PRESIDENT'S MESSAGE

By this time most of you are aware that our ACS Vice President, Dr. Bill Trout, has left California permanently and is now residing at his family home in Richmond, Virginia. One of our most ardent researchers, Bill has recently developed a computerized list of American Canals by State; a listing of American Canals arranged Alphabetically, a World Listing of Canal Passage Stamps; a listing of Canals on the National Register of Historic Places; an updated listing of Canal Trips in the United States; and a working on a Bibliography of Historic Sites in Stream Beds.

In the past, Dr. Bill has also developed (and published) three excellent regional AMERICAN CANAL GUIDES, and is working on the fourth regional guide right now. He is also currently working on a complete History of the Canals of Virginia, which should soon be in print. It may be necessary for ACS to set up a special Sales Agent to handle all of the valuable "tools of the trade" which Bill Trout has developed. In the meantime, it is suggested that anyone having urgent need for any of the above studies might write Bill directly at 35 Towana Road, Richmond, Virginia 23238.

When not busy on research, Bill Trout is also administering the affairs of the Virginia Canals and Navigations Society as President!

Since the last issue of AMERICAN CANALS, the following have joined ACS as LIFE MEMBERS: William A. Sprowls, Indianapolis, Indiana; Diamond Harris, Vancouver, B.C., Canada; and Dr. Roger Quirey, England. This brings the total to 33 dues-paying members of the Society who have made a donation of $100 or more for a permanent place on our mailing list. As of October 1, 1983, ACS LIFE Membership will be increased to $150.

The regular issue of AMERICAN CANALS for May of 1983 is somewhat more brief than usual because of the necessity for a special eight-page insert of Dennis McDaniel's excellent study on Indiana Canal Canals, as published in a recent issue of THE INDIANA MAGAZINE OF HISTORICAL McDaniel is the Director of the Peabody Museum in Baltimore and an ACS Life Member.

Bill Shank

LOWELL CANAL TOURS

Lowell (Mass.) National Historical Park's summer tour season featuring the popular Mill and Canal Tour began May 28, 1983. The Mill and Canal Tour, a three-hour journey by boat, is a hearken to the history of Lowell's mills, canals, and people. The tour includes a mill exhibit, working machinery, and a ride on the Northern and Pawtucket canals. Reservations are required for this free tour which will be offered nine times daily through October 10, 1983. For information and reservations call (617) 459-1000.

OLD LOCK GETS NEW LIFE

In June 1982, the Weirton Dam Preservation Association held the official opening of rebuilt "Old Lock One" for the Second Welland Canal in Port Dalhousie, St. Catharines.

The following is an excerpt from the speech given at the opening by W.C.A. President, Richard R. Fair.

"One hundred and fifty-four years ago, on a chilly November day, there was another ceremony taking place at this very spot, ... The occasion was the official opening of the First Welland Canal. Crowds of excited onlookers lined either side of these banks to cheer as the first two schooners were sent on their historic voyage to Buffalo, New York.

"Lock One looked much different in 1829. It was smaller and made of oak timber, but it did its job during those important first years of the canal.

"Within a decade, the picture changed: Lock One, along with the other thirty-nine wooden locks of the original canal, was rapidly decaying and in need of replacement. Steamships were beginning to replace the smaller sailing vessels, and costly canal maintenance had brought financial ruin to the Welland Canal Company.

"In 1837, the Province of Upper Canada took over the Canal and proceeded with plans to construct a second one roughly paralleling the original route. The locks were increased in size, rebuilt using local timbers, and reduced to twenty-seven in number.

"Lock One was given special attention when rebuilt. It was made 50 feet longer and 10 feet wider than the standard lock, to allow steamers to enter the canal .... By 1846, the small village of Port Dalhousie was fast becoming a bustling town centered around the busy canal. Shipyards and factories developed, and homes flourished with the constant flow of sailors.

"Lock One remained in service until the completion of the Third Canal, in 1881, after which it fell victim to abandonment, neglect, and progress. Three-quarters of its length was filled with rubble and dirt while Lake Ontario was built over its southern end.

"In 1981, in cooperation with the City of St. Catharines, and with the assistance of a Canada Community Development Project Grant and numerous private donations from residents of our community, the Welland Canal Preservation Association began digging out the remains of these beautifully intact walls of Old Lock One .... Today, as you can see, a long time has been transformed into a place where residents and visitors can stroll, sit and reflect on the beauty, workmanship and historical significance of this spot, the beginning of the Second (and final) Welland Canal.

"Development of the remainder of the park is well underway and is worth a visit.

(From Autumn 1982 Newsletter of the Welland Canals and Preservation Association.)

Page One
HORSEBRIDGE ADDED AT MUSEUM

This familiar picture has been used many times in canal publications. It shows a canal boat crew "taking off" a team of horses, over a horsebridge to shore. The photo was made, circa 1900, at Durhamville, New York, on the Erie Canal. (Courtesy Canal Museum, Syracuse, N.Y.)

A horsebridge has been installed between the west plaza and the Erie Laker bow at the Canal Museum in Syracuse, N.Y., giving visitors safe access to the Museum's major outdoor exhibit for the first time.

Historically, the horsebridge was carried onboard a Laker boat and was used in moving horses or mules from the forward cabin to the towpath. Carrying an extra team of animals allowed a Laker to travel the canal twenty-four hours a day, only stopping at six-hour intervals to replace the working team, both male driver and mule, with a fresh team.

The Museum's horsebridge, which consists of white pine and white oak with forged iron fittings, was constructed by J. M. Gray, Inc., of Syracuse. The working drawings for the horsebridge were developed by Dr. Robert Hager who serves as canal boat historian on the Canal Boat Archaeological Needs Assessment and Location Survey project and was actively involved in the work to authentically reconstruct the Erie Laker bow.

The new horsebridge rounds out the exhibits in the west plaza which are designed to present visitors with a clear picture of the Weighlock Building's original purpose as a canal boat weighing station on the Erie Canal.

(After the "Canal Packet" for June 1983, official publication of the THE CANAL MUSEUM at Syracuse, N.Y.)

AMERICAN CANAL SOCIETY

MEMBERSHIP BREAKDOWN

Several months ago, we made a geographical analysis of our 745 membership listing, to guide us in the selection of editorial material, for the information of all of our members. Here is what we found:

Pennsylvania: 138
New York State: 89
New Jersey: 59
Ohio: 63
Virginia: 51
Maryland: 46
Illinois: 33
Connecticut: 30
Massachusetts: 29
Canada: 27
England: 18
District of Columbia: 19
Indiana: 16
Florida: 15
California: 12
Michigan: 12
West Virginia: 9
Wisconsin: 7
Vermont: 6
Maine: 6
Texas: 5
New Hampshire: 5
North Carolina: 5

Delaware: 5
Minnesota: 4
Alabama: 4
South Carolina: 4
Connecticut: 3
Nebraska: 3
Rhode Island: 3
Arkansas: 2
Hawaii: 2
Georgia: 2
Holland: 2
Alaska: 1
New Mexico: 1
Arizona: 1
Arkansas: 1
Florida: 1
Indiana: 1
India: 1
Sweden: 1
Japan: 1
Finland: 1
Saud Arabia: 1
International: 1
You bet!

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GEORGE WASHINGTON'S CANAL

To the surprise of archeologists, the gates of lock #1 of George Washington's Patowmack Canal were still intact under the swamp silt—the oldest surviving lock gates in North America. (Collection of the Department of Anthopology, University of Maryland.)

Walter was important to the city's industries as well as a source of power and transportation. Across the Potomac River from the District of Columbia, at Great Falls Park, Virginia, are the archeological ruins of the Patowmack Canal and its associated town, Marietta. This canal was George Washington's grand project designed to bypass the Great Falls of the Potomac along the river's southern bank. In order to provide a commercial trade route to the west, constructed between 1785 and 1802, the canal and its five locks provided a total lift of seventy-six feet in little more than one mile.

In 1799 stabilization work on the lock and its locks required the removal of some silt from the bottom of lock #1. The silt mixture had accumulated over the years since the canal went out of business in 1828. To the surprise of those involved, buried in the wet silt of the lower gate pocket were timbers and boards. Exploratory excavations the following year revealed that these artifacts are the remains of the lock gates, left in a closed position upon abandonment of the canal. Subsequent research indicates that there are probably the oldest surviving lock gates in North America.

The lock gates were salvaged in 1962 as part of the two-hundredth anniversary celebration of George Washington's birth. The gates were uncovered by archeologists at the University of Maryland under contract to the National Park Service. After the gates were completely exposed, they were lifted out and taken to the visitor center at Great Falls Park, Virginia, where they are currently undergoing conservation treatment by the National Park Service personnel. It will take two or three years to treat the waterlogged wood in order to prevent it from disintegrating or drying. During this time, the gates will be on display in a specially constructed room so the public can see this remnant of George Washington's engineering dream.

NATIONAL PARKS - March/April 1983

PORTAGE CANAL DOCUMENTS

Frederica Klein has received from Earl Heydering the Report of the Transportation Route, Wisconsin and Fox Rivers in the State of Wisconsin between the Mississippi and Lake Michigan. The report is dated 1876 from the 1st Session, Senate, Document No. 28. The value of the document lies in its description of the rivers, the Portage Canal, and most importantly, the First Wisconsin River Lock. The report described the navigation between the Fox and Wisconsin rivers at being 2500 yards. The report states that, "The portage runs over a forested prairie. There is a Frenchman residing on the prairie ground among the rivers. He keeps the proper transportation for boats and barges."

Frederica Klein requests that ACS members keep on the lookout for additional documents. An abstract marked "AA" which includes maps, 42nd Congress, Session, House of Representatives Document No. 159, maps showing the canals, locks, dams, and water power lots of the Fox and Wisconsin Improvement Company surveyed by W.S. Neary, Assistant Engineer, under the direction of Daniel C. Jones, 1850; Appendix No. 20, 1901 Survey by Corps of Engineers, May 34, 35, and 36 and 37, Numbers 72, No. 34, Captain Ziem's Report. Appendix page 2, concerning the Portage Lowe.

Readers knowing the location of any of these papers are requested to write to Frederica Klein, ACS, 328 W. Cook St., Portage WI 53901.
PROPOSED CANAL FROM BALTIMORE TO CONEWAGO

By George Thames

As early as 1783, the importance of improving navigation on the Susquehanna was recognized in Baltimore with the signing of the charter for the Susquehanna (Port Deposit) Canal. The Baltimore's intention was to increase their trade with this area at the expense of their rivals in Philadelphia. The canal was opened in 1802 but quickly proved to be inadequate and by 1817 it was bankrupt. Philadelphia's attempts at establishing a better trade route with the Susquehanna had also been thwarted in 1806 when construction had stopped on the Chesapeake and Delaware Canal. By the beginning of the second decade of the 19th century, neither city had increased its trade potential significantly.

However, in 1822 renewed interest in two canal projects threatened to shift the balance in Philadelphia's favor. Contracts were being let on the Union Canal while simultaneously a prominent Philadelphian was reorganizing the Chesapeake and Delaware Canal Company. In response, the General Assembly of Maryland in December 1822 gave a mandate "directed to lay out, and survey a route for a Canal, which will connect the waters of the Susquehanna with the city of Baltimore, beginning at the Conewago Falls, ...".

The plan was to provide a canal with an inlet near the Union Canal so boats from the upper Susquehanna could just as easily pass south as to Philadelphia. Considering the inadequacies of the Union Canal, this was a good idea. Also, continuing the canal directly to Baltimore rather than stopping at tidewater would reduce the number of boats crossing the bay to the Chesapeake and Delaware Canal.

Setting out in June 1823, the appointed Maryland Canal Commissioners traveled to New York City and met with Mr. DeWitt Clinton, builder of the Erie Canal, who gave them advice (on the politics of canal building no doubt) and introductions to various engineers working on the Erie Canal. They proceeded to Albany and then along the Erie Canal until they reached the water filled section. By boat they proceeded 140 miles to Montezuma, crossed Cayuga Lake by suspension bridge to Ithaca, and then ran 130 miles overland to Oswego on the Susquehanna. Here they obtained an open flat bottom boat and descended as far as Harrisburg, and finally by land back to Baltimore.

While on their trip through New York, they engaged Mr. James Geddes to be their canal director. He instructed them to have levels surveyed, so he could determine the best route. A local surveyor was hired for this task, but the terrain was too rugged to allow completion of the job by the time Mr. Geddes arrived. Therefore, the Commissioners petitioned the President of the United States, James Monroe, to supply two officers from the corps of topographical engineers. Expressing support for their project, the President supplied four officers who immediately began surveying from Conewago Falls to tidewater. These officers were the start of what is known today as the Army Corps of Engineers.

Upon completion of the survey, Mr. Geddes arrived to take command. He determined that the best route was along the river from Conewago Falls to tide. A direct route, however, was rejected because of the higher elevations that would have to be crossed, the deficiency of water in summer, and the "immense amount of mills and manufactories" that would have to be bought out if the streams were redirected to lead the canal. Likewise, the idea of bringing the canal down the west side of the river to McCalls Ferry, crossing on a aqueduct and continuing over the country to Baltimore was rejected. In the view of the Commissioners, the west side of the river was the only "manageable" choice for a canal route.

Once the river section of the canal was established, the survey for the City of Baltimore was contracted to complete the surveying from Havre de Grace to Baltimore. The Commissioners felt that stopping at tide would be unsuitable for the bay and transshipment would be required. They estimated that by canal a 40 ton boatload would cost $31 and take two days, whereas by the Chesapeake and Ohio it would cost $38-52 and take eight days. More importantly, they stated that Baltimore would not face competition from another port if the canal was completed all the way.

The canal would have been 92 1/2 miles long, divided into three sections in the following way:

<table>
<thead>
<tr>
<th>Section</th>
<th>Length (mi)</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>41 1/2</td>
<td>$1,220,265</td>
</tr>
<tr>
<td>2</td>
<td>14 1/8</td>
<td>$644,471</td>
</tr>
<tr>
<td>3</td>
<td>27</td>
<td>$81,923</td>
</tr>
</tbody>
</table>

The Commissioners estimated the average toll through the canal as $1.60 per ton which would have been 130,000 tons of ore and coal. This would have been more than enough to cover interest and expenses with some left over. Comparison of the distance and cost of transportation of goods shipped from Columbia in Philadelphia versus Columbia to Baltimore were $10 per ton over 14 miles of tunnelling as opposed to $2 per ton over 80 miles of canal.

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Additional projected benefits of the canal to Baltimore included an increased market for its products, such as fish. River navigation only allowed for seasonal trade, consisting mostly of agricultural products, but with the advent of the canal, year-round traffic would have been possible too. Further justification of the canal included a 1795 report to the Governor of Pennsylvania on the feasibility of a water route to Pittsburgh. The Commissioners claimed that a route from Baltimore to Pittsburh via the Juniata and Allegheny Rivers was entirely practical. They proposed two different alternatives, both of which required building a canal across the mountains which were ultimately scaled by the Allegheny Portage Railroad on the Pennsylvania Main Line Canal. The commission to the west would have stopped the Mississippi and Ohio River steamboats from taking trade rightfully belonging to Baltimore. Looking northward, the Commissioners asserted that a short canal could easily be opened between Seneca Lake and the Susquehanna, providing an all-water route to Buffalo. Their route to Buffalo would only have been 30 miles longer than New York City to Buffalo over the Erie Canal.

The Commissioners concluded their report by begging the state to own the canal exclusively rather than allow a chartered or joint stock company to own and operate it. The majority of J. Geddes were praised to the highest degree and later, they justified the overrun of their expenses while engaged in the canal survey.

The Maryland Commissioners never addressed the problem of how they expected to win approval for a canal which passed through Pennsylvania but gave all the spoils to Baltimore. Although the report was filed in 1823, it was not until 1835 that Pennsylvania finally authorized a Susquehanna canal. The big difference between the 1823 canal and the one proposed in 1823 was that the former could use tidal water. This apparently gave equal chances to a boat proceeding either to Baltimore or Philadelphia. In 1831 the Susquehanna and Tidewater Canal was completed, essentially along the route mapped by Geddes in 1823, except that it stopped at Wrightsville rather than York Haven (Cornwall Falls). (The author, George Thomas, is an ACS member living in Toronto, Canada.)

**CANAL CALENDAR**

**June 23, 1983** - Lehigh Canal Festival (with march program) sponsored by Friends of the Hugh Moore Park at Easton, PA. For information write: Canal Museum, P.O. Box 977, Easton, PA 18042.

**June 25-27, 1983** - Champlain Canal Cruise on the Genesee Spirit. For details contact: vdse-423 Contact: Hayward Madden, 5647 Pepper Road, Livonia, New York 14087.

**June 27- July 1, 1983** - Joint trip of Canal Society of New Jersey and Delaware and Hudson Canal Society along the path of the old Erie Canal. Contact: Paul Hous, 19 Circle Ave., Elizabethtown, New York 12428.

**July 17, 1983** - NeverSink Valley Area Museum Canal Day Picnic and Craft Sale, Oxford, N.Y. For information on craft displays call Maggie Riba (014) 754-8747.


**July 29-31, 1983** - Canal Days, Civil Holiday Weekends, Port Colborne. (Contact Heather Ott, Port Colborne Historical & Marine Museum, 289 King St., Port Colborne, Ont. L3K 4H1. Tel: 416-834-7904)


**October 2-5, 1983** - Canal Society of Ohio Fall Tour along the Muskingum River on the steamboat Miss Arrow, Tour Exp. Tour dates: Columbus. (Call: 614-793-2600. Write: Buckhout Tours, P.O. Box 32068, Euclid, Ohio 44132, or call: 216-265-6606).

**October 7-10, 1983** - Steamship Historical Society Fall Meeting in Pittsburgh, PA, including a two-night cruise on the DELTA QUEEN, Pittsburgh to Wheeling, and return. Contact: your travel agent about the DELTA QUEEN trip 5000!

**ILLINOIS CANAL ARCHIVES**

The Illinois Canal Society has given an extensive collection of Illinois and Michigan Canal materials to Lewis University in Romeoville, Illinois. The collection consists of maps of the canals and the area, early documents and letters, prints and photographs, oral history tapes and a number of secondary sources relating to the canals of Illinois and the communities along their course. The collection will form the basis of the Lewis University Canal Archives. The Canal Archives will be structured so that it can be used by students in local history courses at the University as well as the public at large. The Illinois Canal Society wants the collection to be as available to the public as possible. In order to achieve this goal the Illinois Canal Society has helped the university form an advisory council of 12 members from the museum, historical societies, libraries, business and industry in order to form the Lewis University Canal Archives Advisory Council. This collection will be an invaluable asset in understanding the 19th Century development of Illinois, and the continuing waterway usage in the state. It will help develop an historical understanding of the area encompassed by the proposed Illinois and Michigan Canal National Heritage Corridor. If you would like to be a part of this project, please contact the Illinois Canal Society.

(John Lamb, ACS Director and President of the Illinois Canal Society)
In the canal bed itself, the clay lining created most to wet conditions, welcoming wetland plants that like a lot of water. Parts of the canal bed that have been altered for better drainage, and the irrigation banks still retain quite a bit of moisture, so they seem to be most favorable to high river-bank plants and the ditch plants of the area. The tops of the banks and the wide twoway are usually very sunny, well-drained areas, and invite a large variety of large-seeded plants, including many we know as prairie and pasture plants, usually rather unceremoniously referred to as weedy or wasteland plants, which actually thrive in the liminal grove of the canal banks, and even grow well amid the stone ruins.

An early and distinctive perennial plant to look for is the Horsetail or Shave Grass. This familiar, blue-green stover, often called also the Rainbow Goddess, Irish, has flashy crossing reedlike (rhizomes) rather than bulblets, as most cultivated varieties do. It spreads fast! very well in favorable conditions.

Another interesting plant is the on the edge of the canal bed. It is very sunny, white, and has pink, gray-green seeds. The flowers grow in clusters of tiny blossoms that are white, dotted with purple. Being of the same family, they are not a pleasant smelling. Lilies definitely recognize this color, so cat owners are advised to snip a sprig or two to distract their pets, to prevent clothes from being stained.

Wild Raspberries or Blackberries also like a moist but well-drained soil, and are, luscious! A very hardy canal perennial. This shrubby plant has serrated, heart-shaped leaves and is covered with stickers. It flowers in May and June, and produces luscious, deep purple berries in July. Blackberries love sun, do especially well in clay loam, and quickly take over large areas of canal bank.

A beautiful succulent plant is the Teasel. This Bennial has a tall, rigid prickly stem large pair of leaves at the base, and a cylindrical flower head. They are, unfortunately, perhaps best known as an accent in dried flower arrangements. It is unfortunate because the bloom is lovely, and the flowers bloom profusely. The flower heads are a mass of semi-petals. Each head is encircled by narrow green bracts arising in a ring at the base of the stem and forming a ring around the flower head. The flower heads bloom in September and are followed by seed heads.

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A very popular plant is the Prairie Cone-Flower. It is a native of the western prairies that has spread rapidly throughout the Midwest. It is a perennial that likes sun, is drought resistant and tolerates poor soil, so weeded a growing bush on the side of the road. Along the way, many daisy-like flowers have a brown, cone-shaped center which is surrounded by yellow-golden petals arranged in rays. It has sparse, dark green leaves, grows two to four feet high and blooms at night and in summer.

We find several kinds of Thistles along the canal, since they thrive on dry banks, gravelly soils, and lime-poor. The tall branched stems, two to five feet high, and the coarse, dark green leaves are spiny, and the flowers are a brush-like crimson bloom. They have a delicate, sweet fragrance, and bloom through July and August.

The most fragrant plant, I think, is the Chamomile. It grows tufts of leaves and flowers up to a foot high. The stems are freely branching, covered with thread-like leaves that give the whole plant a delicate, feathery appearance. The small flowers grow solitary on long stems. They have yellow centers and a fringe of white petals. It is noted for its sweet scent of apples. Chamomile is Greek, means Ground Apple. When hiking, especially on a warm sunny day, the scent is a real treat. Chamomile is a perennial that loves dry, gravelly soil, and spreads rapidly over the bank tops.

Toadflax or Wild Snap Draggers prefer dry soil, too, especially limestone, and spread quite rapidly. The plant has several slender stems, not too branched, one to two feet high. The stems are covered with many long, narrow pale blue-green leaves. The stems hold spikes of shiny yellow blossoms. The pale yellow flowers are shaped like snapdragons, but with long spurs, and the lower lip of the blossom is crumpled. This gives it its popular nickname: Bumble and Eggs. These perennial blooms are June to October.

This is but a small sampling of plants to look for and enjoy. Dog Roses, Yarrow, members of the Sunflower or Daisy family, Cucumber Plant, Wild Grapes, and many native grasses grow along the canal, and the insects on and off. From the first warm days of spring until the heavy frosts, the canal lines are alive with beautiful, interesting greenery. The mixture of plants-life is fantastic, and the wild flowers, spring through fall, are a special treat.

**American Canals, No. 45 - May 1983**
THE JONGLEI CANAL

SUDAN

At a Carmen Basilio Fight Night recently at a bar in Hagerstown, Maryland, your editor had occasion to talk with the ex-welter weight and middle weight world champion. When Mr. Basilio told me that he was from Brooklyn, New York, I remarked that he might be familiar with the Erie Canal. He said that he spent many a day on the canal, and that he had fallen through the ice more than once while ice skating in the winters there. Boxing enthusiasts may be interested in knowing that Mr. Basilio is still in good condition and is a very amiable and interesting person to talk with.

D. & R. CANAL “SWING BRIDGE”

The following items are from the Great Miami River Corridor Committee Annual Report of 1982.

Boone Lock: One of the best preserved canal locks between Cincinnati and Dayton is located just south of Troy off Boone Drive. Privately owned, the Miami County Coordinator has met with the property owner to advise him of the historic significance of this structure in hopes he will preserve this impressive remnant of the Miami & Erie Canal.

Turtle Creek Culverts: In mid-July, a local contractor began the thankless task of demolishing the majestic 140-year-old structure. Many concerned individuals and agencies had worked for over four years to find a way and the means of saving this deteriorating monument to the pioneer spirit of the canal era. The Great Miami River Corridor Project sent its final impassioned plea for financial assistance to many of the largest national foundations. But the emotional plea for assistance fell on sympathetic but unresponsive ears. The demolition of the Turtle Creek Culvert leaves a new void on the National Register of Historic Places.

Lockington Project

Lock: Workers from the Shelby County Work Relief Program swarmed onto the lock in early September to rid the grand structures of an unsightly accumulation of weeds, trash, and debris. It is hoped that this omission will also be an annual corridor project.

Canal Rush: At the request of the Heritage Festival Committee, the River Corridor sponsored a “Canal Rush” during the Labor Day holiday. The nearly sixty canoes and numerous spectators who lined the covered section of the Miami & Erie Canal at the Johnstown Farm complex enjoyed the excitement and unusual ability of this very successful two-day event.

Hiking Trail: The Buckeye Trail parallels the Great Miami from Dayton to the Piqua Historical Area where it picks up sections of the Miami and Erie Canal through Shelby County.

Farrington Lock: Members of the Piqua Task Force began clearing and clearing the Farrington lock on June 12th. Located south of Piqua, this site has been used as a dump for years. (Provided by Harry E. Wright, ACS, Miami County Corridor. His address is 1711 S. Washington St., Piqua, OH 45356.)

ACS Director Bill McKelvey, Jr. sent us this photo of a “Swing Bridge” model on the Delaware and Raritan Canal. The model was made by Ed W. Cunningham of Somerset, New Jersey, from plans obtained from the Historic American Building Survey of the Kingston Lock and Bridge.
A modern student of nineteenth-century technology once observed that the technology of canals has been their least-studied aspect. Works on canals have examined their politics, financing, folklore, and economic impact but nearly ignored technical matters. This paper treats the least-studied aspect of this little-studied technology: canal culverts. Though obscure, the topic is important. Culverts were by far the most frequently used devices to get canals past intersecting streams, a vital task without which there could be no canals.

In the design and construction of a canal there are four primary tasks that an engineer must accomplish: survey a useful route with minimum elevation changes, deal with any unavoidable elevation changes present on the route; guarantee an ample supply of water for the canal; and cross lateral watercourses. The Wabash and Erie Canal, built to connect Lake Erie with the Wabash River, followed the relatively flat valleys of the Maumee and the Wabash. The much shorter Whitewater Canal in southeastern Indiana connected the east-central part of the state at the National Road with the Ohio River. Necessary changes in elevation on these canals were effected by locks which sealed one elevation from another and which served to pass canal boats up or down. The generally low relief of the Maumee, Wabash, and Whitewater valleys meant that no tunnels were required in Indiana, although the Whitewater extension to Cincinnati went through one ridge. The numerous tributaries generally provided ample supplies of water, with occasional exceptions during the dry summer months. All of these aspects of canal construction have frequently been discussed because of their political and economic implications or because of the interesting technical problems they present.

The last engineering problem faced by the builder was to carry the canal across lateral streams, ensuring either separation or controlled mingling of the two lines of water. This subject apparently has seldom been the subject of historical research; certainly no published research exists for Indiana. On rare occasions that scholars have studied stream-crossing or other canals, they have given their attention to aqueducts. Yet these, interesting as they are, constitute only a small percentage of canal stream-crossing structures for the simple reason that most watercourses are too small to merit such elaborate water-bridges. Indiana’s Wabash and Erie, for example, from the Ohio state line over the 185.5 miles of the 1847 survey used in this study, crossed over or through 189 watercourses and only ten required aqueducts. The canal crossed five streams in slack-water pools formed by dams, but the remaining 144 crossings utilized culverts.

It is the problem of canal culverts in Indiana in the period 1832-1847 which is examined here. The methods used to carry Indiana canals of the 1830s and 1840s across lateral streams are surveyed and discussed. Three distinctly different kinds of data are used: archival materials from the 1830s showing what presuppositions a canal engineer approached the problem; a canal survey report of 1847 showing what was actually constructed on one Indiana waterway during the first round of culvert building; and the results of a recent on-site examination of one particularly well preserved but typical Indiana canal culvert from 1840. These data permit a coherent survey of canal culvert technology in one state during a fifteen-year period of canal construction.

The Hoosier state is an apt subject for such a study because it was far enough west to benefit from the ideas and practices that had earlier been developed in the older part of the nation. Little additional canal building was done west of Indiana, as the entire transportation method was soon rendered economically inviable by the railroad. The men who thought about, designed, and supervised the building of Indiana’s canals were themselves the inheritors of several decades of accumulated experience and informal education. But the engineers are not
the main focus here; beyond a few names and references to earlier canal experience in states further west, one will find little about the men's Canal culvert technology has center stage.

Nothing can be imagined that is more prosaic than a modern culvert. The simple task of passing relatively small quantities of water under rights-of-way is now inconsequentially managed by metal or pre-cast concrete tubes. In the 1830s, however, at the time Indiana canals were being, engineers gave substantial attention to the design and installation of culverts, and they developed rules to help them decide when to install a culvert in preference to other structures.

The engineering records of the Wabash and Erie, Indiana's longest canal, have apparently been lost, but the Indiana Commission on Public Records holds the notebooks and drawings of M.S. Webb, an engineer in about 1836-1840 on the Whitewater Canal, then under construction. The narrative sections of his notebooks include guidelines that amount to a canal-builder's handbook. The drawings provide additional information on dimensions and bills of material. Stone-arch culverts are emphasized and wooden culverts slighted. All information is general and not identified with specific sites where culverts were to be built.

Ohio and the older eastern states were the fonts of knowledge for Indiana canal builders. Webb noted, for example, that he had obtained much of his information, especially that on hydraulic calculations, from an Ohio engineer named Cooper. Similarly, Jesse L. Williams, Indiana's chief engineer for all internal improvements and author of the important 1847 Wabash and Erie survey, had come to Indiana from the Ohio canal system in 1832.

M.S. Webb gave his canal rules in narrative form under three headings: (1) General Rules for Crossing Streams; (2) Culverts; and (3) Arched Culverts. The treatment was not systematic. Table I summarizes the solutions he recommended.

Under "General Rules," Webb described how a canal is to be carried across warercourses according to the varying sizes of the streams. He divided them into three classes according to the maximum amount of water each carried when in flood. The smallest, Class 1, could be accommodated at flood by a semicircular culvert of four-foot chord or span (6.3 square feet in cross-section). The largest, Class 3, had a maximum flow greater than could be passed through a semicircular arch of thirty-foot span (350 square feet in cross-section). Between these extremes fell the middling culverts, which represented the vast majority of all streams encountered in Indiana canal building. For these middle-size (Class 2) warercourses Webb recommended passing the water under the canals by means of a culvert or set of culverts, an answer which, as Table I shows, he recommended less frequently for the largest and smallest streams.

The arrangements designed to cover the mid-range conditions, Classes 2a and 2b in Table I, received most of Webb's attention, but before examining them in detail it may be best to place them in context by examining Webb's solutions for the largest and smallest streams. In most cases he recommended letting the small Class 1 brooks flow directly into the canal, avoiding the trouble and cost of any elaboration at all. His only proviso in such cases was that a sufficient number of waste weirs or overflow outlets be provided near enough to ensure that excess water might leave the canal without damaging the banks. If the stream carried so much sand or gravel that it might tend to fill the canal, he indicated that a small culvert should be built to pass the water under the canal.

At the upper end of the scale, Webb wrote that large streams and rivers of Class 3 ought to be crossed by aqueducts because these provided the surest navigation. He described an
Joseph feeder. Except for infrequent remarks on the condition of the bank, he concentrated on the dams, bridges, aqueducts, culverts, locks, and waste weirs—the "works of art," in the terminology of the time.

Williams's report is organized differently than Webb's Whitewater notebooks. Williams did not state the quantity of water or flow rate of each stream, nor did he indicate the probable flow rates in the future. He simply reported the location, dimension, and condition of the mechanical structures that he found on the canal. From these data one can only surmise the relative size of each stream from the dimensions of the structure erected upon it. Precisely the opposite approach from Webb's a priori classification explained above. There can, therefore, be no precise ranking of stream size on the Wabash and Erie that would strictly parallel Webb's Whitewater classifications. The general size of the streams crossed by the Wabash and Erie can be estimated from the 1847 report, but erroneous deductions could be drawn, as, for example, in cases where large arches or even aqueducts might have been put up, not for the quantity of water that they could handle, but to gain height for the canal bed.15

Williams concentrated on the elaborate structures and did not necessarily mention the very small brooks of Class I that simply flowed into the canal. He did mention the location of movable-gate waste weirs, and since there were only four or five on the canal not accounted for by proximity to large feeders, one may deduce that there were probably not many other small streams that simply flowed into the canal.16 Only three non-urban culverts of less than 8.3 square feet of cross section (Webb's Class I) were found on the Wabash and Erie in 1847; such other streamlets as may have existed at that time apparently fed into the canal. Even the four or five weirs mentioned may not have had any purpose other than general control of water depth since they were used also to drain a canal level whenever maintenance was required.

Williams's report provides complete coverage only for larger streams. Selection of a particular culvert dimension did not necessarily imply a stream of a certain size—there was simply too much latitude, as the rules in Webb's Table 1 show
larger the river crossed, the more sophisticated the engineering solution required. Conversely, Table II implies that wherever possible the engineer chose the cheapest and simplest device that he thought would work, with the result that wooden rectangular boxes, single or multiple, carried the canal over three-quarters of the streams, and even over some of apparently large dimension.

Table III amplifies column 2 of Table II by showing how many openings or elements there were at the twenty-eight streams where multiple-box rectangular wooden culverts were built. In some instances these were sizable installations, as much as 72 feet wide. Wooden rectangular culverts were low and flat, typical dimensions being 10 by 1.5 feet, or 12 by 3 feet each element. For wooden culverts Webb specified a length of 86 feet under the canal, exclusive of head or wing walls, 6 feet longer than the stone arch culvert tubes which normally had much more elaborate protective head and wing walls. Probably the two types similarly varied in length on the Wabash and Erie.

Metal was rarely used on the Wabash and Erie except in the fittings of the lock gates. However, four rectangular wooden culverts (numbers 362-365) between Delphi and Aurora were banded with iron straps to give them added strength against upward pressure when the nearby Wabash River was high. On older canals in the East, iron had sometimes been used for the entire body of the culvert. There also was a certain variety among stone culverts. One stone culvert, described only as "small," was rectangular. For convenience it has been grouped with the smallest wooden culverts in Table II. And one stone arch culvert had double arches, each eleven feet in span. From a similar extant double culvert in Ohio and from Webb, it is clear that both arches were erected on a common foundation and formed one structure. The only other deviation from standard types on the Wabash and Erie was a small stone arch that sprang from vertical stone walls 2.5 feet high. In later years, this form was very common under railroads.

Greater detail on the stone culverts listed in columns 5 and 8 of Table II is provided in Table IV, but in this table they are listed in geographical order westward from the Ohio border, the numbering method that Williams used. The remarks column shows that during the initial round of construction, until about 1846, almost all stone arches were built of rough material and displayed poor workmanship. The Burnett's Creek arch (number 109), built ca. 1839-1840, is the earliest arch of over ten-foot span described as still in sound condition in 1847. The other three of that size then in good condition—culvert number 1 on the St. Joseph feeder and canal culverts 73 and 86—had been built or rebuilt just before the survey was made; obviously

<table>
<thead>
<tr>
<th>Culvert Number</th>
<th>Span (ft.)</th>
<th>Cross-Section (ft.²)</th>
<th>Location</th>
<th>Williams's Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>15.5</td>
<td></td>
<td>Hecker's Run</td>
<td>excellent (built 1845)</td>
</tr>
<tr>
<td>22</td>
<td>0</td>
<td>14</td>
<td>Ewing's Warehouse</td>
<td>good condition</td>
</tr>
<tr>
<td>48</td>
<td>8</td>
<td>36</td>
<td>Lagro Creek</td>
<td>2.5 ft. abutments</td>
</tr>
<tr>
<td>54</td>
<td>11 ea.</td>
<td>38</td>
<td>Lagro Creek</td>
<td>good stone of substantial quality</td>
</tr>
<tr>
<td>66</td>
<td>8</td>
<td>38</td>
<td>rough stone; badly constructed</td>
<td></td>
</tr>
<tr>
<td>61</td>
<td>8</td>
<td>38</td>
<td>rough stone; imperfectly built</td>
<td></td>
</tr>
<tr>
<td>68</td>
<td>8</td>
<td>14</td>
<td>rough stone; material and workmanship imperfect</td>
<td></td>
</tr>
<tr>
<td>73</td>
<td>8</td>
<td>36</td>
<td>La Fontaine's Creek</td>
<td>recently rebuilt from present site; good workmanship</td>
</tr>
<tr>
<td>76</td>
<td>8</td>
<td>25</td>
<td>Georgetown cut stone; stone mason; pipe of cast iron</td>
<td></td>
</tr>
<tr>
<td>78</td>
<td>8</td>
<td>14</td>
<td>rough stone; imperfect</td>
<td></td>
</tr>
<tr>
<td>87</td>
<td>8</td>
<td>36</td>
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<td>88</td>
<td>10</td>
<td>30</td>
<td>built last winter of Georgetown stone; excellent</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>23</td>
<td>117</td>
<td>Burnett's Creek</td>
<td>hammered dressed stone; good workmanship</td>
</tr>
<tr>
<td>132</td>
<td>30</td>
<td>350</td>
<td>Bear Creek</td>
<td>very soft cut sandstone; some doubt of durability; workmanship appears good</td>
</tr>
</tbody>
</table>


**NOTE:** as St. Joseph feeder; all others on canal itself.

The first versions had been inadequate or they would not have been replaced. Williams's report is peppered with statements alluding to the poor quality of the work, the insecurity of the arches, and the need to rebuild a number of them soon with good cut stone.

The tension between the two opposing philosophies of building quickly and cheaply in order to get the canal into service, or building securely of good stone from the cutstone, had long been a feature of American canal building. In general, the first method implied construction of locks, culverts, dams, and aqueducts from wood, with the goal of quickly opening the canal and using the revenues generated from operations to
TABLE V. Stone Arch Culvert Dimensions

<table>
<thead>
<tr>
<th>Span of Chord of Arch (ft)</th>
<th>Linear ft. under central portion of arch body (1)</th>
<th>Length of thickness in culvert (2)</th>
<th>Linear ft. under portion of arch body (3)</th>
<th>Length of thickness in culvert (4)</th>
<th>Linear ft. under wings (5)</th>
<th>Length of thickness in culvert (6)</th>
<th>Thickness of timber (in.)</th>
<th>Length of tie spans (in.)</th>
<th>Depth of ring stones (in.)</th>
<th>Thickness of stone in wings at ends and range to arch (in.)</th>
<th>Radius of curve of wings (in.)</th>
<th>Length of pilings (ft.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>80</td>
<td>11</td>
<td>8</td>
<td>18</td>
<td>12</td>
<td>11</td>
<td>10 x 10</td>
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<td>15 or</td>
</tr>
<tr>
<td>7</td>
<td>80</td>
<td>10</td>
<td>8</td>
<td>18</td>
<td>14</td>
<td>23 1/2</td>
<td>10 x 10</td>
<td>18</td>
<td>15 or</td>
<td>10</td>
<td>18 or</td>
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<tr>
<td>8</td>
<td>75</td>
<td>12 or 18</td>
<td>8</td>
<td>21</td>
<td>18</td>
<td>25</td>
<td>10 x 10</td>
<td>18</td>
<td>15 or</td>
<td>10</td>
<td>18 or</td>
<td>15 or</td>
</tr>
<tr>
<td>10</td>
<td>75</td>
<td>15</td>
<td>10</td>
<td>24</td>
<td>16</td>
<td>20</td>
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<td>10</td>
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<td>17 or</td>
</tr>
<tr>
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<td>8</td>
<td>36</td>
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<td>10</td>
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<tr>
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<td>28</td>
<td>16</td>
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<td>21</td>
<td>18 or</td>
<td>19 or</td>
</tr>
<tr>
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<td>6</td>
<td>37 1/2</td>
<td>18</td>
<td>24 1/2</td>
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<td>21</td>
<td>19 or</td>
<td>21 or</td>
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<tr>
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<td>31 1/2</td>
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<td>37 1/2</td>
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<td>19 or</td>
<td>21 or</td>
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<td>35</td>
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<td>21</td>
<td>21 or</td>
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<td>21 or</td>
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<td>23 or 34</td>
<td>23 or</td>
<td>23 or</td>
<td>23 or</td>
<td>5 x 10 or 25 x 10</td>
</tr>
<tr>
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<td>80</td>
<td>72</td>
<td>20</td>
<td>60</td>
<td>20</td>
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<td>34</td>
<td>34 or 38</td>
<td>34 or</td>
<td>34 or</td>
<td>34 or</td>
<td>7 x 10 or 35 x 10</td>
</tr>
</tbody>
</table>

Barnett's Creek Arch

LATROBE was long dead when others built the Wabash and Erie Canal, but the conflict between the engineer's desire to build in a manner of which he could be proud and the exigencies of capital shortage or great hurry were still in evidence in Indiana in the 1830s and 1840s. The problem of financing Indiana's internal improvements lies beyond the scope of this paper, but funds were short, and the people of the Wabash Valley applied great pressure to see that their canal was pushed to rapid completion.21

One very practical problem was obtaining suitable stone. When he was building the Chesapeake and Delaware Canal feeder in Maryland in 1804, Latrobe had had part of the canal dug and filled with water and then used the completed section to transport stone.22 A similar method was used on the Wabash and Erie. This canal did not reach a source of suitable stone until it came to the Georgetown quarry in Cass County. As a result, until that source of good stone was reached southwest of Logansport, wooden culverts went up quickly at sites where they could not long endure or rough stone arches were thrown

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SOURCE: Specifications for Masonry, in Whitewater Canal Papers, and Plans of Culvert at 20 Foot Chord, both by Indiana Commissioners on Public Roads, Indiana State Library Building, Indianapolis.

13 1/2 Col. 1, 3, and 5 add to 120.60 = 44.19'

Latrobe was long dead when others built the Wabash and Erie Canal, but the conflict between the engineer's desire to build in a manner of which he could be proud and the exigencies of capital shortage or great hurry were still in evidence in Indiana in the 1830s and 1840s. The problem of financing Indiana's internal improvements lies beyond the scope of this paper, but funds were short, and the people of the Wabash Valley applied great pressure to see that their canal was pushed to rapid completion.21

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up where quality building stone lay too distant to be economically transported by wagon.23 Once the canal reached the Georgetown quarry, however, stone could be shipped back on the completed canal for distances that had therefore been uneconomical. Early defective arches and locks could be replaced. The remarks column of Table IV shows that this was done in 1845-1847. Even at that early date, builders shipped stone back as far as LaFontaine’s Creek (culvert number 73) in Miami County, about seventeen miles from Georgetown.24

The Georgetown quarry sat beside the canal between culverts 88 and 100. Table IV shows that number 100 was not only the earliest large arch still in good shape in 1847, but also that it was the only major arch on the canal built of adequate stone on the first attempt. All the others to that point were either rough and not durable or had been rebuilt just before Williams conducted the survey.

On the Wabash and Erie Williams did not provide specific information on the source of the poor stone used in the arches, although he did comment upon the locks built of inferior stone.25 The raw material for all of these had come from the “Salamania” quarry, and in every instance it was found wanting. The “Salamania” stone locks were distributed over that section of the canal from about the Huntington-Wabash County line westward to near Peru, or approximately where stone arches 54 through 73 were located (see Table IV and Map). In all probability the unsatisfactory stone used in the culverts on that stretch had come from the same quarry. The “Salamania” quarry was apparently located about where part of the Salamonie Reservoir now stands, between Lagro and the Wabash-Huntington County line.

As the foregoing shows, the builders did not easily or quickly accomplish the task of obtaining good stone and employing it in arches on the Wabash and Erie. Few large stone arches existed at any time, and it is remarkable that at least one of the largest original arches has survived until the present day: culvert number 100, the stone arch that carried the canal over Burnett’s Creek in Carroll County (Fig. 1).26 Nowadays the arch serves as a county road bridge and has been slightly altered and repaired, but in all major respects it stands as it did when completed in 1840.27 It was the second largest arch built on the canal by 1847, and Williams’s remarks show that he found it sound but not in perfect condition when it was seven years old. He reported that some of the ring stones on both ends were “soft” and “falling to pieces,” just as they are today, as shown in the photo of the north face (Fig. 2).28 County workers enveloped the south face in concrete to prevent further weakening from the same cause.29

The recent photographs accompanying this article, when compared with Webb’s drawings (Figs. 4 and 5), and his data in Tables V and VI (unfortunately fragmentary for twenty-foot arches), show that the engineers built the Burnett’s Creek arch upon the same principles and dimensions that Webb prescribed. Further explanation of these tables appears below.

The casual passerby on Towpath Road today might not even notice the arch. The great 85.5-foot length of the culvert makes it in effect a very wide bridge, and it means that a broad expanse of earth extends far from the road’s edge on the south side, concealing the creek below. Only by looking down sharply on the north side of the road can one see the stream below.

The height of the arch in relation to the former canal prism is not easy to determine because the road has replaced the canal bed, but Webb’s rule called for a minimum of two feet of earth (called a “pile”) between the top of the arch stones and the bottom of the canal bed, and this gives an indication of the minimum probable elevation of the canal. Note also Webb’s comments in Table I, mentioning an arch if the bed of the stream to be crossed lay fur below the level of the canal. The site at Burnett’s Creek suggests this condition. The fact that the engineer there chose a rather large twenty-foot arch, with its attendant ten-foot rise (in addition to stone thickness and pile), indicates that the desire to gain height may have motivated him.

Canals sometimes leaked through the stone arches when the clay bed was new.30 The winter photo (Fig. 6) showing telltale icicles under the arch proves that more than a century of settling has not eliminated this problem at Burnett’s Creek.

Tables V and VI bring together large amounts of information scattered in Webb’s notes and drawings. For comparative purposes data gathered in a recent survey of the accessible parts of the Burnett’s Creek arch appear at the bottom of Table V.31 The two tables possess detail that may require patience to
<table>
<thead>
<tr>
<th>Span of Chord or Arch in feet</th>
<th>Total foundation timbers (12)</th>
<th>Total timbering oiled (6.25)</th>
<th>Timbering in arch body</th>
<th>Timbering in each wall</th>
<th>Timbering in each parapet</th>
<th>Total timbers, 1 arch, 4 wings</th>
<th>Public tithe</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>1680</td>
<td>260</td>
<td>72.94</td>
<td>5.68</td>
<td>260</td>
<td>400</td>
<td>100</td>
</tr>
<tr>
<td>7</td>
<td>1470</td>
<td>230</td>
<td>62.94</td>
<td>5.68</td>
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<td>200</td>
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<td>1625</td>
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</tr>
<tr>
<td>10+10</td>
<td>1625</td>
<td>500</td>
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<td></td>
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<td>720</td>
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<td>1625</td>
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<td>131 or 150</td>
<td></td>
</tr>
<tr>
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<td>2200</td>
<td>900</td>
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</tbody>
</table>


To understand this idea, one may take as an example the data for the 12-foot arch, which are interpreted as follows: from the inside mid-point of the culvert, 30 feet (half of 75) in each direction was underlaid by foundation timbers 17 feet long laid transversely to the arch body. Then beyond that there were 5 feet under each parapet of timbers 28 feet long, then for 2 more feet there were also 28-foot timbers where the wings began to extend from the parapet, then a further 8 feet of 31-foot timbers and finally, for the last 10 feet there were 34.5-foot beams reaching across to support the further extremities of the wing walls. In every case the timbers extended completely across the stream and tied together both sides of the arch and both wing walls. The overall result was a large, hourglass-shaped platform of wood supporting all the masonry.

**Figure 5—"CULVERT, CHORD 8 FEET." DRAWINGS BY M.S. WEBB, WHITETWATER CANAL ENGINEER, CA. 1839.**

Webb did not amplify certain bits of data contained in Tables V and VI. For example, builders apparently drove the piling listed in Column 12 of Table V only near the ends of the horizontal foundation timbers. Figures 4 and 5 at least lend to that conclusion.

Also unclear are the two quantities Webb gave for the two-inch oak planking (Table VI, column 2). Apparently these two numbers are added in each case, since elsewhere he said that a ten-foot arch required 750 square feet of oak planking.

As is well known, the Indiana canal system was an economic failure. The large sums expended upon it were not recouped directly in tolls and fees and probably not indirectly in economic benefit, although the Wabash and Erie did for a time lower the shipping costs of Hoesier farm products headed for market. This brief period of efflorescence was from about 1847 until 1855. The much shorter Whitewater provided some of the same benefit on an even more modest scale in about the same period.

The principal purpose of this paper has been to describe and summarize canal culvert technology of the mid-nineteenth century. A second purpose has been to draw attention to the historical value and aesthetic appeal of an often overlooked but impressive monument to early Indiana engineering. The Barney's Creek arch stands and serves—cared for by Carroll County and marked by the Carroll County Historical Society—as a valued physical reminder of early canal development in Indiana during the era of the internal improvements mania.

**Figure 4—"CULVERT 24 FEET CHORD". DRAWINGS BY M.S. WEBB, WHITETWATER CANAL ENGINEER, CA. 1839.**

(Images and text as per original document)
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