HISTORIC STRUCTURE REPORT
GUARD LOCK NUMBER 4
CHESAPEAKE AND OHIO CANAL

PART I

Historic Data Section
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Introduction

The purpose of this report is to present all of the documentary evidence that has been located pertaining to the construction of Guard Lock Number 4, Stop Lock Number 4, and the flume associated with the Guard Lock.

Construction of Guard Lock Number 4

Guard Lock Number 4 served two purposes in connection with the operation of the C & O Canal. One was to feed water from the impoundment above Dam Number 4 to the 23.2 miles of canal between Guard Lock 4 and Guard Lock 3 across from Harpers Ferry. The other was to provide ingress and egress between the slackwater above the dam, which was used for navigation for 3.3 miles, and the canal.

The guard lock is located one mile and 320 yards above Dam 4. The lock and dam were connected by a guard wall or dyke, whose purpose was to protect the towpath and canal from the impounded water of the slackwater.
In March 1933, the President and Board of Directors authorized the Resident Engineer of the Fourth Residency, Thomas F. Purcell, to enter into a contract with Joseph Hallam, contractor for Dam Number 4 and his partner, Harry, to construct a guard lock above the Dam.

The contract, which has not been preserved, was negotiated within a short time.

The following is the specification for a guard lock:

The foundation shall be excavated feet wide, about feet below the bottom of the Canal on the lowest level. At each end of the Lock the excavation, so far as may be necessary for the wing walls will be forty-six feet wide. The length of the Lock will be one hundred and forty-eight feet, the width of the Chamber fifteen feet, and the length between the Gates one hundred feet. The inlet walls will be fourteen feet long, measured from the upper hollow quoins; the outlet walls will be fourteen feet long; and from the termination of the inlet and outlet walls there will be wings splaying sixteen feet in length, measured in the continuation of the Lock walls.

When the foundation shall have been excavated to its intended level, seventy timbers, hewed two by twelve inches, and feet long, and twelve other timbers, of an average length of forty feet, and of the same size as the last, shall be laid thereon, so that each timber shall rest firmly on the bed prepared for it. The whole of the upper surface formed by these timbers shall be dressed to a uniform plane. Three courses of sheet pile plank, two inches thick, and extending at least five feet below the bottom of the timbers, shall be driven entirely across the Lock and its walls, and be lathed, secured, and arranged, as directed by the Superintending Engineer. The space between these timbers and in front of each row of sheet piling, shall then be well raked and puddled. The whole of these timbers will be covered with a course of well jointed three inch yellow pine planks; each and every plank to be secured to the timbers below by at least nine locust tree-nails, and a quarter inches square and nine inches long.

When the masonry is completed, there shall be a second course of planking, of first rate heart pine, two inches thick, well jointed and squared, and laid, as nearly water tight as possible, over the whole of the other planking, from the breast of lock throughout the chamber, and ten feet below the lower gates. There shall be two spikes, not less than eight inches long, at each end of each plank, and at least ten tree nails, of one inch diameter, and nine inches long, in each plank, to secure it well to the timbers below.

MASSONRY

The main walls will be feet thick at the bottom, and four feet at the top, but the thickness may be increased or diminished as local circumstances may require or justify.

All the face stone to be well dressed with the hammer and coursed in every part of the lock which is exposed to view when the lock is completed. No course of stone to be less than a foot thick, and no stone for face work to have less than eighteen inches bed. The stone to be of a quality to endure frost and ice, and such as shall be approved by the Engineer or Superintendent of Masonry of the Company. The stone for the backing or dead work, to be of such size and quality as shall make the best of durable and solid wall.

On the face stone, for face work, there shall be a header or bond stone for at least every ten feet in length on each course, dividing the spaces in every upper course between the headers in the course below, which shall not be less than two feet in width on the face, and generally wider, and shall extend at least four feet into the wall.

The stone shall have parallel beds in all cases; or, in most, not deviating one quarter of an inch from the parallel beds, so as to lie firm and solid on each other. No stone called a stretcher shall be less than three feet long, nor its ends (tileable) an even joint with the ends of the adjacent stones of less than twelve inches throughout. The coping shall not be less than twelve inches thick and three feet wide, of a uniform thickness, and be so laid as to prevent a nearly uniform width on the top, which shall be fairly and handsomely cut. There shall be iron cramps of such sizes as shall be directed, to connect the coping around the gates, and from the gates to the lower gates to the lower and upper ends of the locks. If bolts at the head of the locks shall be found better to connect, in one solid mass, the three upper courses of the splayed corners, so as
to prevent any stone from being started by the stroke of a
loaded boat, they shall be put in, in such manner as shall
be directed, and secured by lead.

The backing against the face work of the Lock shall be
well selected flat stone, of durable quality, and the whole
masonry, both backing and face work, shall be grouted at each
course in height, in such manner as that there shall be at least
three bushels of cement used to each perch of masonry. This
cement must be of the best quality which the upper country will
afford, to be approved by the Superintending Engineer, and
shall be transported from the mill to the works and preserved
there until used, in such manner as the Engineer may in writing
direct. The sand must be clean and sharp, and if not found
naturally, combining these qualities it must be washed.

The walls of the Locks will rise to the height of one foot
above the intended surface of the water, in the upper level, the
depth of water in each level being six feet. The lower wains'
will be sloped downwards inclining to the level of the lower
towing path.

The breast of the Lock shall be of a masonry similar to
that prescribed for the Lock walls; its thickness will be six
feet at bottom and four feet at top. The breast is to be closed four
feet wide, and the coping may be formed of two pieces clamped to-
gether; the position of this breast will be above the recess of
the upper gates.

The plan of the masonry, as to its foundation, elevation
and thickness of the courses of the face stone, shall be furnished
each Contractor, and if any explanations are necessary, they shall
be given by the Engineer or Superintendant of Masonry, at all times
when required.

When the masonry of a Lock is completed, according to the
intention as above, the Lock walls shall be backed up with earth
behind them, so as to be level with the coping, and in such manner
as shall be directed by the Engineer. Pudding behind the walls
may be required as the work progresses.

The timber sills shall be of good locust timber; they shall
be nine inches thick, planed, jointed and framed, in the best
manner; the lowest timber sill shall be placed immediately on the
flooring of three inch planks before mentioned, and the upper sill
shall be placed on a platform of well jointed timbers one foot thick,
laid close together, of the breadth of the chamber of the Lock and
a length of six feet; these nitre sills and platform to be secured by tree mallees and iron bolts of a size and quality to be directed by the Engineer of the Company.

Dry walls of good stone will be built from the wing walls, to the bank or left side of the Canal.

LOCK GATES

The upper will be one foot shorter than the lower Gates of the Lock, and the Lock will be filled and emptied through the Gates by means of cast iron paddle valves placed thereon of such size and form as the Engineer may adopt. There will be two of these paddles in each gate, or eight to each Lock.

The Heel and Teeposts, and Balance Beams shall be made of the best straight grained, sound white oak timber; the Heelposts will be twelve by fourteen inches, the Teeposts will be ten inches square, and the balance beams will be ten inches square at the smaller, and sixteen inches square at the larger end, and the length will be twenty-four feet each.

The arms of the Gates must be made of the best sound locust timber, and the upper and lower arms to be ten inches, and the intermediate one eight inches thick; these arms are to be framed so as to be two inches longer on the upper side, than they are on the lower side of the gate, and the Heel and Teeposts to be so bevelled as to form the nitre with the arms. The arms of each Gate will be about two feet apart, measured vertically. The Gates shall be planked on the upper side with two inch heart yellow pine, and by rabbiting the Heelposts, Teeposts, and the upper and lower arms, the surface of the plank shall be made to range flush with the surface of these timbers. The arms of each Gate shall be secured to the Heel and Teeposts by six sets of L's and T's with shanks eighteen inches long, ten inches broad and five eights of an inch thick. Each set of L's and T's to be secured by five screw bolts about five eights of an inch square. The lower side of the Gates shall be planked up as the Engineer may direct.

Each Heel and Teepost, shall be secured at the lower end with an iron bank on inch thick by two inches bread. The Balance Beams shall be fastened to the Teeposts by approved iron straps.

The entire Gates shall be smooth planed, well framed, and put together in the best manner and the whole painted with three coats of paint. The iron rods which are intended to work the valves shall be two inches diameter, of suitable length and furnished with proper iron handles.
Any stone or other material excavated from the Lock pit, if approved by the Engineer, may be used in the construction and embankment of the Lock, but the surplus material excavated shall be deposited at any place the Engineer may direct within the distance of one hundred and twenty feet from the pit.

Where stone may be required for the construction of the Lock, and the Contractor cannot agree with the owner thereof, for the same on reasonable terms, the President and Directors will upon application cause the same to be condemned according to the Charter of the Company, the Contractor paying the expense of the condemnation as well as the sum awarded by the Jury, for the stone.

Should the Lock be placed on rock, and the foundation of timber be dispensed with, either in whole or in part, the Engineer shall judge the difference in cost between the timber foundation dispensed with and the extra masonry necessary for the foundation as high up as the floor of the Lock, which difference shall be deducted from, or added to, the estimate on the Lock as the case may be.

The details of the story of the construction of the guard lock are not reflected in the Canal Company's papers. A change in the division of responsibilities of Engineers Purcell and Fisk took place, which may have affected the keeping of a more nearly definitive set of records.

Purcell's records, usually careful and detailed, are almost silent on this structure; and Fisk's correspondence contains no illuminating references.

2 Records of the C & O Canal Co., National Archives
Construction of the Guard Bank

The Guard lock was connected to Dam Number 4 by a "guard bank." which was built during 1833 and 1834. Canal Company papers contain no data concerning the original construction of the guard bank. The canal from Dam 4 downstream was opened in December, 1834, and shortly thereafter Purcell wrote the following to the President and Directors of the Company:

"Permit me to draw your attention to that part of the Canal lately finished between Hollands Dam (Dam 5) and Guard Lock No. 4. The guard bank designed to keep the water of the river in times of high freshets from entering the canal needs raising and strengthening. The bank from 6 to 10 chairs below the Dam should be raised and such other security as may appear to the Superintending necessary on inspection should be attended to without delay; for should the spring freshets overtop this bank great injury will result."

The enlarging of the guard bank was placed under the direction of Charles Fisk, in whose superintendency that portion of the canal had been placed.

Fisk prepared the following specification, in preparation for letting a contract for the new works:

**SPECIFICATIONS**

for enlarging the guard bank from the Abutment at Dam 4 of the C & O Canal to Guard Lock No. 4 - and thence to the hill. Also, for enlarging the securing the Gd Lk from the Abutment across the Stop Lock to the hill.

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3 Records of the C & O Canal Co., National Archives, ltr., Ingle to Edward Colsten, Jan. 17, 1834; ltr., Purcell to President and Directors, Dec. 19, 1834

4 Ibid., ltr., Ingle to Fisk, Dec. 24, 1834.
At and near the abutment of Dam No. 4 - and Guard Lock
No. 4, the embankment will be more than 7 feet in width, but
between the Abutment and the Lock, the general width will be
7 feet on top, with inner and outer slopes of 1 h to 1.

The height of the bank from the abutment across the Stop
Lock to the hill, and for 100 feet from the abutment towards
the Guard Lock, shall be that of the top of the said abutment
after which it shall rise, with a uniform grade (of 24/100
of a foot in each fifty feet) to the head of the Guard Lock,
where it shall be 3 feet higher than at the Dam.

At such points as in the opinion of the Engineer it is
required, and before the embankment shall be commenced at or
near such points, there shall be made a dyke of rock, 5 feet
wide on top at the level of the low water in the pool of Dam
No. 4, with slopes of 1 to 1, against the inner side of which
the embankment shall be made. From the top of this dyke and for
such distance above and below it, as the Engr. may direct, the
slope of the embankment shall be protected by stone, to such
height and of such thickness as may be deemed necessary by the
Engr.

If it should be necessary to move in a part of the Guard
Bank, so as to occupy [8½] the whole or a part of the width of
the Tow-path, there shall be made by the contractor, such road
to & from the Guard Bank, as may be necessary for the convenient
proposed boat teams, and he shall also conduct his work in making
the embankment at such point in such manner as to cause the least
possible interruption to free passage to boats and boat teams.

Before any embankment shall be made the whole space to be
covered by the bank or so much thereof as may be required by the
Engr. shall be well grubbed and cleared of all trees, brush,
roots, grass, heavy stones and shall then be well ploughed and
cross ploughed. The earth shall be carted in in horizontal
layers not exceeding six inches in thickness and the length
of a piece of embankment made at one time, shall not be less
than 200 feet.

The Bens Bank from which the earth will be hauled shall
be cut with a uniform slope of 1 to 1 down to the level of the
bottom of said excepting only a small bank next to the Canal,
which shall not be more than 6 inches higher than the water line
of the Canal. 5

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5 Records of the C & O Canal Co., National Archives
The firm of Byrne and Company was engaged to enlarge the guard bank. In the course of the work the embankment was increased from 39,100.5 to 43,017.3 cubic yards, an increase of approximately ten per cent. The rear bank was excavated to widen the canal and to provide material for the embankment. The dike of the bank received 1,234 cubic yards of material, and 451.7 cubic yards of rip rap were installed. 6

Purcell's letter to the President and Directors of December 19, 1834, had recommended the installation of a pivot bridge across the guard lock. 7 In the instructions given Fisk, the Company left to his discretion the determination of the type of bridge installed. 8 He chose to install a simple bridge that would accommodate the rules. 9 It is probable that this was intended to be a temporary expedient, but a more elaborate structure was never erected.

Construction of the Pier Head

The only other construction, excepting the trunk of the canal between the dam and the guard lock concerning which data was found was a "pier head" above the guard lock. Built by Benjamin Polley, its construction entailed 1,550 cubic yards of excavation; 1,044 cubic yards of embankment; 2,086.2 perchas of dry wall; 855.16 perchas of rip rap for the outside wall, and 195 perchas of stone. 9

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6 Ibid., Balance Sheet: Repair of Guard Bank at Dam No. 4, Chie. & Chie. Canal.
7 Ibid., ltr., Purcell to President and Directors, Dec. 19, 1834
8 Ibid., Ingle to Fisk, Dec. 24, 1834
9 Ibid., Records of Estimates from Section No. 133 to Section No. 202 (inclusive), pp 292-3.
Construction of Sections 156, 157, and 157

The sections of the trunk of the canal lying between Dam Number 4 and the impounded slack water were Sections 156, 157 and 157. The estimate book recorded the following data for those sections:

Section 156

Excavation, Earth &c. = 265,523 cubic yards

Excavation, Rock = 250 cubic yards

Excavation, Slate = 0

Embarkment pd as Ex over 120 ft = 6,440 cubic yards

* not pd = less than 120 ft = 330 cubic yards
* = = = over 120 ft less 1/4 mile = 14,650 cubic yards
* not pd = over 1/4 mile = 10,020 cubic yards

Walling from Canal = 0

* not = = 3,120 perches

The final assessment was dated April 16, 1834

Section 157

Excavation, Earth &c. = 362,701 cubic yards

Excavation, Rock = 1,733 cubic yards

Excavation, Slate = 0

Embarkment pd as Ex over 120 ft = 0

* not pd = less than 120 ft = 330
* not pd = over 120 ft less than 1/4 mile
* = = over 1/4 mile

Walling from Canal = 0

Walling not from Canal = 0

Spoil Bank = 75,437.9 cubic yards

Final Assessment: February 1, 1834

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Excavation, Earth Gravel &c = 212,752 cubic yards

Excavation, Granite or other Rocks = 0

Excavation, Slate = 0

Embankment Pd as Ex on over 120 ft = 17,377 cubic yards

- Not Pd = less than 120 ft = 3,035 cubic yards
- " " = over 120 ft less than 1/4 mile = 0
- " " = over 1/4 mile = 0

Walling from Canal = 0

- Not = 5431 perches

Spoil Bank Transformed over 120 ft = 53,742 perches

- " " = 155 ft = 53,620 perches

Tinder under wall = 1615 feet

Final assessment - April 7, 1894

Stop Gate and Control Gate

Two masonry components of the Dam No. 4 complex, i.e., the Stop Gate (sometimes identified as a Stop Lock) and the Control Gate have posed some unanswered problems. Documentary data pertaining to these structures is very scanty. Neither construction information nor dimensional statistics were located among the Records of the C & O Canal Co. Engineer Thomas Purcell's "Records of Estimates from Section No. 133 to Section No. 202" contains no references to either unit; neither do his letter books. Purcell was the Resident
Engineer for the portion of the Canal that included the Dam 4 area during the period of original construction; and his records are almost invariably full and well organized. Purcell was succeeded in this position by Charles B. Fick, an able engineer who left less useful records. A careful search of Fick's correspondence with the President and Directors of the Canal Company has failed to reveal any data on these features. The Index of the Proceedings of the President and Directors and the Proceedings for the years 1832 - 3 was examined, with negative results.

The Records of the Topographical Bureau, War Department, National Archives, were examined for the years 1832 - 1859. These contain no references to the subject features.

At first blush, it would appear that both structures were built several years after the construction of the dam and guard lock. However, in so far as the Stop Gate (Lock) is concerned, this assumption is obviously erroneous. The first paragraph of the specifications for the guard bank, cited on page 7, include the statement: "... Also, for enlarging and securing the Gd Bk from the Abutment across the Stop Lock to the hill." This indicates that this structure was in place prior to the end of 1834.

References to the structures at Dam No. 4 are contained in the Records of the Circuit Court of Washington County, Maryland, in connection with the case: Brown et al Trustees vs. The Chesapeake and Ohio Canal Co. Two documents, dated June 13, 1839 and May 18, 1850, report on the results of the flood of May, 1839.
The first of these was in connection with the Dam 4 area:

... at Guard Lock No. 3. The gates are gone, the backing washed out and lock filled. Also the new Lock House is washed out.

On the same level the Company boarding house and other buildings are gone. There is a break on Feeder level below Dam No. 1, 30 feet long and 3 feet below bottom. The stop logs and lock house here are gone. In the protection breake between stop lock and Feeder No. 4; there are two breaks aggregating 13.00 ft. in length, 27 ft. wide and 11 ft. deep. The Gates and lock house are gone.

The May 10, 1850, report noted:

Dam No. 4 is a Masonry Dam, built about twenty years ago to supersede the old crib dam originally erected at that point. The Guard Lock through which boats enter the Canal from the pool of the dam, is about a mile above the dam. The head walls of this guard lock were raised after the freshet of 1852 so as to be higher than a similar freshet - (the freshet of last year was eight feet and seven inches higher at that point than the freshet of 1852) - This guard lock was connected with the main land by a bank of equal height and with the dam abutment by a guard bank between the Canal and river. The abutment of the Dam was connected by a high embankment with a Masonry Stop-gate which was connected with the high ground to the East of it by a bank. This guard bank which was about twenty-five feet above the level of the Canal was intended to bar out all water from the Canal below the Dam, especially with the passage at the stop lock closed by stop timbers, but the late freshet overlapped these barriers making a breach in the bank at the guard lock, another through the guard bank above the Dam abutment; it swept away the bank connecting the stop gate with the Dam abutment and carried out some six hundred feet of the tempath...

A brief search was made of the Canal Company papers of the period of receivership. However, this portion of the collection is in a poor condition, not lending itself to a rapid search; and no construction data...

11 Reserv'd, Circuit Court of Washington County, Harford, Hagerstown, Md.
on the subject structure was located.

The Level Books, prepared in connection with repairs made in 1855-1 were consulted, both contained data re: the dam, temple, guard lock, guard bank, and stop gate (1836). Also included is a delineation of the control gate and the flume around the guard lock.

The Kickel Map of the S & O R., 1856, contains a delineation of the Dam 4 complex, including the control structure and its flume.

On the basis of the above cited evidence, which fails for short of proof, the writer believes that: (1) the Stop Gate (Lock) was constructed shortly after Purcell was succeeded by Fisk as Resident Engineer in the early part of 1835; (2) that the flume around the guard lock and the gate controlling it were installed sometime prior to 1835, possibly during the 1870's, when the heavy traffic using the guard lock made an increase in the supply of water below the lock necessary.

Conclusion

The paucity of documentary evidence would render any conclusions based thereon very tenacious. However, this evidence, until with a study of engineering data and a study of the physical remains of the structures, should result in a valid picture of the construction of the complex as Dam No. 4 that could be useful in restoring and interpreting the portion of the Canal that extends downstream from the slackwater above the Dam to Lock No. 43.

Note: If these were installed in the 1870's the absence of information concerning construction may be explained by the loss, through fire, of Company papers in President Jackson's possession.