, specifically the Girard Canal, the longest segment of canal within the system.

The thesis will address that lack. This study for the first time will provide a much needed history of the former life of the artifact called the "Schuylkill Navigation" system, its actual construction, its expansion and its eventual abandonment (see Chapter II). Since the

documentation of its engineering and building has been so fragmented, there has not been any one source available which presented the initial information needed to begin a meaningful preservation program for the system itself.

The largest segment of the "Schuylkill Navigation" system, with its 108 miles, was the Girard Canal, with its length of some 22 miles. The types of structures and the mechanisms found in and along the Girard Canal will be identified and explained in Chapter III. These will provide an index for yet other sites in the larger system. All of the Girard Canal sites, 129 of them (not including canal bottom, berm banks, and tow paths), have been identified by name; their locations have been physically searched for; and they have been researched and documented in the engineer's reports and company papers.

Although too many of them have been obliterated (see Appendix), some splendid structures and sites, fortunately, do remain. Those sites which still have identifiable ruins or surviving structures, 66 of them, have been identified, located, photographed (see Plates), and have been documented using the engineer's reports or company records when available (Chapter IV). Above ground archeological survey and backmapping were also among the methods used to find these often elusive sites hidden under decades of vegetative growth or accumulations of flood debris. The finding of the physical location of these sites was a challenging

undertaking, punctuated by droves of mosquitos, snakes, prickly bushes, poison ivy, and irate dogs. However, it also provided an opportunity to meet a number of helpful and interesting persons. Old people, hunters, fishermen, and children proved to be the best informants. The precise chronological documentation of the engineering history of the sites and their artifacts was compiled from primary source materials, especially the engineer's reports to the Board of the Schuylkill Navigation Company. Other primary documentation was found in various business records, including those of the Philadelphia and Reading Railroad Company. Local and county histories also were consulted. Chapter I alludes to some of the problems encountered when researching canal history.

Although many of these remaining structures are in ruins, they do present an integral whole as a system. The Girard Canal in the Schuylkill Navigation does present a part of a system. Integrity is demonstrable when one recalls that one is dealing with transportation and that all the sites and remaining structures are beads on the former string or ribbon of an old inland waterway.

Some of the stone work and the great arches, the locks and waste weirs are awesome achievements, and coming upon them suddenly after traversing the underbrush (see Plates 28 and 69, Haws Culvert and Snyder's Culvert) is an unforgettable experience. These utilitarian structures were

not intended to be "art," but the forgotten craftsmen and masons indulged at times in details and, especially, fine workmanship that seem, at least to this observer, absolutely worthy of aesthetic consideration.

Suffice it here to say, these structures should be preserved; they have historical, scientific, and aesthetic significance; it would be worth every effort expended in this study if some of these sites and structures could be saved.

CHAPTER I

SOME COMMON MISCONCEPTIONS ABOUT THE "SCHUYLKILL CANAL"

We may begin this study by pointing out that the terms "Schuylkill Canal" or "Erie Canal" are actually misnomers if one wishes to be precise. These early inland waterways really were "canal and slackwater" systems in conjunction with the river itself. As will be explained below, we are dealing with segments of canals. Each segment had its own name, but they, together with the Schuylkill River, made up the so-called "Schuylkill Navigation." The Girard Canal constituted the largest segment of the Schuylkill Navigation System, or the Schuylkill Navigation, as it was referred to in contemporary records. Before discussing the history and the construction of the Girard Canal, it is important to clarify some aspects of the history of the Schuylkill Navigation and, consequently, the Girard Canal.

It is commonly stated that the Erie Canal was the first of the large inland waterway works in the United States and that all of the larger canals were built afterwards as a result of the Erie Canal's success. This assumption is stated as fact and is reported in numerous publications and

histories dealing with transportation in general or canals specifically in the United States. One example can be taken from the "Canal or Railroad? Imitation and Innovation in the Response to the Erie Canal in Philadelphia, Baltimore, and Boston" in Transactions of the American Philosophical Society (1961) by Julius Rubin, Assistant Professor of Economics, Columbia University. Professor Rubin opened his article in the following manner:

One of the great American technological feats of the early nineteenth century, one that revolutionized the transportation system and soon became a dominant factor in the rapid development of the interior of the country, consisted of a 364-mile canal between Albany and Buffalo, begun in 1817 and completed in 1825. The Erie Canal was a true innovation. Of the American canals preceding it only three were more than two miles long and the longest of these, the Middlesex, was hardly 28 miles in length and in severe financial difficulties by 1816.¹

It is to be noted here that the Schuylkill Navigation was neither an "imitation or innovation" in "response" to the Erie Canal. Construction of the Schuylkill Navigation began in 1816; it commenced on the Erie in 1817. The Erie was completed in 1825; the Schuylkill Navigation also finished in 1825, but five months before the completion of the Erie Canal. Furthermore, the 28-mile Middlesex Canal was not the longest inland water navigation system in the United States prior to the Erie Canal; the Schuylkill Navigation was over 108 miles long. A 108-mile long canal and slackwater system in 1825 was no mean engineering feat.

¹ Rubin, p. 5.

It is correct that the Erie Canal had a tremendous impact upon Philadelphia, and in response to the construction of New York's Erie Canal the Commonwealth of Pennsylvania began its own state works in 1826 called the Pennsylvania Main Line. However, the Schuylkill Navigation Company was a private company, and while it may be true that the proposals of canal promoters in New York provided some added incentive for the supporters of improved navigation on the Schuylkill River to organize, it would be erroneous to say that the Schuylkill Navigation Company was imitating the state canal works of New York in 1815. It was not until 1816 that New York had come up with a practical proposal in which locks and slackwater navigation would be used to build the Erie Canal. By that time the Schuylkill Navigation Company had already begun construction of their own lock and slackwater navigation system.²

Rubin's quotation above was not singled out in order to criticize his fine article; rather it is cited here as a concisely stated example of a widespread misconception regarding the Schuylkill navigation system. It also should be noted that Professor Rubin's writings are primarily concerned with the economic history of American canals. Most of the histories, in fact, that deal with the Schuylkill Navigation have been economic histories; very

² James E. Vance, Jr., Capturing the Horizon: The Historical Geography of Transportation (New York: Harper and Row, Publishers, 1986), p. 123.

little attention has been turned to the actual construction and works of the Schuylkill Navigation. Consequently, the historical importance of the 108-mile long Schuylkill Navigation has been overlooked and almost forgotten. It is one of the objectives of Historic Preservation to reclaim and to save engineering and technological historic sites, monuments of the industrial past. It is important then to look at the lock and slackwater system of, if not the oldest, then at least one of the oldest major canal systems in the United States--and certainly the oldest canal system in Pennsylvania³--and rescue it from oblivion. It should also be remembered that for five months in 1825 the Schuylkill Navigation was the longest canal system anywhere in the United States.

Why has the Schuylkill Navigation been the stepchild of transportation and canal history? An answer may be found, as mentioned above, in the primary economic interests of historians writing about canals. The answer, as this study revealed, lies also in the fragmentation of the historical documentation, requiring much historical ferreting.

³ "The locks upon the Schuylkill Navigation Company's works were the first erected in the state, and by their charter required to be eighty feet long by seventeen feet wide; of these dimensions they were all put up, from Philadelphia to Mount Carbon. After these were built, the Legislature authorized that those subsequently erected might be reduced in width to thirteen feet six inches, of which dimensions the Twin Locks were made, and some few of the old ones that required rebuilding were reduced." Schuylkill Navigation Company Report to the Stockholders, January 1, 1838, pp. 7-8.

As early as 1908, Chester Lloyd Jones, Professor at the University of Pennsylvania, in his Economic History of the Anthracite-Tidewater Canals, had this to say:

The material dealing with the coal carrying canals is nowhere available in satisfactory condition, and it has been found impossible in several cases to obtain complete sets even of the official records issued by the companies. The fragmentary character of the material available is in some instances remarkable...⁴

The situation had not improved in 1989.

The following study of the Girard Canal necessitated a study of the history of the Schuylkill Navigation in its entirety. Chapter II presents such a history. The search for company records and other documentation obviously entailed frustration as well as surprises, including coal dust falling out of the dog-eared pages of company minutes, apparently not used since the last entries.

The visual inspection of remaining sites along the Girard Canal has also elevated trespassing to a fine art, provoked some remarkable adventures, and, hopefully, may be an aid to future reclamation and preservation.

⁴ Chester L. Jones, The Economic History of the Anthracite-Tidewater Canals: Publications of the University of Pennsylvania Series in Political Economy and Public Law No. 22 (Philadelphia: The John C. Winston Co., Selling Agents, 1908), p. 166.

CHAPTER II

A HISTORY OF THE CONSTRUCTION, EXPANSION, AND ABANDONMENT OF THE SCHUYLKILL NAVIGATION

The idea of improving the Schuylkill River for navigation had been discussed long before the Schuylkill Navigation Company came into existence, but most of the early improvement plans dealt with connecting the Schuylkill River with the Susquehanna River via a canal along the Tulpehocken Creek from Reading to Middletown. William Penn had written about such a plan in 1690.⁵ In the 1760's David Rittenhouse and the University of Pennsylvania's first provost, Dr. William Smith, began to survey the route which William Penn had suggested; but no canal construction was undertaken.

Already in the 1720's there was agitation and trouble over the conflicting interests of farmers and fishermen in the Schuylkill valley. Difficulties arose because farmers floated their produce down the Schuylkill River to Philadelphia in large canoes or rafts when the river level was high. Frequently their progress was impeded by dams, fishing weirs, and racks constructed in the river by

⁵ Some Proposals for a Second Settlement in the Province of Pennsylvania. Published in England, 1690.

Schuylkill River fishermen. The fishermen were angered by the damage to their dams and weirs caused by the passage of the farmers' canoes and rafts. The farmers argued in turn that they had a right to navigate the river. The obstructions that the fishermen built in the river often capsized the farmers boats, spilling their goods into the water; often the farmers were forced to leap into the icy waters of the spring thaw in order to save their shipments of produce. In 1738 William Richards, constable of Amity Township, Berks County, and Robert Smith, constable of Oley Township, Berks County, were given a warrant to remove all obstructions from the river. The fishermen gathered in hostile groups to defend their property, and with clubs and poles they successfully drove the constable and his deputies away.⁶ A week later the justices of Philadelphia and Chester Counties also issued warrants against the riotous men so that the sheriffs from all three counties were able to arrest the offenders and clear the river for navigation from Amity Township (above Pottstown) to Philadelphia.⁷

In 1768 a plan for the improvement of navigation on the Schuylkill River was published in the Pennsylvania

⁶ Morton L. Montgomery, A History of Berks County in Pennsylvania (Philadelphia: Everts, Peck and Richards, 1886) p. 426.

⁷ Ibid., pp. 426-427.

Chronicle.^a The plan involved the building of sixteen dams between Reading and Philadelphia to increase the water depth in the river; it also called for the construction of a good road along the river bank so that flat boats could be pulled by draft animals. One of the main arguments voiced against this slack water navigation system was that it would ruin the shad fisheries along the Schuylkill River.

Nevertheless, the proposal opened up a lot of serious discussion. Benjamin Franklin wrote a letter to Mr. S. Roads, the mayor of Philadelphia, regarding the improvement of the Schuylkill River for navigation. In the letter Franklin expressed his concern about the lack of engineers in America and suggested that a good salary be offered to engage a British engineer who was knowledgeable about the canal construction in England. Franklin pointed out that the salary would be worth paying when one considered the expense of construction errors. Franklin went on to say:

With regard to your question, whether it is best to make the Schuylkill a part of the navigation to the back country, [A slack water navigation] or whether the difficulty of that river, subject to all the inconveniences of floods, ice, etc., will not be greater than the expense of digging locks, etc., I can only say that here [in England] they look on the constant practicability of a navigation, allowing boats to pass and repass at all times and seasons, without hindrance, to be a point of the greatest importance, and, therefore, they seldom or ever use the river where it can be avoided. Locks in rivers are subject to many more accidents than those in still water canals; and the carrying away a few locks by freshets of ice, not

^a Jay V. Hare, "History of the Reading," The Pilot 13:9, p. 290.

only creates a great expense, but interrupts business for a long time till repairs are made, which may soon be destroyed again, and thus the carrying on a course of business by such a navigation be discouraged, as subject to frequent interruptions. The toll, too, must be higher to pay for such repairs. Rivers are ungovernable things, especially in hilly countries. Canals are quiet and very manageable. Therefore they are often carried on here by the sides of rivers, only on ground above the reach of floods, no other use being made of the rivers than to supply occasionally the waste water of canals.⁹

The supporters of the improvement of navigation on the Schuylkill River met with little success over the years, but as the population, the farms, and the industries increased in the Schuylkill Valley, more people came to realize the growing need for improved river navigation. By the end of the year 1813 the supporters of improved navigation on the Schuylkill River had organized themselves in order to encourage the state legislature to act upon the matter. On March 8, 1815, the legislature introduced the bill incorporating a company called "The Presidents, Managers and Company of the Schuylkill Navigation Company."¹⁰

The Schuylkill Navigation Company, as the new organization was called, was authorized to control the waters of the Schuylkill River and to construct a lock

⁹ J. L. Ringwalt, Development of Transportation Systems in the United States. . . . (Philadelphia: Railway World, 1888. Johnson Reprint Corporation, 1966), pp. 41-42.

¹⁰ An Act to Authorize the Governor to Incorporate a Company to Make a Lock Navigation on the River Schuylkill (Philadelphia: Office of the United States' Gazette, 1815).

navigation system.¹¹ The Navigation Company was also granted exclusive water power rights of the Schuylkill River to sell, rent, or lease as a source of income.¹² The legislation also stipulated that the construction was to be done in two sections and that no tolls could be collected at a lock in one section until another lock was completed in the other section.¹³

The lower section of the Schuylkill Navigation extended from the Lancaster Schuylkill Bridge (Callowhill St.) in Philadelphia to the Borough of Reading, in Berks County. The upper section stretched from Reading to a locale in the Blue Mountains, the mouth of Mill Creek in Schuylkill County about two miles above Pottsville. The construction had to be carried out in both sections simultaneously; for each lock or structure built in one section, a lock or structure was to be constructed in the other section.¹⁴ This stipulation created some hardships

¹¹ Ibid., Section 15, page 18.

¹² Ibid.

¹³ Ibid., Section 16, pages 18-20. See also Senate File 59, A Supplement to an Act Entitled: Act to Authorize the Governor to Incorporate a Company to Make a Lock Navigation on the River Schuylkill (Philadelphia: John S. Wiestling, 1816), lines 13-14.

¹⁴ After a pair of locks had been completed, one in each section, the governor would send three inspectors to examine the locks. If the locks were satisfactory, the governor would approve the locks, and tolls could be collected at a rate of 12 1/2 cents per ton for locks in the lower section (below Reading) and of 8 cents per ton for locks in the upper section (from Reading to Port Carbon).

for the Schuylkill Navigation Company. It was difficult to find anyone in America with experience as an engineer. It should be noted that the first civilian school for engineering in the United States, the Rensselaer Polytechnic Institute, was not founded until 1835. Having to carry on construction at two locations over 60 miles apart made the canal project all the more arduous to plan and the more difficult to supervise. It is 60 miles from Philadelphia to Reading and 108 miles from Philadelphia to Mill Creek.

The Schuylkill Navigation Company was given three years to begin construction and then fifteen years to complete it. On May 1, 1815, the company opened for subscriptions to shares; by September of the same year, the necessary number of shares which was fixed by law had already been exceeded. Letters of patent were issued on September 2nd, and the president and managers for the new company were elected October 5, 1815.¹⁵ The first president of the Schuylkill Navigation Company was Cadwalader Evans, Jr. A committee was organized during the autumn of 1816 and sent up to Connecticut in October to examine works constructed in the Connecticut River. The committee met with Ariel Cooley, who had constructed locks and dams in the Connecticut River between Springfield, Massachusetts, and Hanover, New Hampshire, as well as in the James River near Richmond, Virginia. The committee also observed a large dam at

¹⁵ Hare, The Pilot 13:9, p. 293.

Holyoke, Massachusetts, which had been constructed from timber fastened together with iron bolts and planked on the upstream side. The Holyoke dam was 1040 feet long, including a small rocky island near the center of the river, and 25 to 35 feet high. The committee reported that the dam ". . . although constructed almost entirely of logs with scantling,¹⁶ strongly bolted down with iron bolts to the rocky bottom, and planked on top, with scarce any stones, had then stood twelve years."¹⁷ The dam was used as a model for the dams to be built by the Schuylkill Navigation Company. However, the Schuylkill Navigation Company modified the design by constructing dams with stone filled cribwork. The Holyoke dam had a minimal amount of stone filling.

The committee and Mr. Cooley agreed that he should come to Philadelphia in the spring of 1816 "to explore, examine, and give the board his opinion in respect to [the] Schuylkill."¹⁸ Mr. Cooley, after examining the Schuylkill River, gave his recommendations about how the construction of the Schuylkill Navigation should be carried out. His plan called for construction to begin at the Schuylkill

¹⁶ "Scantling" is timber cut to narrow dimensions.

¹⁷ Address of the President and Managers of the Schuylkill Navigation Company to the Stockholders, and to the Publick in General (Philadelphia: Office of the United States' Gazette, 1817), p. 3.

¹⁸ Ibid.

Falls at Philadelphia. His recommendation was "First--that a dam to be formed out of logs, braces, and stones such as is commonly called a crib dam, about six-hundred feet in length across the river, and thirteen or fourteen feet high, should be erected . . ." ¹⁹ Ariel Cooley offered to undertake the construction project at the Schuylkill Falls, but the Schuylkill Navigation Company did not feel they could afford what he asked, so he returned to Springfield.

Construction began in the summer of 1816 after the Schuylkill Navigation Company had entered an agreement on the fourteenth of August with Josiah White to build a dam at the Schuylkill Falls in Philadelphia. Along with the dam a short canal and lock to bypass the seven foot fall of the river was built. Josiah White had agreed to take the responsibility of construction and to pay for the costs in exchange for the use of the water power to improve his mill. In March 1817, the legislature authorized the governor to approve the subscription of one thousand shares to the company, which gave the Schuylkill Navigation Company the additional funds it needed. They hired Mr. Cooley to construct the four locks near the Schuylkill Falls as previously planned. ²⁰ Construction on the upper section at Mount Carbon was commenced in the spring of 1818 when Lewis Wernwag was given the contract to construct the first dam in

¹⁹ Ibid., pp. 4-5.

²⁰ Ibid., p. 6.

that section.²¹ The first transportation tunnel built in America was dug for the canal in Schuylkill County near Auburn, 1818 to 1821, by the Scottish engineer George Duncan.²² It was 450 feet long with an arch 75 feet wide.²³

Thomas Oakes was the principal engineer for the Schuylkill Navigation until his tragic death in 1826. In 1821 the unfinished works were close enough to completion that flat boats came down from Port Carbon, at the head of the Navigation, to Hamburg, above Reading. The canal system was not yet opened from Reading to Phoenixville, so the flat boats entered the Schuylkill River, which had been dammed at several points. The boats reentered the canal again at Phoenixville; from there the canal system was completed all the way to Philadelphia.²⁴ Construction was hindered by a serious outbreak of fever among the workers in 1821. Not only did workers die but Mr. Thomas Oakes, the principal engineer of the Navigation, died August 13, 1823, and Mr. King, his successor, also became ill and died on October 3,

²¹ History of Schuylkill County, Pa. with Illustrations and Biographical Sketches of Some of Its Prominent Men and Pioneers (New York: W. W. Munsell and Co., 1881), p. 446.

²² Hare, The Pilot 14:2, p. 35.

²³ Hudson Coal Company, The Story of Anthracite (Scranton, Pennsylvania: International Textbook Press, 1932), p. 49.

²⁴ History of Schuylkill County, p. 80.

1823.²⁵ In spite of these hardships by 1824 boats could use almost the entire length of the Schuylkill Navigation. The President reported that:

owing to the unprecedented and severe sickness that prevailed during last summer [1821], our engineer and all the agents under him were taken sick, and nearly all the contractors and labourers, there being upwards of three hundred sick at one time, rendered it impossible to erect the dams or progress in the intended works, and which has caused a considerable increase in the expenditure that would otherwise have been avoided, besides the delay in completing the work.²⁶

The last section of the Schuylkill Navigation from Philadelphia to Port Carbon to be put under construction was the canal which passed through the borough of Reading. The celebration for the opening of this section was set for October 23, 1824. Unfortunately, when the water was let into this section of canal, it would not fill. The water vanished through the ground into a limestone formation over which the canal passed.²⁷ The water never even reached the

²⁵ Hare, The Pilot 14:3, p. 70.

²⁶ Report of the President and Managers of the Schuylkill Navigation Company to the Stockholders, January 7, 1822 (Philadelphia: James Kay, Jun. and Brother, 1822), p. 9.

²⁷ Interestingly, there are stories of how the water that leaked out of the canal in one instance did not seep back down to the Schuylkill River but ran through fissures in the rock only to reappear in a field on the opposite side of the river. See Montgomery, History of Berks County, p. 447, and Arthur D. Graeff and George M. Meiser. Echoes of Scholla-Illustrated: Choice Bits of Berks County History and Lore (Kutztown, Pa.: Berksiana Foundation, Publishers, 1976), p. 22.

locks.²⁸ On December 3, 1824, after repairs had been completed, the water filled the locks, and the boat Pioneer was the first to pass through.²⁹ On July 5, 1824, a grand opening celebration was held in Reading. There were canon salutes and speeches.³⁰ Three boats carried local politicians and distinguished guests down the canal, and a fourth boat, loaded with agricultural implements, followed.³¹ However, still more leaks developed, and the water had to be shut off once again. By the time the repairs were completed, the Schuylkill Navigation had been shut down for the winter. Canals are not operable during the very cold winter weather because the water in them freezes. It was not until spring, May 20, 1825, that the Schuylkill Navigation was opened from Philadelphia to Pottsville.³² However, the canal bed still leaked so badly

²⁸ Severe leakage resulted when water dissolved the calcium carbonate in the vein of limestone, creating what are called swallow-holes.

²⁹ Hare, The Pilot 14:3, p. 77.

³⁰ Montgomery, History of Berks County, p. 447.

³¹ The agricultural implements were representative of the farm goods that would be carried on the canal; the Schuylkill Navigation Company still had not realized what the magnitude of the coal trade would be. In fact, in 1824, a boat carrying 28 tons of coal paid no tolls in Reading because no rate had been fixed for coal although all manner of agricultural products had rates fixed, even to a bushel of hickory nuts. See Montgomery, History of Schuylkill County, p. 80 and Alvin F. Harlow, Old Towpaths: The Story of the American Canal Era (New York: D. Appleton and Company, 1926), pp. 88-89.

³² Hare, The Pilot 14:4, p. 78.

near Reading that the line again had to be closed for repairs. After lining the troublesome section of the canal with planking, the entire length of the Navigation from Philadelphia to Mount Carbon was reopened on October 1, 1825.³³

The Schuylkill Navigation Company did not have good towpaths at that time. Boats had to be pulled by men pushing against a strong stick tied to the tow rope as a cross-bar.³⁴ Construction of a proper towpath for beasts of burden was started in 1825.³⁵ In 1828 a short segment of the Navigation, from Pottsville to Mill Creek, was completed, fulfilling the requirements set forth by the act of incorporation of 1815.³⁶

The locks of the Schuylkill Navigation Company were required by law to be 80 feet long in the chamber and 17

³³ Solomon W. Roberts, Report to the Board of Managers of the Schuylkill Navigation Company, on the Improvement of the Schuylkill Navigation, January 2nd, 1845 (Philadelphia: Joseph and William Kite, 1845), p. 4.

³⁴ History of Schuylkill County, p. 80; Montgomery, History of Berks County, p. 448; Harlow, Old Towpaths, p. 88; and Hare, The Pilot 14:3, p. 75.

³⁵ Report of the President and Managers of the Schuylkill Navigation Company to the Stockholders, January 6, 1826 (Philadelphia: Lydia R. Bailey, 1826), p. 8.

³⁶ Report of the President and Managers of the Schuylkill Navigation Company to the Stockholders, January 5, 1829 (Philadelphia: Lydia R. Bailey, 1829), pp. 3-4.

feet wide.³⁷ The Navigation was a little over 108 miles long. It consisted of 62 miles of canal and 46 miles of slack water navigation. There were 120 locks, 29 of which were guard locks having no lift. Thirty nine locks were below Reading and 81 above Reading. The Schuylkill Navigation overcame a fall of 588 feet. The channels of the navigation were, at first, crooked in many places, and the depth of the navigation was only three feet. In spite of this boat loads of anthracite weighing 25 tons were brought down from the mines in Schuylkill County. The boatmen during the first years of navigation were aided by a guide book published in 1827 called Schuylkill Canal Navigator in which directions were given regarding how to avoid running aground or getting caught on stumps or rocks. The preface to the book pointed out that the lower section of the Navigation, from Reading to Philadelphia, was the most difficult because it was "occasioned by points, rocks, and bars."³⁸

³⁷ The original charter of 1815 called for the locks to be built at least 20 feet wide and 120 feet long, but in 1816 a supplement to the charter was written which reduced the minimum size requirement to 17 feet wide and 80 feet long.

³⁸ S. Alspach, Schuylkill Canal Navigator (Philadelphia: Joseph Rakestraw, Printer, 1827). Reprinted in Historical Sketches, A Collection of Papers Prepared for the Historical Society of Montgomery County Pennsylvania, Vol.4, (Norristown, Pennsylvania: Herald Printing and Binding Rooms, 1910), p. 355.

By 1830 the Schuylkill Navigation Company was doubling locks in order to decrease the amount of time necessary to pass boats through the line. The canals became congested as boats arrived at the locks and waited for other boats to be locked through to the next level. The additional locks were thirteen and one half feet wide, not the original width of seventeen feet. The boats in use at that time did not require so much width, and the narrower locks used less water to pass a boat to the next level than the wider locks did. In 1830 the surveyor and cartographer H. S. Tanner reported the "Schuylkill Navigation, consisting of pools and canals, commencing at Philadelphia, passes through Manayunk, Norristown, Pottstown, Reading, Hamburg, and Pottsville, and extends to Port Carbon, at the junction of Mill Creek with the Schuylkill; length from Philadelphia to Port Carbon 112 miles; 125 locks, each lift lock 17 by 80 feet; ascent 620 feet; canal 36 feet wide at top, 24 at bottom, 3 feet deep. General course north-west; average ascent 5.64 feet per mile."³⁹ Mr. Tanner apparently counted his milage of the Schuylkill Navigation from the Delaware River to Mill Creek (above Port Carbon). This accounts for the additional four miles of navigation and the additional 32 feet in fall. The official Schuylkill Navigation Reports count milage from

³⁹ H. S. Tanner, Memoir on the Recent Surveys, Observations, and Internal Improvement in the United States, with Brief Notices of the New Counties, Towns, Villages, Canals, and Railroads, Never Before Delineated (Philadelphia: H. S. Tanner, 1830), p. 42.

just below the Fairmount Dam at the Lancaster Schuylkill Bridge (Callowhill Street) to Mill Creek. Tanner's report also indicated that five locks had probably already been doubled. In 1830 it was proposed that all of the combined locks or double lift locks, should have a second set of locks built adjacent to the first.⁴⁰ The work was carried out during the following decade. In 1833 the troublesome section of canal which passed over the limestone formation near Reading was abandoned and the river itself was used for navigation instead. The abandonment of the section changed the canal mileage to 60 miles of canal navigation and 48 miles of slack water navigation. The task of deepening the Schuylkill Navigation to four feet of depth was started in 1834.⁴¹ The deepening was accomplished by raising the dams, locks, and canal banks and by clearing out the channels in the river.

The Schuylkill Navigation Company's period of greatest prosperity was during the 1830s up until the 1840s. The company's peak profit year was 1839.⁴² Although the tonnage

⁴⁰ Report . . . 1830, p. 7.

⁴¹ Report of the President and Managers of the Schuylkill Navigation Company to the Stockholders, January 6, 1834 (Philadelphia: James, Kay, Jun. and Co., 1834), p. 7.

⁴² Chester L. Jones, The Economic History of the Anthracite-Tidewater Canals: Publications of the University of Pennsylvania Series in Political Economy and Public Law No. 22 (Philadelphia: The John C. Winston Co., Selling Agents, 1908), p. 135.

carried by the company continued to increase until the end of the 1860s, the company's profits were not as great because of a reduction in the toll rates charged. The reduction in toll rates was necessary to keep prices competitive with the rates charged by the Philadelphia and Reading Railroad Company. The Philadelphia and Reading Railroad had opened a railway to Mount Carbon in 1842 thus ending the period of the Schuylkill Navigation Company's monopoly on the transport of anthracite. The Schuylkill Navigation Company never had a complete monopoly on the coal trade, however, because there was a stipulation in their charter which prevented the company from building or owning its own boats. The company also did not own any coal fields, unlike the Lehigh Canal or the railroad companies which did; the Schuylkill Navigation Company was exclusively a public transportation line much like a turnpike. The boats on the Schuylkill Canal were privately owned and built by independent companies. It was not until after 1845 that the Schuylkill Navigation Company applied for a supplement to their charter⁴³ which authorized the company to own boats.⁴⁴ However, they still could not own

⁴³ Frederick M. Binder, Coal Age Empire: Pennsylvania Coal and Its Utilization to 1860 (Harrisburg: Pennsylvania Historical and Museum Commission, 1974), p. 136. See also Jones, Economic History, p. 136; Montgomery, History of Berks County, p. 450.

⁴⁴ Jones, Economic History, p. 138; History of Schuylkill County, p. 81.

or operate boat yards. The Schuylkill Navigation Company had to have their own boats to prevent those who were interested in the railroad from renting boats in order to take them out of circulation, an indication of the fierce struggle between the canals and railroads. The Philadelphia and Reading Railroad Company ran in direct competition with the Schuylkill Navigation Company at a time when most railroad companies ran feeder lines to canals or else ran lines into areas that canal companies could not reach. The Schuylkill Navigation and the Philadelphia and Reading Railroad ran side by side from the coal fields to Philadelphia. The competition was vicious.

The president of the Schuylkill Navigation Company, Solomon W. Roberts, who was a civil engineer, prepared a report on the estimated cost of enlarging the canal,⁴⁵ and in 1845 plans were prepared for the improvement.⁴⁶ In 1846 a major project to widen and deepen the canal was undertaken. James F. Smith was the engineer in charge of the work. The large scale improvement of the canal was undertaken in response to the Philadelphia and Reading Railroad's line to Port Carbon. The Schuylkill Navigation

⁴⁵ Solomon W. Roberts, Report to the Board of Managers of the Schuylkill Navigation Company, on the Improvement of the Schuylkill Navigation, January 2nd, 1845 (Philadelphia: Joseph and William Kite, 1845).

⁴⁶ Edward Miller, Report of Edward Miller, Civil Engineer, on the Improvement of the Schuylkill Navigation, Made to the Board of Managers, March 11, 1845 (Philadelphia: John C. Clark, Printer, 1845).

Company and the Philadelphia and Reading Railroad fought for the profitable coal traffic. An excerpt from an 1852 pamphlet entitled "The Schuylkill Navigation Company" summarizes the situation in the 1840s.

The Managers of the Schuylkill Navigation Company, in view of the dangerous rivalry with which they were threatened, and of the constant increase and importance of the coal trade, felt it to be necessary to devise some means by which coal could be brought to market, through their works, at a less expense than it had heretofore been done. It was believed that it cost just about as much to bring down a boat laden with 80 tons, as it would to bring down one laden with 180, or even 200 tons. A general enlargement of the canal, therefore, was determined on in the winter of 1845.⁴⁷

Not only were the improvements of 1846 to facilitate the passage of larger boats, but also the improved canal was to have fewer locks so that travel time could be decreased. The canal locks were also to be standardized at that time. Edward Miller, Civil Engineer, reported in 1845 that there were 31 different lock chamber lengths and 21 different lock chamber widths;⁴⁸ it should be noted, however, that some of the chambers which were tabulated as having different sizes were sometimes within inches of being the same size.

The work was completed rapidly in spite of high water and flood damage. In the Report of the President and Managers of the Schuylkill Navigation Company to the

⁴⁷ The Schuylkill Navigation Company (Philadelphia: Crissy & Markley, Printers, 1852), pp. 3-4.

⁴⁸ Miller, Report, pp. 17-18.

Stockholders in January of 1847, the following was presented as part of the report:

It is not deemed expedient or necessary to enter into all the details of the operations of this laborious year. It may suffice to say, that the navigation has been increased from a canal of very irregular and contracted surface, to one averaging more than 70 feet in width; from a depth of 4 feet to nearly, if not quite, 6 feet; and from a capacity to carry boats of 60 tons, to a capacity for boats of not less than 180 tons burthen.

That 71 locks, (none less than 110 feet long by 18 feet wide,) and 11 stop gates, have been built:

That 25 culverts have been lengthened, and 4 new ones built:

That 10 aqueducts have been raised, improved, and strengthened:

That 82 bridges, with their embankments, have been raised, and that 5 have been lengthened out so as to vent the floods of the river with more certainty:

That all the pools have been more or less deepened, and nearly all the old channels thoroughly cleaned out; and two entirely new channels cut for the river:

That divers new guard banks have been made, and many of the old ones raised and strengthened, for the better protection of the works:

That new sluices have been put in many of the dams, for the purpose of facilitating the future cleansing of the channels:

That 18 new waste weirs have been built, and 13 old ones raised and improved:

That the tunnel has been widened and enlarged, many of the towpaths have been raised, and new basins cut and walled, for the accommodation of the miscellaneous trade:

That 6 new lock-houses have been built; the bottom and sides of the canal, in the worst portions of the limestone formations, have been lined with plank, and buoys, floating or fixed, have been set in all the channels of which the navigation is at all doubtful:

That surveys have been made of all available streams which furnish sites for reservoirs, and several of the most valuable sites have been secured by purchase:

That ground for new landings has been secured, and the work of construction commenced:

That 120 boats and scows, and 150 additional cars have been constructed, and delivered to the Company.

These are the things which have been accomplished: the labor which they have involved can only be appreciated by those who have witnessed or participated in it.⁴⁹

Because the Philadelphia and Reading Railroad and the Schuylkill Navigation Company, due to the price wars, each tried to charge the least expensive tolls for tonnage, the Schuylkill Navigation Company had reduced receipts in spite of high tonnage. The enlargement of the Schuylkill Navigation put such a financial burden on the Schuylkill Navigation Company that for the first time since the opening of the canal they found themselves unable to make their payments to the bondholders and creditors.⁵⁰ Unfortunately the Schuylkill Navigation Company found that

the stock of boats and cars,^[51] formerly used in trade of the Schuylkill valley, has either from natural decay or some other sufficiently controlling cause, sunk into inadequacy, and the arrangements of the railroad company for the trade of the mining district for 1847, and the profitable employment of the boats on other canals, in carrying of the great agricultural products of the country to market, under the stimulus of an

⁴⁹ Report of the President and Managers of the Schuylkill Navigation Company to the Stockholders, January 4, 1847 (Philadelphia: Joseph Kite and Co., 1847), pp. 7-8.

⁵⁰ Report of the President and Managers of the Schuylkill Navigation Company to the Stockholders, January 3rd, 1848 (Philadelphia: Kite and Walton, 1848). For more detail see also The Schuylkill Navigation Company (Philadelphia: Crissy and Markley, 1852), p. 4.

⁵¹ The Schuylkill Navigation Company ran its own railroad cars on the lines of some of the railway companies that served as feeders from the coal mines to the Schuylkill Navigation ports. The Schuylkill Navigation coal cars were painted yellow to identify them. The most important of the feeder railroad lines was that of the Mine Hill and Schuylkill Haven Railroad.

unusual foreign demand, have limited the business for us, to the extent that our own independent means could meet.⁵²

In addition to the heavy expenditure for rebuilding and enlarging the Schuylkill Navigation, the company found that they had to spend even more money for the construction of boats. The company's president, Mr. Fraley, was able to negotiate a loan for an additional \$3,600,000 in 1849. The new enlarged boats were leased to individual boat captains, who not only maintained and managed their boats but also gradually paid for them.⁵³ Ironically, 1850 turned out to be a phenomenally unfortunate year for the Schuylkill Navigation Company. Having just recently purchased new boats and still straining under the cost of the enlargement of their works, the Schuylkill Navigation was hit by a large flood on the 19th of July. The flood "injured in its progress several important portions" of the Schuylkill Navigation, but the company was able to repair and reopen the whole line by August 26.⁵⁴ An even greater flood swept down the Schuylkill valley that same season.

On the second of September last our history is marked by a flood, with which nothing that has heretofore occurred in the valley of the Schuylkill, within the memory of man, can be compared. In the great elevation of the waters, in the destruction of property and life,

⁵² Report. . . 1848, p. 4-5.

⁵³ Hare, The Pilot 14:4, pp. 111-112.

⁵⁴ Report of the President and Managers of the Schuylkill Navigation Company to the Stockholders, January 6th, 1851 (Philadelphia: Kite and Walton, 1851), p. 7.

and, indeed, in all its accompaniments, no living witnesses have seen parallel. The most stable buildings were compelled to yield to the fury of the raging waters, and the very foundations of the mountains in many places were actually swept out.⁵⁵

The company immediately turned its energies toward rebuilding and repairing the Schuylkill Navigation again. In many cases the crib work of the dams was extended fifty to seventy-five percent and additional guard gates were constructed to safeguard the works against future floods.⁵⁶ The Schuylkill Navigation Company began a new policy:

In the making of our repairs, we endeavored to get additional strength and security wherever they could be attained, and it is proposed to follow this system up, in all cases of ordinary repair hereafter. With this in view, the chief engineer has been directed to make a complete examination of all the dams and mechanical work, and wherever he finds any part falling into decay, or betraying other signs of weakness, forthwith to take steps for repairing or securing it. Such a course may increase the current annual expenses, but it will tend to put at rest a great part of the anxiety and fear which the floods of 1850 have given birth to.⁵⁷

The navigation was reopened from Philadelphia to Reading on November 14, 1850;⁵⁸ the remaining portion, from Reading to the Blue Mountains, was opened in April of 1851.⁵⁹ The combined expenditures for the enlargement of

⁵⁵ Ibid., p. 6.

⁵⁶ Ibid., p. 8.

⁵⁷ Ibid., p. 9.

⁵⁸ Ibid., p. 12.

⁵⁹ Report of the President and Managers of the Schuylkill Navigation Company to the Stockholders, January 5th, 1852 (Philadelphia: Kite and Walton, 1852), p. 3.

the works, the purchase of new boats, and the repairs occasioned by the floods of 1850 caused a cumulative debt that the Schuylkill Navigation Company could never really overcome.

In order to encourage an increase in the coal tonnage carried on the canals, the Schuylkill Navigation Company in 1852 began awarding premiums to boatmen for "dispatch." The captains of the boats which carried the greatest tonnage or made the most trips were given cash awards at the end of the boating season.⁶⁰ The awarding of premiums continued for several years until the Schuylkill Navigation Company decided that the racing and the rivalry among boatmen was self-defeating.⁶¹ The Schuylkill Navigation Company hauled its peak tonnage in 1859.⁶² The canal was still proving to be a significant competitor with the Philadelphia and Reading Railroad. In 1858 the Philadelphia and Reading Railroad carried 1,543,646 tons of freight, and the Schuylkill Navigation Company carried 1,323,804 tons; in

⁶⁰ Report of the President and Managers of the Schuylkill Navigation Company to the Stockholders, January 2, 1854 (Philadelphia: Crissy and Markley, 1854), p. 11.

⁶¹ One should realize that the top speed for a loaded boat in the canal was about four miles an hour. If an attempt was made to pull the boat faster, the water confined in the canal was pushed up into a wave at the bow of the boat thus significantly increasing resistance; moreover, the wake from the boat eroded the canal banks. Canal boats made better time in the sections of the dammed river because the water was not confined around the boat as it was in the canal and the wake was not a problem.

⁶² Hare, The Pilot 14:5, p. 139.

1859 the Philadelphia and Reading Railroad carried 1,632,932 tons and the Schuylkill Navigation Company carried 1,372,109 tons.⁶³ The Schuylkill Navigation Company, more so than other coal carrying canals, experienced a drop in tonnage during the Civil War, particularly during the years 1861-1863. Some reasons for the drop were that the government purchased many of the Schuylkill Navigation boats for its own use and that the Confederate raid into Pennsylvania in 1863 and the battle at Gettysburg caused such a scare that all coal trade stopped entirely for a month.⁶⁴

The Philadelphia and Reading Railroad entered into negotiations with the Mine Hill and Schuylkill Haven Railroad in 1863. The Mine Hill and Schuylkill Haven Railroad was the feeder line which brought the greatest coal tonnage to the Schuylkill Navigation. The Philadelphia and Reading Railroad took control of this important feeder line through a nine hundred and ninety year lease and canceled all of the contracts it had held with the Schuylkill Navigation Company.⁶⁵ The Philadelphia and Reading Railroad then agreed to allow the Schuylkill Navigation Company to continue to operate its coal cars on the lateral lines for the same fee as any other company's cars but stipulated that the total tonnage of all traffic was to be divided between

⁶³ Binder, Coal Age Empire, p. 140.

⁶⁴ Jones, Economic History, p. 140.

⁶⁵ Ibid., p. 142.

the two companies, 45 percent to the Schuylkill Navigation and 55 percent to the Philadelphia and Reading Railroad.⁶⁶

The year 1869 proved to be a tragic one for the Schuylkill Navigation Company. At the beginning of the boating season strikes in the coal mines caused a major drop in the amount of tonnage shipped.⁶⁷ By the time the strike had ended a terrible drought was underway. During the drought the low river level caused a water shortage. When the water level is low, boats must carry lighter payloads to keep from running aground. The situation was worsened by the fact that the Philadelphia Water Works drew off more water at the Fairmount Dam than allowed by the agreement made in 1819 between the City of Philadelphia Watering Committee and the Schuylkill Navigation Company. On several earlier occasions the city had violated the agreement and stopped navigation by drawing off more than their share of water at the Fairmount Dam but never before as drastically as in 1869. Navigation on the Schuylkill Canal was blocked at Fairmount Dam due to insufficient water from July until heavy rains fell on the 25th of September. Navigation resumed on September 27, but incredibly, on the 4th of October the Schuylkill valley was smashed by a flood which

⁶⁶ Hare, The Pilot 14:5, p. 138.

⁶⁷ See Donald L. Miller and Richard E. Sharpless, The Kingdom of Coal: Work, Enterprise, and Ethnic Communities in the Mine Fields (Philadelphia: University of Pennsylvania Press, 1985), pp. 152-153 for more information about the strike.

was 21 inches higher than the Great Flood of 1850.⁶⁸ The managers reported to the stockholders and loanholders

We have to record and present to you several important matters, which have seriously interfered with our business and profits. First is the strike among the miners in the coal regions, which nearly stopped the coal trade for six weeks in May and June. This was expected, but its effects fell heavily on us under causes that were in operation in August and September, when the trade was most active and the charges for transportation at the highest rates. Second. In the latter part of July, and the beginning of August, owing to a low level of water in the Schuylkill, not at all unusual at that season, we found it necessary to call on the City of Philadelphia for compliance with the terms of the contract under which it has the right to use the water-power of the dam at Fairmount, for pumping water into its reservoirs. Our requests were partially complied with, and the navigation was not very materially interfered with until the 11th of August, when the agents of the City positively refused to close the inlets to the water-power, and drew down the water on the dams to a point that rendered it impossible for loaded boats to pass At various times, between the middle of August and the first of September, we asked them to comply with the contract, so that navigation could be resumed, but the reply invariably was, that they could not stop the use of water-power for pumping Third. On the 4th of October, the heaviest flood ever known on the river Schuylkill swept the valley for its whole length, and at various places damaged and breached our works."⁶⁹

The Schuylkill Navigation Company also had trouble receiving payment for damages from the City of Philadelphia. The Navigation Company reported: "We regret to state, that the city has failed to agree to any amicable settlement of our claim for remuneration, and also for the claims of boat

⁶⁸ Hare, The Pilot 14:5, p. 139.

⁶⁹ Report of the President and Managers of the Schuylkill Navigation Company to the Stockholders and Loanholders, February 8, 1870 (Philadelphia: Crissy & Markley, 1870), pp. vi-viii.

men and others who were seriously affected in their interests and business, by the acts which interfered with the use of a great navigable highway, but has compelled us and them to resort to the courts of the Commonwealth for redress."⁷⁰

The Company did not have the reserve capital it needed to survive such a disastrous season. The Schuylkill Navigation Company, therefore, entered into a 999-year lease with the Philadelphia and Reading Railroad Company.⁷¹ Under the terms of the contract, the Philadelphia and Reading Railroad was required to keep and maintain in good order and condition the works of the Schuylkill Navigation throughout the 999-year term of the lease.⁷² The railroad was also to pay an annual rent of \$655,000.⁷³ Under the control of the Philadelphia and Reading Railroad, the Schuylkill Canal's tonnage slowly declined. The canal never turned a profit for the railroad company, and, in fact, the annual receipts from operation of the canal were usually only about half the annual cost of the lease.

In spite of the annual loss under the lease, it was worthwhile for the railroad to have control of the canal.

⁷⁰ Ibid., p. vii.

⁷¹ Lease & Contract between the Schuylkill Navigation Company and the Philadelphia & Reading Railroad Company, 1870. Indenture made 12th day of July A.D. 1879.

⁷² Ibid., p. iii.

⁷³ Ibid., p. iv.

It enabled the railroad to increase the tonnage it carried and thus its profits because the Schuylkill Navigation Company was no longer competition. The 1873 Report of the Philadelphia and Reading Railroad reflected the management's attitude toward the canal. After a not particularly profitable year, it reported that the year's depressed condition "of the coal trade not only reduced the tonnage on the canals, but necessitated a very low rate of tolls. Indeed, had the Schuylkill Canal been closed for the year, its entire rent account, \$642,336.13, charged to profit and loss, and its coal-tonnage of 838,190.10 tons, transferred to and carried by the railroad, it is believed that the profit of carrying its tonnage by rail would have exceeded the rent account of the canal, so that the net result of the year's business would have been at least \$350,000 better than it is."⁷⁴ However, the report went on to state that because of the ever increasing demand for coal, the management deemed it prudent to possess the canal so that it could take up the overflow of coal tonnage from the railroad. But the expansion and improvements made to the railroad over the years obviated the need for a canal to take up overflow tonnage.

⁷⁴ Report of the President and Managers of the Philadelphia and Reading Railroad Company to the Stockholders, January 13, 1873 (Philadelphia: Helfenstein, Lewis, and Greene's, 1873), p. 75.

The Philadelphia and Reading Railroad went into receivership on May 24, 1880, but this event did not affect the securities of the Schuylkill Navigation Company or the terms of the lease. The Philadelphia and Reading Railroad went into receivership a second time on June 2, 1884, and under the reorganization, as amended December 14, 1886, major portions of the stock and mortgage obligations of the Schuylkill Navigation Company were deposited with the Philadelphia and Reading Railroad in exchange for new securities of the railroad company. Holders of outstanding securities of the Schuylkill Navigation Company who did not deposit their shares were obliged to file suit if they did not collect their interest before January of 1888. The securities of the Schuylkill Navigation Company, received by the railroad in 1886, were deposited as collateral with the trustee of the mortgage of the Philadelphia and Reading Railroad in a transaction dated January 3, 1888.⁷⁵ The last Annual Report to mention the Schuylkill Canal, other than as an item on a financial statement, was that of 1887. Since there were no more holders of Schuylkill Navigation stock, the railroad company no longer reported about the canal.

Although there were no longer any Schuylkill Navigation Company stockholders, the terms of the 999-year lease with

⁷⁵ Letter from the Philadelphia Hydro-Electric Company and the President and Managers of the Schuylkill Navigation Company to the United States of America Federal Power Commission, April 29, 1947, pp. 4-5; see also, Hare, The Pilot 14:5, p. 140-142.

the Schuylkill Navigation Company were still in effect, requiring the Philadelphia and Reading Railroad to keep the canal functioning. It should be pointed out that not only did the railroad company own boats but also that there were many privately owned and operated boats navigating the canals. Private boat owners would certainly have been concerned that the canal continue to be maintained even if the railroad company did not feel strongly motivated to do so.

The Philadelphia and Reading Railroad Company went into the hands of receivers again on February 20, 1893, and was sold on September 23, 1896. The property, including the Schuylkill Navigation, was purchased, at a foreclosure sale, by Charles H. Costes and Francis L. Stetson. When the property had been purchased, the lease made between the Philadelphia and Reading Railroad and the Schuylkill Navigation Company in 1870 was disclaimed. On December 1, 1896, the operation of the Schuylkill Navigation, once again, became the responsibility of the Schuylkill Navigation Company. But the Schuylkill Navigation Company was for all practical purposes defunct. It did not have the means to take over the financial responsibilities or the maintenance of the canal. The newly formed Philadelphia and Reading Railway Company⁷⁶ agreed to act as the agent for the

⁷⁶ The name change from Philadelphia and Reading "Railroad" to Philadelphia and Reading "Railway" should be noted.

canal from December 1, 1896, and it continued as agent until April 9, 1902 after which it declined to continue such operations.⁷⁷ The First Annual Report (1898) of the Reading Company, which by 1896 owned the majority of the stock in the Philadelphia and Reading Railway Company as well as in the Philadelphia and Reading Coal and Iron Company, stated that "the Reading Company is the owner of all the rolling and floating equipment formerly belonging to the Philadelphia and Reading Railroad Company. This equipment was leased to the Railway company which undertakes to keep unimpaired its carrying capacity and its working efficiency . . . The stipulation has been fully complied with. The expenditures for this purpose have been heavy and will continue so for two or three years."⁷⁸

Tables listing the equipment of the Philadelphia and Reading Railway Company serve to indicate the company's declining use of the Schuylkill Canal. In 1882 the Philadelphia and Reading Railroad Company owned 328 canal barges; this number was already fewer than the number owned in the 1870's.⁷⁹ In 1898 the Philadelphia and Reading

⁷⁷ Letter from Hydro-Electric Company, pp. 5-6.

⁷⁸ Reading Company. First Annual Report for the Nineteen Months, December 1, 1896 to June 30, 1898 (Reading Company, 1898), p. 8.

⁷⁹ Report of the President and Managers to the Stockholders of the Philadelphia and Reading Railroad Company and the Philadelphia and Reading Coal and Iron Company, Together with the Report of the Operations by Receivers from the Year Ending November 30, 1883

Railway Company had only 38 canal boats, with a carrying capacity of 7,600 tons; in 1899 there were but 2 canal boats, with a carrying capacity of 400 tons. By 1902 the company still owned 2 canal boats, but the tonnage they could carry had dropped to 213.24 tons. It seems reasonable to infer that the drop in capacity indicates that the canal was no longer being properly maintained and that culm and silt deposits in the canal had not been dredged out; boats must carry light loads in shallow canals. After 1903 canal boats are no longer listed in the Reading Company reports.⁸⁰ This clearly indicates that the Reading Company did not use the canals for navigation after 1902.⁸¹

By 1910 some of the upper levels of the Navigation, closest to the coal mining operations, were being abandoned. The coal companies developed the sand flotation method⁸² for separation of impurities from the coal. The method used massive quantities of water which after passing through the

(Philadelphia: Allen, Lane, Scotts, 1882), p. 39.

⁸⁰ Reading Company Annual Reports 1898-1904.

⁸¹ It would seem, then, that the transactions described above were motivated, at least in part, by a desire of the railroads to escape from competition with and then financial responsibility for the canal.

⁸² The sand flotation method uses a mixture of sand and water to clean the coal. The separation of impurities is accomplished by churning the material from the mine in a sand and water mixture. The specific gravity of the coal is less than that of the sand so that the coal can be skimmed off the top; the impurities such as slate, on the other hand, have a greater specific gravity than the sand so it sinks to the bottom.

machinery was dumped back into the tributaries of the Schuylkill River.

The Schuylkill River had become the principal means of disposal of mine waste. Culm and silt washed down stream, choking the river and collecting behind dams and in the canal. The expense and labor involved in constantly removing the tons of waste which steadily collected in the waterways was too great. The waterways closest to the mining regions silted shut first. It is not clear exactly when the last coal boat navigated the canal. The Schuylkill River Project Engineers reported that the last coal boat locked through the lower section of the Navigation in 1917.⁸³ Others report that the last boat to carry coal to Philadelphia operated in 1916.⁸⁴ The last coal delivered at Blackrock (Phoenixville) was in 1919, and the last commercial passenger trip from Reading to Philadelphia took place in 1922.⁸⁵ Different segments of the Schuylkill Navigation were abandoned at different times as they slowly became unfit for navigation and were no longer maintained.

Pleasure boats, such as canoes, used the canal up into the 1940s. A letter dated July 25, 1940, from the

⁸³ The Schuylkill River Desilting Project; Final Report of the Schuylkill River Engineers, 1 July 1951, p. 3.

⁸⁴ Arthur D. Graeff and George M. Meiser. Echoes of Scholla-Illustrated: Choice Bits of Berks County History and Lore (Kutztown, Pa.: Berksiana Foundation, Publishers, 1976), Pt. 8, p. 15.

⁸⁵ Ibid., p. 15.

superintendent of the Schuylkill Navigation Company to all lock tenders concerned stated that canoes with outboard motors would be charged the same as a motor boat for passing through the locks. The letter also discussed fees for mooring boats in the canal levels.⁶⁶

During the 1940s the Schuylkill Navigation Company still functioned as a subsidiary of the Reading Company. The Schuylkill Navigation Company took advantage of its water right privileges to operate small hydro-electric generating stations at some of the old Navigation's dams. A hydro-electric plant at Manayunk generated electricity for the Philadelphia Transportation Company.⁶⁷ Another small hydro-electric plant near Reading also generated electricity which was used by the Neversink Trolley Line.⁶⁸ The

⁶⁶ See explanation of "canal levels" on pages 54-56 of this paper.

⁶⁷ Application of the President, Managers, and Company of the Schuylkill Navigation Company for a License in Connection with a Constructed Hydro-Electric Project of More than 100-Horsepower Installed Capacity, Located in the Vicinity of Manayunk on the Schuylkill River, in the Counties of Philadelphia and Montgomery, Pennsylvania. Lockwood W. Fogg, Jr., Attorney for Applicant, 1944. In the application it is stated that the Schuylkill Navigation Company applied only because it was requested to by the Federal Government. The application also states, however, that since the company's charter granted exclusive water rights of the Schuylkill River to the Schuylkill Navigation Company, it, therefore, did not really need to have a license from the Federal Power Commission to operate. The document also pointed out that the company was considering the abandonment of the hydro-electric project as soon as the war was over.

⁶⁸ Graeff, Echoes, p. 53.

operation of hydro-electric plants by the Schuylkill Navigation Company was discontinued by the end of World War II.

In 1945 the segments of Schuylkill Navigation Company property located in or along the river were taken over by the Commonwealth of Pennsylvania as part of the Schuylkill River Desilting Project.⁸⁹ Dams and locks were destroyed; channel rectification included "the removal of brush and stumps from a strip 40 feet in width along both banks of the river."⁹⁰ Most Schuylkill Navigation structures located in or along the river were either torn down or buried. Canal hardware and machinery, such as iron straps and cranks, were sold to scrap yards. The water no longer flowed the length of the Schuylkill Navigation as it had for so many years, and an important but little known chapter in the history of canaling and American transportation had closed.

⁸⁹ Commonwealth of Pennsylvania: Act No. 441, June, 1945.

⁹⁰ Schuylkill River Desilting Project, p. 41.

CHAPTER III

THE HISTORY OF THE GIRARD CANAL AND THE TYPES OF STRUCTURES AND MECHANISMS FOUND IN AND ALONG IT

Introduction

The preceding history of the Schuylkill Navigation Company's important canal and slackwater navigation system, and the following historical documentation, identification, location, and photographic record for all of the remaining structures on the abandoned Girard Canal is intended to be used as a resource to overcome, what I believe, has been one of the largest stumbling blocks to preservation planning for the Schuylkill Navigation: the lack of awareness of the historical background and the physical context of the sites. Because the remaining significant structures of the Schuylkill Navigation are spread over a large geographic area and because the records and documentation regarding the Schuylkill Navigation are fragmented and scattered among several libraries and archives, physical and historical context of the sites have been obscured. The few canal structures that people are aware of today and show an interest in preserving are perceived of as in a vacuum. There is scarcely any awareness of other related structures that often were built within only a few thousand feet of the

remaining, more visible sites, and there is only a sketchy understanding of the historical background, the function, and relationship of the remaining sites. The present lack of awareness of the physical and historical context has been crippling for any major efforts for historic preservation of the Schuylkill Navigation.

What is needed is a cohesive compilation of the history of the Schuylkill Navigation system coupled with a careful identification, location, and documentation of the structures of the Schuylkill Navigation remaining today. The magnitude of such a research and survey project and the time and energy entailed are, however, enormous, and to date attempted preservation projects have fallen short. It is from a perception of this need that the idea for this study developed. This study is not a preservation plan for a specific site; instead, it provides, for all of the remaining structures on the Girard Canal, the documentary foundation on which future preservation plans can be based.

The following chapters, then, present the history of the Schuylkill Navigation Company's Girard Canal and furnish the present day location, identification, and documentation of the remaining navigation structures on this, the longest of the Schuylkill Navigation Canals. Chapters III and IV provide the relevant historical information about the operation of the system, the construction of the structures

of the system, the building materials used, the repairs made, the expansions and alterations necessitated, as well as the exact locations of structures existing at the present. Chapter IV also provides directions for getting to and finding those structures as well as references to the visual documentation of the sites, the photographs to be found at the end of the text (see Plates, pp. 146-207).

The Girard Canal and the Mechanisms and Structures
Found In and Along It

The Girard Canal, which was the longest continuous canal segment on the Schuylkill Navigation, was 21.62 miles long ⁹¹ (usually rounded to 22 miles.) It began at Lewis's Dam on Poplar Neck at Klapperthal about two miles below Reading. It continued on the southwest side of the river down through Birdsboro, passed Pottstown Landing and Kenilworth, flowed by Parkerford and through Lawrenceville and then reentered the Schuylkill River. The Girard Outlet, where the canal reentered the river, was located about one and one-quarter miles above Spring City (Figures 4, 5, 6, 7, 8). Contrary to what one might expect, the canal did not run directly alongside the river; in fact, at Unionville (three and one-quarter miles above Pottstown) the canal was about one-third of a mile away from the river.

⁹¹ Miller, Report, p. 10.

The Girard Canal was named for the prominent Philadelphian, Stephen Girard, whose strong backing of the Schuylkill Navigation Company was crucial to the completion of the navigation project in the early years. In 1845 Solomon Roberts, president of the Schuylkill Navigation Company, when reflecting upon the earlier years of the company, summed up the importance of Stephen Girard's role:

Difficulties being experienced in obtaining the necessary funds [to complete construction], the late Stephen Girard, having examined the subject, made a heavy investment in the enterprise, which enabled the Managers to bring the whole work into use; and Mr. Girard continued until his decease to take a lively interest in the company which he had so essentially aided . . ."⁹²

The planning of the Girard Canal was carried out in 1821. Thomas Oakes was the engineer in charge of the planning and construction of the Girard Canal, but after his death in 1823, the engineer Ephraim Beach took over the responsibility of the canal construction.⁹³

The Schuylkill Navigation Report to the Stockholders of 1822 stated:

They have also laid out a canal of twenty-two miles in length from Lewis's Falls dam to within a short distance of Custard's Island. The digging of this canal is let out on contract, and is to be completed by the first day of November next; and from the spirit with which the work has been commenced, the Board have no reason to doubt the contract being completed

⁹² Solomon W. Roberts, Report to the Board of Managers of the Schuylkill Navigation Company, on the Improvement of the Schuylkill Navigation, January 2nd, 1845 (Philadelphia: Joseph and William Kite, 1845), p. 4.

⁹³ Hare, The Pilot 14:3, p. 70.

according to and within the time for which it is limited.⁹⁴

In spite of the terrible and decimating outbreaks of fever among the Schuylkill Navigation work force, they managed to turn the water into the new section of canal in 1824.⁹⁵ The canal at the Girard inlet, which was located about two miles below Reading on Poplar Neck, was subject to leaking, similarly, but not so badly as the canal section at Reading which had to be abandoned due to the limestone formations there. (See pages 20-22 of this paper.) Unlike in the Reading Canal, however, planking the leaky section proved to be a successful remedy in the Girard Canal.

Most of the locks on the Girard Canal had been doubled during the 1830s. In the Report to the Stockholders of 1830 it was asserted of the Schuylkill Navigation that the ". . . capacity may be greatly enlarged by an additional set of locks where the locks are at present combined."⁹⁶ The construction of an additional set of locks at the combined, or double lift locks, proved to be so successful that the company also built a second set at the other locks on the Girard Canal. In 1845, with Antes Snyder, civil engineer, as the superintendent in charge,⁹⁷ plans were set for the

⁹⁴ Report . . . 1822, p. 7.

⁹⁵ Hare, The Pilot 14:3, pp. 70-71; also see Montgomery, History of Berks County, p. 447.

⁹⁶ Report . . . 1830, p. 5.

⁹⁷ Report . . . 1847, p. 8.

enlargement of the Schuylkill Navigation; most of the new construction was carried out during 1846. It was during this period that the Girard canal was widened and deepened and new locks, aqueducts, and bridges were built. Edward Miller, civil engineer, indicated that "for locks 18 feet wide, with 5 1/2 feet of water on the mitre sills, the dimensions for the Canal in ordinary cuttings, should be 40 feet on bottom, 56 1/2 feet surface. . . . The present Canal is generally 25 to 28 feet on bottom, having been enlarged already, in a great measure from the original width of 22 feet."⁹⁸ Mr. Miller went on to state that the Schuylkill Navigation Company engineers proposed to widen the canal ". . . principally by raising the banks with materials taken from the sides of the canal, thereby widening and deepening at once."⁹⁹ The surviving artifactual evidence indicates that when the enlarged locks were built, the "twin locks" which had been built during the 1830s were kept and only the old locks were torn down. This will be explained further in the historical analysis of some individual sites of the Girard Canal.

Before turning to the specific sites on the Girard Canal, I will discuss some of the types of structures and general mechanics to be found there.

⁹⁸ Miller, Report, p. 5.

⁹⁹ Ibid., p. 28.

The dams of the Schuylkill Canal were timber dams constructed with 10 X 10 and 12 X 12 timbers¹⁰⁰ fastened together with long iron spikes to form a crib work which was filled with stone. The stone filled cribbing was then finished by constructing a slope on the upriver side with timber¹⁰¹ and covering it with plank sheeting which was fastened by bolts.¹⁰²

The Schuylkill River was dammed in order to raise the water level sufficiently and to slow the current enough to make river navigation practical. Floating boats through long pools created by damming the river is called slackwater navigation. The entrances into sections of canal from the river were located near the river dams.¹⁰³ Usually a guard gate would be placed at the entrance of the canal. A guard gate stands open most of the time, but it can be closed to keep high river waters from entering and flooding the canal, or it can be closed in order to drain all the water out of the canal for maintenance purposes. In fact, a type of guard gates, called stop gates, are placed at various points along long sections of canal so as to facilitate maintenance work.

¹⁰⁰ Graeff, Echoes, p. 65.

¹⁰¹ Report . . . 1839, p. 15; Report . . . 1840, p. 6.

¹⁰² Report . . . 1867, p. 25.

¹⁰³ The outlets from sections of canal were situated in the upstream ends of the pools, as far from the dam as possible.

Locks are constructed so that a boat can pass from one canal level to the next. The Schuylkill Canal, as is true of any other canal, does not follow the natural fall of the river, but instead it is made up of the various canal levels, each having a gradual and level slope, whereas the river is unregulated and has rapids and falls. The canal was constructed with just enough fall to allow the water to slowly flow through. Because the ground level changes, the canal builders would either have to dig into a rise or fill and build embankments over a depression in order to maintain the canal level. As the Schuylkill Navigation came down from the Blue Mountains, the change in elevation made it impossible to maintain just one level. Locks overcome changes in elevation by acting as "elevators" from one canal level to the next. The canal levels form a sort of "staircase" from the mountains. The Schuylkill Navigation had 620 feet of lockage;¹⁰⁴ this means that the canal overcame 620 feet of fall from its highest point at Mill Creek to its lowest point at Philadelphia.

The lock chambers were large rectangular box like structures that were built into the ground like the basement of a building. The higher level of the canal led into the top of the chamber at one end; the lower level led into the

¹⁰⁴ H. S. Tanner, Memoir on the Recent Surveys, Observations, and Internal Improvements in the United States (Philadelphia: Published by the Author, 1830), p. 42, and Mitchell, Compendium of Internal Improvements, p. 36.

bottom of the chamber at the other end. The chamber had gates at each end, but only one gate was opened at a time. In order to move a boat from a higher level to a lower level, the boat would be pulled into the lock chamber full of water, the gates would be closed behind it, and the water would be slowly drained out of the chamber. The upper gate which the boat had just passed through would remain tightly shut holding back the water from the upper level while the water level in the chamber became equal to that of the lower level. After the level in the lock chamber and that of the lower level were equal, the gates in front of the boat were opened, and the boat could continue on its journey. The operation was the same for moving from a lower to a higher level, except that the chamber would be filled with water instead of being emptied. The locks on the Schuylkill Navigation had an average of 6.42 feet of lift which was later changed to 9.48 feet of lift.¹⁰⁵ A lock chamber which had 9.48 feet of lift with a canal depth of 5.5 feet would have to be able to accommodate a water depth of 15 feet in order to allow boats to pass through to the upper level.

The earliest lock chambers on the Schuylkill Navigation were constructed with rough stone and mortar;¹⁰⁶ these chambers were not very satisfactory so the company put wooden linings in them. In 1833 the Schuylkill Navigation

¹⁰⁵ Miller, Report, p. 11.

¹⁰⁶ Ibid., pp. 12, 14.

Company began to build with cut stone and hydraulic cement.¹⁰⁷ The Company also began constructing some chambers with dry masonry and lined with wood planking,¹⁰⁸ probably during the 1845 enlargement of the works (Figure 1). After the enlargement some lock chambers were fitted with new iron fasteners which allowed the removal of the wooden linings from the stone chamber walls without disturbing the stonework.

The locks used on the Schuylkill Navigation were pound locks with balance beam mitre gates. Pound locks are canal locks which have gates on both ends of the lock chamber so that the chamber water level can be raised or lowered when both lock gates are shut. Mitre gates are made in pairs, like double doors, but they close at an angle to form a "v" shape when viewed from the top or in a plan. The edges of the gates which come in contact with each other, when closed, are mitred to an angle to make a water tight seal. There are mitre sills mounted on the floor of the lock chamber; the gates close against them. These mitre sills add to the stability of the gates and help to prevent water pressure from staving the gates in. The gates were constructed of white oak and the balance beams were made of pine. The "v" shape of the gates face upstream; this positioning, by transferring some of the weight and pressure

¹⁰⁷ Report . . . 1834, p. 9.

¹⁰⁸ Report . . . 1861, p. 28.

of the water to the walls of the lock, prevents the gates from bursting inwards. Opening and closing the gates is accomplished by leaning on the balance beams. The balance beams are long timbers, fastened across the tops of the gates, which extend beyond the hinges of the gates and provide plenty of leverage for ease of operation. The hinges of the mitre gates are properly called heel posts. The heel posts, held in a groove in the lock chamber walls by iron straps, pivot at the base of the posts to allow the gates to move.

The water level in the lock chamber was raised and lowered by opening and closing a valve assembly in the gates. The valve assemblies used by the Schuylkill Navigation Company were called "wickets." Vertical wickets had a rack and pinion assembly mounted on top of each gate, which when turned by a large hand crank, slid open or slid closed a valve near the bottom of the gate (Plate 106 and Figure 1).

By the late 1870s the Schuylkill Navigation had drop gates installed in some of the locks. Drop gates are hinged at the bottom and fall into a pocket at the bottom of the canal when opened (Figure 2). The canal boats floated over the top of the open drop gate. Like the mitre gate, the drop gate also opened upstream or toward the higher level of the canal. It also was held tightly shut by water pressure. Unlike the mitre gate which had to be opened by hand, the

drop gate would naturally fall open by the force of gravity once the water level was equal on both sides of the gates. This feature helped to speed up the process of locking from one level to the next. Pulleys and chains were used to crank shut the gates. Drop gates used horizontal wickets instead of vertical ones (Figure 3). Because the drop gate was submerged under the water each time it was opened, the machinery to open and close the wickets had to be mounted on the side of the chamber and not on top of the gate. Therefore, the wickets were mounted horizontally in the gate and activated by pulleys and chains at the side of the gate, not vertically from the top of the gate.

A feeder, or bypass flume, had to be installed along the side of each lock. The feeder was needed to allow water from the upper levels to continuously flow to the lower levels. Without feeders, the lower levels of the canal would have had the water supply cut off by the lock gates on the upper levels, the gates acting as a dam.

Other structures which regulated water flow in the canal were waste weirs and sluices. A waste weir was not a weir in the ordinary sense of being a dam constructed in a river to divert the water. Waste weirs are not built across a body of water, but rather they are built along side of one. Waste weirs were built parallel to the canal in the space which would ordinarily be occupied by a towpath or

berm bank.¹⁰⁹ The purpose of the waste weir was to prevent the canal from overflowing its banks when the water level became too high. If the water in the canal was too high, the excess water would flow over the waste weir thus preventing the towpath and berm bank from becoming water damaged. The major difference between a waste weir and a sluice is that a waste weir is above the water level during normal conditions. The sluices on the canal had sluice gates to regulate the water flow; they were installed below the normal water level. A feeder is a kind of a sluice. Sluices were also located at the bottom of canal basins so that they could be drained.

The locks often had canal basins constructed above or below them. Canal basins or lie-bys were large bodies of water that were designed to accommodate the heavy traffic that could build up at the locks. They also provided mooring for boats; wharves were always located in basins.

Trunks were wooden box-like tunnel structures which were used to provide for the passage of water under the canal from one side to the other. The trunks were often mill trunks, that is, they carried water used to run mills. The water carried in the trunks was sometimes water from the Schuylkill Canal which the Schuylkill Navigation Company

¹⁰⁹ The tow-path was a wide embankment, level on top, that provided a road upon which walked mule drivers and the draft animals which pulled the canal boats. The berm was the narrow embankment, opposite the tow-path, which held in the canal waters.

supplied to individuals or companies for a fee. The trunks were constructed of oak timbers and pine planking.

Aqueducts and culverts were needed to bridge the canal over creeks and streams. Strictly speaking, canal aqueducts are properly called aqueduct bridges to distinguish them from other aqueducts which merely carry water and not boats as well. The aqueducts of the Schuylkill Canal were often large wooden structures built upon masonry piers that carried the canal over other bodies of water. Interestingly, the word "culvert" when used by the Schuylkill Canal engineers did not necessarily describe an arched drain. Instead, it usually connoted a massive masonry aqueduct bridge. Apparently, to the men who worked for the Schuylkill Navigation Company, "culvert" and "aqueduct" were used primarily to indicate stone construction or wooden construction, respectively. The Engineers' Report of 1881 states: "The Aqueduct at Seidel's Creek, a wooden structure of two spans, having been found unsafe, was taken down and a three-span culvert erected in its stead. This structure rests on a new foundation, and has been built in a permanent manner with brick arches and heavy masonry laid in cement. . . ." ¹¹⁰ This quotation gives evidence of the rather unusual usage of terms by the Schuylkill Navigation employees. However, one must be careful because, although "culvert" always indicated a stone structure, "aqueduct" did

¹¹⁰ Report . . . 1881, p. 72.

not always mean a wooden structure. An 1860 Engineer's Report refers to "the large stone aqueduct of five spans. . . ." ¹¹¹ Apparently a masonry aqueduct was called an aqueduct only if it was of huge proportions. Very frequently culverts and aqueducts were built so that one side of the bridge doubled as a waste weir. In this way excess water would be diverted into the creek over which the aqueduct bridge passed.

¹¹¹ Report . . . 1860, p. 22.

CHAPTER IV

IDENTIFICATION, LOCATION, AND HISTORICAL DOCUMENTATION FOR THE REMAINING SCHUYLKILL NAVIGATION COMPANY STRUCTURES OF THE GIRARD CANAL

Introduction

The following chapter, dealing with the identification, location, visual record, and historical documentation for the remaining Schuylkill Navigation Company structures of the Girard Canal, provides specifications and data gleaned from contemporary sources, including extensive citations from the Schuylkill Navigation Company Engineers' Reports. One trusts that the gathering together of these material within the compass of this study will be of service to future research. The engineers' reports are the main sources used in this part of the study; these sources are extensively quoted from to provide primary documentation and to assure a high degree of historical accuracy. It is hoped that by the use of these contemporary professional records this study will provide the necessary historical detail and documentation needed to carry forward historic preservation projects for sites along the Girard Canal.

The names of the structures in this study are the names used in an inventory list, entitled List of Works on the Schuylkill Canal, produced by the Philadelphia and Reading Railroad Company. (See Appendix for the complete list.) No date is given, but the fact that the list was made by the railroad suggests that it was an inventory taken in 1870 at the time the Schuylkill Navigation Company entered its lease with the Philadelphia and Reading Railroad Company.

"Schuylkill Canal" is the name used by the Railroad Company rather than "Schuylkill Navigation," perhaps because the latter sounded too much like the "Schuylkill Navigation Company." Comparisons between the names recorded on the list of structures and the names in pre-1870 and post-1870 atlases indicate that place names used in 1870 that had changed by 1876 were recorded on the list by the earlier title and updated to the later name in the margins of the list.

The list contains one hundred and ninety-two entries for the Girard Canal. The breakdown of the types of structures on the list is as follows:

27 entries for road bridges	5 entries for feeders
21 entries for tow paths	5 " " lie bys
21 " " berme banks	2 " " towpath bridges
21 " " canal bottoms	1 " " dirt trap
20 " " farm bridges	1 " " planking
18 " " trunks	1 " " sluice
14 " " waste weirs	1 " " wharf
9 " " culverts	1 " " stop gate
8 " " locks	1 " " company shop
7 " " aqueducts	1 " " company farm
6 " " lock houses	1 " " dam

Of the structures on the list, the sites of all of the locks, lock houses, feeders, and lie-bys were located. All of the culverts and aqueducts were located. The sites of eleven road bridges and two farm bridges were located. The sites of both tow path bridges were also found. Only one trunk could be located, and from the list only three waste weirs (which are often very small structures) were found, but also found were two waste weirs that had been built after 1870. The planking in the canal could not be found (probably due to the perishable nature of the material), and the dirt traps can no longer be seen. The sluice, wharf, stop gate, dam, company shop, and the site of the company farm were all located. The entries for the tow path, berm banks, and canal bottom represent one continuous waterway; therefore, I have not treated the 63 entries separately but treat them as one entity. It should be noted that the survival rate for bridges is very poor. Most road bridges have been razed and filled over for new roads. The farm bridges were wooden structures not built in a very permanent manner, so they have collapsed and rotted leaving very little to identify. Trunks which also were usually constructed of wood and were built underground have collapsed and vanished. The only trunk that was located survived because it was built of stone instead of wood. Waste weirs frequently were built as part of wooden

aqueducts that have rotted or on walls of stone culverts which have partially collapsed.

The remaining structures will be identified and documented below.

Dam No. 24: Lewis's Dam

The head of the Girard Canal was at Dam No. 24, commonly called Lewis's Dam, and later known as Big Reading Dam (Plates 1, 2 and Figures 4, 9). The dam appears to have been built in accordance with Ariel Cooley's plans which were submitted in 1816 to the Schuylkill Navigation Company. Mr. Cooley said that "From Reading to Tidewater the fall is about ninety-eight feet . . . the principal obstruction is at Lewis's Falls four miles below Reading, and that may be improved by a dam or dams and locks . . ." ¹¹² The Schuylkill Navigation Company's Dam No. 24 was constructed in the years 1820-1824. The dam was about 18 feet high; ¹¹³ the pool of the dam was 2 1/2 miles long. The average width of the pool was 328 feet, comprising about 109 acres of surface area. It had 49,479,418 cubic feet of storage capacity which held 370,106,100 gallons of water. ¹¹⁴ It was

¹¹² Address of the President . . . 1817, p. 4.

¹¹³ Report . . . 1840, p. 6.

¹¹⁴ Statements Made on Behalf of the Reading and Schuylkill Navigation Companies to Joint Committees of Finance and on Water of Select and Common Councils of the

one of the largest dams on the Schuylkill Navigation. A date stone which read "Jerid Goldrich 1820" was at one time visible on one of the masonry abutments at the northeast side of the river.¹¹⁵

The abutment has been razed. Presumably Jerid Goldrich was one of the stone masons hired to construct the dam. Unfortunately records of the original contracts for construction of the structures along the canal have been lost. In 1838 a construction project was started in order to "strengthen" by "cribbing with logs, filled with stone, and finished in such a manner as to form a slope or inclined plane in front of each."¹¹⁶ This construction method was typical of the Schuylkill Navigation dams. The dam was an improved version of the dams Mr. Cooley had built in the Connecticut River. The model used was a pair of dams at Montague, near Holyoke, in the Connecticut River.

These dams are built with timber, in the manner of crib dams, secured to the rocks below with iron bolts--from the top of the breast of the dam, heavy scantling laid so close together as to be water tight is extended up the river, with their upstream ends bolted to the rocks at the bottom, and the other ends upon the breast of the dam. Some stone is thrown into the river upon the ends of the scantling thus bolted, as a further security to them. These dams are level on the top, so

City of Philadelphia. January 28, 1898 (Philadelphia: Allen, Lane, and Scott's, 1899), p. 22.

¹¹⁵ Graeff, Echoes, p. 65.

¹¹⁶ Report . . . 1839, p. 15.

that the water flows over every part of them to preserve them from decay.¹¹⁷

The major difference between the Schuylkill River dam and those of the Connecticut River is that the cribbing is filled with stone in the Schuylkill dam, whereas the Connecticut dams used some stone but were not filled. In 1839 the project for strengthening Lewis's Dam was continued, and it was further described as a crib work dam "placed in front, forming a slope, all firmly bolted together, filled with stone and covered with timber its whole extent, by which the dam has been made substantial, and as free from leaks as possible."¹¹⁸

By 1840 the new reinforcement dam had been completed.¹¹⁹ When the Schuylkill Navigation Company was preparing to undertake its massive rebuilding and enlargement in 1845, the engineer Edward Miller reported to the managers of the company that "[m]ost of the dams on this section [below Reading] have been rebuilt, and are now of a most superior character--tight and substantial."¹²⁰ During the enlargement the only major work that needed to be done at Lewis's Dam was the widening and straightening of the

¹¹⁷ The Committee Appointed by the Board of Managers of the Schuylkill Navigation Company, to View the Improvements, by Means of Dams and Locks, of the Navigation of the Connecticut River, Report (Philadelphia: n. d. [c. 1816]).

¹¹⁸ Report . . . 1840, p. 6.

¹¹⁹ Report . . . 1841, p. 9.

¹²⁰ Miller, Report, p. 10.

channel in the pool.¹²¹ After the "great flood of 1850" it is possible that the dam's crib work was extended.¹²² The fact that Lewis's Dam was not destroyed by the flood and also the fact that it very seldom needed repairs testifies to the practicality and success of the dam construction methods adopted by the Schuylkill Navigation Company.

New sluices were installed in 1857.¹²³ By 1861 the dam's combing was out of level, so it was renewed and brought back to the proper height.¹²⁴ In 1866 Lewis's Dam needed 30 feet in length of new plank sheeting; in addition, the old sheeting was rebolted, and a section of the dam was opened up and refilled with stone.¹²⁵ The dam survived the high flood waters of 1869, but maintenance was required in 1872: "Two hundred and fifty feet of the back slope of Lewis's dam, No. 24, which is one of the largest on the river, was rebuilt and new comb timbers put on; the structure is now in good order."¹²⁶ During 1876 the towpath was raised and strengthened along some sections of the pool of dam No. 24,¹²⁷ and by 1878 culm and silt, which

¹²¹ Report . . . 1849, p. 16.

¹²² Report . . . 1851, p. 8.

¹²³ Report . . . 1858, pp. 20, 22.

¹²⁴ Report . . . 1862, p. 28.

¹²⁵ Report . . . 1867, p. 25.

¹²⁶ Report . . . 1877, p. 86.

¹²⁷ Report . . . 1877, p. 88.

constantly washed down the river from the mining regions and settled in the pools, had to be removed from the pool at Lewis's Dam.¹²⁸

There were no extraordinary repairs made to Lewis's Dam during the rest of the dam's service life although, presumably, ordinary maintenance was continued.¹²⁹ Modifications must have been made on the northeast side of the pool at the end of the 19th century when the Klappertal Power House was being installed (Plates 3, 4, 5). The Power House, which dated back to 1894,¹³⁰ was a hydro-electric generator which used the water power supplied by the pool at Lewis's Dam. The electricity which was generated was used by the Neversink Trolley Line. The Schuylkill Navigation Company's Dam No. 24 finally broke during the flood of 1942. Contemporary photographs reveal that the reinforcement dam which was built in 1830-40 was still in remarkably good condition (Plate 6).

Big Reading Dam was razed as part of the Schuylkill River Desilting Project. The removal of the dam was part of the work contract held by Eastern Engineering Company, dated April 16, 1949, and the work was completed November 21,

¹²⁸ Report . . . 1879, p. 83.

¹²⁹ It should be remembered that the Schuylkill Navigation Company's lease arrangement with the Philadelphia and Reading Railroad began in 1870 and by 1896 the Railroad Company was no longer legally responsible for the maintenance of the canal.

¹³⁰ Graeff, Echoes, p. 64.

1950. Ironically, the Schuylkill Navigation Dam No. 24 was removed under Contract #24 between the Eastern Engineering Company and the Water and Power Resources Board.¹³¹

The sequence of photographs shown in Plates 1, 2, 7, and 8, present a visual history of the site from the turn of the century to the present day.

Lock No. 50: The Girard Inlet

Lock No. 50, The Girard Inlet, was a guard lock which served as a lift lock part of the time (Plates 9, 10 and Figures 4, 9). The upper gate of Lock No. 50 opened into the pool of Lewis's Dam. When the river was at a flood stage, the upper gate of Lock 50 would be kept shut to exclude the river from the Girard Canal. At the times when the river level was higher than the level of the canal, the Girard Lock served as a lift lock in order to bring boats down from the river level to the canal level. When the river was at its normal level, the gates could be left open. The first level below Lewis's Dam and Lock 50 was known as the "6 mile level" for it was six miles to the next lock. The original lock was constructed along with the dam, but by 1838 the Engineer's Report stated that "at the entrance of the Girard Canal, a single lock has been found inadequate to

¹³¹ The Schuylkill River Desilting Project; Final Report of the Schuylkill River Engineers, 1 July 1951 (Philadelphia, 1951), p. 92.

the accommodation of the trade; the boats were subjected to considerable delay. To remedy this inconvenience, a new one built in the best manner of cut stone and cement has been put up in addition to the old lock"¹³² E. H. Gill's compilation, Map of the Schuylkill Navigation Section No. One, Extending from the Head of the Girard Canal to Philadelphia,¹³³ which was published c.1833-34, shows the Girard Canal just before the enlargement. This source indicates that the original lock was 86 feet 3 inches long 17 feet wide and only 2 feet 8 inches deep. These dimensions were in accordance with the 1816 Supplement to the Schuylkill Navigation Charter. The second lock was 88 feet 5 inches long and 15 feet wide, although the Schuylkill Navigation Company's Report to the Stockholders states that it was 90 feet long by 15 feet wide in order to correspond with the size of the locks used on the Pennsylvania Canal.¹³⁴

It was believed that boats would cross back and forth between the Schuylkill Canal and the Pennsylvania Canal via the Union Canal which connected the Schuylkill and Susquehanna Rivers. The Schuylkill Navigation boats and the

¹³² Report 1839, pp. 7-8.

¹³³ Pennsylvania State Archives, Record Group MG110, Schuylkill Navigation Company.

¹³⁴ Report 1839, pp. 7-8.

Pennsylvania Mainline¹³⁵ system's boats never could cross on the Union Canal, however, because the Union Canal was too narrow. The Union Canal engineers found that the works could not be enlarged because there was not a sufficient water supply. The small Union Canal boats could use the Pennsylvania and Mainline canal system and the Schuylkill Navigation Company, but large canal boats had to be unloaded onto smaller boats if they were to cross on the Union Canal.

The new lock was completed by 1839, before the improvements to Lewis's Dam were complete.¹³⁶ One lock was taken down during the 1845 expansion project. It is not completely clear which lock was saved, the older but wider lock or the newer lock which was two feet narrower but three feet longer. Presumably the second lock which was only five years old was saved. Most of the work was carried out during 1846 and finished by 1847. After the expansion there were no locks less than 110 feet long by 18 feet wide on the Schuylkill Navigation, except in cases like that of the Girard Inlet where one of the older locks was kept in addition to the larger lock.

It is interesting that the Engineer's Reports say that all of the old locks were taken down and replaced by the new

¹³⁵ The Pennsylvania Mainline System was a state owned hybrid canal and railroad system. The canal boats were loaded onto the portage railroad to cross the mountains the canal could not traverse.

¹³⁶ Report . . . 1840, p. 9.

locks, yet maps and photographs indicate that at the locks which had been doubled, only one lock was taken down. Evidently when the engineer reported that all of the older locks had been taken down, he did not mean that all of the locks had been taken down, but only the older ones. If a lock had already been doubled, then only one lock was taken down. The reason that the new locks were constructed 18 feet wide and 110 feet long was that the dimensions corresponded to the enlarged locks on the Erie Canal and the locks in use on the Delaware and Raritan Canal. Schuylkill canal boats hauled coal to New York by using the Delaware and Raritan Canal of New Jersey which joined the Erie Canal of New York.

Lock No. 50 had a new pair of upper mitre gates installed in 1876. Each gate was 15 feet 10 inches in height with 7 more inches to the coping on top, and each gate was 11 feet 3 inches from the heel post to the mitre. In 1880 the upper gates were replaced again, but the height was increased to 18 feet 5 1/2 inches with 9 1/2 more inches of coping. The width from heel post to mitre was 11 feet 1 inch. The lower gates in Lock 50 were replaced in 1873. They were each 11 feet 3 inches in height with 6 1/2 inches to the coping, and the width of each gate was 11 feet 2 7/8 inches. The lower gates were replaced again in 1881.

It is interesting to note that the cost of the new gates in 1880 was \$164.83. The materials cost \$95.37 plus

the labor of one man who worked 372 hours at 18 cents an hour, totaling \$66.96, and another man who worked 20 hours at a rate of 12.5 cents per hour, totaling \$2.50, making the grand total of \$164.83.

The ordinary maintenance at a masonry lock included such mundane tasks as patching the walls in the chamber and clearing the grass which grew between the stones of the structure.¹³⁷

A new lie-by was built at the Girard Inlet during 1863 and completed by 1864.¹³⁸ Below Lock 50 was a section of canal which was planked to prevent leaking; periodically the planking had to be renewed.

The site of Lewis's Dam and Lock 50, the Girard Inlet, is located in Cumru Township, Berks County, on a large undeveloped expanse of land called Poplar Neck; it lies about three mile below Reading. Poplar Neck is formed by a sharp bend in the Schuylkill River which gives it a peninsula-like shape. The northern half of Poplar Neck, out to its tip, has no roads or buildings on it. Access to this land was cut off by the construction of the four-lane highway Route 422. The area is located near the point where Route 176 intersects Route 422. There is no public access

¹³⁷ Pennsylvania State Archives, Record Group MG110, Schuylkill Navigation Company.

¹³⁸ Report . . . 1864, p. 21; Report . . . 1864, p. 30. A lie-by is a basin built for boats to pull into from the main channel and wait without blocking traffic.

to the land where the sites are located; however, they can be reached from Route 724 by taking a small road which leads to the Reading Bone Fertilizer Company. The access road to this company joins the abandoned towpath at the Cumru Township Police Department pistol range. From that point one may walk along the towpath, pass under the 422 highway bridge, and proceed two furlongs farther to the site where Big Reading Dam once stood and the ruins of the Girard Inlet remain. The lockkeeper's house and barn at Lock 50 have been razed (Plate 11), and the farmer's fields that were once located on Poplar Neck have totally reverted to woodland. A massive cut stone wall stands in the woods; the wall is only a fraction of the even larger masonry structure which lies buried beneath the rubble and fill that covers the site (Plates 12, 13). I believe that the lock built during the 1845 expansion was not razed but was buried during the Schuylkill River Desilting Project. The fragment of wall which protrudes from the ground could be the south wall of the older and smaller lock, which has been razed along with the remains of the towpath bridge. Rubble and fill were bulldozed into the larger lock, and it is now covered with secondary growth. When one compares a c.1883¹³⁹ drawing of Schuylkill Navigation Company properties which illustrates the Big Reading Dam and the

¹³⁹ "Maps of the Schuylkill Navigation through the lands of . . ." 1882-1884. Pennsylvania State Archives, Record Group MG110, Schuylkill Navigation Company.

Girard Inlet with 19th century photographs and with photographs taken in the 1940s as well as with contemporary photographs, it appears that the Girard Inlet was not so much razed as buried (Plates 6, 7, 8, 12 and Figure 9).

This site certainly merits some archaeological probing to determine its state of preservation. In the meantime, if a lock of the Girard Inlet does still exist hidden below ground, the fact that it is buried may actually help to preserve it from the detrimental effects of vegetation growth on its masonry. The roots of shrubs and trees break apart masonry walls and cause structures to crumble (Plate 14). The size of some of the trees which have grown up around the site since 1940 is truly remarkable. The fill may actually serve to stabilize the remains of the structure until the day when appropriate preservation can be done. On the opposite side of the Schuylkill River, part of a brick dam abutment can be found (Plate 15), and the ruins of the foundation of the Klapperthal hydro-electric plant can be seen. One should not try to drive a vehicle down the abandoned power plant road because at one point the road passes through a low tunnel under a railroad grade, but the road has been washed out on the farther side of the tunnel. The concrete road bed sags unsupported above a 15-20 foot drop where it exits the tunnel.

Dick's Culvert

Dick's Culvert was located about a half mile below Lewis' Dam and the Girard Inlet (Plate 16). The site where the structure once stood is west of Ridge Way Road and to the north side of Route 724. The stream which the stone aqueduct bridge had spanned runs through Ridge Wood Farms. The only trace of the structure left today is the bottom course of stone at the foundation of the abutments. The stones are angled springer stones, indicating that there had once been a stone arch canal bridge at the site.

Beidler's Road Bridge

Beidler's Road Bridge was located about one third of a mile east of Dick's Culvert (Plate 17). The site of Beidler's Road Bridge is marked by two abandoned twentieth-century bridge abutments that once supported the bridge span over the canal. The abutments stand on either side of Route 724 at the small village of Naomi near Seyfert.

Allegheny Aqueduct

The Allegheny Aqueduct, which spans the Allegheny Creek, still stands in remarkably good condition (Plates 18,

19, 20, 21), with the exception of the partial collapse on the under side of one arch (Plate 22). The aqueduct is located in Robeson Township, Berks County, northwest of the junction of Route 724 and Route 568. The Allegheny Aqueduct is visible from Route 724, and there is a pull-off for cars on Route 568 (a small road) so that people can look at the massive structure. The five-arched Allegheny Aqueduct which stands on the site today was built in 1861 to replace an earlier structure.¹⁴⁰ In 1875 major work was done on the aqueduct when "two stone arches of the Allegheny Aqueduct together with the sidewalls of the canal resting upon them were rebuilt."¹⁴¹ When one looks at the structure today, one can see that the stone used for the repairs did not match the early stonework. The later work was constructed with an assortment of reused stone (Plate 23). Late in the 1870s a concrete liner was put in the canal bed over the aqueduct.¹⁴² Long after transportation on the canal had ceased, the Birdsboro Steel Company continued, into the 1930s, to rent water which was carried across the aqueducts

¹⁴⁰ Report . . . 1866, p. 28. The Engineer's Report is awkwardly worded in that it says rebuilt "near" Allegheny Creek instead of "at" or "over"; however, there were no other culverts in the vicinity of the Allegheny Creek, so the statement could mean only the large stone culvert over the creek.

¹⁴¹ Report . . . 1876, p. 65.

¹⁴² Lorah Hopkins, "The Gibraltar Aqueduct," The Schuylkill River News, Issue No. 15 (September 1983): 1-3.

of the Girard Canal.¹⁴³ Photographs from the 1940s show the aqueduct still carrying the waters of the canal over the Allegheny Creek (Plate 24). At the present time the Girard Canal no longer has water in it, but runoff water still collects and stands in the Allegheny Aqueduct.

Today the Allegheny Aqueduct is the best known structure on the Girard Canal; it is popularly known as the Gibraltar Aqueduct, because it is near the village of Gibraltar. There have been some unsuccessful local efforts to create a mini-park around the structure. One attempt was made by the school children of Robeson Township in 1973. In 1983 the Schuylkill River Greenway Association launched another effort to put the structure on the National Register of Historic Places and create a park with a pedestrian path along the Allegheny Creek to unite the Aqueduct and the Schuylkill River. It seems that this effort also has lost its momentum, although local citizens have been keeping the structure clear of trees and Indian sumac. When the time comes for planning a preservation program for the Girard Canal, this site would be a good place to start. Local interest already exists, but there is no central organization.

Thompson's Road Bridge was once located just east of the aqueduct, but it has been razed and replaced by newer road construction.

¹⁴³ Ibid., p. 2.

Seidel's Aqueduct

The next standing structure along the Girard Canal, about a half a mile from the Allegheny Aqueduct, is Seidel's Aqueduct (Plates 25, 26). Seidel's Aqueduct carried the Girard Canal over Seidel Creek. It is also located in Robeson Township, Berks County. The site is not far from the intersection of Route 724 and Gibraltar Road. It lies about 870 feet east of Gibraltar Road and behind a small picnic park. Seidel's Aqueduct, also referred to as Seidel's Culvert, is a small three-arch aqueduct which is a little over 40 feet long. The structure was built in 1880,¹⁴⁴ and it is presently in even better condition than the Allegheny Aqueduct. Unlike the Allegheny Aqueduct, however, hardly anyone knows of its existence. Local children who do know of the aqueduct call it "the old tunnel" probably because from their perspective, while playing in Seidel Creek, it appears to be three low tunnels through a massive stone wall. The only damage to the structure is that the brick lining inside the center arch has crumbled away around the outside edge (Plate 27). Originally a wooden aqueduct occupied the site. The wooden aqueduct was rebuilt on the site in 1858,¹⁴⁵ and repairs

¹⁴⁴ Report . . . 1881, p. 72.

¹⁴⁵ Report . . . 1859, p. 18.

were made to the wooden aqueduct in 1875.¹⁴⁶ In 1880 the wooden structure was replaced by the stone and brick aqueduct that stands on the site today. A waste weir can be seen built into the north wall of the aqueduct; excess water from the Girard Canal would have been vented into Seidel Creek.

Haw's Double Culvert

Approximately one and a quarter miles farther down the canal stands the ruin of Haw's Double Culvert (Plates 28, 29, 30). This is the tallest remaining aqueduct on the Girard Canal. Haw's Culvert spans the Indian Corn Creek. Incorporated into this structure are the abutments to Haw's Road Bridge (Plate 31). These structures are in Robeson Township, just north of Route 724, about two and three-quarter miles above Birdsboro. The site is easily found on River Road; the aqueduct is on the south side of River Road near the point where the road intersects with Route 724. It is not clear when Haw's Double Culvert was built. The fact that it is extremely wide might suggest that it was constructed during the 1845 enlargement of the canal works; however, the fact that there is no reused stone incorporated into the structure means that it is unlikely that it was built at the time of expansion. During the expansion, the

¹⁴⁶ Report . . . 1876, p. 76.

materials from the structures which were taken down were recycled, so a structure of the size of Haw's Double Culvert would have had several kinds of reused stone incorporated into its construction. The smooth, evenly cut ashlar construction of Haws's Double Culvert suggests an early construction date. Post-1870 masonry structures on the canal most frequently were of boulder face or rusticated stone. Seidel's aqueduct, built in 1880 of rusticated stone, is an example. Post-1845 masonry structures usually had a mixture of recycled stone; the Allegheny Aqueduct is an example (Plate 26). The stone in post-1830 structures was most often smooth, hammer face, combed, and sometimes beveled. Haw's Double Culvert exhibits that kind of construction. A simple rule of thumb when studying structures on the Girard canal is "the rougher the stone, the later the date."

Both of the side walls of Haw's Double Culvert are standing, but the center section collapsed and is gone. The interesting point about this condition is that the collapse was in 1874, not after the canal was abandoned. The Engineer's Report stated,

On the 17th day of June a break occurred at the stone culvert of two spans carrying the canal over Haw's Creek above Birdsboro, which destroyed that portion of the work under the bed of the canal, leaving side walls with the towing-path and berme-bank uninjured. In place of restoring the stone arches, an aqueduct of two spans was substituted, leaving the permanent end arches of the old work intact, to admit of rebuilding the

vaults under the canal at some future time, when the timber-work demands renewal.¹⁴⁷

The stone vaults never were rebuilt, and today one can still see parts of the timber aqueduct in the creek with the iron spikes which used to hold the timberwork together (Plates 32, 33, 34).

If one drives from the Haw's Double Culvert site towards Birdsboro along Route 724, one's car passes over the obliterated site of Hill's Culvert. There is nothing to see but a few brick fragments scattered in the bed of a tiny stream. This section of Route 724 leading to Birdsboro was built on top of the level grade of the old canal bed. The bed of the Girard canal has been a favorite place for modern road construction because a right of way had already been established and the ground had already been leveled. Before Route 724 intersects with Route 82, one passes Lock No. 51 where the Schuylkill Navigation Company's shop at Birdsboro was located.

Lock No. 51: Birdsboro Lock

Lock No. 51, Birdsboro Lock, is located on the south side of Route 724 at the point where the highway crosses under a railroad bridge. River Road also joins 724 at the railroad bridge. The lie-by above Lock 51 has been filled

¹⁴⁷ Report . . . 1875, p. 85.

with cinder and is used as a parking area for heavy trucks. The filling appears to have been done in the 1960s (Plates 35, 36).¹⁴⁹ The feeder that went with Lock 51 has also been buried. Lock 51 is six miles from Lock 50, the Girard Inlet. Like the Girard Inlet, Lock 51 had been doubled prior to the enlargement of the canal. The original lock at Birdsboro was 80 feet 7 inches long by 16 feet 9 inches wide and was 8 feet 8 inches deep. The second lock measured 79 feet 3 inches long by 13 feet 6 inches wide.¹⁴⁹ When the canal was enlarged, the new 18 by 110 foot lock was built, but one of the old locks was also kept (Figure 10). The lock in Birdsboro had been doubled by a lock completed in 1836 (Plate 37).¹⁵⁰ The 1836 lock was kept during the enlargement, and, in fact, the date stone can still be read in the north wall of the lock chamber (Plate 38).¹⁵¹ The 1836 lock was a cut stone lock that needed no lining (Plate 39). This lock has been filled in, but the opening at the lower end of the lock, near the basin of the Birdsboro furnace, was not filled entirely (Plate 40). The lock built during the 1845 expansion project was a stone lock which had

¹⁴⁹ Photographs taken in 1959 show water still standing in the lie-by.

¹⁴⁹ E. H. Gill, comp., Map of the Schuylkill Navigation Company Section One, Extending from the Head of the Girard Canal to Philadelphia, ca. 1833-1844. Chamber dimensions are taken from notations on this map.

¹⁵⁰ Report . . . 1837, p. 9.

¹⁵¹ Report . . . 1867, p. 25; Report . . . 1875, p. 57.

a wooden lining; it is on the north side of the 1837 lock (Plate 41). Part of the floor of Lock 51 was replaced in 1866,¹⁵² and in 1874 ". . . lock No. 51 (Birdsboro) . . . [was] relined and furnished with new mitre-sills and quoin-posts."¹⁵³ The quoin-posts appear to be the braces which were placed behind the apex of the "v" shape formed by the mitre-sills. Their purpose was to reinforce the mitre-sills against which the mitre gates pressed when shut. New mitre-gates were put into the upper end of the lock chamber in 1866, and the mitre-gates in the lower end of the chamber were replaced in 1885. Edward Miller, a civil engineer with much canal experience, reported, "The average durability of the linings of locks on the Schuylkill Navigation appears to be about ten years. . . ."¹⁵⁴ The lock gates needed to be replaced at similar intervals although they would last somewhat longer because they were constructed with better wood than the linings. The lock has been completely filled, probably also in the 1960s, but the stone coping on the top of the chamber walls can still be seen. If one examines the coping, one can see the carved recession where the iron straps which held the mitre gates had once been fastened. Also visible are the half-round grooves in which the heel

¹⁵² Report . . . 1867, p. 25.

¹⁵³ Report . . . 1875, p. 84.

¹⁵⁴ Miller, Report, p. 15.

posts had been seated and the pockets into which the gates swung when they were opened (Plate 42).

The field stone lockkeeper's residence was built ca. 1822-1824 (Plate 43). The lockkeeper's residence was found to be too small so later an addition was added to its west end. In 1864 new offices were built for the toll collector at Lock 51. There are still two small frame buildings standing between the two locks (Plate 44). These buildings were once used by the toll collectors and the lock tender. The basin below Lock 51 has not been entirely filled, but it is very overgrown (Plate 41). This basin once had very heavy boat traffic in connection with the Birdsboro Iron Furnace (Plate 45). The Iron Furnace consumed vast quantities of coal and also used limestone as a flux during the blast. Coal and limestone were transported on the canal; the iron pigs that the furnace produced were also carried by canal to the various forges in the area.¹⁵⁵ The basin below Lock 51 had been deepened and walled in 1854.¹⁵⁶ In 1856 new wharf walls were built, and the canal was widened at Birdsboro.¹⁵⁷ In 1860, the chief engineer, James

¹⁵⁵ An iron furnace produced iron bars, called "pigs," from iron ore. An iron forge then processed the pig iron that came from the furnace. It should be recalled here that the Schuylkill Navigation, including the Girard Canal, was also a very important part of the iron industry in Berks County.

¹⁵⁶ Report . . . 1855, p. 15.

¹⁵⁷ Report . . . 1857, p. 19.

F. Smith, reported that "sluice gates, supplied with iron pipes of large dimensions, built in masonry, were placed near Lock No. 51, in the second level of the Girard Canal at Birdsboro, to afford a convenient means of relieving the canal when it might be required to draw the water hastily."¹⁵⁸ Brick sluices, which no longer have iron pipes in them, can be found in the basin below Lock 51 (Plate 46). There was once a set of sluice pipes that ran from the canal into the Schuylkill Navigation shop in Birdsboro (Plate 47). The shop still stands, and it houses a machine shop now. The building is located on the north side of Route 724 directly across from Lock 51. The pipes carried the water used to power the machinery in the building. Inside the shop one can see where the pipes entered through the back wall of the building. The pipes have been removed and the brick circles through which the sluice pipes had passed are now cemented shut.

Hay Creek Aqueduct

The next structure which is still to be found along the abandoned Girard Canal is the ruin of the Hay Creek Aqueduct (Plates 48, 49). The Hay Creek Aqueduct is located in Birdsboro near the junction of Route 82 with Route 724, and, more specifically, between Mill Street and Water Street,

¹⁵⁸ Report . . . 1860, p. 22.

north of Main Street (Route 724). The aqueduct used to span the Hay Creek, and was the longest aqueduct on the Girard canal. The Hay Creek Aqueduct was constructed in the early 1820s and had not been rebuilt during the 1845 enlargement project. The additional weight over the aqueduct caused by increasing the depth of the water during the "enlargement of the works" wore heavily on the aqueduct:

Toward the close of the season of 1858, the large stone aqueduct of five spans, over Hay Creek, appeared to require extensive repairs to the foundations and arches, and preparations were then made, by the delivery of materials, for that purpose. This work had been originally planned for a much less depth of water than is now upon it; and although it has stood remarkably well ever since the enlargement of the works, it was deemed proper in the repairs, besides the removal of all the defective stone in the walls and a thorough underpinning of the same, to strengthen the vaults by interior arches of brick-work, laid in cement, supported on new side walls connected with the old piers' end abutments. The bases of these abutments were taken down and rebuilt of larger size, and with more durable stone. All the new walls, like the original foundations, are upon the solid rock.¹⁵⁹

The newly rebuilt Hay Creek Aqueduct of 1859 turned out to be of a lower quality than the earlier aqueduct. The rebuilt Hay Creek Aqueduct had not "stood remarkably well" because already by 1866 major sections needed to be rebuilt again. The Engineer's Report stated:

The Aqueduct over Hay Creek, in Birdsboro, requiring a renewal of the face work of its five arches, together with the buttresses and walls on the upper berme side, they [sic] were taken down to the foundation and rebuilt in a permanent manner, in heavy rock work masonry, with an increase of two and a half feet in the thickness of the walls, and of one and a half foot in

¹⁵⁹ Report . . . 1860, p.22.

the height to bring the coping sufficiently above the water surface of the canal and prevent overflow from sudden rises by rain storms.¹⁶⁰

This time the aqueduct really was "re-built in a permanent manner." In 1875 the sides of the canal bed inside the aqueduct were relined.¹⁶¹ The Hay Creek Aqueduct stood firmly until it was taken down in September of 1955.¹⁶² All that remains now are the two massive abutments which lead up to either side of the Hay Creek. The aqueduct no longer spans the creek; all of the arches have been razed.

Hook's Farm Bridge and Campbell's Road Bridge

The site of Hook's Farm Bridge can still be found, but very little remains of the bridge itself (Plate 50). The site is a short distance east of Hay Creek and north of the intersection of Main Street (Route 724) and Walnut Street. Due to the fact that farm bridges were seldom referred to specifically in engineers' reports, but instead were considered to be under general canal maintenance and therefore needed no special mention, there is very little documentation for the sites. Hook's Farm Bridge has completely rotted away, and the insubstantial abutments on which its timber framework rested toppled long ago. A few

¹⁶⁰ Report . . . 1867, p. 24.

¹⁶¹ Report . . . 1876, p. 76.

¹⁶² Meiser, Passing Scene, Vol. 3, p. 178.

stones strewn along the canal banks and the path of the old farm lane are all the evidence of the old site that can be seen.

Most road bridges have been razed whereas farm bridges just rot away from neglect. Campbell's Road Bridge, which is a short distance east of Hook's Farm Bride, was replaced by a modern corrugated drain pipes and fill (Plate 51).

Bland's Turn Waste Weir

Bland's Turn Waste Weir was named after Bland's Turn, the sharp bend in the Girard Canal which was immediately above the weir. Bland's Turn Waste Weir still stands in Union Township, Berks County, in the village of Monocacy.¹⁶³ Route 724 follows the same route through Monocacy that the old nineteenth century road did. A sharp bump in the highway on the western edge of the village marks the point where the road once crossed Bland's Turn Road Bridge. There are no longer any remains of the road bridge; the canal has been filled over. The turn of the canal can still be seen where the road and canal had crossed. Bland's Turn Waste Weir is just a few hundred yards farther down the canal (Plate 52). Bland's Turn Waste Weir was taken down and

¹⁶³ Monocacy was called Mt. Airy until the end of the nineteenth century when the name was changed. The new name was taken from the Monocacy Furnace which was located a short distance from the village.

rebuilt in 1866. The chief engineer reported that "at Bland's Turn, on the second level of the Girard Canal, a new waste weir of cemented masonry, has been built, supplied with iron pipes for drainage of the canal when drawn off for repairs."¹⁶⁴ The improved waste weir was a combination of both a waste weir and a sluice which allowed excess water to overflow and a sluice with gate which was used to drain the canal (Plate 52).

In 1878 the Bland's Turn was improved in order to prevent boats from running aground while trying to negotiate the curve (Figure 10). The Engineer's Report had this to say about the situation:

Every season for a number of years, numerous and serious detentions to the trade have occurred at Bland's Turn, on the six mile level of the Girard Canal, [¹⁶⁵] caused by boats jamming. To remove this obstruction to the navigation, a vertical crib wharf and wall 300 feet in length was built on the towing-path side, and the inner slope of the embankment removed. This, with the deepening of the canal around the bend to allow of the free passage of feed water, has given satisfactory result, as shown by the fact that no detentions during this year have occurred.¹⁶⁶

What the engineer was talking about was the changing of the prism of the canal. The "prism" of a canal is the angle of the sides inside the canal in relation to the flat bottom,

¹⁶⁴ Report . . . 1867, p. 25.

¹⁶⁵ Actually there is an error in the Report here. Bland's Turn is not in the 6 mile level, between Lock 50 and Lock 51; rather, it is in the next level of 8 miles between Lock 51 and Lock 52-53.

¹⁶⁶ Report . . . 1879, p. 83.

or bed of the canal. By building a wharf, which is vertical, and removing the slope inside the canal, the bed of the canal was widened. A wider canal bed gave the boats more room to maneuver without striking against the shallower edge or slope of the canal sides that had existed before the improvement. The other problem that the engineer referred to was that of the passage of feed water. We have discussed above the importance of feeders, or by-pass sluices. It was essential that the water supply in the canal was not blocked, for if it was, and there were no by-pass sluices, water would run out of the canal below the blockage, and there would be no supply with which to replenish it. Similar to the need for having by-pass sluices at locks to provide a constant water supply to the canal was the necessity that the canal itself be designed so that there was enough extra space around the hull of a loaded boat in the canal that the water could flow around the boat freely. Before the improvements at Bland's Turn, a loaded boat would run aground diagonally in the canal while trying to negotiate the turn. When the bow of the boat struck bottom, the stern of the boat drifted against the opposite canal bank. With the boat so positioned, it acted as a dam. Not enough water could get around the boat to feed the downstream side of the canal. The canal level would become lower on one side of the boat and higher on the other; at that point the boat was jammed in the canal. For this

reason the improvements at Bland's Turn included a deepening of the canal in addition to the changing of the prism of the canal.

Hartman's Culvert

Approximately another 1000 feet farther east along the canal from Bland's Turn Waste Weir is the ruin of Hartman's Culvert (Plate 54). There are currently no records or engineer's reports that provide information pertaining to the date of construction or the changes that may have been made to the structure. The best information obtainable at the time of this study is that the structure was called Hartman's Culvert. I have been able to locate this structure in Monocacy. Hopefully, increased interest in and awareness of the Schuylkill Navigation will stimulate further research and bring to light new data regarding this structure and the other elements of this important navigation system. The fact that the structure was called Hartman's Culvert indicates that it was probably a stone arched aqueduct bridge and not a wooden one. However, the remaining fragments of the structure appear to be stone support piers such as were used in a wooden aqueduct and thus seems not to be the remains of an arched masonry structure that the appellation "culvert" implies.¹⁶⁷ If the structure were the

¹⁶⁷ See pages 47-48 of this study.

ruin of an arched aqueduct bridge, then one would expect the remaining fragment of wall beside the creek to be a short segment of squared corner stones serving as a pier to support an impost and springer stone from which the arch would rise. Any wall remaining above the springer would be jaggedly broken away. At Hartman's Culvert this is not the case; instead there is a wall which has a squared edge rising all the way up to the canal level. This method of construction strongly suggests that a timber aqueduct had been constructed on the site and that the fragment of stone wall was part of a pier which supported the ends of the timbers which spanned the creek. Other ruins of timber aqueducts on the Girard Canal show similarities in construction to the ruin on the site. For example Frick's Aqueduct and Kirlin's Aqueduct, which will be discussed below, both show the same semi-dressed, field stone construction that Hartman's "Culvert" has. Since the List of Works on the Schuylkill Canal,¹⁶⁸ a document which is post 1870 yet pre-1876, gives the name "Hartman's Culvert," it is reasonable to assume that a wooden aqueduct was constructed on the site of an earlier culvert sometime after

¹⁶⁸ The fact that the list was made by the Philadelphia and Reading Railroad Company suggests that it was an inventory taken in 1870 at the time the Schuylkill Navigation Company entered its lease with the Philadelphia and Reading Railroad Company. Furthermore, by comparing the names of property owners and of places recorded on the list with maps dated 1862 and 1876, one can see by the changes in names that the list was made between the dates of the two maps.

1870-76. Of course there is always the possibility that the person recording the works of the Schuylkill Canal in the 1870s somehow made an error; however, that would not be a highly plausible assumption.

Sixpenny Culvert

The next structure one encounters traveling eastward along the Girard Canal is the Sixpenny Culvert. The Sixpenny Culvert was almost entirely obliterated when it was razed and Route 724 was built on top of the canal, with a new road bridge in place of the old culvert. This site is located about 1/3 mile east of Monocacy on Route 724. It can be found at the point where Crusher Road intersects 724 from the north and Monocacy Road intersects 724 from the south. The creek which runs along the western side of these two roads is the Sixpenny Creek. Sixpenny Culvert had two arches. Today all that remains of the culvert are some small fragments of the abutments, traces of foundation which can be seen in the creek bed, and a buttress or wall fragment which once protected the abutments on the upstream side (Plates 55, 56, 57). It might appear at first that the buttress which still stands today is a remnant from a pre-1863 Culvert at Sixpenny Creek:

The masonry of the eastern end of the Sixpenny Creek Aqueduct, which had become defective, was taken down to its foundation, and rebuilt in a permanent manner. The work was at the same time lengthened fifteen feet, by

which heavy buttresses previously existing are rendered unnecessary, and space has been secured to permit the widening of the canal for wharf room at a point where it is required for the accommodation of business.¹⁶⁹

The buttresses referred to in the Engineer's Report had been built in 1858.¹⁷⁰ A plan of the Sixpenny Culvert and the Pennsylvania Schuylkill Valley Railroad line drawn January 1884 indicates that the buttress fragment at Sixpenny is in fact the southeastern corner of the later culvert abutments, and not that of the 1858 structure. The plan indicates that the northeastern corner of the railroad bridge joins with the southeastern corner of the Sixpenny Culvert (Plate 58). It is the corner of the culvert which was incorporated into the Pennsylvania Schuylkill Valley Railroad Bridge that still remains standing today (Plate 57). In 1868 work was done to the culvert's south wall. The Engineer's Report explains that the aqueduct at Sixpenny had received "New Buttress on the berme side, and [the] side wall the entire length raised 4 feet."¹⁷¹ The additional information provided by this report would seem to indicate that the corner of the culvert which joined with the railroad bridge was constructed in 1868. The plan also indicates that the Sixpenny Culvert was 100 feet wide and that it stretched 40 feet across the Sixpenny Creek in two spans. The traces of

¹⁶⁹ Report . . . 1864, p. 24.

¹⁷⁰ Report . . . 1859, p. 18.

¹⁷¹ Report . . . 1869, p. 29.

a wall that can be seen in the creek bed are the foundation of the culvert's eastern abutment wall (Plate 56).

In 1858 the basin below Sixpenny Culvert needed to be enlarged to accommodate all of the traffic associated with the Monocacy Furnace. The Engineer's Report explained that the wharf near Sixpenny had been partly walled up to accommodate the business connected with the furnace.¹⁷² A new wharf for the furnace was completed in 1856.¹⁷³ In 1864 the basin at Monocacy Furnace had to be increased and walled even further.¹⁷⁴ At one time a brick culvert also passed under the canal at Sixpenny Creek, carrying the raceway to a nearby mill. Today there is little evidence of the activities of heavy industry and heavy traffic which once occupied the site. Monocacy Furnace is gone, the Pennsylvania Schuylkill Valley Railroad has been abandoned, the Girard Canal and the Basin have been filled, the mill race has vanished, and the wheels which the water once powered are now silent.

Lynche's Waste Weir

Lynche's Waste Weir was located near the Monocacy Basin. A stone wall still stands which served as a

¹⁷² Report . . . 1855, p. 13.

¹⁷³ Report . . . 1857, p. 19.

¹⁷⁴ Report . . . 1865, p. 32.

retaining wall for part of the towpath along the basin (Plate 59). It seems that Lynche's Waste Weir was built into a section of this wall, but the area has been so badly disturbed by the activity of bulldozers filling and regrading the basin that no firm identification can be made. It seems that Lynche's Waste Weir was razed and that a crudely poured concrete drainage trough is in its place. It appears that traces of an older structure's foundations are submerged under a pool of water which collects at the bottom of the rough concrete trough (Plate 60). I suspect that the submerged foundation may be all that remains of Lynche's Waste Weir.

Linderman's Stop Gate

Linderman's Stop Gate is located another mile and a half east on Route 724 from the Sixpenny Creek. It can be found north of 724, a few hundred feet west of Red Corner Road. A stop gate is like a guard gate except that it is not located near the river to keep out flood waters. Instead it is placed in the middle section of a long canal so that part of the canal can be closed off and drained for repairs without necessitating the draining of the entire canal; most of the time, therefore, the gate remained open. The stop gate had no lift, so it needed only a single pair of gates and not the two pairs that a lock had. Linderman's

Stop Gate is in Union Township, Berks County. It is located on the property of a small abandoned refinery; the area is now posted as containing hazardous chemicals. The ruin of the stop gate can be seen in the back yard of the second dwelling house west of the abandoned refinery (Plates 61, 62). Linderman's stop gate had to have been built in the years 1846-47 when the works were enlarged so that the larger boats used after the improvement could fit through the gates. Only the south wall stands today, and it is currently serving as a retaining wall. The side walls of the stop gate were constructed with field stone laid dry; the walls would have had wooden linings built over the masonry in order to make them water tight.¹⁷⁵

Port Union

Port Union is located at the intersection of Route 724 and Red Corner Road. There is a sharp turn on Route 724 because the road still curves to skirt the edge of an abandoned Schuylkill Navigation Company boat basin (Plate 63). There was a privately operated boat yard at this location. Abraham Banner built a dock and a warehouse at this site in 1830, and it is from Mr. Banner's business and the Schuylkill Navigation Company's basin that the name Port

¹⁷⁵ Miller, Report, p. 15.

Union comes.¹⁷⁶ Although the dock, the warehouse, and the Port Union Road bridge have been demolished, the site of the Schuylkill Navigation Company's boat basin can still be located. Some of the embankments still exist along with a scattering of a few building stones in the marshy area, and old tree snags form a row along one side of the basin (Plate 64).

Kirlin's Aqueduct

The next structure is only half a mile from Port Union. Kirlin's Aqueduct is located west of Unionville Road between Black Mat and Yocum Road, north of Route 724. The closest that one can get by car to the structure is by driving to the end of a small residential street named Queen Street. Queen Street dead ends at the canal. From that point the site of the structure is only about 100 yards to the west. There is very little left to see of Kirlin's Aqueduct. It had been a wooden aqueduct built on stone piers. An 1871 entry in an index to a notebook, which apparently contained records of hours of work and kinds of labor done on the canal, indicates that there was a waste weir on Kirlin's Aqueduct;¹⁷⁷ unfortunately the notebook has been lost and

¹⁷⁶ Montgomery, History of Berks County, p. 1188.

¹⁷⁷ Pennsylvania State Archives, Record Group MG110, Schuylkill Navigation Company Records, C. Various, 1814-1940, n. d.

only its index remains. However, a 1912 photograph confirms that there was a waste weir at the location (Plate 65). The timber of the aqueduct is now totally gone, and the stone piers have been knocked down and almost entirely removed (Plate 66). From the fragments of the masonry structure which still exist, one can see that the piers were constructed of grey semi-dressed field stone, the same type of stone used in Hartman's Culvert. The same type of stone was also used in Frick's Aqueduct, which will be discussed later in this paper. The abutments of Kirlin's Aqueduct were constructed from rough field stone (Plate 67). The reason that the stonework of the piers and the abutments do not match is that in 1860 the piers were rebuilt with, apparently, a better quality stone than had originally been used. In 1862 the chief engineer included the following entry in the list of work done over the past season, "Aqueducts, 1 of four spans, at Kerlin's Creek, piers rebuilt in a more permanent manner, abutments underpinned and strengthened, and bottom planking renewed."¹⁷⁰ Today the creek is called Mill Creek, presumably because the Kerlin family had operated a mill powered by its water.

¹⁷⁰ Report . . . 1862, p. 28

Snyder's Culvert

One and one-quarter miles east of Kirlin's Aqueduct is Snyder's Culvert. It is the last culvert above the double lift locks at Laurel Hill. Snyder's Culvert is a four arch aqueduct bridge which spans the Cold Spring Creek, once known as "Goose Neck Crick."¹⁷⁹ It is to be found about 880 feet east of Unionville Road. If one looks closely, he can see where the road crosses the Girard Canal. The old Unionville Road Bridge is gone. Snyder's Aqueduct at Unionville is an amazing survivor; it is in remarkably good condition (Plates 68, 69, 70). The aqueduct is built of smoothly cut and dressed stone. No records could be found which provide details about this monumental structure's construction. The fact that the culvert is built on ground much higher than the river level has prevented it from being damaged by floods and freshets over the years; hence it required fewer repairs. Since the structure never needed any extraordinary or costly repairs, it does not appear in company records or reports. However, the fact that it does not appear in the records indicates that the structure had to have been built either at a very early period or else during 1846 when many structures were rebuilt as part of the expansion project. The period of early construction and the period of construction during the expansion are the only

¹⁷⁹ Meiser, Passing Scene, Vol 3, p. 180.

times that a work of this magnitude and expense could have been built without being specifically cited in the reports to stockholders. If one examines the culvert itself, the materials used in its construction give evidence of the period of its construction. The smooth ashlar construction with no recycled masonry rules out an 1846 construction date. (See the discussion of Haw's Culvert for details about stone use during the expansion project.)

The stonework of Snyder's Culvert suggests an early construction date. We know that the construction of the Girard Canal was begun in 1822 and that the work was completed by 1824. This fact might seem to suggest that Snyder's Culvert was built by 1824. If one investigates what kind of masonry construction was used in the 1820s, however, it becomes apparent that Snyder's Culvert was not built during that period. During the 1820s rough field stone laid with mortar was the norm.¹⁸⁰ Further research indicates that the type of construction used in Snyder's Culvert dates back to 1833. The engineer's report of 1834, while not mentioning Snyder's Culvert by name, does refer to construction using the type of stonework that is to be found in the aqueduct: "The cost of the new locks, built in 1833, has been greater than was estimated, owing to their being made of cut stone with hydraulic cement, instead of rough

¹⁸⁰ Miller, Report, p. 14.

stones lined with plank."¹⁸¹ At the Girard Outlet one can examine a cut stone lock with masonry that is similar to that of Snyder's Culvert. The date stone in the lock reads 1835, and the Engineer's Report confirms the date.¹⁸² Therefore, Snyder's Culvert was built after 1833 but prior to 1845, or in 1839 plus or minus six years.

The westernmost arch of Snyder's Culvert had been breached by a hole blasted through it (Plate 71). This was done by the Schuylkill Navigation Company in order to drain the canal after it was no longer being used for transportation. The action was taken in response to local complaints about the unhealthful stagnant water which the canal contained. According to an elderly resident, the last boat to use the aqueduct was a half-loaded boat of coal which crossed in the spring of 1927 on its way to Pennhurst School, a few miles upstream from Spring City.¹⁸³

Steps should be taken to remove trees which have taken root in the masonry structure. The growth of the vegetation has not advanced so far as to have seriously damaged the structure yet, but conditions are now reaching the critical point. If the trees and shrubs which have taken root on Snyder's Culvert are not removed soon, irreversible damage to the structure is likely to occur. Furthermore, steps

¹⁸¹ Report . . . 1834, p. 9.

¹⁸² Report . . . 1836, p. 6.

¹⁸³ Meiser, Passing Scene, Vol. 3, p. 179.

should be taken to control the rain water which races down the canal after a heavy rainfall and rushes through the hole in the westernmost arch. The water causes a loosening of the masonry, especially during winter freeze-thaw cycles.

Snyder's Culvert deserves preservation, not only because it is one of the oldest surviving structures in the Girard Canal, but also because it is one of its most impressive and aesthetically pleasing sites. It is hoped that efforts to reclaim structures of the Girard Canal from oblivion will not end with this report, but instead that this report will be a tool used in future preservation planning. Specifically, it is hoped that Snyder's Culvert will be saved.

Company Farm

The Schuylkill Navigation Company had a mule farm located at the site which is now occupied by the Coventry Gardens Condominiums. It is about 1/3 of a mile east of Snyder's Culvert, on the Berks and Chester County line. An idea of the size of the farm can be obtained from a description of a roofing contract awarded for the buildings on the farm:

Large Tin Roofing Contract--Mr. Wm. Bridegam, of Reading, has been awarded a contract for roofing with tin all of the buildings on the farm of the Schuylkill Navigation Company near Unionville, Chester County several miles above this borough. Among the building [sic] is a barn 100 feet long, and five sheds each 125

feet long. The entire extent of surface to be covered is 28,000 square feet. To complete the job promptly the contractor imported twelve tons of tin from England.--Pottstown Ledger¹⁸⁴

Locks Nos. 52-53: Laurel Hill Locks

The next site is located in North Coventry Township, Chester County. It is the double lift lock, No. 52 and No.53, located on the property of Laurel Locks Farm (Plates 72, 73). Laurel Locks Farm is very close to the Berks and Chester County lines; one cannot miss seeing it as one drives along Route 724. The locks are on the north side of the highway not far from the Schuylkill River. Locks 52 and 53, also known as Laurel Hill Locks,¹⁸⁵ were originally triple lift locks until the 1845 enlargement project. Doubling or tripling locks was done to overcome a fall that was too rapid and too high for just one lock. The locks were built end to end; the upper lock's lower gate was shared with the lock below; the gate would serve as an upper gate for the lower lock. In this manner the locks would be stacked one after the other to overcome topographical differences. The original triple locks were

¹⁸⁴ West Chester Daily Local News, August 7, 1876.

¹⁸⁵ By the turn of the century the name had been shortened to Laurel Locks.

81 feet long by 16 feet 9 inches wide, providing 24 feet of lift.¹⁸⁶

In 1830 it was decided that, in order to save time when locking boats from one level to the next, all combined locks would be doubled. Two sets of combined locks would reduce waiting time by allowing two boats to lock through at the same time.¹⁸⁷ The Board of Managers determined that any work which required that water be drawn off during the construction of the new locks should be done in the winter when the canal was closed. In that way boats could continue to use the old locks during the regular boating season.

The extensive digging and construction work involved in building a second set of combined locks beside the first set caused some water leakage problems. Regarding the beginning of the 1830 boating season and the construction of the additional locks without closing the lines, the chief engineer had the following to say; it is indicative of a type of problem faced by the builders of the canal:

On letting the water into the Girard Canal, however, it was found, contrary to their [the Board's] expectation, that a few days more delay would be necessary to place the old works in a situation to be used without injury to the new ones, as a leak had occurred at the head of the upper lock at Laurel Hill, caused by a slight defect in the masonry, which got vent by the excavation of the new site.¹⁸⁸

¹⁸⁶ Gill, Map of the Schuylkill Navigation.

¹⁸⁷ Report . . . 1834, p. 4.

¹⁸⁸ Report . . . 1831, p. 4-5.

The new set of triple locks was completed in 1832.¹⁸⁹ The new locks were 81 feet long but only 13 feet 6 inches wide.¹⁹⁰ The reason why the locks were built 4 feet narrower than the original set is that during the 1830s the company managers were interested in making more efficient use of the water, and the narrow locks used less water.

Part of the improvements and enlargement plans made in 1845 involved a reduction in the number of locks along the line. Having fewer locks would reduced the amount of time required for a boat to go from Port Carbon to the Delaware River. The total number of locks which a boat had to pass through prior to the improvements was 109, including 13 guard locks which were usually left open and therefore caused no delay. The plans to enlarge and improve the navigation system entailed a reduction from 109 locks to 82 locks, making the number of lift locks only 65 instead of 96.¹⁹¹ The way that the number of lift locks was reduced was by building new locks that had a greater amount of lift than the old locks. During the reconstruction in 1846, the triple locks at Laurel Hill were replaced by double locks with greater lift which overcame the same amount of fall.

The new Laurel Hill Locks, Numbers 52-53, were constructed of stone. The upper lock was made with cut

¹⁸⁹ Report . . . 1833, p. 4.

¹⁹⁰ Gill, Map of the Schuylkill Navigation.

¹⁹¹ Miller, Report, p. 12.

stone and needed no wooden liner (Plate 74). The lower lock may have also been built with cut stone; it is not clear from the records. In any event, the lower lock was taken down and rebuilt in 1858. "The walls of the lower chamber of the combined locks at Laurel Hill, No. 54 [sic] including the central buttresses, which had bulged in consequence of the defective workmanship and material, were taken down nearly to the foundation and rebuilt. The lining in this lock, and also No. 55 was renewed."¹⁹² The lower chamber of Laurel Hill Locks was then built with dry masonry lined with wood (Plate 75). The reason why the lower chamber was not built of cut stone and cement is that water which seeped from the upper chamber would collect behind the watertight wall of the lower chamber and exert tremendous pressure from the inside of the wall, bursting the cement out from the joints and cracking the masonry. Edward Miller called this phenomenon an example of the principle of the Hydrostatic Paradox, a principle which explained how an extreme force, disproportionate to the quantity of liquid, could destroy the lower chamber walls in combined locks.¹⁹³ When walls were laid dry, water could seep through without causing damage; the wooden lining would serve to contain the water

¹⁹² Report . . . 1859, p. 18. The designation of the lock as Lock 54 is an error; the lower chamber of Laurel Hill Lock is No. 53. Lock No. 54 is the upper chamber of Frick's Locks; it was rebuilt in 1859. It was not rebuilt in 1858 and again in 1859.

¹⁹³ Miller, Report, p. 15.

inside the chamber. Large drainage culverts were built into the masonry wall of the lower chamber at the low water line to drain off any water which collected behind the wooden lining (Plate 76).¹⁹⁴

The locks at Laurel Hill had new tail-walls built in 1873. Tail-walls are the walls which flare out from the entrance of the chambers. The Engineer's Report summarized the work done at Laurel Hill that year: "The tail-walls on both sides of the combined locks (Nos. 52-3) at Laurel Hill were taken down last winter and rebuilt from their foundations, and extensive repairs [were] made to the chamber walls."¹⁹⁵ The upper lock's mitre gate in Lock 52 was replaced with a drop gate, but the date of the replacement is not clear. The 1876 Engineer's Report makes reference to "improvements made to lock-chambers and to the mode of operating gates," but it does not give any details.¹⁹⁶ There is some question as to whether or not drop gates were installed by 1877 because the Engineer's Report is ambiguous; it states, "The timber plank lining of the lower chamber of the combined lock, No. 52-3, at Laurel Hill, was entirely rebuilt and new gates put in. Horizontal valve wickets were renewed at eight locks. The waste weir

¹⁹⁴ Miller, Report, p. 15; Report . . . 1861, p. 28.

¹⁹⁵ Report . . . 1874, pp. 81-82.

¹⁹⁶ Report . . . 1876, p. 75.

and sluice gates at Laurel Hill . . . [were] rebuilt."¹⁹⁷ Horizontal valve wickets are used only in drop gates, but the report does not indicate which eight locks received the new wickets. Lock No. 53, the lower chamber, did not have a drop gate, but Lock No. 52, the upper chamber, did have a drop gate installed.¹⁹⁸ In 1882 a new replacement drop gate was installed in Lock 52, the upper chamber. The drop gate was 29 feet 1 inch long and 8 feet 5 inches tall. The middle mitre gates in Laurel Locks had been renewed in 1886. These mitre gates were 21 feet 3 inches from the bottom beam of the gate to the top beam, with another 5 1/2 inches to the coping on top of the gate. The width of the gates from the mitre to the heel post was 11 feet 4 inches. The lower gates, replaced in 1885, were 18 feet 6 1/2 inches tall with an additional 16 inches to the top of the coping, and they were 11 feet 3 3/4 inches wide from the mitre to the heel post.¹⁹⁹

In 1867 there was a breach in the canal bank above the

¹⁹⁷ Report of the President and Managers of the Philadelphia and Reading Railroad Company to the Stockholders, January 14, 1878 for the Year Ending November 30th, 1877 (Philadelphia: Helfenstein, Lewis, and Greene's, 1878), pp. 87-88.

¹⁹⁸ Lock No. 54 on the Girard Canal had a drop gate installed in 1856.

¹⁹⁹ "Description of Locks and Bridges, 1866-91," in the Pennsylvania State Archives, Record Group MG110, Schuylkill Navigation Company.

locks at Laurel Hill the Engineer's Report described the occurrence:

A breach occurred in the second level of the Girard canal near Laurel Hill Locks, on the 29th day of July. The embankment was the highest on the line of the works. It was built upon rock sloping toward the river, and from this circumstance would have been difficult to repair without consuming more time than was advisable in the midst of the season. Fortunately the whole bed of the canal had been excavated out of the rock, and afforded a secure foundation for crib work around the gap. This plan was adopted in connection with a large amount of earth work at the breach, and enabled the water to be restored without waiting to complete the repair of the embankment, thus preventing any loss of trade by a failure of the boats to reach the landings in time.²⁰⁰

Laurel Hill Locks provide the only surviving example of pre-1830 lock construction on the Girard Canal. The south chamber wall of the original triple lift lock still stands along the north side of the c.1846 double lift lock. Usually when the enlarged locks were built, the locks that had been built in the 1830s were saved and and the early locks were replaced. At Laurel Hill, apparently, both of the earlier triple lift locks were abandoned and replaced by the new double lift lock. The new lock was built over the site of the 1832 triple lift lock. The south wall of the original triple lift lock was probably saved because it served well as a retaining wall along the north side of the new enlarged double lift lock. The old south chamber wall

²⁰⁰ Report . . . 1867, pp. 29-30.

fits the description of early locks being built with "rough stones lined with plank."²⁰¹

The double locks Nos. 52-53 can still be examined today (Plate 79). The locks have not been filled in, and their size and depth are impressive. A large portion of the wall and center buttress between the locks collapsed in 1981, but the greater part of the masonry is intact. A towering fence, which is designed to be reminiscent of the mitre gates, has been erected across the mouth of the lower chamber. One feature that has survived at this site but is no longer to be found at other sites is the by-pass sluice; it can be seen on the south side of the upper chamber of the combined locks (Plate 77). The sluice gates which were used to regulate the flow of water have rotted away; the sluice gates had been renewed in 1877.²⁰² The by-pass sluice pipe is still in good condition.

The lockkeeper's residence is located on the south side of the locks; on the north side of the locks there is a severe drop down to the Schuylkill River. The house was probably built in the early to mid- 1820s during the initial construction of the Girard Canal. The owners of Laurel Locks Farm place the construction date at 1828, which is later than one might expect but is still within the proper

²⁰¹ Report . . . 1834, p. 9.

²⁰² Report . . . 1878, p. 88.

time period. There is no evidence which suggests that it had been rebuilt (Plate 78).

Because the locks have not been filled in, one can examine the cut stone construction of the upper chamber and compare it with the rough dry-laid masonry of the lower chamber. One can see the drainage culverts which were built into the lower chamber walls. Recessed notches in these walls mark where the vertical timbers, to which the horizontal plank-lining would have been nailed, were once attached to the masonry (Plate 75). The timbers were fastened to the masonry wall by permanently attached iron anchors which did not have to be removed to replace the lining. If one examines the iron anchors, one can see that they were designed with three simple iron pieces: a shaft, which was permanently affixed to the wall; a plate, which slid over the shaft; and a pair of pins, which were inserted through the end of the shaft (Plate 80). To fasten the timbers to the chamber walls, one drilled a hole through the timber so that it could be placed over the iron shaft, allowing the shaft to stick out of the wood. The plate would then be slid over the shaft, thereby capturing the timber between the plate and the stone of the wall. The pins would be inserted into the shaft to hold the whole assembly firmly to the chamber wall (Plate 81). To remove the timbers one merely had to drive the pins back out of the

shaft, and the whole assembly would come loose without damaging the masonry walls.

Laurel Hill locks are a truly fascinating artifact of the Schuylkill Navigation and the only combined locks in the Girard Canal that have not been razed or buried. In fact, the only other lock on this canal that has not been filled or razed is Lock 57, the Girard Outlet. Most of the locks on the Girard canal still exist, but lie buried beneath tons of fill.

Price's Culvert

A short distance below Laurel Hill Locks stands Price's Culvert (Plates 82, 83). Price's Culvert is a small single arch aqueduct bridge; it was constructed in the winter of 1872 when an earlier structure was taken down and the new one built to replace it.²⁰³ The structure is in excellent condition; it appears not to need any repairs, only ordinary maintenance work.

²⁰³ Report . . . 1873, p. 85. It should be noted that the reference in the Report which states that the aqueduct is located below locks No. 54-55 is erroneous. There were two sets of combined locks on the Girard Canal, Laurel Hill Locks Nos. 52-53 and Frick's Locks Nos. 54-55. In some of the reports the numbers of Frick's Locks are mistakenly given in place of the numbers for Laurel Hill Locks.

Pottstown Turnpike Bridge

Less than half a mile below Laurel Hill Locks, the four-lane highway Route 422 crosses from the north side of the Schuylkill River to its south side. The four-lane highway then runs on top of the old canal bed for about 2 1/8 miles. At Kenilworth, Route 422 veers back over to the north side of the river, and Route 724 is built on top of the Girard Canal instead. It runs on top of the canal for about another mile. In some places portions of the canal berm bank can still be seen along the south side of Route 422. The stone abutment that once supported the old Pottstown Turnpike Bridge can also still be found (Plate 84). It is located about 75 feet east of Hanover Street, on the south side of 422 in North Coventry Township, Chester County. The bridge abutment probably had originally been a timber trestle, which was replaced with stone in 1869.²⁰⁴ In 1875 the wooden bridge over the canal was replaced with an iron superstructure which presumably rested upon the same stone abutments that the older bridge had rested upon.²⁰⁵ The deep cut excavated through the hill 100 feet east of the abutment was not made by the highway construction crew that

²⁰⁴ Report . . . 1870, p. 5.

²⁰⁵ Report . . . 1876, p. 76.

built Route 422; rather, the cut was originally made for the canal.

Jones' Culvert

A little more than one and a quarter miles east of Hanover Street on Route 724 one can find the remnants of Jones' Culvert (Plate 85). Located on the northern edge of 724, about 50 feet west of Miller Lane, there is just barely enough of the structure left to allow positive identification of it. A fragment of the westernmost abutment still stands, and the springer stone is in position. The rest of the arch is gone, but the fact that there is a springer stone cemented into the wall fragment indicates that Jones' double arch culvert once stood on this site; the remaining masonry is not just a segment of a retaining wall. Part of the center pier also still remains standing. Jones' Culvert was built, or extensively rebuilt, in 1846 during the Schuylkill Navigation enlargement. The report of the chief engineer for the lower division, James Smith, regarding repairs made to the culvert in 1848 stated that the need to repair a breach in the culvert had "arisen from the incomplete state of those portions of the line, caused by the rapid construction of the new work in 1846."²⁰⁶ Today the remaining piece of abutment and the

²⁰⁶ Report . . . 1849, p. 16.

fragment of the center pier serve as retaining walls to hold back fill; they also provide a clear channel for a small stream to run through.

Grubb's Culvert and Grubb's Farm Bridge

The next structure on the Girard Canal is one of the more surprising finds made during my research and identification project. It is Grubb's Culvert, located about half a mile farther east on Route 724 from Jones' Culvert; Route 724 has been built on top of the canal along this section. The surprise is that Grubb's single arch culvert still stands and is currently being used as a highway bridge for Route 724 (Plate 86). Grubb's Culvert is the only structure in the Girard Canal which is still being used for transportation. It can be found just a short distance east of the junction of Old Schuylkill Road with Route 724 and west of Petermann Road in East Coventry Township, Chester County. Oddly, Route 724 does not run down the center of the culvert, but instead it was built over the south wall of the aqueduct bridge. The southern berm wall has been taken down, and Grubb's Culvert has been widened. Perhaps it was decided that it was advantageous to center the side wall under the highway for extra support. From underneath Grubb's Culvert one can see where the original arch joins with the highway department's addition.

No documentation was found that revealed the construction date of Grubb's Culvert, but the width of the structure suggests that it is a post-1845 structure.

Approximately 100 yards east of Grubb's Culvert one can find traces of Grubb's Farm Bridge. The timber supports of the wooden farm bridge once rested on the stone piers. Part of the stone pier on the north side of the canal can still be seen (Plate 87). The retaining wall of the bridge approach on the west side also still stands (Plate 88). The canal has been filled at the site of the bridge and a new gravel road which serves as the entrance to "Tow Path Park" is laid over the top of it. The bridge over the canal was built in 1886.²⁰⁷

Tow Path Park

Tow Path Park is a small community park. There one will find a short segment of the canal which has been refilled with water, but the tow path has not been restored. Although the canal has been refilled with water for about 150 feet and the underbrush has been cleared and replaced by lawn, the fact that the Girard Canal runs through the park is somewhat incidental. The park is primarily oriented to the Schuylkill River, with a boat launch and parking for boaters and fishers. The community park seems to serve the

²⁰⁷ Report . . . 1887, p. 54.

people of the area moderately well, but the visitor to the park is only vaguely aware of the canal; interpretive information is not given. It is unlikely that the park users even know that the canal was called "The Girard Canal."

One reason for the lack of site interpretation is that important historical information regarding the Schuylkill Navigation is almost inaccessible. Attempts to do archival research to obtain the necessary information for a project such as Tow Path Park are frustrating, time consuming, and often unfruitful due to the incomplete and fragmented nature of Schuylkill Navigation documents; such documents that do exist are scattered among a number of libraries and archives. Furthermore, the only histories that have been written since the navigation was closed are economic histories about the Schuylkill Navigation Company. None of the histories have been about the actual artifact built by the Schuylkill Navigation Company, the canal/slackwater navigation system itself. Had such a report been available at the inception of Tow Path Park, signs bearing interpretive information could have been erected. Theoretically, Grubb's Farm Bridge, the only canal structure in the park, could have been reconstructed; but it is doubtful that its existence was even known to the planners of the park. The township planners did make an effort to bring back an important part of their local history by

exhuming the Girard Canal from beneath the heavy overgrowth which had shrouded it; but without essential historical information they were unable to present its significance or to communicate a vital sense of what it had once meant to the community and region. It is hoped that in the future this present study may be used to help reclaim and rejuvenate such sites along the Girard Canal.

Heister's Waste Weir

The next structure to be seen along the Girard Canal is Heister's Waste Weir. Heister's Waste Weir can be found by hiking east from Tow Path Park and following the Girard Canal tow path for half a mile. The tow path is clear of brush along this stretch, and the trail passes along one of the most beautiful sections of the Schuylkill River. It is an extremely pleasant walk. A much shorter route can be taken by walking about 300 yards west from where Sanatoga Road crosses the canal a short distance north of Frick's Lock Road. Although approaching Heister's Waste Weir from the west may save some time and some distance, it is a difficult route that entails passing through dense and unpleasant undergrowth. Heister's Waste Weir is a massive masonry structure built on the northern bank of the canal (Plate 89). To be precise, Heister's Waste Weir is more than just a waste weir; it is also a sluice which would

have had a gate tht could be opened to drain the canal. The way that one can tell that there had been a sluice built into the structure is by sighting through the drainage opening and observing that it is below the level at which the water would have been. Portions of the structure are missing; there are no traces of the mechanics of the structure left. The sluice gates and the slucies themselves have vanished completely. The strucure may have been built in 1859: "Sluice gates supplied with iron pipe of large dimensions, built in masonry [were installed in the second level of the Girard Canal] . . . to afford a convenient means of relieving the canal, when it might be required to draw the water hastily. A similar arrangement was made at one of the waste weirs in the third level of the same canal."²⁰⁸ Heister' Waste Weir is in the third level of the Girard Canal. The iron work has been stripped from the structures along the canal. Had this structure been equipped with iron sluice pipes, then iron salvage operations would explain why there is no evidence of the sluices today.

It must have been a spectacular sight to see the drainage sluice in operation. Heister's Waste Weir is built upon a steep embankment high above the Schuylkill River. The opening by which the water exited through the massive masonry wall is about 10 feet above the ground. The water

²⁰⁸ Report . . . 1860, p. 22.

would have rushed through the opening, crashed onto the steeply sloping ground, and then tumbled and churned on its descent to the river.

Heister's Bridge was located at the point where Sanatoga Road crosses the Canal (Plate 90). As is true of any of the road bridges that once crossed the Girard Canal, there is little of the structure left today. Portions of the stone abutments still stand, but the bridge itself has been rendered unnecessary because today the canal has been filled and graded instead of spanned.

Locks Nos. 54-55; Frick's Locks

The combined locks Nos. 54-55, known as Frick's Locks, are located in East Coventry Township, Chester County. They are one third of a mile from the intersection of Sanatoga Road and Frick's Lock Road. Frick's Lock Road goes directly to the site. The road passes on the west side of the lookkeepers residence. The locks and the lockkeeper's house are built alongside the road just south of a 90 degree bend in Frick's Lock Road and on the western edge of the canal locks.

The upper chamber of Frick's Lock, No. 54, has been filled in and the lower chamber, No. 55, has been at least partially razed and has been filled over (Plates 91, 92). There are no above ground remains of the lower chamber,

whereas the coping at the tops of the upper chamber walls are still visible. Frick's Locks were one of the last combined locks to be doubled after the president and the manager's decision to double all combined locks in 1830.²⁰⁹ By 1834 Frick's Locks had still not been doubled due to insufficient funds. The original estimate for the cost of doubling all of the combined locks had been too low because the new locks were built with cut stone and hydraulic cement, not with the less expensive rough stone with wooden linings:

The Board were induced to incur this additional expense, from observing, during the last winter, that the old locks, built in the less costly manner, required so heavy an outlay for repairs. They were, therefore, compelled to believe, that the most economical course in the end would be to build well at first, even though at a greater cost. The new locks are of a most solid character, equal to any in the country.²¹⁰

Due to the additional expense the Board "prepared the draft of an ordinance, with an estimate of the sums that will be requisite [for repairs and rebuilding] . . . to which is to be added as much more as will be necessary to complete the reservoir and the two locks at Frick's, so necessary to facilitate the trade with Union and State Canals, and such other works as the Stockholders have ordered to be done."²¹¹

²⁰⁹ Report . . . 1830, p. 5.

²¹⁰ Report . . . 1834, p. 9.

²¹¹ Report . . . 1835, pp. 9-10.

By 1835 the two new locks at Frick's were completed and in operation.²¹² The older set of combined locks was taken down in 1846 during the enlargement of the canal, and the new double locks were built to replace it (Figure 8, 11). It is the upper chamber of the new locks that one can see today. The 1835 double lock is located in the woods just east of the enlarged lock. The lock has been filled over and cannot be seen. In 1856 the upper gates in Lock 54, the upper chamber of Frick's Locks were replaced with a drop gate in place of the old mitre-gates.²¹³ In 1859 major repairs had to be made to the upper chamber at Frick's locks: "Defects of a serious character were also discovered in one wall of the upper chamber of the combined locks No. 54, at Frick's. During the winter the whole of the chamber wall was taken down to the foundation and rebuilt of greater strength, in cement."²¹⁴ The lower chamber was rebuilt the next year, 1860. The engineer reported that :

the chamber walls of the lower lock at Frick's, which were of dry masonry and lined, were taken down and rebuilt. In the later, new anchors of an improved form, capable of being removed, when necessary, without disturbing the walls, were introduced and the lining replaced in a more substantial manner. At this point, as well as at several other of the lined locks, where displacement of the linings had been threatened by the waters confined in the walls, drainage culverts of dry masonry were built at the water line of the lower

²¹² Report . . . 1836, p. 8.

²¹³ Report . . . 1857, p. 20.

²¹⁴ Report . . . 1860, p. 19.

levels to carry off such water, from the ordinary leakage through the linings, as could no longer find passage through the walls, owing, as was ascertained, to the gradual filling of the interstices by sediment. The plan has been entirely successful and much more effective than the usual expedient of valves opening into the chambers.²¹⁵

New lie-bys with a total length of two hundred and fifty-six feet were built at locks Nos. 54-55 in 1875.²¹⁶ The overgrown lie-by can still be seen above Frick's Locks; portions of a field stone retaining wall, which served as a wharf wall for boats to take on or unload goods still stands on the west side of the basin. A fragment of wall also still stands at the bottom of the locks (Plate 93). The piece of wall is likely to have been part of the western abutment for the tow path bridge which at one time crossed over the lower end of Lock 55, the lower chamber; but it may have been part of the wing-wall of that chamber (a wing-wall is the flared out wall at the entrance to a lock chamber or bridge).

Frick's Trunk can be found a short distance below Frick's Locks (Plate 94). The survival of Frick's Trunk can be attributed to the fact that it is built of stone; it is not of the usual oak timber and pine plank construction. Frick's Trunk does have the square opening typical of a trunk and not the stone arch that one associates with a

²¹⁵ Report . . . 1861, p. 28.

²¹⁶ Report . . . 1876, p. 76.

culvert. Perhaps the reason that Frick's Trunk was built of stone and not wood is that it is so small. Its opening is less than two feet wide; it was easily constructed with long stones serving as lintels spanning its narrow width. In a case where permanent stone construction could be employed as easily and as inexpensively as it could at Frick's Trunk, it would not make sense to build with perishable wood.

About 400 yards southeast of Locks 54-55 stand the ruins of Frick's Aqueduct (Plate 95). Frick's Aqueduct, a one span aqueduct bridge, was made of wood with field stone abutments. All of the timber has completely rotted away, but both abutments remain standing. The structure was built in 1872 as the engineer's report states: "The one-span aqueduct below locks Nos. 54-55 was rebuilt during the last winter, with new abutment, wing-walls, and sides."²¹⁷

Walt's Road Bridge

Within a mile southeast of Frick's Locks are the sites of Walt's Road Bridge, Walt's Waste Weir, Walt's Trunk, and Foundry Road Bridge. Although the sites can be located, the structures have been obliterated. The sites are north of Route 724 between Anderson Road and Wells Road. Walt's Road Bridge was once located at the point where Anderson Road

²¹⁷ Report . . . 1873, p. 85.

crosses the old canal bed. The span of Walt's Road Bridge was 51 feet 5 inches; its width was 12 feet. The bridge was built in 1853, but in 1866 a new bridge had to be constructed. The stone abutment on the berm (south) side was put up in 1870. By 1879 Walt's Bridge required about 10 square feet of weather boarding for patching.²¹⁸ The location of the site of Foundry Road Bridge is at the place where Wells Road crosses the filled canal, just south of a present day greenhouse. The bridge no longer exists. The old bridge was replaced by a new one in 1864. In 1870 a stone abutment was built on the tow path (north) side, the same year that an abutment was built for Walt's Bridge. In 1872 new girders and joists were put in; by 1879 the posts were getting soft, and extra plank strengthening and braces were required.²¹⁹ About 150 yards northwest of the site of the bridge is the probable site of Walt's Waste Weir and Walt's Trunk. The site is at a small stream which runs along a hedgerow between two farmers' fields. The canal structure, or structures, which were located at this site have collapsed and were partially razed. The ruins are so badly scrambled and overgrown that they can no longer be positively identified. It seems probable, however, that Walt's Trunk conducted the small stream under the canal and

²¹⁸ Pennsylvania State Archives, Record Group MG110 Schuylkill Navigation Company Records, C. Various, 1814-1940, n. d.

²¹⁹ Ibid.

that Walt's Waste Weir was also located at this site so as to dispose of canal waste water into the stream.

Lock 56: Lawrenceville Lock

Lock 56, which was also referred to as the Lawrenceville Lock or the Lock at Pigeon Creek, is approximately one third of a mile southeast of the site of Walt's Bridge at Wells Road (Plate 96). Lock 56 is northeast of the intersection of Route 724 and Linfield Road. It is only a few hundred yards from the intersection and on the northwest side of Linfield Road. Lock 56 is two miles below Frick's Locks. The lock at Pigeon Creek was doubled in 1835; the engineer's report states: "A new lock has been erected at Pigeon Creek, which will be ready for the passage of boats on the opening of navigation in the spring"²²⁰ The dimensions of the original locks were 16 feet 9 inches wide, 80 feet long, and 11 feet 3 inches deep. It was doubled with a lock 13 feet 7 inches wide, 79 feet 2 inches long, and 11 feet 2 inches deep. In 1846 the older of the two locks, which was nearest to the lockkeeper's residence, was taken down and replaced with one of the new 18 feet by 110 feet locks (Figures 8, 12). In 1855 it was noticed that in addition to normal maintenance, Lock 56 would need substantial repairs during the winter; chief

²²⁰ Report . . . 1836, p. 6.

engineer James F. Smith reported, "As far as known, the winter repairs will be of the usual character, embracing as principal items some fourteen pairs of lock gates to be replaced; the construction of six bridges; the renewal of portions of the lock linings, [and] rebuilding of a part of one of the lock walls at Pigeon Creek, which has become somewhat too narrow." Mr. Smith's work list went on to include five more construction and repair projects to be carried out at three more locations along the Schuylkill Navigation.²²¹ The work was carried out over the winter, and in the next season's report, Mr. Smith informed the stockholders that "the walls of one side of lock 56, or Pigeon Creek, were taken down and rebuilt . . ."²²² In 1857 the mitre-gates at the upper end of the chamber at Lock 56 were replaced with a drop gate. The drop gate was installed in the large lock, not the smaller lock of 1835. The chamber walls of Lock 57, which were bulging into the chamber again, had to be rebuilt in 1869. The engineer's report said, "The chamber walls of lock No. 56 (Lawrenceville) which had been gradually pressing inward, were taken down to within four feet of the bottom, and rebuilt with larger and better stone, and with new studding and lining, thus restoring the lock to its original

²²¹ Report . . . 1855, p. 18.

²²² Report . . . 1856, p. 15.

width."²²³ The upper drop gate was renewed in 1885; the dimensions of the gate were 20 feet 43 inches wide and 8 feet 4 inches high.

One should be careful not to make the mistake of thinking that a 20 foot wide drop gate indicates that the lock has a 20 foot wide chamber. It is much more reasonable to assume that the chamber was built to the 18 foot wide specification. The extra two feet can be explained by the fact that the drop gate was installed in place of the old mitre-gates. It is important to remember this because the extra two feet in the width of the drop gate were required to take up the space into which the former mitre gates were opened. The heel post was recessed into the chamber wall, and the mitre gates each had a pocket about one foot deep into which they swung so as to be flush with the chamber wall when opened. The extra 2 feet in width required to operate a pair of mitre-gates accounts for there being a 20 foot drop gate installed into a lock with an 18 foot chamber. The lower mitre gates that were installed in 1877 measured 18 feet tall with an added 10 1/2 inches to the top of the coping, and measuring 11 feet 22 1/4 inches wide from the heel post to the mitre.

Today the 1835 lock cannot be seen; the chamber walls may have been pushed in or have collapsed before it was filled in. The larger lock has been filled, but the top of

²²³ Report . . . 1870, p. 4.

the chamber walls can be partially seen. A piece of wall which has not been entirely buried can be seen at the southwestern corner of the lock (Plate 97). It appears to be a segment of the wing-wall from the lock. The lockkeeper's residence, still a home, dates back, apparently, to the original construction period of the 1820s.

Pigeon Creek Aqueduct

Pigeon Creek Aqueduct is only a short distance below Lock 56. It is located northeast of the intersection of Route 724 with Linfield Road, and it can be seen along Old Schuylkill Road, about two hundred yards north of the pavement. Pigeon Creek Aqueduct was a four span wooden aqueduct bridge with stone abutments and piers (Plate 98 and Figure 12). Its broad width indicates that it probably was constructed about 1846 during the Schuylkill Navigation's enlargement. In 1866 the aqueduct bridge at "Pigeon Creek [was] entirely rebuilt on the towing-path [north] side, and piers [were] extended on the berm [south] side."²²⁴ In 1886 a "freshet formed ice gorges below Lawrenceville and Spring City, causing the water to break one side of Pigeon Creek Aqueduct . . ."²²⁵

²²⁴ Report . . . 1868, p. 25.

²²⁵ Report . . . 1887, p. 54.

The stone and the stonework of the Pigeon Creek Aqueduct are different from that of any other aqueduct or culvert still standing along the Girard Canal. It is not constructed of grey field stone as are Hartman's, Kirlin's, and Frick's aqueducts, and the stone is not the same as the stone used in the culverts remaining along the Girard Canal. Pigeon Creek Aqueduct is built of a reddish brown stone. Similar stone can be found, however, in a number of the locks along the Girard Canal. Regarding construction, Pigeon Creek Aqueduct has rounded corners on the abutments and piers; all of the other remaining wooden aqueducts have square corners. The sparseness of the documentation available about the structure necessitates some speculation concerning the different type of construction at the site. The difference in construction at Pigeon Creek Aqueduct compared with that of other aqueducts may be explained by comparing the size of the creek to the size of other creeks on the Girard Canal. Pigeon Creek is a fairly large creek; the only others which compare in size are the Allegheny Creek and the Hay Creek. Both, however, have stone aqueduct bridges over them; the only sites with wooden aqueducts are located on small streams, with the exception of Pigeon Creek. Apparently the reason why Pigeon Creek Aqueduct is constructed differently from other wooden aqueducts on the Girard Canal is that it spans a larger creek than any other and, therefore, requires a stronger and more flood resistant

construction. Better quality stone was used, and the corners were rounded in order to better resist and deflect fast moving water and debris during times of flood. Why a wooden aqueduct bridge was built over Pigeon Creek and not a stone aqueduct bridge cannot be explained reasonably without further data.

Setzler's Aqueduct

At the east end of the little village of Lawrenceville, not more than a furlong from the Pigeon Creek Aqueduct, is a small wooden aqueduct. Setzler's Aqueduct was a two span aqueduct constructed of cut stone (Plates 99, 100 and Figure 13). The flood of 1869, which damaged many segments of Schuylkill Navigation, did very little damage to the Girard Canal. The most notable damage from that flood to the Girard Canal occurred when the high waters "lifted the bottom of an aqueduct" in Lawrenceville.²²⁶ When the flood waters rose as high as the canal water level, the wooden aqueduct became buoyant and the high water lifted it off its stone piers. The report did not specify whether the damaged aqueduct was the Pigeon Creek Aqueduct or Setzler's Aqueduct. However, Pigeon Creek was a name well known, so much so that Lock 56 was known as "the lock at Pigeon Creek." Had the damage been done to the Pigeon Creek

²²⁶ Report . . . 1870, p. 11.

Aqueduct certainly the report would have so stated. On the other hand, Setzler's Aqueduct was not so well known; it made more sense to refer to "an aqueduct at Lawrenceville" than by a name that most people would not have been able to recognize. The ruins of the surviving cut stone abutments and center pier date back to 1881; none of the timber work has survived. That an older aqueduct on the site was rebuilt is recorded in the annual report of 1882: "The abutments and center pier of Setzler's Aqueduct were rebuilt in cement and masonry during the winter season of 1880-81, and the bottom timber and flooring renewed at a cost of \$1,583.96."²²⁷ The ruins of the aqueduct can be seen about 75 yards north of Old Schuylkill Road.

Lock 57: Girard Outlet

Lock 57, the Girard Outlet, is a little over three quarters of a mile below Lock 56 and only about one third of a mile below Setzler's Aqueduct (Plates 101, 102). It is located on the property of a small water company at the end of Shady Lane. The original lock of the 1820s was 81 feet by 16 feet 9 inches, with a depth of 11 feet 3 inches.²²⁸ It was doubled with a lock 79 feet 2 inches long, 13 feet 7

²²⁷ Report . . . 1882, p. 56.

²²⁸ Gill, Map of the Schuylkill Navigation.

inches wide, and 11 feet 3 inches deep. The second lock was built in 1835:

. . . the lock at the Outlet of the Girard Canal, near to which a considerable slip from a hill had happened in 1824, and filled the canal; since which time, until recently, there seemed to be no further danger, but another inclination to move has been lately observed, which threatens a dangerous obstruction, and it was deemed best, without delay, to construct an additional lock about 800 feet above the old, and entirely out of reach of such a formidable accident. This has been commenced, and will be ready early in the Spring. The new lock will obviate all apprehension from this cause.²²⁹

The construction was completed on schedule, as is evidenced by the engineer's report at the end of the following season which stated, "At the Outlet of the Girard Canal the new lock has been finished, and has been in operation since the early part of last season . . ."²³⁰

At first it might seem curious that the collection of maps, "Maps of the Schuylkill Navigation . . ."²³¹, which dates from 1882-1884, does not show two locks at the Girard Outlet (Figures 8, 13). Usually during the expansion project of 1845, where locks had been doubled, the newer lock was kept and the older lock was rebuilt. But according to the maps the Girard Outlet had only one lock. There are several considerations that may explain this. The engineer's report of 1835 states that the second lock was

²²⁹ Report . . . 1835, p. 9.

²³⁰ Report . . . 1836, p. 6.

²³¹ Pennsylvania State Archives. MG110, Schuylkill Navigation Company, Maps E, Level 5, Case 21.

being built "eight hundred feet above the old one." The fact that the new lock was built upstream from the old lock suggests that upon the completion of the new lock the old one may have been removed or filled to avoid the problem of the slipping hill. Furthermore, all of the doubled locks on the Girard Canal were built side by side--except for the Girard Outlet. It does not make sense to believe that the locktender had to run 800 feet from one lock to the other in order to operate them. The fact that the 1864 maps show one lock and the fact that the second lock was built so far away from the first lock strongly imply that the first lock was removed or bypassed after the completion of the new lock. Additional evidence is provided by the site itself. The lock is situated so that its lower gate opens directly into the Schuylkill River. There is not 800 feet below the lock to the river or, more precisely, 800 feet plus the 80 additional feet that the old lock's length would have added had it remained in existence. Apparently the old lock and the canal had either been razed and excavated so as to make a clear opening to the river, or the new lock was positioned in a manner that bypassed the earlier lock and afforded entrance to the river sooner.

The 1835 lock still stands today, and the date stone can be seen on its north wall near the lower gate (Plate 103). However, the north and south walls do not match. The south wall has been cemented over. The upper gate end of

the north wall matches the cemented south wall. If we hypothesize that in 1845 there was only one lock at the Girard Outlet, that is, at the time when it was decided to enlarge the Schuylkill Navigation locks, the builders would not have had the option of saving one lock and rebuilding the original lock. Instead, the builders could have saved the north wall of the 1835 lock, removed the south wall to widen the chamber, then added more length to the lock at the upper end of the chamber. This theory clarifies the seemingly contradictory and idiosyncratic elements of the Girard Outlet. All of the available evidence seems to indicate that the first lock was situated poorly and in 1835 a new lock was constructed in a new location away from the troublesome hill, after which the first lock was abandoned. Further supporting evidence can be gleaned from Edward Miller's 1845 report on the proposed improvement of the Schuylkill Navigation. He suggested, relative to the construction of new enlarged locks on the Schuylkill Navigation, "In a few instances where the locks have already been doubled, and one of them is a good cut stone lock, I propose to take down and rebuild one wall, and lengthen the chamber, using the materials as far as they will go, and completing the rest of the work in the same style of excellence."²³²

²³² Miller, Report, p. 16.

In 1872 " . . . the mitre-sills and floor of the cut-stone lock No. 57, at the 'Girard Outlet [were] renewed."²³³ New mitre-gates were installed in the upper chamber in 1883. The gates measured 18 feet 10 1/4 inches from the bottom of the lower beam to the top of the upper beam with 3 1/2 more to the top of the coping. The gates were 10 feet 10 1/2 inches wide from heel post to mitre.²³⁴ The lower mitre-gates which were replaced in 1886 measured 18 feet 5 inches from top to bottom with 8 1/2 inches more to the top of the coping. They were 10 feet 10 3/4 inches wide from heel post to mitre.²³⁵

In 1866 there was a "wall 93 feet long, [and] 7 feet high built at Girard Canal Outlet."²³⁶ Presumably the wall was built as part of the lie-by above Lock 57. Further work was done at the lie-by of Lock 57 when in 1869 "a breach [was] made in the berme-bank of the inlet above lock No. 57."²³⁷ The breach would have been caused by the severe flood of that year.

The lockkeeper's residence no longer stands, but the foundations of the structure can still be found on the north

²³³ Report . . . 1873, p. 85.

²³⁴ Pennsylvania State Archives, MG110, Schuylkill Navigation Company, Box 1, Vol. 1, Description of Locks and Bridges, 1866-71.

²³⁵ Ibid.

²³⁶ Report . . . 1867, p. 25.

²³⁷ Report . . . 1870, p. 11.

side of the lie-by. In spite of the fact that the lockkeeper's residence is gone, the Girard Outlet has a high degree of integrity. The basin has not been filled, and even more remarkably, the lock has not been filled. The lock chamber walls are still intact and in good condition. The bottom beams or girts of the wooden mitre gates have not completely disintegrated yet, and the rotted off ends of the heel posts stick up about a foot out of the mud in the chamber (Plate 104). The lower, or easterly, end of the chamber still has the abutments on which the wooden tow path bridge once rested (Plate 105). A modern concrete bridge has been built over the chamber near the location of the upper gate to allow water company vehicles to cross to the north side of the canal.

The combined locks at Laurel Hill and the Girard Outlet are unique in being the only locks on the Girard Canal that have not been filled in.

CONCLUSION

The Schuylkill Navigation was vital to the growth of industry, particularly to the iron and coal industries, and to the marketing of farm produce in the Schuylkill Valley. Rapidly the canal system became the largest anthracite carrier of any canal system in America. The average tonnage of the Schuylkill Navigation boats was greater than the tonnage hauled by boats in the Erie Canal:

On the Schuylkill Navigation with the same depth of water, with locks twenty-two inches narrower and eleven feet shorter [than the Erie], the loads are about forty per cent greater than the Erie average, which the commissioners deemed so large, and under similar circumstances of high water, they are fifty-six per cent greater.²³⁸

And as Jones, the authority on anthracite-tidewater canals, has pointed out, "The Schuylkill Navigation had become not only the greatest of coal carrying canals, but it carried about as much as all the other routes combined."²³⁹ The Erie Canal system was the only canal that could exceed the Schuylkill Navigation in its gross annual tonnage of all types of freight combined.

²³⁸ Miller, Report, p. 4.

²³⁹ Jones, Economic History, p. 132.

Although the Schuylkill Navigation carried such a high tonnage of coal, it should be remembered that there was also considerable tonnage carried of other types of freight such as grain, flour, hay, and other farm products. Lumber, stone, and marble were also hauled. Iron ore and limestone were transported to iron furnaces, and cast iron products and iron pigs were carried from the furnaces. There was a large trade in miscellaneous items along the canal, even such luxuries as the very popular nineteenth-century commodity of fresh oysters.²⁴⁰

One of the more lasting effects of the Schuylkill Navigation Company's works was the development of industries which leased their water power from the navigation company and shipped their products on its canals. The mills at Manayunk serve as a prime example of the growth of industry brought about by the Schuylkill Navigation Company: "The source of water power for mills had always been there, but it was the transportation facility of the Schuylkill Navigation Company and its dam and millrace that created Manayunk and helped push Philadelphia into the first rank in the textile field."²⁴¹

²⁴⁰ The Chester County paper, the Village Record, on March 21, 1827, announced that "on Thursday last a fine looking shallow arrived at this place loaded with prime oysters."

²⁴¹ Nicholas B. Wainwright, "The Age of Nicholas Biddle, 1825-1841," in Philadelphia: A 300-Year History, Russell F. Weigley, ed. (New York: W. W. Norton and Company, 1982), p. 275.

The historical significance and the importance of the Schuylkill Navigation to the history of Pennsylvania was undoubtedly substantial, and yet little effort has been made to preserve the remains of its monumental works. In southeastern Pennsylvania the Schuylkill Valley is experiencing a building boom. Rural areas are disappearing as well as the remaining open spaces along the Schuylkill River and the old canal sites. The Girard Canal has had segments razed and built upon even as this study was being conducted.

The compilation contained in this work of historical documentation, location of sites, identification of structures, and photographic documentation of the Girard Canal should provide preservationists with archival and geographical information about sites and structures that has been quite difficult to access until now. This study responds to that need. The next step is for this information to be used as a reference guide to aid in placing sites on the historic register, developing preservation plans, interpreting sites, and stabilizing structures, as well as increasing awareness, interest, and community support for preservation projects along the Girard Canal.

The first chapter offers necessary definitions. The second chapter, by presenting information regarding the construction, expansion, and abandonment of the Schuylkill

Navigation as a whole, provides the background historical information that will be needed for preservation planning at any site on the Schuylkill Navigation system. The third chapter gives historical information particular to the Girard Canal. The fourth chapter presents in detail the specific documentation needed for historic preservation of individual structures along the Girard Canal. Also offered in the fourth chapter are suggestions regarding the desirability and feasibility of preserving specific sites, such as the Girard Outlet, Laurel Locks, Snyder's Culvert, Haw's Double Culvert, and others.

But, in conclusion, it seems that any preservation planning should look first, not to specific sites, as marvelous as they are, but to the Schuylkill Navigation as a significant whole. The Schuylkill Navigation presents a system with its associative and historical values. It profoundly affected and reflected the life and growth of the Commonwealth of Pennsylvania. It was a vast system employing hundreds of laborers in its construction and maintenance. Thousands were dependent upon the goods and services it provided. It was a part of almost everyone's life in southern Pennsylvania and the Schuylkill Valley for scores of years. This vital element in the growth of the state and region needs to be better known and its artifacts should be preserved. Some of these remaining structures

present beautiful examples of nineteenth-century technology and building techniques.

It is my hope and intent that the information presented in this study may be a step in having the Girard Canal and the entire Schuylkill Navigation system declared an Historic District and that the remaining individual elements of the system may be preserved and their links to other elements of the system be made evident to the public and their significance and contribution explicated. As an Historic District this old slackwater canal system would show integrity, demonstrating the various types of structures found along the canal. In this way a significant though almost forgotten part of Pennsylvania's heritage will be preserved for future generations.

PLATES



Plate 1. Site of Dam No. 24 in 1989, looking northwest up the Schuylkill River.



Plate 2. Turn of the century view of Dam No. 24 and the Girard Inlet, looking southeast down the river.



Plate 3. Power House at Dam No. 24 as seen from the north.



Plate 4. Southeast view of the Power House.

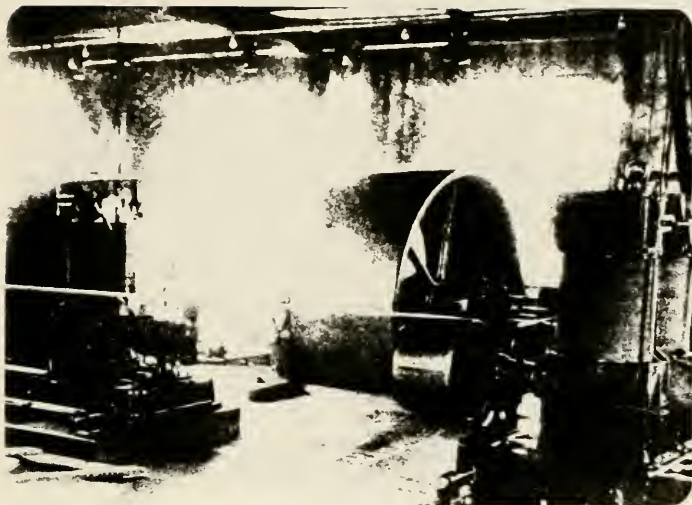


Plate 5. Interior of the Klapperthal Power House.

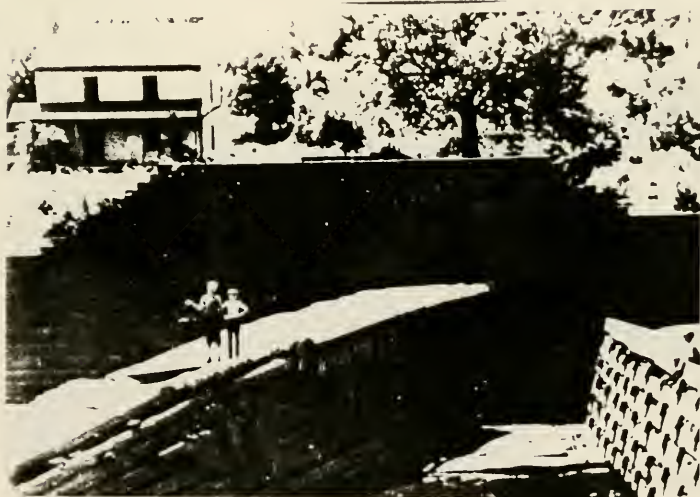


Plate 6. Photograph of Dam No. 24 after it broke in 1942; Lockkeeper's residence can be seen in the background.

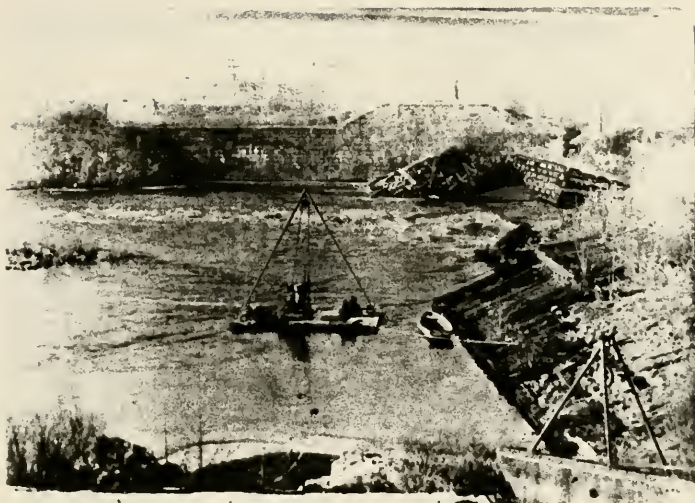


Plate 7. Dam No. 24 c. 1949, prior to the Eastern Engineering Company's removal of the dam.



Plate 8. Photograph taken in 1950 after the completion of Eastern Engineering's Company contract with the Schuylkill River Desilting Project.



Plate 9. Girard Inlet photographed in the 1890s
from the northwest.



Plate 10. 1890s view of the Girard Inlet from the
East.



Plate 11. Early 20th century photograph of the lockhouse at the Girard Inlet.



Plate 12. Present day ruin of the Girard Inlet viewed from the north.



Plate 13. West view of the Girard Inlet ruin.



Plate 14. Damage caused by vegetation in the masonry at Lock No. 50.



Plate 15. Dam abutment on the north side of the Schuylkill River near the site of the Klapperthal hydro-electric plant.



Plate 16. Ruin of Dick's Culvert.



Plate 17. Abutments of Beidler's Road Bridge, right hand side, bottom left corner of photograph.



Plate 18. View of the Allegheny Aqueduct from the south.



Plate 19. View of the Allegheny Aqueduct from the north.

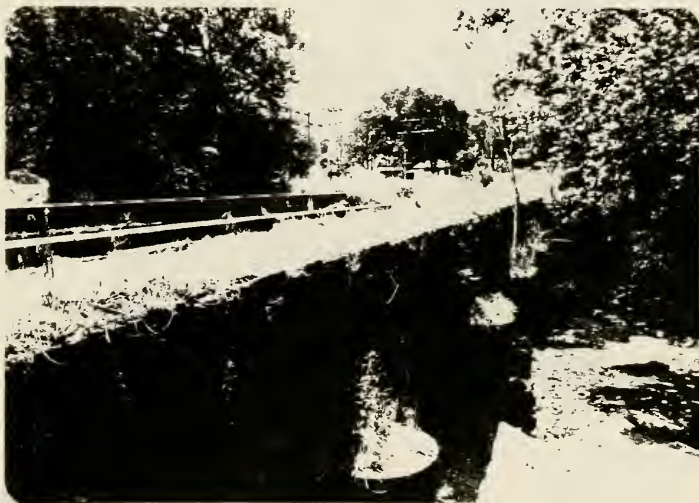


Plate 20. Tow path on the Allegheny Aqueduct.



Plate 21. 1899 Photograph showing a tugboat crossing the Allegheny Aqueduct, viewed from the north side; notice the tow path railing.

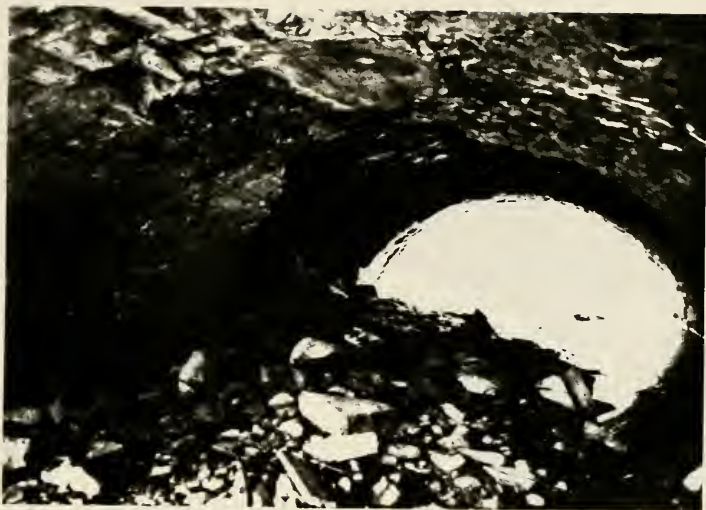


Plate 22. Partial collapse of one vault of Allegheny Aqueduct.



Plate 23. Unmatched and recycled stonework in the south wall of the Allegheny Aqueduct.



Plate 24. 1940s photograph of the Girard Canal crossing the Allegheny Aqueduct; probably taken from Thompson's Road Bridge east of the aqueduct.



Plate 25. Seidel's Aqueduct viewed from the north; note the waste weir built into the wall of the structure.



Plate 26. Detail of the north wall of Seidel's Aqueduct.



Plate 27. Damaged arch in the south wall of Seidel's Aqueduct.



Plate 28. Haw's Double Culvert viewed from the south.



Plate 29. Detail of south wall of Haw's Double Culvert showing center pier and arches.



Plate 30. Western span of Haw's Double Culvert viewed from the north side.



Plate 31. Modern bridge span resting on the old abutments of Haw's Road Bridge; in the background is the north side of the eastern arch of Haw's Double Culvert.



Plate 32. Remains of timber work aqueduct built to replace Haw's Double Culvert in 1874.



Plate 33. Detail of iron spike in the timber work at Haw's Double Culvert. (Note 35mm film roll left of the spike for scale).

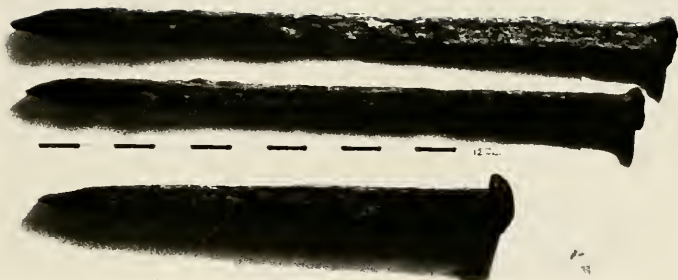


Plate 34. Iron spikes found in Indian Corn Creek, downstream from Haw's Double Culvert; the spikes once held the timber aqueduct together.



Plate 35. 1959 photograph taken from the lie-by above Lock No. 51; note the lockkeeper's residence on the left and the toll house on the right.



Plate 36. 1989 photograph taken from the filled lie-by above Lock No. 51; note the good condition of the buildings; the car is parked in the filled lock.



Plate 37. 1959 photograph showing the 1836 lock before it was filled.

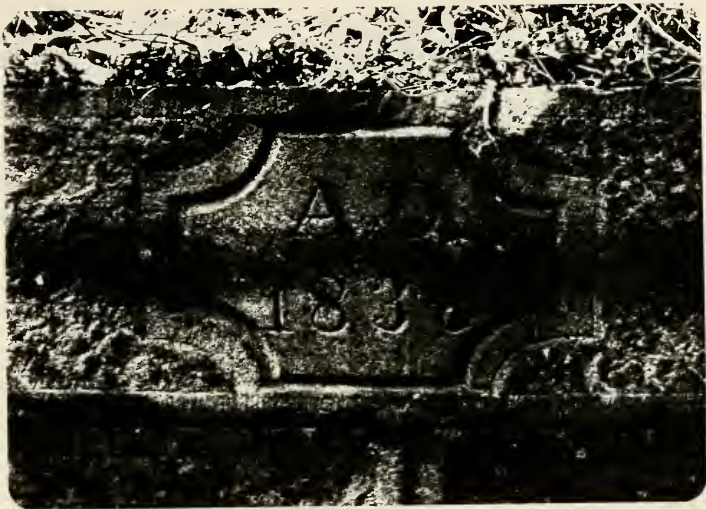


Plate 38. Date stone in the north chamber wall of the older lock at Birdsboro; photo taken in 1989.



Plate 39. 1959 photograph of the 1836 lock chamber.



Plate 40. 1989 photograph of the north wall of the mostly filled 1836 lock chamber.



Plate 41. View from the basin below Lock 51, looking into the c. 1846 enlarged lock chamber.



Plate 42. Detail of stone coping at the enlarged Lock 51 showing the mitre gate pocket and the traces where the iron straps for the heel posts were attached.



Plate 43. Lockkeeper's residence at Lock 51,
Birdsboro Lock.



Plate 44. Gate house and toll collector house at
Lock 51.

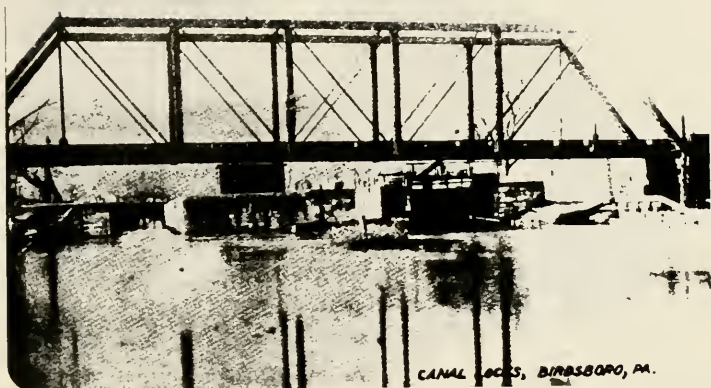


Plate 45. Turn of the century photograph taken from the basin below Lock 51, looking toward the lock.



Plate 46. Dual sluice pipes in the basin below Lock 51 which appear to have fed water to the Birdsboro shop.



Plate 47. Schuylkill Navigation shop at Birdsboro.



Plate 48. South wall of the Hay Creek Aqueduct
photographed c. 1955.



Plate 49. South wall of the eastern abutment of Hay Creek Aqueduct, photographed in 1989.



Plate 50. Site of Hook's Farm Bridge.



Plate 51. Site of Campbell's Road Bridge.

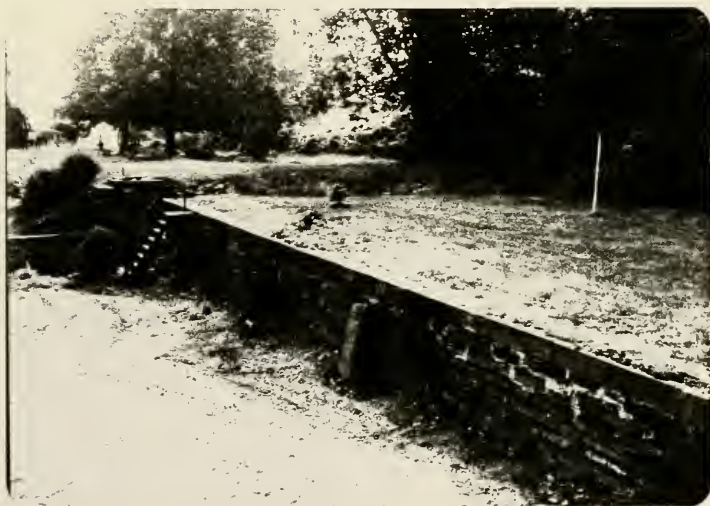


Plate 52. Bland's Turn Waste Weir (filled) built 1866.



Plate 53. Ruins of the sluice built at Bland's Turn Waste Weir.



Plate 54. Ruins of Hartman's Culvert.



Plate 57. Remaining buttress of Sixpenny Culvert.



Plate 55. Fragment of the western abutment of Sixpenny Culvert.



Plate 56. Remaining foundation of Sixpenny Culvert beneath the modern Route 724 highway bridge.



Plate 58. Sixpenny Culvert buttress wedged between the abandoned Pennsylvania Schuylkill Valley Railroad Bridge and the current Route 724 highway bridge (left side of photo).



Plate 59. Retaining wall built on the north side of the tow path at the Monocacy Furnace Basin near Sixpenny Creek.



Plate 60. Possible submerged foundations of Lynche's Waste Weir near the site of the Monocacy Furnace Basin.

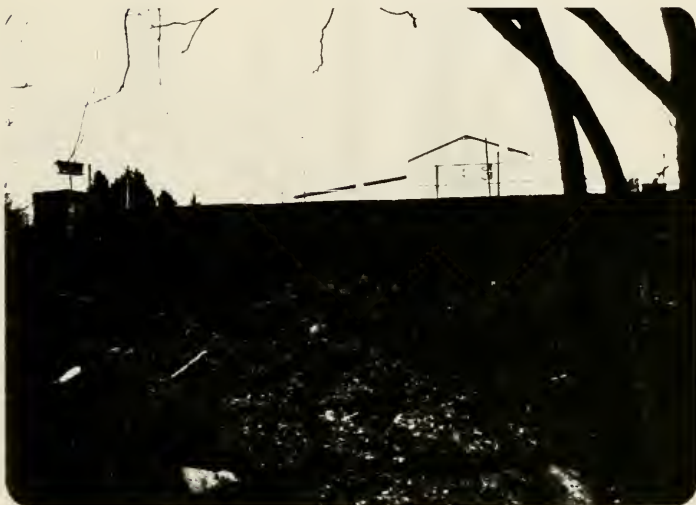


Plate 61. South wall of the ruin of Linderman's Stop Gate.

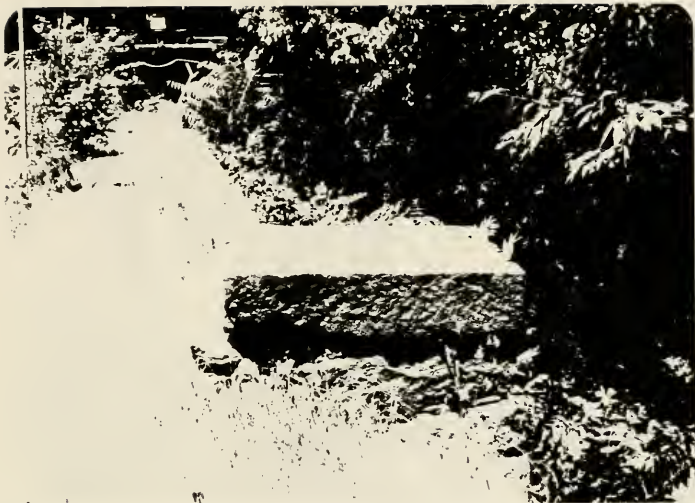


Plate 62. Coping along the top of the south wall of Linderman's Stop Gate.



Plate 63. Port Union boat basin.



Plate 64. Old tree line along the east side of the Port Union boat basin.



Plate 65. 1912 photograph showing children playing in the waste weir at Kirlin's Aqueduct; the tow path and canal are on the left edge of the photo.



Plate 66. Ruin of a stone pier which supported the timber work at Kirlin's Aqueduct.



Plate 67. Fragment of the eastern abutment of Kirlin's Aqueduct.



Plate 68. North side of Snyder's Culvert.



Plate 69. Detail of the arches in the north wall of Snyder's Culvert.



Plate 70. South side of Snyder's Culvert.



Plate 71 Holes through the canal bottom breaching
the western most vault of Snyder's
Culvert.



Plate 72. Lower entrance to the double lift locks
at Laurel Hill, Nos. 52-53.



Plate 73. View into the chambers at Locks 52-53 from the east end.



Plate 74. The upper chamber, Lock 52, at Laurel Hill Locks.



Plate 75. The lower chamber, Lock 53, at Laurel Hill Locks.



Plate 76. Detail showing one of the drainage culverts built into the lower chamber at Laurel Hill Locks.

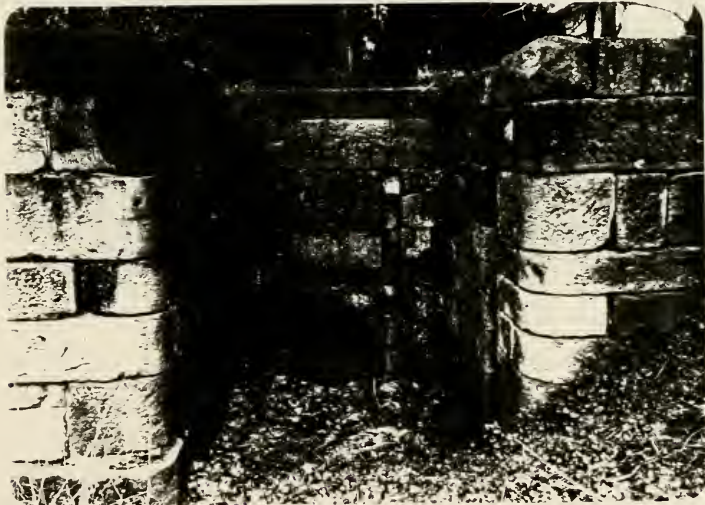


Plate 77. Bypass sluice at Laurel Hill Locks.



Plate 78. View of Laurel Hill Locks and the lockkeeper's residence from across the lie-by above the locks.



Plate 79. Miter gate pocket in the third chamber of the early triple locks at Laurel Hill.



Plate 80. Detail showing anchor assembly used for attaching timber linings to the chamber walls.



Plate 81. Beam held by iron anchor assembly
outside the lower gate of Lock 53 at
Laurel Hill.



Plate 82. Price's Culvert viewed from the north.



Plate 83. Price's Culvert viewed from the south.



Plate 84. Ruins of the southern abutment of the Pottstown Turnpike Bridge.



Plate 85. Ruin of Jones' Culvert.



Plate 86. Grubb's Culvert viewed from the north.



Plate 87. Small stone pier on north bank of the canal for Grubb's Farm Bridge.



Plate 88. Retaining wall for the road approach to Grubb's Farm Bridge.



Plate 89. Heister's Waste Weir viewed from the north.



Plate 90. Southern abutment of Heister's Bridge (car tire in left corner of photo for scale).



Plate 91. Filled upper chamber of Frick's Locks and the lockkeeper's residence.



Plate 92. Site of the middle lock gates between Lock 54 and Lock 55 at Frick's Locks.



Plate 93. Possible fragment of the western abutment of the tow path bridge over Lock 55 at Frick's Locks.



Plate 94. Frick's Trunk.



Plate 95. Ruin of Frick's Aqueduct viewed from the north.



Plate 96. Lockkeeper's residence at Lock 56 viewed from the east; the filled lock is on the left side of the photograph.



Plate 97. Possible fragment of a wing-wall at Lock 56.



Plate 98. Ruin of Pigeon Creek Aqueduct.



Plate 99. View of Setzler's Aqueduct from the south.



Plate 100. The ruins of Setzler's Aqueduct from the north.



Plate 101. Lock 57, the Girard Outlet.

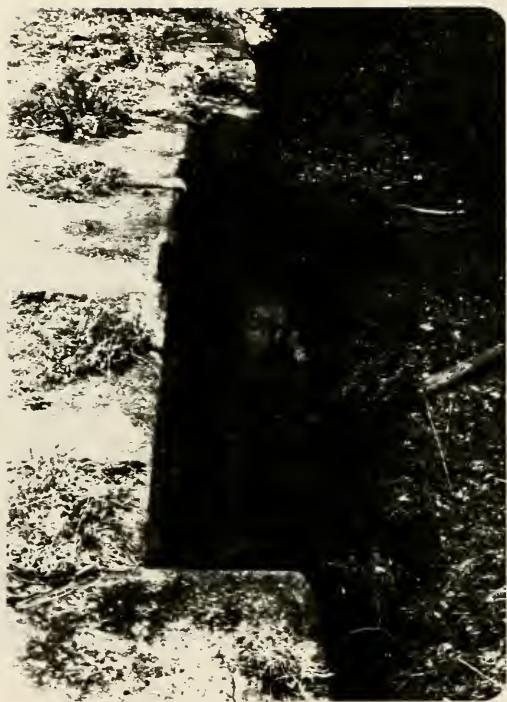


Plate 102. Detail showing miter gate pocket at Lock 57; note the two notches in the middle of the pocket which allowed room for the vertical wickets.

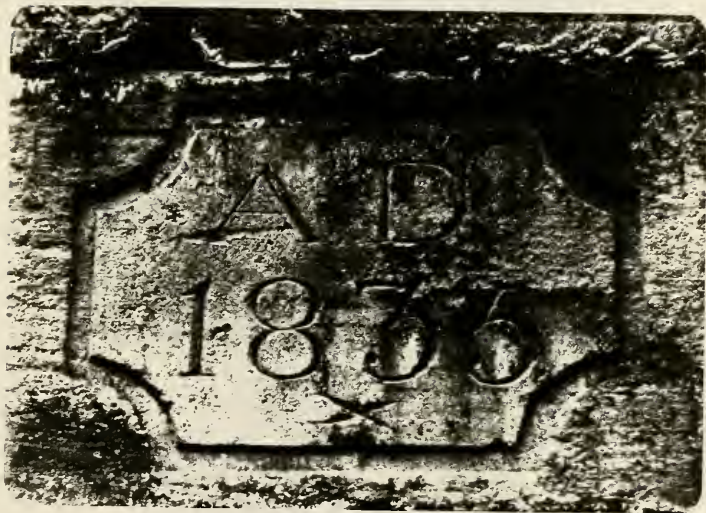


Plate 103. Date stone in the north chamber wall of the Girard Outlet.



Plate 104. Remains of rotted heel post and bottom girt at Lock 57.



Plate 105. View of the Girard Outlet from the east. Note the tow path bridge abutments at the corners of the lock walls.



Plate 106. Men cranking open the wickets on a Schuylkill Navigation mitre gate.

MAPS AND FIGURES

Figure 1. (Overleaf) 1918 sketch showing detail of wooden lining used in locks and detail of vertical wicket used for lock gates on the Schuylkill Navigation.

Figure 2. (Overleaf) 1883 elevation of drop gate
used on the Schuylkill Navigtion.

Drop Gate

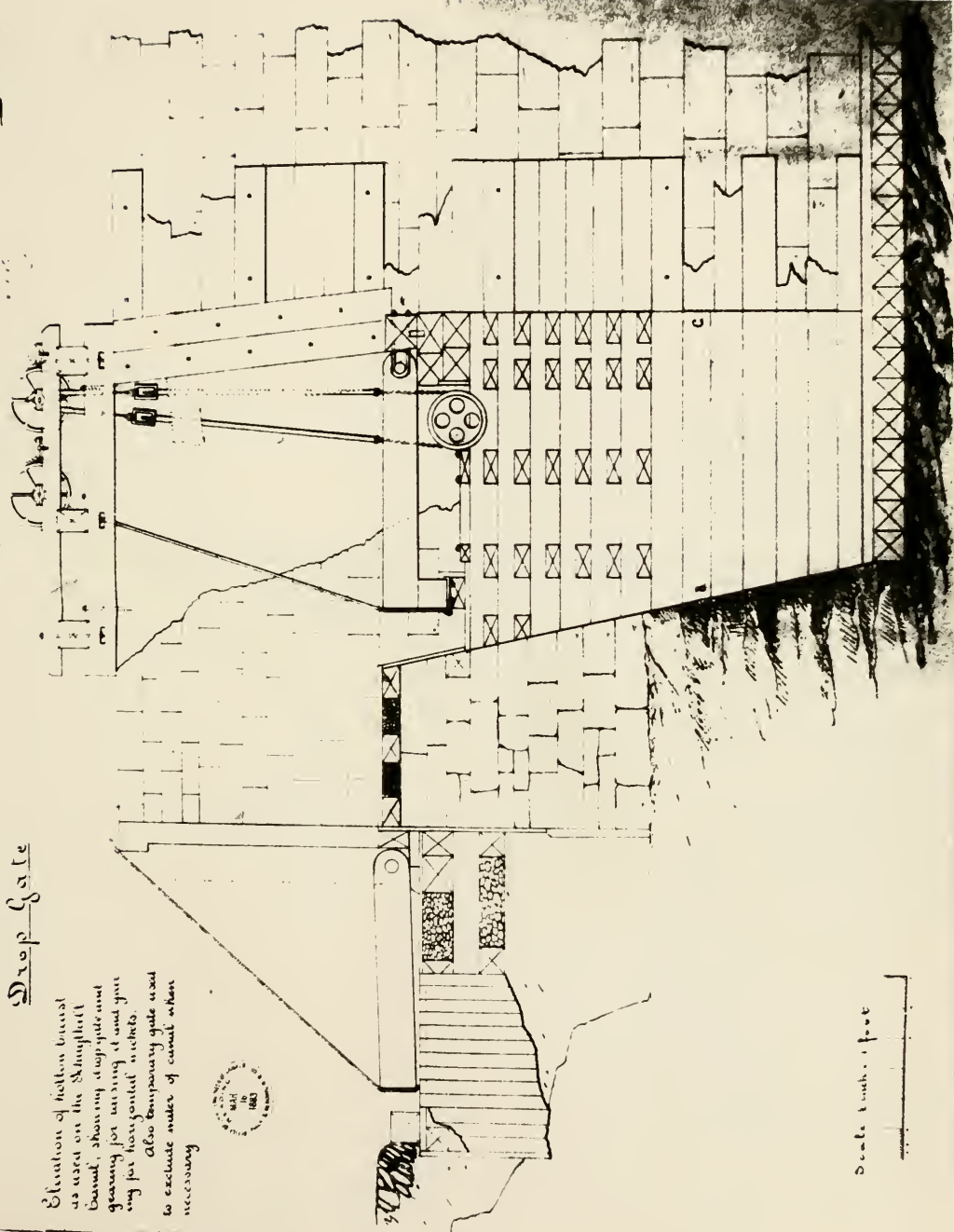
Elevation of hollow barrel as used on the Shimpflett Canal, showing drop-gate and gearing for raising it and gear for horizontal niches.

Also temporary gate used to exclude water of canal when necessary



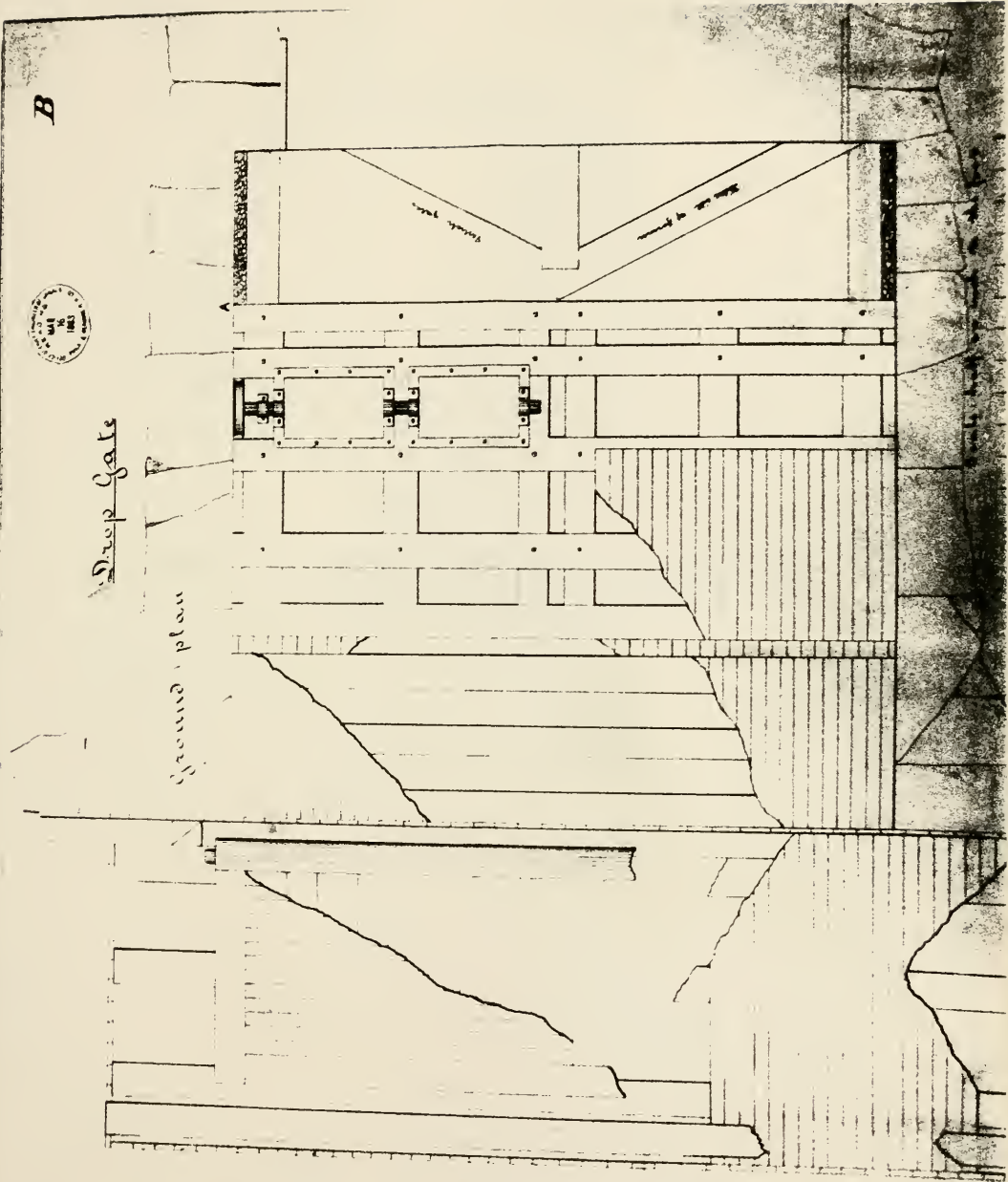
D

Front elevation



Scale 1 inch = 1 foot

Figure 3. (Overleaf) 1883 plan of drop gate and horizontal wickets; note mitre sills on left side of the plan.



B



Drop Gate

Second plan

Drop gate

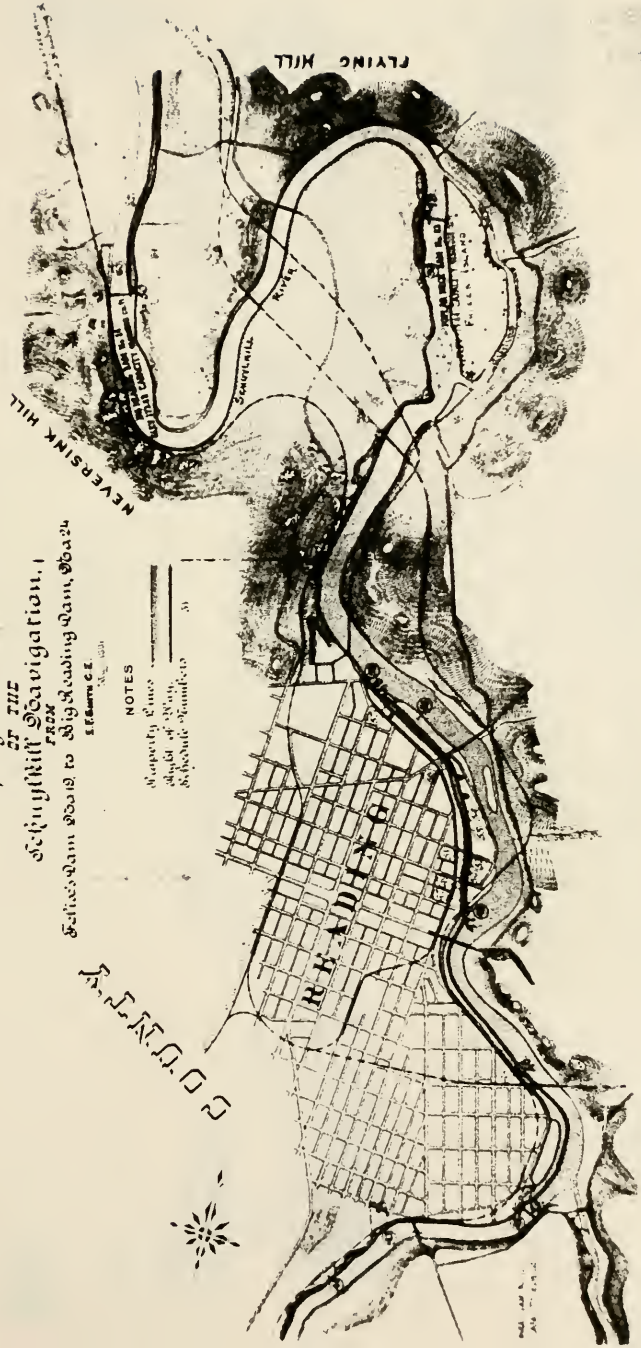
Drop gate

Plan of floor abrest on Chuyffill Canal
 showing arrangement of the frame work, position of the horizontal rubbers and
 the upper drop gate used to exclude the water of the canal to afford access to main
 drop gate and horizontal rubbers

Figure 4. (Overleaf) 1891 map of the Schuylkill Navigation showing Big Reading Dam, No. 24, and the Girard Inlet.

PLAN OF
 Property and Works
 OF THE
 City Mill Navigation,
 FROM
 Schuylkill Dam to Digging Dam, 1862

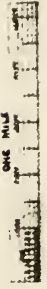
DOUGLASS



NOTES

- Property Lines —————
- Grid of City ————
- Schedule Grounds ————

SCALE
 ONE MILE



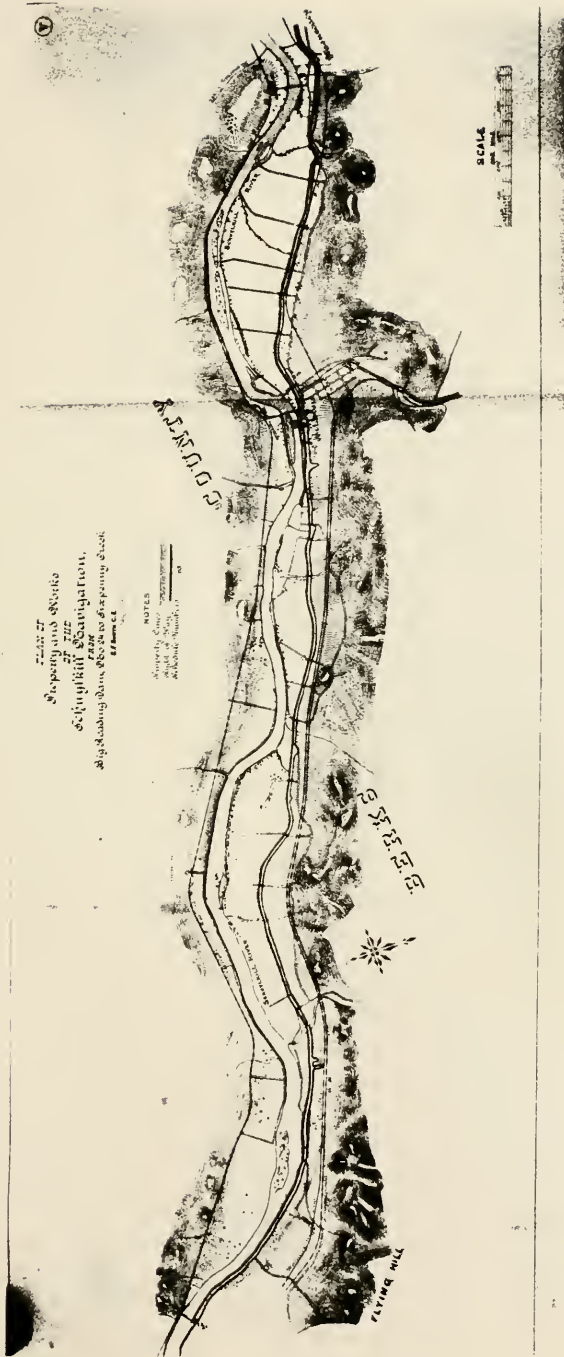


Figure 5.
 1891 map of the
 Schuylkill
 Navigation, Girard
 Canal, from Big
 Reading Dam, No.
 24, to Sixpenny
 Creek.

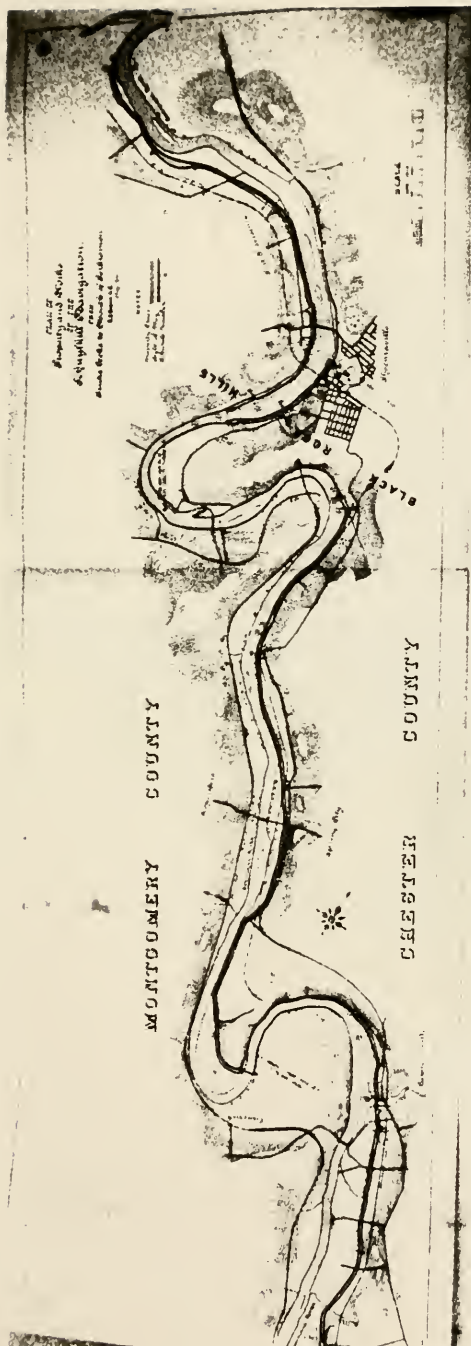


Figure 7.
 1891 map of the
 Schuylkill
 Navigation showing
 the Girard Canal
 from Frick's Locks
 to the Girard
 Outlet.

Figure 8. (Overleaf) Detail of 1891 map of the Schuylkill Navigation showing Frick's Locks, Nos. 54, 55, Lawrenceville Lock, No. 56, and the Girard Outlet, Lock No. 57.

Figure 9. (Overleaf) Map of Dam No. 24 and the
Girard Inlet, 1882-1884.

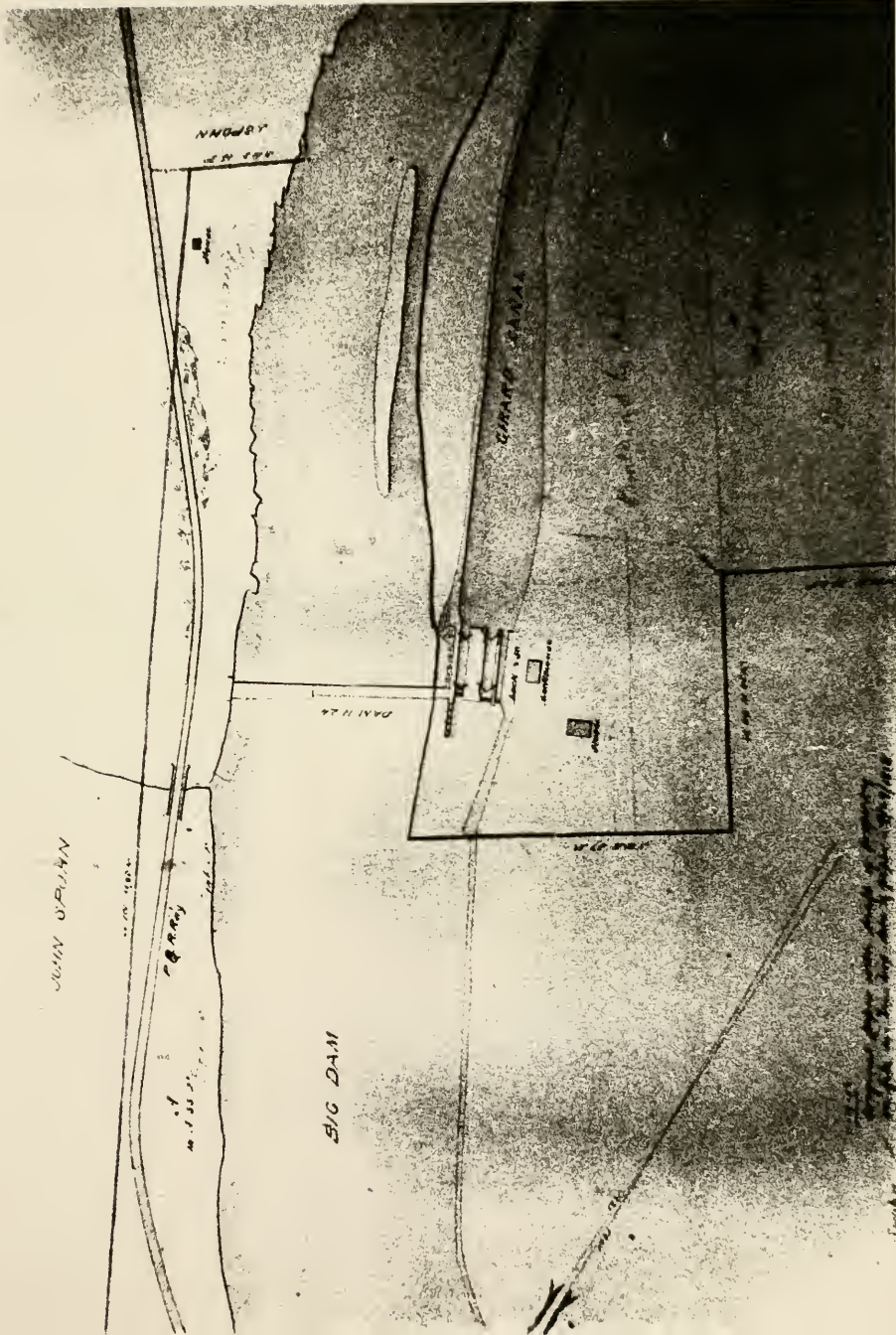
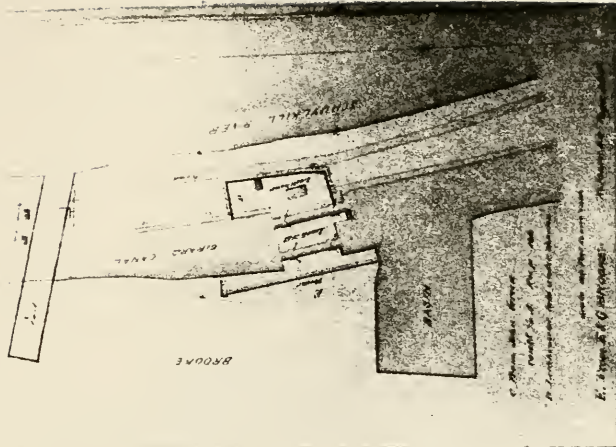
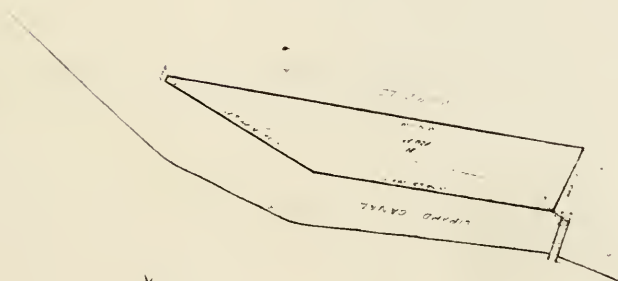


Figure 10. (Overleaf) Maps of the Schuylkill Navigation Company showing Bland's Turn on the left side and the Brdsboro Lock, No. 51, on the right side, 1882-1884.



1. Plan of the Bay
 2. Plan of the Grand Cayal
 3. Plan of the Stairwell
 4. Plan of the Bay
 5. Plan of the Bay
 6. Plan of the Bay
 7. Plan of the Bay
 8. Plan of the Bay
 9. Plan of the Bay
 10. Plan of the Bay

MUSEUM TO



1. Plan of the Liping Cayal
 2. Plan of the Liping Cayal
 3. Plan of the Liping Cayal
 4. Plan of the Liping Cayal
 5. Plan of the Liping Cayal
 6. Plan of the Liping Cayal
 7. Plan of the Liping Cayal
 8. Plan of the Liping Cayal
 9. Plan of the Liping Cayal
 10. Plan of the Liping Cayal

TO THE



1. Plan of the Liping Cayal
 2. Plan of the Liping Cayal
 3. Plan of the Liping Cayal
 4. Plan of the Liping Cayal
 5. Plan of the Liping Cayal
 6. Plan of the Liping Cayal
 7. Plan of the Liping Cayal
 8. Plan of the Liping Cayal
 9. Plan of the Liping Cayal
 10. Plan of the Liping Cayal

Figure 11. (Overleaf) Map of Frick's Locks Nos.
54, 55, 1882-1884.

Figure 12. (Overleaf) Map showing Lawrenceville
Lock 56 and Pigeon Creek Aqueduct.

John Nelson
Schuylkill

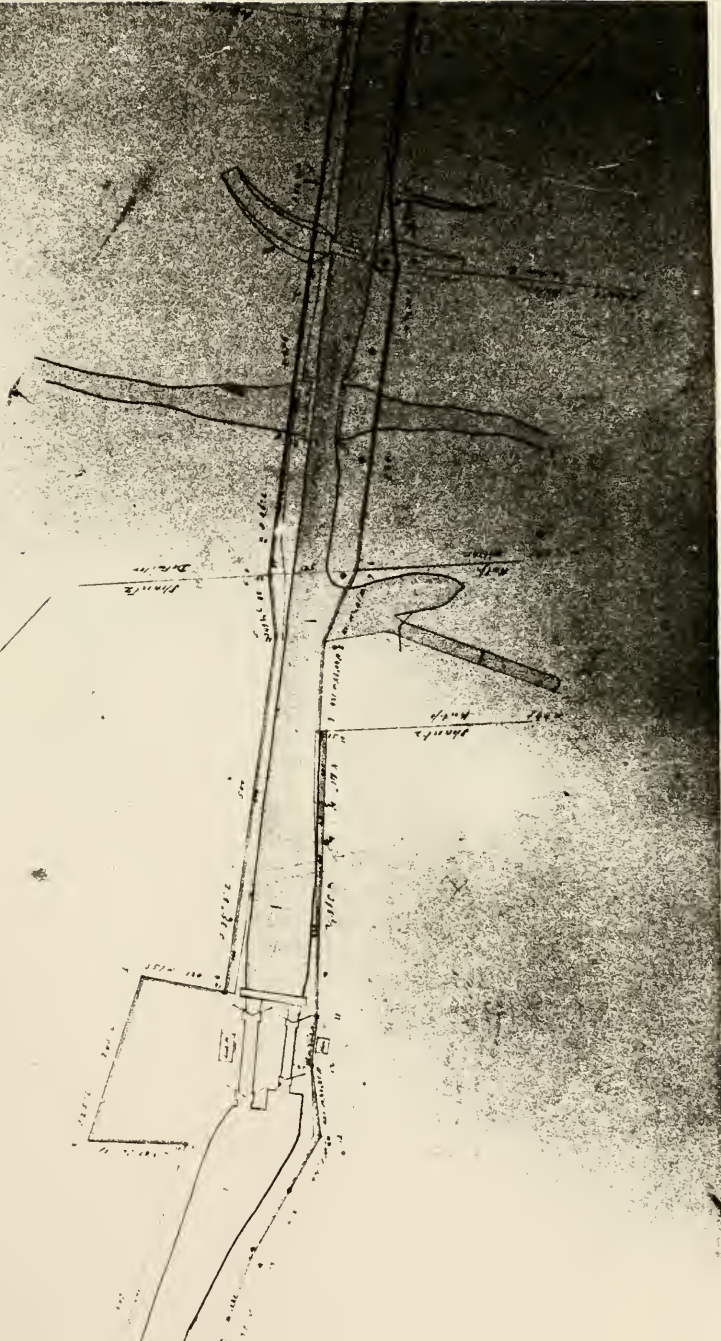


Figure 13. (Overleaf) Map showing Setzler's
Aqueduct and the Girard Outlet, Lock
No. 56.

APPENDIX I

The following list of the structures on the Girard Canal is an extract from a much larger list entitled List of the Works on the Schuylkill Canal produced by the Philadelphia and Reading Railroad Company, ca. 1870. The list contains one hundred and ninety-two entries. All of the items were analyzed. The notation on the right indicates the present condition of the site. The results are to be found in Chapter IV. The notation "unident," for unidentified, is used to denote structures that no longer can be located due to the action of nature or man. Berm banks, canal bottoms, and tow paths represent one continuous waterway and thus the 63 such entries are not treated separately here (see page 57).

LIST OF WORKS ON THE SCHUYLKILL CANAL

Section 6

403.	Dam No. 24 (Lewis' or Big Reading)	Razed
404.	Lie by above Lock No. 5	Filled
405.	Lock No. 50	Ruin/Filled
406.	Lock House at Lock No 50	Razed
407.	Feeder at Lock No. 50	Razed/Filled
408.	Lie by below Lock No. 50	Filled
409.	T. P. [Tow Path] Bridge below Lock No. 50	Razed
410.	Planking in Narrows below Lock No. 50	Unident
411.	Lewis' Waste Weir	Unident
412.	Dick's Culvert	Razed
413.	Beidler's Road Bridge	Ruin
414.	Beidler's Waste Weir	Unident
415.	Mill Trunk at Allegheny Aqueduct	Unident
416.	Allegheny Aqueduct	Stands
417.	Thompson's Road Bridge	Razed/Filled
418.	Green Tree Road Bridge	Unident
419.	Seidle's [sic] Trunk abv. Seidle's Aqueduct	Unident
420.	Seidle's Aqueduct	Stands
421.	John Brown's Farm Bridge	Unident
422.	Seidle's Trunk bel. J. Brown's Road Bridge	Unident
423.	John Philip Brown's Farm Bridge	Unident
424.	Haw's Farm Bridge	Unident

425.	Haw's Waste Weir		Unident
426.	Haw's Road Bridge		Ruin
427.	Haw's Double Culvert		Stands/Ruin
428.	Gicker's Farm Bridge		Unident
429.	Focht's Road Bridge		Unident
430.	Brooke's Upper Trunk		Unident
431.	Brooke's Lower Trunk		Unident
432.	Brooke's Upper Farm Bridge		Unident
433.	Brooke's Lower Farm Bridge		Unident
434.	Brooke's Waste Weir		Unident
435.	Mohr's Farm Bridge		Unident
436.	Hill's Culvert		Razed/ Filled
437.	Hill's Farm Bridge		Unident
438.	Shop at Birdsboro		Stands
439.	T. P. between Lock No 50 & 51	1st mile	
440.	" "	2nd mile	
441.	" "	3rd mile	
442.	" "	4th mile	
443.	" "	5th mile	
444.	" "	6th mile	
445.	Berme Bank	1st mile	
446.	Berme Bank bet. Lock No. 50 & 51	2nd mile	
447.	" "	3rd "	
448.	" "	4th "	
449.	" "	5th "	
450.	" "	6th "	
451.	Canal Bottom bet. Lock No. 50 & 51	1st mile	
452.	" "	2nd "	
453.	" "	3rd "	
454.	" "	4th "	
455.	" "	5th "	
456.	" "	6th "	
457.	Lie by above Birdsboro Lock No. 51		Filled
458.	Lock No 51, Birdsboro		Stands/Filled
459.	Lock House at Lock No. 51		Stands
460.	Feeder at Lock No.51		Filled
461.	Lie by below Birdsboro Lock No. 51		Stands
462.	Double Iron Pipe Sluice below "		Ruin
463.	Birdsboro Road Bridge		Unident
464.	Hay Creek Aqueduct		Ruin
465.	Hook's Farm Bridge		Ruin
466.	Kupp's Upper Farm Bridge		Unident
467.	Harrison's Waste Weir		Unident
468.	Harrison's Trunk		Unident
469.	Mohr's Trunk short dist[ance]-bel. Harrison		Unident
470.	Mohr's Farm Bridge --Rays-- [Rea's]		Unident
471.	Campbell's Ford Road Bridge		Razed/Filled
472.	Bland's Turn Road Bridge		Razed/Filled

Section 7

473.	Bland's Turn Dirt-Traps	Unident
474.	Bland's Turn Waste Weir	Stands
475.	Kirlin's Farm Bridge	Unident
476.	Hartman's Culvert	Ruin
477.	Hartman's Bridge	Unident
477 1/2.	Small wooden trunk above 6 Penny Creek Aqueduct formerly used for navigation	Unident
478.	Brick Culvert at Sixpenny Creek for mill race	Unident
479.	Monocacy Road Bridge	Unident
480.	Miller's Waste Weir	Unident
481.	Hop Yard Ford Bridge	Unident
482.	Lynche's Farm Bridge	Unident
483.	Lynche's Waste Weir	Razed
484.	Kupp's Farm Bridge	Unident
485.	Ryan's Trunk	Unident
486.	Flannery's Farm Bridge	Unident
487.	Linderman's Waste Weir	Unident
488.	Linderman's Stop Gate	Ruin
489.	Linderman's Road Bridge	Unident
490.	Linderman's Trunk	Unident
491.	Port Union Road Bridge	Razed/Filled
492.	Port Union Trunk	Unident
493.	Gunson's Trunk	Unident
494.	Kirlin's Aqueduct	Razed
495.	[sic]	
496.	Kirlin's Trunk	Unident
497.	Yocum's Road Bridge	Unident
498.	Unionville Road Bridge	Razed/Filled
499.	Snyder's Culvert	Stands
499 1/2.	Buildings at Co. Farm	Razed/Filled
500.	Steinmetz's Trunk at Co. Farm	Unident
500 1/2.	County Road Bridge at Reiffsnnyder's Farm	Unident
501.	Laurel Hill Waste Weir	Unident
[sic]	Public Road Bridge at Laurel Hill W. Weir	Unident
502.	Neimans Road Bridge	Unident
503.	Lie By abv. Lock 52-3 Laurel Hill	Stands
504.	T. P. bet. Lock 51 & 52-3	1st mile
505.	" "	2nd "
506.	" "	3rd "
507.	" "	4th "
508.	" "	5th "
509.	" "	6th "
510.	" "	7th "
511.	" "	8th "
512.	Berme Bank Bet. L. 51 & 52-53	1st "
513.	" "	2nd "
514.	" "	3rd "
515.	" "	4th "
516.	" "	5th "

517.	"	"	6th	"	
518.	"	"	7th	"	
519.	"	"	8th	"	
520.	Canal Bottom bet. L. 51 & 52-3		1st	"	
521.	"	"	2nd	"	
522.	"	"	3rd	"	
523.	"	"	4th	"	
524.	"	"	5th	"	
525.	Canal Bottom bet. L. 51 & 52-53		6th	"	
526.	"	"	7th	"	
527.	"	"	8th	"	
528.	Lock No. 52-3; Laurel Hill				Stands
529.	Lock House at Lock 52-3				Stands
530.	Feeder at Lock No. 52-53				Stands
531.	Lie by below Lock No. 52-53				Stands
532.	Price's Culvert				Stands
533.	Price's Road Bridge				Unident
534.	Reiff's Farm Bridge				Unident
535.	Reiff's Waste Weir				Unident
536.	Pottstown Landing Road Bridge				Unident

Section 8

537.	Root's Trunk				Unident
538.	Pottstown Turnpike Bridge				Ruin
539.	Stoever's Farm Bridge				Unident
540.	Parker's Landing Road Bridge				Unident
541.	Geist's Road Bridge (Jones)				Unident
542.	Jones' Culvert 2 arches				Ruin
543.	Evan's Farm Bridge				Unident
544.	Grubb's Culvert 1 arch				Stands
544 1/2.	Grubb's Farm Bridge				Ruin
545.	Sheffy's Trunk				Unident
546.	Sheffy's Waste Weir				Unident
547.	Heister's Waste Weir				Stands
548.	Heister's Bridge				Ruin
549.	Wharf on Bern Side abv Lock No. 54-5				Ruin
550.	T. P. bet. Lock 52-3 & 54-5;		1st	mile	
551.	"	"	2nd	"	
552.	"	"	3rd	"	
553.	"	"	4th	"	
554.	T. P. Lock 52-3 & 54-5;		5th	"	
555.	Berne Bank	"	1st	"	
556.	"	"	2nd	"	
557.	"	"	3rd	"	
558.	"	"	4th	"	
559.	"	"	5th	"	
560.	Canal Bottom bet L. 52-3 & 54-5		1st	"	
561.	"	"	2nd	"	
562.	"	"	3rd	"	

563.	"	"	4th	"
564.	"	"	5th	"
565.	Lock No. 54-5;	Frick's		Ruin/Filled
566.	Lock House at Lock No	54-5		Stands
567.	Feeder at Lock	54-5		Filled
567	1/2. Road Bridge across tail of L.	54-5		Razed
568.	Frick's Trunk			Stands
569.	Frick's Aqueduct			Ruin
570.	Baugh's Farm Bridge			Unident
571.	Walt's Road Bridge			Razed/Filled
572.	Walt's Waste Weir			Razed
573.	Walt's Trunk			Razed
574.	Foundry Road Bridge			Razed/Filled
575.	T. P. bet. Lock	54-5 & 56		
576.	Berne Bank bet. Lock	54-5 & 56		
577.	Canal Bottom			
578.	Lock 56; Lawrenceville			Ruin/Filled
579.	Lock House at Lock	56		Stands
580.	Feeder at Lock	56		Filled
581.	Pigeon Creek Aqueduct			Ruin
582.	Old Mill Trunk			Ruin
583.	Setzler's Aqueduct			Ruin
584.	Towpath between Lock	56 & 57		
585.	Bern Bank	"	"	"
586.	Canal Bottom	"	"	"
587.	Lock	57	"	"
588.	Lock House at Lock	57		Stands
588	1/2. Tow-Path bridge across tail of Lock No.	57		Razed

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