DUCK CREEK AQUEDUCT
(Whitewater Canal Aqueduct)
(Metamora Aqueduct)
Spanning Duck Creek at Whitewater Canal
Metamora
Franklin County
Indiana

HAER IN-108
IN-108

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
U.S. Department of the Interior
1849 C Street NW
Washington, DC 20240-0001

HISTORIC AMERICAN ENGINEERING RECORD

DUCK CREEK AQUEDUCT
(Whitewater Canal Aqueduct)
(Metamora Aqueduct)

HAER No. IN-108

LOCATION:	Spanning Duck Creek at Whitewater Canal, Metamora, Franklin County, Indiana UTM: 16.660903.4367969, Metamora, Indiana, Quad.
STRUCTURAL TYPE:	Burr through truss covered bridge
DATE OF CONSTRUCTION:	1848; modified 1868, 1901 and 1947
DESIGNER/ BUILDER:	Whitewater Canal Company
OWNER:	Indiana Department of Natural Resources
PREVIOUS USE:	Canal aqueduct
PRESENT USE:	Canal aqueduct
SIGNIFICANCE:	Covered wood aqueducts were never common, but there were reportedly several such structures on the Whitewater Canal, and some noteworthy examples once existed at places like Johnstown, Pennsylvania, and Washington, DC. The Duck Creek Aqueduct is the only surviving covered wood aqueduct in the United States. It still carries the Whitewater Canal over Duck Creek and illustrates the widespread application of covered bridge technology to nineteenth century transportation systems.
HISTORIAN:	Researched and written by Lola Bennett, November 2005
PROJECT INFORMATION:	The National Covered Bridge Recording Project is part of the Historic American Engineering Record (HAER), a long-range program to document historically significant engineering and industrial works in the United States. HAER is administered by the Historic American Buildings Survey/Historic American Engineering Record, a division of the National Park Service, U.S. Department of the Interior. The Federal Highway Administration funded the project.

RELATED
DOCUMENTATION: See also HABS No. IN-24-20, Whitewater Canal Aqueduct.

Chronology

1811 Larkin Sims receives a 160-acre land grant at the site of present-day Metamora

1816 Indiana becomes nineteenth state admitted to the Union

1822 Indiana Senator James Brown Ray proposes construction of Whitewater Canal

1826 Post Office established at "Duck Creek Crossing"

1836 Indiana Governor Noah Noble approves $10 million for internal improvements

1838 Construction of Whitewater Canal begins; Town of Metamora platted

1843 First aqueduct built at this site

1847 Whitewater Canal completed

1848 Duck Creek Aqueduct rebuilt following flood

1852 Following a disastrous flood, Whitewater Canal Company suspends use of canal

1863 Indianapolis & Cincinnati Railroad (ICRR) purchases canal towpath right-of-way

1866 Whitewater Valley Railroad, an ICRR subsidiary, lays tracks through Metamora

1868 Duck Creek Aqueduct strengthened

1901 Duck Creek Aqueduct repaired and raised 18"

1933 US Highway 52 bypasses Metamora

1934 Historic American Buildings Survey records Whitewater Canal Aqueduct

1946 Whitewater Canal Association formed

1947 Duck Creek Aqueduct repaired

1973 Whitewater Canal Aqueduct listed on the National Register of Historic Places

2005 Historic American Engineering Record records Duck Creek Aqueduct

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ADDENDUM TO:
DUCK CREEK AQUEDUCT
(Whitewater Canal Aqueduct)
(Metamora Aqueduct)
National Covered Bridges Recording Project
Spanning Duck Creek at Whitewater Canal
Metamora
Franklin County
Indiana

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

REDUCED COPIES OF MEASURED DRAWINGS

FIELD RECORDS

HISTORIC AMERICAN ENGINEERING RECORD
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HISTORIC AMERICAN ENGINEERING RECORD

Addendum to
DUCK CREEK AQUEDUCT
(Whitewater Canal Aqueduct; Metamora Aqueduct)
HAER No. IN-108

This report is an addendum to a five-page report submitted to the Library of Congress in 2005. The 2005 HAER report, which was based on the 1934 HABS report and several secondary sources, contains errors. This report, which is based on historical research conducted in 2012, attempts to correct those errors and contains up-to-date information on the structure.

Location:	Spanning Duck Creek at Whitewater Canal, Metamora, Franklin County, Indiana The aqueduct is located at latitude: 37.81972, longitude: -120.67111.This coordinate was obtained on September 18, 2012, by plotting its location on Google Earth. The accuracy of the coordinate is +/- 12 meters.
Construction Date:	1846[1]; restored 1946-49
Builder:	Whitewater Valley Canal Company
Original Owner:	Whitewater Valley Canal Company
Present Owner:	Indiana State Museum and Historic Sites
Original Use:	Canal aqueduct
Present Use:	Canal aqueduct, historic landmark and tourist attraction
Significance:	The Duck Creek Aqueduct is the only surviving historic covered wood aqueduct in the United States. It is a remnant of the vast national internal improvements movement that occurred in the early to mid-nineteenth century. It also illustrates the widespread application of timber bridge technology to nineteenth-century transportation systems. Used for transportation and hydraulic power, the Whitewater Canal stimulated settlement and economic growth in Indiana in the mid-nineteenth century.

[1] Although secondary sources disagree on the construction date, most state that the Duck Creek Aqueduct was built in 1846, 1847, or 1848. The 1846 date is supported by contemporary accounts from the *Brookville American*, as well as a number of secondary sources, including: *Indiana Covered Bridge Topics* (1940s); Richard Sanders Allen, *Covered Bridges of the Middle West* (1970); George Gould, *Indiana Covered Bridges thru the Years* (1977); American Society of Civil Engineers, *National Historic Civil Engineering Landmark Nomination* (1992); Ball State University, "Historic Structure Report for Duck Creek Aqueduct" (2009); and the National Society for the Preservation of Covered Bridges' *World Guide to Covered Bridges* (2009).

Project Information: The National Covered Bridges Recording Project is part of the Historic American Engineering Record (HAER), a long-range program to document historically significant engineering and industrial works in the United States. HAER is administered by the Heritage Documentation Programs Division (Richard O'Connor, Chief) of the National Park Service, United States Department of the Interior. The Federal Highway Administration's National Historic Covered Bridges Preservation Program funded the project. Christopher H. Marston, HAER Architect, served as project leader. The 2012 HAER field team consisted of Jeremy T. Mauro, field supervisor, Pavel Gorokhov and Ben Shakelton, architects.

Lola Bennett, Historian, Fall 2012

Related Documentation: HABS IN-24-20, Whitewater Canal Aqueduct

Chronology

1800 Indiana Territory established by Congress
1805 America's first documented covered bridge completed at Philadelphia
1806 Theodore Burr patents the Burr truss
1812 David Mount settles near the present-day village of Metamora, Indiana
1816 State of Indiana admitted to the Union
1822 Indiana Senator James Brown Ray proposes construction of Whitewater Canal
1823 Whitewater Valley delegates meet to discuss building a canal in southeastern Indiana
1824 U.S. Army Engineers survey Whitewater Valley to locate line of Whitewater Canal
1836 Indiana Legislature authorizes $13 million for internal improvements
Indiana Board of Internal Improvements begins construction of Whitewater Canal
1838 David Mount and William Holland plat village of Metamora, Indiana
1839 State of Indiana declares bankruptcy and suspends internal improvements program
1842 Whitewater Valley Canal Company resumes construction of Whitewater Canal
1843 First Duck Creek Aqueduct completed by this date
1845 Whitewater Canal completed to Cambridge City, Indiana
1846 First Duck Creek Aqueduct washed out by a flood
Present Duck Creek Aqueduct constructed[2]
1847 Hagerstown Canal Company completes 8-mile canal extension north of Cambridge City
Floods cause extensive damage along Whitewater Canal
1863 Indianapolis & Cincinnati Railway obtains Cincinnati & Whitewater Canal right-of-way
1865 White Water Valley Railroad Company chartered
1866 Brookville & Metamora Hydraulic Co. formed
South elevation of Duck Creek Aqueduct sided
1868 Duck Creek Aqueduct strengthened with auxiliary trusses
Whitewater Valley Railroad opened to traffic
1901 Duck Creek Aqueduct trough repaired
1919 Indiana Department of Conservation formed
1922 Whitewater Canal last used for hydraulic purposes
1930 US Highway 52 bypasses Metamora[3]
1931 Duck Creek Aqueduct pictured in Rosalie Wells' *Covered Bridges in America*
1933 New York Central Railroad discontinues passenger service in the Whitewater Valley
1934 Historic American Buildings Survey (HABS) records Whitewater Canal Aqueduct

[2] The 2005 HAER report states that the aqueduct was built in 1848, but recent research suggests that the aqueduct was built in 1846 (see footnote 1).

[3] The 2005 HAER report states that US Highway 52 bypassed Metamora in 1933, but recent research indicates that the highway was realigned around 1930.

1939 Duck Creek Aqueduct floor collapses
1941 Franklin County engineers supervise temporary repairs to Duck Creek Aqueduct
Whitewater Canal Association formed[4]
1944 Duck Creek Aqueduct floor repaired
1945 Whitewater Canal Association conveys Whitewater Canal property to State of Indiana
Indiana Department of Conservation establishes Whitewater Canal State Memorial
1946 Duck Creek Aqueduct restoration begins[5]
1949 Duck Creek Aqueduct restoration completed
1968 Duck Creek Aqueduct spillway repaired
1972 Whitewater Valley Railroad incorporated
1973 Whitewater Canal Historic District listed in the National Register of Historic Places
1975 Duck Creek Aqueduct trough replaced
1988 Duck Creek Aqueduct trough repaired
1990 Duck Creek Aqueduct trough repaired
1992 Duck Creek Aqueduct designated a National Historic Civil Engineering Landmark
Metamora Historic District listed in the National Register of Historic Places
1996 Duck Creek Aqueduct abutments repaired
1998 Limestone retaining walls installed along canal at each end of Duck Creek Aqueduct
2005 Duck Creek Aqueduct trough replaced
2008 Duck Creek Aqueduct roof repaired
2012 Historic American Engineering Record (HAER) records Duck Creek Aqueduct

[4] The 2005 HAER report states that the Whitewater Canal Association was formed in 1946, but according to the Whitewater Canal Association Records at the Indiana Historical Society, the association was formed in 1941.

[5] The 2005 HAER report states that the aqueduct was repaired in 1947, but according to records of the Indiana Department of Natural Resources, the restoration began in 1946 and was completed in 1947.

Covered Wood Aqueducts

Covered wood aqueducts were never commonplace, but perhaps more existed than was previously believed. Where timber was readily available, canal companies erected wood aqueducts to save time and money. The majority of wood aqueducts were probably left uncovered, but some were partially or fully housed in the same manner as traditional covered roadway bridges. Because most canals were quickly superseded by railroads, most covered wood aqueducts disappeared before they could be documented.

Some impressive examples of covered wood aqueducts once existed on major canal corridors in Pennsylvania, Ohio, and Washington DC, and at least one other covered wood aqueduct reportedly existed on Indiana's Whitewater Canal.[6] Below is a list of known covered wood aqueducts that once existed in the United States; presumably, there were others that have not yet been identified.[7] Duck Creek Aqueduct is the only surviving historic covered wood aqueduct in the country.

STATE	LOCATION	CANAL	SPANNING	DATE	BUILDER	TYPE	NOTES
DC	GEORGETOWN	ALEXANDRIA	POTOMAC RIVER	1843	TOWN & DAVIS	TOWN	REPLACED 1866
IN	METAMORA	WHITEWATER	DUCK CREEK	1846	HENRY C. MOORE	BURR	RESTORED 1949
IN	CONNERSVILLE	WHITEWATER	WILLIAMS CREEK	1856	J.C. MACY		WASHED OUT
IN	FORT WAYNE	WABASH & ERIE	ST. MARY'S RIVER	1846		BURR	REMOVED 1882
IN	ATTICA	WABASH & ERIE	BIG SHAWNEE CREEK	1847			
OH	VANDALIA	MIAMI & ERIE	GREAT MIAMI RIVER	1859	D.H. MORRISON	BURR	COLLAPSED 1903
OH	CIRCLEVILLE	OHIO & ERIE	SCIOTO RIVER	1838	JOHN HOUGH		BURNED 1915
PA	PITTSBURGH	PENNSYLVANIA	ALLEGHENY RIVER	1836	SYLVANUS LOTHROP	LONG	REPLACED 1845
PA	JOHNSTOWN	PENNSYLVANIA	LITTLE CONEMAUGH RIVER	1845			
PA	DUNCANNON	PENNSYLVANIA	SUSQUEHANNA RIVER	1839		BURR	REMOVED

[6] George Gould, *Indiana Covered Bridge thru the Years* (Indianapolis: Indiana Covered Bridge Society, 1977): 31. According to the 1992 ASCE National Historic Civil Engineering Landmark nomination, there may have been covered wood aqueducts on the Whitewater Canal at Brookville and Laurel, but no primary documentation has been found to confirm this.

[7] This list was largely compiled from the following sources: Richard Sanders Allen, *Covered Bridges of the Middle Atlantic States* (Brattleboro, Vermont: Stephen Green Press, 1959): 94-96; Allen, *Covered Bridges of the Middle West* (Brattleboro, Vermont: Stephen Greene Press, 1970): 17, 73-74; Allen, "Covered Wooden Aqueducts," *Covered Bridge Topics* 1, no. 9 (December 1943): 1; Gould, *Indiana Covered Bridge thru the Years*: 31-32; Alvin F. Harlow, *Old Towpaths: the Story of the American Canal Era* (New York: D. Appleton & Co., 1926): 269; Fred J. Moll, *Pennsylvania's Covered Bridges, Our Heritage* (Fleetwood, Pennsylvania: by author, 2004), 96-97; and William H. Shank, *Historic Bridges of Pennsylvania* (York, Pennsylvania: American Canal & Transportation History, 1980): 39-43.

Duck Creek Aqueduct Description

Duck Creek Aqueduct is a single-span through truss covered bridge on mortared limestone abutments. It carries the Whitewater Canal over Duck Creek at the east end of the historic village of Metamora, Indiana. The structure is located on a northwest-southeast axis parallel to Metamora's Main Street and the tracks of the former Indianapolis & Cincinnati Railroad (today, the line carries the Whitewater Valley Railroad, a weekend excursion line). The superstructure is approximately 87' long, 25' wide, and 30' deep overall, with a clear span (between abutment faces) of 69'-4", a canal width of 17'-7", and overhead clearance of approximately 17'. The trusses are approximately 12' deep and spaced 21'-4" on center. The bottom of the aqueduct trough is approximately 10' above Duck Creek.

The superstructure is a Burr through truss with inclined posts.[8] It comprises two eight-panel multiple kingpost trusses. Each truss is flanked by a pair of tied arches, measuring 9"x18" in section. The arches are bolted to the truss posts and set in notches at the ends of the lower chords, where the connection is reinforced with ½"-thick metal plates.[9] The upper chords are paired 8"x9" timbers. The lower chords are paired 9"x16" timbers. The upper and lower chords are connected by a 12"x20" tapered center post and 10"x12" posts whose tops incline outward toward the ends of the bridge; the post angle varies from vertical at mid-span to a maximum of 20 degrees from vertical at the ends of the span. There are 8"x12" braces, angled down toward the ends of the bridge, between the posts. The upper lateral bracing system consists of 12"x14" tie beams, spaced approximately 16' apart, with 6"x6" cross-bracing between them.

The trough (or flume) is approximately 17'-7" wide and 4'-6" deep overall. It is constructed of white oak tongue-and-groove boards (2"x8" for the deck and 2"x6" for the walls), supported by a series of thirty-five 6"x16"x24' transverse floor beams spaced at 2' centers. The outer ends of the floor beams bear on two 10"x12" longitudinal beams that run the length of the bridge. The longitudinal beams are suspended from the lower chords by 1¼"-diameter metal rods spaced at 3' centers. Each rod passes between the lower chord members, through the outer ends of a floor beams, and through the longitudinal beam. Each rod is secured above the lower chord members and below the longitudinal beam with a plate and nut.

The normal water depth is 24" and the high water depth is 36", except when the canal is drained in winter, or for maintenance. A 4'-wide spillway is integrated into the west abutment; this regulates the water level of the aqueduct under normal conditions. During times of heavy precipitation, the water level can be regulated by means of four metal relief valves (flood gates), two on each side of the trough near mid-span. Each relief valve consists of a pivoting metal gate and a chute made up of ¼" metal plates. When the relief valves are opened by inserting and turning a metal T-handle, the excess water is released through the chutes into the creek below.

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[8] Some sources describe this structure as a Wernwag truss, but aside from the inclined posts, it does not have any Wernwag characteristics. For further discussion, see: Joseph D. Conwill, "Burr Versus Wernwag," *Covered Bridge Topics* 55, no. 2 (Spring 1997): 4-5.

[9] In Burr trusses, the arches usually spring from the abutments at a point below the lower chords, but occasionally the arches are tied into the lower chords. At least a few examples of the tied arch method of construction once existed in Indiana.

A 4-foot-wide walkway is cantilevered from the north side of the structure. Its outer edge is supported on 3"x4" braces that are supported on the outer ends of the floor beams. The walkway comprises of five lines of 2"x8" boards nailed to the floor beams. Four 1"x8" boards, spaced at 10" on center, form a 3'-6" high railing on the outside of the walkway.

The structure is fully covered with board-and-batten siding on the south side and is left open on the north side, where the roof extends 3'-9" over the walkway. The portal ends have horizontal wood siding on the gables. The siding is painted red.

The gable roof is supported on 3"x4" rafters, spaced at 24" on center, with their outer ends resting on an 8"x9" sill. The original roof covering was wood shingles. Sometime prior to 1934, the roof was covered with galvanized standing-seam metal, as shown in the 1934 HABS drawings. During the 1946-49 restoration, state engineers elected to use a metal roof to decrease the risk of fire.[10] The present roof is covered with standing-seam metal panels on 1"x6" rough-sawn skip sheathing.

A modern historical marker stands near the southwest corner of the aqueduct. A bronze plaque attached to a nearby boulder states that the structure was designated as a National Historic Civil Engineering Landmark by the American Society of Civil Engineers (ASCE) in 1992.

The Burr Truss

Theodore Burr (1771-1822) is a major figure in the history of covered bridge building. He built many important bridges over the course of a twenty-year career and is credited with the invention of the Burr truss, which was one of the most popular timber truss types in the nineteenth century and continued to be built in some areas until about 1920.[11] Born in Connecticut, Burr learned construction at an early age from his father, who was a miller and millwright. In 1800, Burr built his first bridge, a simple timber stringer span, across the Chenango River on the Catskill Turnpike at Oxford, New York. He subsequently experimented with a wide variety of timber arch designs for bridges that spanned the Hudson, Mohawk, Delaware and Susquehanna rivers. He built his first covered bridge across Schoharie Creek at Esperance, New York in 1811. Burr's masterpiece was the short-lived, McCall's Ferry Bridge (1815) across the Susquehanna River near Lancaster, Pennsylvania; with a clear span of 360'-4", this was the longest timber arch span ever erected during the historic period of covered bridge building.

[10] Eugene R. Bock, "Aqueduct Project near Completion," *Indiana Covered Bridge Topics* 4, no. 3 (June 1949): 2.

[11] The Edna Collins Bridge (1922) in Putnam County, Indiana was the last historic Burr truss covered bridge built in the United States.

In 1806, and again in 1817, Burr received patents for the truss design that bears his name.[12] The Burr truss was an innovative trussed arch design, in which a separate segmental arch was superimposed on a multiple kingpost truss.[13] Its structural action was such that the arch bolstered the truss, while at the same time being stabilized by it, a complex interaction. A major advantage of this design was that it allowed for a level deck, in contrast to earlier arched truss spans built by Timothy Palmer (1751-1821) and Lewis Wernwag (1769-1843), an important feature for multiple-span bridges, and later, for railroad bridges. The Burr truss was the first patented bridge truss to gain widespread acceptance among bridge builders, although the inventor reportedly collected few royalties from it. The design was popular in the mid-nineteenth century for both railroad and roadway spans.

In 1822, Burr died under mysterious circumstances while supervising construction of a bridge at Middletown, Pennsylvania.[14] The Union Bridge (1804) spanning the Hudson River at Waterford, New York was the last survivor of the bridges Burr built himself; it was destroyed by fire in 1909. Of the thousands of Burr truss covered bridges that once existed, about 185 historic examples (more than twenty-five percent of the nation's covered bridge population) survive in the United States, with some of the finest examples located in Pennsylvania and Indiana.[15]

History of the Whitewater Canal

Following the War of 1812, the Whitewater Valley in southeastern Indiana saw rapid settlement. The valley had fertile soil, abundant natural resources, and was ideally suited to farming and the establishment of water-powered industries, and because of its geography, the Whitewater River served as a major waterway into the interior of Indiana. By 1820, the Whitewater Valley was the most heavily populated region in the state and agitation soon began for internal improvements that would better existing economic and social conditions.[16]

In 1822, residents of the Whitewater Valley began lobbying the Indiana legislature for a canal that would provide easy access to the Ohio River.[17] A meeting held at Harrison in 1823 included delegates from each county in the region. In 1824, the United States Army Engineers surveyed

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[12] Theodore Burr, United States Letters Patent No. 2769X, 3 April 1817. The 1806 patent was lost in the 1836 patent office fire, but the 1817 patent was recovered.

[13] The truss design Theodore Burr used was not new, as it had been published in the *Columbian Magazine* in 1787, but he is believed to be the first builder to use that design in bridge building.

[14] Hubertis M. Cummings, "Theodore Burr and His Bridges across the Susquehanna," *Pennsylvania History* 23, no. 4 (October 1956): 484.

[15] Joseph D. Conwill, "Burr Truss Bridge Framing," *Timber Framing*, no. 78 (December 2005): 4.

[16] Harry O. Garman, "Whitewater Canal, Cambridge City to the Ohio River," *Indiana History Bulletin* 39, no. 9 (September 1962): 127.

[17] Augustus Jocelyn (1821-1873), publisher of *The Western Agriculturalist* at Brookville, Indiana, used his newspaper to generate interest in the establishment of a canal in the Whitewater Valley.

the valley, locating a route along the West Fork of the Whitewater River, from the National Road at Cambridge City to the Ohio River at Lawrenceburg. The State was unable to finance such a large venture, so the plan was set aside for more than a decade.

On January 27, 1836, Indiana Governor Noah Noble (1794-1844) signed the Internal Improvements Act, which created the Board of Internal Improvements and provided $13 million for an ambitious public works program intended to establish a network of canals, railroads and turnpikes throughout the state. These transportation corridors would connect to the Great Lakes to the north, the Ohio River to the south, and the Erie Canal to the east. The proposed projects included: construction of the Whitewater Canal from the National Road at Cambridge City to the Ohio River; construction of the Central Canal from the Wabash River to Indianapolis; extension of the Wabash & Erie Canal from the Tippecanoe River to Terre Haute; construction of a railroad from Madison to Lafayette via Indianapolis; construction of a macadamized turnpike from New Albany to Vincennes; construction of a railroad or macadamized road from Jeffersonville to Crawfordsville; removal of obstructions to navigation of Wabash River; and construction of the Erie & Michigan canal or railroad.[18]

On September 13, 1836, contracts for the Whitewater Canal were let at Brookville, followed by a groundbreaking ceremony. Construction required clearing and draining the land, excavating and lining the canal, building the embankments and towpath, and constructing dams, locks, aqueducts and culverts. The canal was 76 miles long, 26' wide at the bottom, 40' wide at the surface, and 4' deep, with a 10'-wide towpath on one side and a 5' wide embankment on the other; the embankments were sloped at approximately 30 degrees from level. The topography of the Whitewater Valley required construction of seven feeder dams to impound and feed water from the river, fifty-six locks to lower and raise boats 490 feet, and twelve aqueducts to carry the canal over rivers and streams. The total cost of construction was $1,164,665, which averaged approximately $15,000 per mile.[19]

The Whitewater Canal was built from Lawrenceburg to Cambridge City, and later extended to Hagerstown. The canal followed the West Fork of the Whitewater River, crossing from the west bank to the east bank at Harrison, and the east bank to the west bank at Laurel. Between Lawrenceburg and Harrison, the canal was diverted into Ohio for a distance of seven miles.[20] The canal was considered such a promising venture that the State of Ohio spent $800,000 on the construction of a 25-mile spur canal from Harrison, Indiana to Cincinnati; that branch opening in 1843 and remained in use until 1856.

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[18] Allen A. White, "Indiana's Network of Canals was Merely a Dream," *Indianapolis Star*, 10 June 1934. This article contains an excellent map showing the canals, railroads, and turnpikes proposed under Indiana's Internal Improvements Act of 1836. Of the 857 miles of canals proposed in Indiana, only 472 miles (55 percent) were built.

[19] These numbers include the Hagerstown extension north of Cambridge City.

[20] Due to some high ground at Harrison, seven miles of the section of canal between Harrison and Lawrenceburg had to be located in Ohio. The State of Ohio initially objected, but when they realized the canal might be of mutual benefit, they approved construction and subsequently built their own branch.

By the time the canal was completed between Lawrenceburg and Brookville in 1839, the State of Indiana was experiencing serious financial difficulties. With $193,000 in bond interest due, and just $45,000 in tax revenue, the State declared bankruptcy, abolished the Board of Internal Improvements, suspended work on its internal improvement program, and transferred the projects to private companies.[21]

In 1841, the Whitewater Valley Canal Company was chartered with a capital stock of $400,000. That company resumed construction of the canal the following summer. The Whitewater Canal was completed to Laurel in 1844, to Connersville in 1845, and to Cambridge City in 1846. The Hagerstown Canal Company completed an eight-mile extension north of Cambridge City in 1847.

From its inception, the Whitewater Canal was beset by financial misfortune, which was in large measure due to repeated floods that swept down the Whitewater Valley, disrupting navigation and necessitating costly repairs.[22] Although it served as a valuable transportation corridor for a time, the Whitewater Canal was never a financial success. Slow return on investments, coupled with increasing competition from railroads, caused the canal to go out of business in less than two decades. Commercial navigation ceased after a series of floods just prior to the beginning of the Civil War.

In 1863, the Indianapolis & Cincinnati Railway purchased the towpath right-of-way; they chartered the White Water Valley Railroad in 1865, laid tracks along the towpath, and began rail service in 1868.[23] In 1866, the Brookville & Metamora Hydraulic Company was formed to continue hydraulic use of the canal from Brookville to Laurel.[24] During the late nineteenth century, the Whitewater Canal corridor continued to be used for railroad transport and hydraulic power.

In the early 1920s, the Brookville & Metamora Hydraulic Company found business unprofitable and cut off the canal's water supply, leaving a dry ditch, which eventually became choked with vegetation and debris. By the late 1920s, the entire Whitewater Canal corridor had fallen into disuse and disrepair. Many canal-related structures had decayed or sustained extensive damage. What had once been the lifeblood of the Whitewater Valley was now nothing more than an unsightly relic of yesteryear.

In the late 1930s, the idea of preserving a section of the canal for historical purposes began to form, largely under the influence of Lawrenceburg banker and politician Cornelius O'Brien

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[21] Richard Simons, "Indiana's Canal Days," *Indianapolis Star Magazine*, 24 April 1949: 7.

[22] The Whitewater River is a rapid stream that flows through a steep valley and is subject to frequent flooding. The Whitewater Canal fell 490 feet over the course of 76 miles (an average fall of 6.45 feet per mile); in comparison, the Erie Canal fell 565 feet over the course of 363 miles (an average fall of 1.55 feet per mile).

[23] Passenger service was discontinued in 1933; freight service was discontinued in 1973.

[24] The Brookville & Metamora Hydraulic Company Records, Manuscript Collection #L335, B10, at the Indiana State Library contains additional details about the canal's history from 1836 to 1944.

(1883–1953), who served on the boards of the Indiana Historical Society and the Indiana Historical Bureau. O'Brien worked closely with Brookville businessman John P. Goodwin (1880-1972), who served on the boards of the Indiana State Library and the Indiana Historical Society. When the feeder dam at Laurel was damaged and the aqueducts at Metamora and Brookville partially collapsed in 1939, O'Brien brought the idea to the attention of Indiana Historical Bureau director, Christopher B. Coleman (1875-1944):

> *The remains of the old Whitewater Canal around Brookville and Metamora should be preserved as an exhibit of one of the most important means of transportation in its days. It seems to me that it would be a distinct historical loss if this little piece of it were allowed to disappear. I think it would be fine if it could be preserved as a state park.*[25]

On October 24, 1941, O'Brien, Goodwin, and Coleman, along with a number of their associates, formed the Whitewater Canal Association for the purpose of preserving a fifteen-mile section of the canal, from the feeder dam at Laurel to the Whitewater River at Brookville, as a state memorial. In 1942, the Whitewater Canal Association was incorporated as a non-profit organization. Over the next three years, the association worked tirelessly in securing funding for canal repairs, obtaining title to the most intact section of the canal and easements from adjoining property owners, and lobbying for the State's preservation of the Whitewater Canal.[26]

On February 27, 1945, the Indiana General Assembly passed an act authorizing the Indiana Conservation Commission to accept and maintain a section of the Whitewater Canal in Franklin County, with an appropriation of $10,000 for the first year and $15,000 annually thereafter.[27] The Whitewater Canal Association subsequently conveyed the canal property between Laurel and Brookville to the Indiana Conservation Commission, which designated it the "Whitewater Canal State Memorial."[28]

Over the next three decades, the Indiana Department of Conservation (which became the Indiana Department of Natural Resources in 1965) undertook the restoration of representative transportation and industrial features that form the Whitewater Canal State Memorial. The Duck Creek Aqueduct was restored in 1946-49, several locks and dams and a stone arch aqueduct were repaired by 1953, and the canal was dredged by 1955. Canal boat excursions began in 1964.[29] In 1973, the restoration of the old Metamora grist mill was completed. Soon thereafter, the

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[25] Cornelius O'Brien to Christopher B. Coleman, 30 September 1939, *Cornelius O'Brien Papers, 1938-1944*, Manuscript Collection #M0597, Indiana Historical Society, Indianapolis, Indiana.

[26] *Whitewater Canal Association Records, 1939-1964*, Manuscript Collection #SC1567, Indiana Historical Society, Indianapolis, Indiana; "More Funds Needed to Restore Old Canal," *Brookville Democrat*, 3 August 1944: 1.

[27] *Acts of the Indiana General Assembly, 1945* (Indianapolis: Bookwalter Company, 1945): 142-143.

[28] The Whitewater Canal Memorial became the Whitewater Canal State Historic Site sometime after 1988.

[29] Launched in 1964, the motorized, wood hull *Valley Belle* remained in service until 1980, when it was replaced with the horse-drawn, wood hull *Ben Franklin II* (named after the first boat to traverse the canal in 1839), which remained in service until 1988. The horse-drawn, fiberglass hull *Ben Franklin III* was launched in 1990 and was still in service as of 2012.

Indiana Department of Natural Resources developed a picnic area near the Laurel feeder dam and erected the Whitewater Canal State Historic Site headquarters at Metamora. In 1974, the Whitewater Valley Railroad (a Connersville-based non-profit organization) leased tracks from the Penn Central Railroad and began running weekend steam train excursions between Connersville and Metamora. Since the late 1960s, the Whitewater Canal State Memorial (now, Whitewater Canal State Historic Site) has been a popular tourist destination in Indiana.

History of Metamora

In 1812, David Mount (1778-1850) of Pennington, New Jersey, settled near this site on Duck Creek, approximately 65 miles southeast of Indianapolis and 50 miles northwest of Cincinnati. The following year, he established a saw mill, a grist mill, a carding mill, and a fulling mill on the White Water River. Along with a handful of other settlers, Mount was influential in establishing a thriving agricultural and industrial hamlet here.[30] By 1826, the village at "Duck Creek Crossing" was large enough to warrant the establishment of a post office. A dozen years later, when construction of the Whitewater Canal was assured, David Mount and William Holland platted the village of Metamora on the proposed route of the canal.[31]

> *The subscribers will offer at public sale on Thursday the 26th of April, A.D. 1838, about fifty in-lots, in the above named town. This place is situated in one of the most extensive, fertile and beautiful valleys of the white water river. …The white water canal is located directly through the centre of the town. …The great State Road and stage route from Indianapolis through Rushville and Brookville to Cincinnati, strikes the canal at this point and runs side and side with it through the centre of the town, and nearly all of the lots offered will front on one or the other of these great thoroughfares.*[32]

Metamora was one of three towns founded along the proposed canal route, the other two being Laurel (platted 1836) and Cedar Grove (platted 1837); other towns along the corridor, like Brookville and Connersville, predate the planning of the canal. In the 1840s, Metamora grew rapidly as a bustling canal port. By mid-century, this enterprising community of about 1,000 inhabitants boasted a thriving commercial district and a number of mills that produced grain, flour, cotton, wool, wooden barrels, and liquor.

After the canal was supplanted by the railroad in the 1860s, Metamora lost its position as a commercial hub, as larger towns were just a short train ride away. In subsequent decades, water-powered industries began to decline and the population began to shift to urban centers. By 1910, Metamora's population had dwindled to 588 residents. In 1922, the Brookville & Metamora Hydraulic Company drained the canal, leaving a dry ditch in its place. Then, in the early 1930s,

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[30] August J. Reifel, *History of Franklin County, Indiana* (Indianapolis: B.F. Bowen & Company, 1915): 187.

[31] According to local legend, the village of Metamora was named after the Native American heroine of John Augustus Stone's 1829 play, "Metamora; or, the Last of the Wampanoags."

[32] "Notice of Public Sale," *Brookville American*, 23 March 1838: 4.

US Highway 52 bypassed the village, the railroad discontinued passenger service, and Metamora slid into a period of serious economic decline.

When the State of Indiana established the Whitewater Canal State Memorial at Metamora in 1945, less than 100 residents remained.[33] After the canal and associated structures were restored, the village gradually became a tourist destination, creating economic opportunities for entrepreneurs and artists, who saw the quaint village as an affordable, unique, and laid-back place to live and work. Since the mid-1970s, Metamora's historic district (listed in the National Register of Historic Places in 1973) has featured a variety of craft shops, antique galleries, museums, restaurants, and bed & breakfast establishments. Today, Metamora is the best preserved canal village in the Whitewater Valley. It hosts tens of thousands of visitors annually, particularly during special events sponsored by Historic Metamora, Inc., a local non-profit organization dedicated to preservation and education.

History of Duck Creek Aqueduct

The first aqueduct at this site was reportedly a non-housed timber structure comprising two 50' spans. It was built sometime between 1839, when assistant engineer Myron S. Webb (1810-1871) laid out work along this section of the Whitewater Canal, and 1843, when boats were traveling as far north as Connersville.[34]

On August 21, 1846, Duck Creek Aqueduct washed out during a storm that caused heavy flooding in the Whitewater Valley. According to the *Brookville American*:

> *The Canal had been empty for near two months and was just filled ready for the fall business—merchants, farmers and boatmen were just looking on tiptoe for the profits of the opening trade. But their hopes were suddenly blasted on Friday evening last by the washing away of the Duck Creek aqueduct. This Creek rose in a few minutes to some feet higher than ever known before, undermined the abutments and swept away that noble structure.*[35]

Other sections of the canal also suffered damage, including another aqueduct across Big Cedar Creek south of Brookville. The Whitewater Canal Company immediately set to work repairing the damage and restoring service on the canal. In a September 2, 1846 letter to the *Brookville American*, engineer Henry C. Moore (b.1813) said, "*We hope to have a new aqueduct across Duck Creek at Metamora ready for water by the first day of October and possibly a few days earlier. We have as large a force engaged as can work to advantage, and are getting along very*

[33] Louis Hiner, Jr., "Old Canal Aqueduct to be Restored Soon," *Indianapolis News*, 22 March 1948: 1.

[34] Henry C. Prange, "The Whitewater Aqueduct over Duck Creek at Metamora," unpublished typescript, 1946 (Indiana Department of Natural Resources files, Indianapolis, Indiana): 1.

[35] "High Waters—Canal," *Brookville American*, 28 August 1846: 2.

well."[36] The work of constructing the aqueduct took about six weeks. On September 30, 1846, engineer Moore wrote, "*The new aqueduct at this place is now ready for the water, which will probably pass over it sometime tonight—at all events it will do so on tomorrow. I think the Canal will be filled to Brookville and ready for navigation by Saturday afternoon next.*"[37]

Duck Creek Aqueduct has carried the Whitewater Canal almost continuously since its construction, except when closed for inspection, maintenance or repairs.[38] In 1868, the aqueduct was strengthened with auxiliary queenpost trusses, additional braces and iron tension rods.[39] In 1901, the structure was again repaired.

By the 1930s, the aqueduct was abandoned and in very bad shape. Photographs show that it was severely deflected and wracked. On September 28, 1939, the floor of the aqueduct collapsed.[40] Franklin County engineers completed some temporary repairs with a crew of volunteers and donations from local businesses.[41] Around that time, a group of local businessmen and politicians formed the Whitewater Canal Association for the purpose of preserving a fifteen-mile section of the canal between Laurel and Brookville as a state memorial. The Association raised money to keep the aqueduct stabilized until the State took over its maintenance in 1945.

In 1945, the Whitewater Canal Association conveyed the canal property between Laurel and Brookville, including the Duck Creek Aqueduct, to the Indiana Conservation Commission for designation as a state memorial. The "Preliminary Planning Report on the Whitewater Canal Memorial," dated August 2, 1945, discussed restoration of various components of the canal, and the language of that report suggests, at least, that the intent of the entire project, including the aqueduct, was restoration:

> *This venerable structure can and should be restored. …The structure is in such bad condition it appears to have been spared from complete collapse only by a kind Providence. …This is a unique structure that commands keen interest from visitors. It is worthy of a good job of restoration.*[42]

The Duck Creek Aqueduct was restored to its present appearance in 1946-49, under the direction of Indiana Department of Conservation Engineer Thomas Godfrey MacKenzie (b.1899) and Assistant Engineer Henry C. Prange (b.1904). Foreman Donald E. Bates (1896-1959) of

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[36] H.C. Moore, Letter to the Editor, *Brookville American*, 4 September 1846: 2.

[37] "The Canal," *Brookville American*, 2 October 1846: 2.

[38] In winter, the canal water depth is lowered to a few inches.

[39] These elements, which are shown in the 1934 Historic American Buildings Survey (HABS) drawings, were removed during the 1946-1949 restoration.

[40] "Aqueduct Falls Thursday Night," *Brookville Democrat*, 5 October 1939: 1.

[41] "Aqueduct Repair is now Complete," *Brookville Democrat*, 23 October 1941: 1.

[42] Richard E. Bishop, "A Preliminary Planning Report on the Whitewater Canal Memorial, 2 August, 1943," *Goodwin Family Papers*, Manuscript Collection #M0115, Box 3, Folder 11, Indiana Historical Society, Indianapolis, Indiana: 3.

Metamora was able to use the original arches and portions of the original trusses. Deteriorated sections of wood were replaced in kind with local white oak and yellow poplar.[43] Elements from the 1868 strengthening were removed during this restoration.

According to records of the Indiana Department of Natural Resources and the Indiana State Museum and Historic Sites, the Duck Creek Aqueduct spillway was repaired in 1968 and the abutments were repaired in 1996. The trough, which is especially susceptible to decay, has been repaired numerous times in recent decades; it was most recently replaced in 2005 by J.A. Barker Engineering, Inc., of Bloomington, Indiana, a firm with expertise in the rehabilitation of historic covered bridges.

Since the 1930s, Duck Creek Aqueduct has been celebrated as a local landmark, due in part to its prominent location in the picturesque village of Metamora, Indiana. In 1931, a photograph of the structure was published in Rosalie Wells' (b.1876) *Covered Bridges in America*, which was the first book to look at covered bridges from an historical perspective.[44] In 1934, this structure was one of the first covered bridges in the United States to be recorded by the Historic American Buildings Survey (HABS), a division of the National Park Service.[45] By the late 1930s, antiquarians and historians recognized Duck Creek Aqueduct as the only surviving covered wood aqueduct in the United States.[46]

In recent decades, Duck Creek Aqueduct has received national recognition. It is a contributing structure to the Whitewater Canal Historic District, which was listed in the National Register of Historic Places in 1973, and the Metamora Historic District, which was listed in the National Register of Historic Places in 1992.[47] Also in 1992, the American Society of Civil Engineers (ASCE) designated Duck Creek Aqueduct a National Historic Civil Engineering Landmark.[48] The Historic American Engineering Record (HAER) documented the structure as part of the National Historic Covered Bridges Recording Project, with large-format photographs in 2005, and a written history and measured drawings in 2012. Duck Creek Aqueduct is one of twenty nationally significant covered bridges proposed for National Historic Landmark consideration in the National Park Service's 2012 "Covered Bridges NHL Context Study."[49]

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[43] Richard Sanders Allen, "Indiana Moves to Preserve Aqueduct, *Covered Bridge Topics* 4, no. 2 (June 1946): 9; Eugene Bock, "Famed Aqueduct Fully Restored," *Indiana Covered Bridge Topics* 4, no. 2 (March 1949): 1.

[44] Rosalie Wells, *Covered Bridges in America* (New York: William Edwin Rudge, 1931): 92.

[45] See HABS No. IN-24-20, Whitewater Canal Aqueduct, Franklin County, Indiana.

[46] Frederick Polley, "Decline of Unique Aqueduct Bridge," *Indianapolis Star*, 14 May, 1939.

[47] Robert D. Starrett, "Whitewater Canal Historic District," *National Register of Historic Places Inventory-Nomination Form*, 1973; and William L. Selm and R. Paul Baudendistel, "Metamora Historic District," *National Register of Historic Places Registration Form*, 1992.

[48] American Society of Civil Engineers, "Whitewater Canal Duck Creek Aqueduct," *National Historic Civil Engineering Landmark Nomination*, 1992.

[49] Lola Bennett, "Covered Bridges NHL Context Study," National Historic Landmarks Program, National Park Service, Washington, DC, 2012.

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