

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

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**NATIONAL REGISTER OF HISTORIC PLACES
INVENTORY -- NOMINATION FORM**

SEE INSTRUCTIONS IN *HOW TO COMPLETE NATIONAL REGISTER FORMS*
TYPE ALL ENTRIES -- COMPLETE APPLICABLE SECTIONS

1 NAME

HISTORIC

Old Waterworks

AND/OR COMMON

Old Waterworks

2 LOCATION

STREET & NUMBER On east bank of Monocacy Creek immediately north of
Hill-to-Hill Bridge and immediately west of Main St.

CITY, TOWN

Bethlehem

VICINITY OF

STATE

Pennsylvania

CODE

42

COUNTY

Northampton

CODE

095

3 CLASSIFICATION

CATEGORY	OWNERSHIP	STATUS	PRESENT USE
<input type="checkbox"/> DISTRICT	<input checked="" type="checkbox"/> PUBLIC	<input type="checkbox"/> OCCUPIED	<input type="checkbox"/> AGRICULTURE <input checked="" type="checkbox"/> MUSEUM
<input checked="" type="checkbox"/> BUILDING(S)	<input type="checkbox"/> PRIVATE	<input checked="" type="checkbox"/> UNOCCUPIED	<input type="checkbox"/> COMMERCIAL <input type="checkbox"/> PARK
<input type="checkbox"/> STRUCTURE	<input type="checkbox"/> BOTH	<input type="checkbox"/> WORK IN PROGRESS	<input type="checkbox"/> EDUCATIONAL <input type="checkbox"/> PRIVATE RESIDENCE
<input type="checkbox"/> SITE	PUBLIC ACQUISITION	ACCESSIBLE	<input type="checkbox"/> ENTERTAINMENT <input type="checkbox"/> RELIGIOUS
<input type="checkbox"/> OBJECT	<input type="checkbox"/> IN PROCESS	<input checked="" type="checkbox"/> YES: RESTRICTED	<input type="checkbox"/> GOVERNMENT <input type="checkbox"/> SCIENTIFIC
	<input type="checkbox"/> BEING CONSIDERED	<input type="checkbox"/> YES: UNRESTRICTED	<input type="checkbox"/> INDUSTRIAL <input type="checkbox"/> TRANSPORTATION
		<input type="checkbox"/> NO	<input type="checkbox"/> MILITARY <input type="checkbox"/> OTHER:

4 OWNER OF PROPERTY

Write: Karen Z. Huetter, Historic Bethlehem Inc.
City of Bethlehem Gordon Mowreer, Mayor

NAME

(Leased for 99 years to Historic Bethlehem Inc., 516 Main St., 18018)

STREET & NUMBER

10 East Church Street

CITY, TOWN

Bethlehem

VICINITY OF

STATE

Pennsylvania

5 LOCATION OF LEGAL DESCRIPTION

COURTHOUSE,
REGISTRY OF DEEDS, ETC.

Recorder of Deeds

STREET & NUMBER

Northampton County Courthouse/Seventh & Walnut Sts.

CITY, TOWN

Easton

STATE

Pennsylvania

6 REPRESENTATION IN EXISTING SURVEYS

TITLE Historic American Buildings Survey; National Register of
Historic Places; Historic American Engineering Record

DATE

1969; 1972; 1975

FEDERAL STATE COUNTY LOCAL

DEPOSITORY FOR
SURVEY RECORDS

Library of Congress; National Register; Library of Congress

CITY, TOWN

Washington

STATE

D.C.

285

7 DESCRIPTION

CONDITION		CHECK ONE	CHECK ONE
<input checked="" type="checkbox"/> EXCELLENT	<input type="checkbox"/> DETERIORATED	<input type="checkbox"/> UNALTERED	<input checked="" type="checkbox"/> ORIGINAL SITE
<input type="checkbox"/> GOOD	<input type="checkbox"/> RUINS	<input checked="" type="checkbox"/> ALTERED	<input type="checkbox"/> MOVED DATE _____
<input type="checkbox"/> FAIR	<input type="checkbox"/> UNEXPOSED		

DESCRIBE THE PRESENT AND ORIGINAL (IF KNOWN) PHYSICAL APPEARANCE

The Old Waterworks was erected in 1762. It stands today in its original location on the flood plain of Monocacy Creek about 100 feet east of the present creek bed, immediately north of Hill-to-Hill Bridge, and adjacent to the site of the 1755 waterworks in the old Moravian industrial area, now a Historic Bethlehem Inc. park undergoing restoration.⁷ The pumphouse is original; the waterwheel, pumps, and other machinery are reconstructions based on mechanical drawings of the original equipment. The drawings, prepared about 1767, were found in the Moravian Archives in Herrnhut, East Germany. Archological investigation of the Old Waterworks began in 1964, and restoration of the pumphouse was accomplished in 1972-73 when the limestone walls were repainted, the red tile roof reconstructed, and the original architectural features restored.⁸

The east-west oriented pumphouse is a 2 1/2-story native limestone rubble structure that measures 24 feet square and features a red-tile-covered bellcast-hipped-gable roof. A single red brick chimney pierces the roof crest east of center. The building rests on a stone foundation over a holding pit for spring water, which entered the structure until 1765 via an open trench and after 1765 was conveyed in wooden pipes. Neither system survives, but Historic Bethlehem Inc., hopes to restore the trench sometime in the future.

Three doors, each set under a segmental arch of red brick, provide pedestrian access to the pumphouse. One single wood plank door admits to the wheelroom from the west end, and a second, which has a three-light transom, admits from the south side. The third door, similar to the first, opens into the second floor storage area from ground level at the east end of the building where it abuts the sloping bluff. In each gable end another wood plank door gives access to the attic space. These openings, like the pedestrian doors and the windows as well, also feature segmental brick arches. Six symmetrically placed windows, three on each full story, light the north side of the pumphouse, and five light the south side. On each side all

(continued)

⁷ See Section 8, Statement of Significance, for a description of the original equipment and the modifications made between 1762 and 1832.

⁸ See Section 8, Statement of Significance, for a description of the condition of the Old Waterworks in 1964 and a discussion of restoration process.

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windows are six-over-six sashes except the northernmost one on the first floor. It is a single six-pane opening. Finally, one six-over-six sash window lights the west end of the second floor.

Inside, the machinery duplicates that described in the significance portion of this inventory, with the apparent exception that the waterwheel measures about 17 1/2 feet in diameter compared to the original wheel's 18 feet. Built of oak cut, as was all timber in the reconstruction, within 50 miles of Bethlehem, the wheel measures 2 feet 10 inches deep, has 6 sections of 48 fins each, and is situated with accompanying machinery on a 12-by-12-foot oak frame. The wheel hub is 24 inches in diameter and 9 feet long and is made of oak fitted around a steel shaft. Positioned on that same shaft, the oak wallower wheel measures 4 feet 6 inches in diameter, is 1 foot 4 inches deep, and has 33 turned hickory pegs set to mesh with the pump drive gear. This gear measures 7 feet 3 inches by 7 feet, and its hub measures 2 feet by 2 feet. Each of the three wooden connecting rods measures 5 by 14 inches by 8 feet. The pump features a laminated 20-by-21-inch wood cylinder block that is 7 feet long and has three 11 inch cylinders lined with cast-iron casings. Its pistons are made of steel plates with leather washers. Presently the waterwheel is turned for effect by electricity, but Historic Bethlehem Inc., hopes in the future to restore the old stone-lined raceways and allow Monocacy Creek to power the works once again.

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8 SIGNIFICANCESIGNIFICANT IN BOTH
ENGINEERING AND INDUSTRY

PERIOD	AREAS OF SIGNIFICANCE -- CHECK AND JUSTIFY BELOW				
<input type="checkbox"/> PREHISTORIC	<input type="checkbox"/> ARCHEOLOGY-PREHISTORIC	<input type="checkbox"/> COMMUNITY PLANNING	<input type="checkbox"/> LANDSCAPE ARCHITECTURE	<input type="checkbox"/> RELIGION	
<input type="checkbox"/> 1400-1499	<input type="checkbox"/> ARCHEOLOGY-HISTORIC	<input type="checkbox"/> CONSERVATION	<input type="checkbox"/> LAW	<input type="checkbox"/> SCIENCE	
<input type="checkbox"/> 1500-1599	<input type="checkbox"/> AGRICULTURE	<input type="checkbox"/> ECONOMICS	<input type="checkbox"/> LITERATURE	<input type="checkbox"/> SCULPTURE	
<input type="checkbox"/> 1600-1699	<input type="checkbox"/> ARCHITECTURE	<input type="checkbox"/> EDUCATION	<input type="checkbox"/> MILITARY	<input type="checkbox"/> SOCIAL/HUMANITARIAN	
<input checked="" type="checkbox"/> 1700-1799	<input type="checkbox"/> ART	<input checked="" type="checkbox"/> ENGINEERING	<input type="checkbox"/> MUSIC	<input type="checkbox"/> THEATER	
<input checked="" type="checkbox"/> 1800-1899	<input type="checkbox"/> COMMERCE	<input type="checkbox"/> EXPLORATION/SETTLEMENT	<input type="checkbox"/> PHILOSOPHY	<input type="checkbox"/> TRANSPORTATION	
<input type="checkbox"/> 1900-	<input type="checkbox"/> COMMUNICATIONS	<input checked="" type="checkbox"/> INDUSTRY	<input type="checkbox"/> POLITICS/GOVERNMENT	<input type="checkbox"/> OTHER (SPECIFY)	
		<input type="checkbox"/> INVENTION			

SPECIFIC DATES 1755-1832

BUILDER/ARCHITECT Johann Christopher Christensen

STATEMENT OF SIGNIFICANCE

According to the Historic American Engineering Record and Historic Bethlehem Inc., the Old Waterworks was the first municipal pumping system to provide drinking and washing water in the American Colonies.¹ As such it marks an important milestone in the history of American technology. Johann Christopher Christensen devised the system in 1754 to transfer spring water from the Monocacy Creek flood plain to the Moravian settlement on the bluff above it. Six years later, in 1762, Christensen enlarged the waterworks and installed it in a 24-foot-square limestone rubble structure with a red-tile-covered hipped-bellcast-gable roof. The system's 18-foot undershot waterwheel powered three single acting cast-iron pumps which forced spring water through wood (later lead) pipes 320 feet (94 vertical feet) to a collecting tower, and from there water flowed by gravity to strategically placed cisterns throughout the community.¹ Historic Bethlehem Inc., restored the pumphouse and machinery in 1976. Today the waterworks is both a National Historic Civil Engineering Landmark and an American Water Landmark.

History

Middle-European communitarian Protestants known as the Unity of Brethren, or Moravians, founded Bethlehem in 1741 and made it the seat of their ecclesiastical government in America. The settlement's first permanent residences rested on a bluff overlooking the flood plain of Monocacy Creek just northeast of that stream's confluence with the Lehigh River. A spring in the plain supplied the community with fresh water, and the

(continued)

¹P.H. Scott, "The Old Water Works," Historic American Engineering Record Inventory Card, 1975; and Historic Bethlehem, Inc., "1762 Waterworks Data Sheet." Mimeographed. (Bethlehem, Pa., 1976).

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creek furnished power for some 32 industries which the Moravians established along its banks by 1747. Among these enterprises were a pottery, linseed oil mill, grist mill, fulling mill, and dyehouse.

By 1750 Bethlehem's population had reached several hundred, and the task of hauling sufficient drinking and washing water from the flood plain to the top of the bluff had become increasingly laborious.² Desiring to ease this chore and provide a measure of protection against fires in the community, the town officials asked mill-builder Henry Antes to suggest a remedy. There is no record that he responded, nor is there evidence that the officials subsequently asked carpenter-millwright Johann Christopher Christensen, who arrived in Bethlehem in 1751, to propose a solution. In any case, in the spring of 1754 Christensen, assisted by missionary John Böhner who had built a model pump, designed a pumped water system for the town.

Machines to raise water had been in use in Europe for centuries, but until now none had been erected in the American Colonies. In 1652 the Water-Works Company of Boston had constructed a gravity conduit system that used bored logs to convey water from wells and springs to a 12-foot-square reservoir, but the system had not fulfilled the expectations of its promoters and had fallen into disuse.³ Christensen, born in Schleswig-Holstein in 1716 and trained during his youth in a royal mill in Hadersleben, probably took his ideas for the Bethlehem system from his knowledge of the forcing pumps that had been in use in many German cities since the end of the fifteenth century.

(continued)

²In 1782 the Marquis de Chastelleux estimated Bethlehem's population to be about 600, but Karen Zerbe Huetter, of Historic Bethlehem, Inc., places it at over 1,000 by the mid-1750's. De Chastellux, Travels in North America in the Years 1780, 1781 and 1782, vol. 2. Translated by Howard C. Rice, Jr. (Chapel Hill, 1963), 524; Huetter, The Bethlehem Waterworks. Bethlehem Heritage Series, vol. 1 (Bethlehem, Pa., 1976), 9.

³Nelson Manfred Blake, Water for the Cities: A History of the Urban Water Supply Problem in the United States (Syracuse, 1956), 15.

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Early Bethlehem records show that by mid-March 1754, Christensen had begun floating hemlock logs, from which he planned to fabricate distribution pipes, down the Lehigh River from the Gnadenhuetten sawmill near present Lehigh. In June he tested his and Böhner's pump using power supplied by the waterwheel in the oil mill. The pump, which was made of Caribbean hardwood and had two cylinders, proved able to force water up the bluff to the town, but soon after the test, for reasons that remain unclear, Christensen traveled to North Carolina, where he remained until 1756. Construction of the waterworks proceeded without him but presumably according to his plans. A one-story, 14-by-18-foot building housed the system's machinery just east of the oil mill. On May 21, 1755, the works pumped water up the bluff to the Platz, or center of town, and from there the liquid flowed through wooden pipes to the Brethern's House. By the end of June other pipes had been installed to take water to the Sisters' House. Christensen and his colleagues had launched what, according to the Historic American Engineering Record and Historic Bethlehem, Inc., was the first municipal pumping system to provide drinking and washing water in the American Colonies.⁴ As waterworks historian Nelson Manfred Blake, has pointed out, the next workable pumping system devised in an American community was the steam-powered New York City system which was abandoned shortly after going into operation in 1776. No other municipal system succeeded until Philadelphia opened its Fairmont Waterworks in 1811.⁵

Although successful initially in supplying the town with water, the Bethlehem system soon developed problems. The wooden pipes burst under pressure, and apparently the waterwheel, which powered the pumps, was positioned incorrectly in the wheelpit. In the summer of 1759 the Gemein Conferencz, or Community Council, began discussing the possibility of rebuilding the system. Two years later Christensen, Frederick von Marshall, and John Arbo who is believed to have owned an

(continued)

⁴Scott, "The Old Water Works," Historic American Engineering Record Card, 1975; and Historic Bethlehem, Inc., "1762 Waterworks Data Sheet."

⁵Blake, Water for the Cities, 15-43. See also: Huetter, The Bethlehem Waterworks, 12-13.

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illustrated copy of the 1724 German volume Theatri Machinarum Hydraulicarum, began planning the necessary changes. With the help of an assistant, Christopher Demuth, Christensen had the new pumping system operating by July 6, 1762, but he did not complete the new pumphouse until 1764, due in part to damage from a fire that destroyed the nearby oil mill in 1763.

When finished, the pumphouse was a 24-foot-square, 2 1/2-story native limestone rubble structure with a red-tile-covered hipped-bellcast-gable roof. The pumping mechanism, which was positioned over spring water channeled into a holding pit, consisted of three single acting force pumps of 4-inch caliber and 18-inch stroke. Made of iron cast at the Durham Furnace, they worked on a triple crank that had been foraged by blacksmith Stephen Blum. An 18-foot undershot waterwheel turned by the flow of Monocacy Creek powered the pumps through a wallower of 33 rounds and a spurwheel of 52 caps.⁶ Spring water entered the pumphouse via an open trench until 1765, after which time it was conveyed to the holding pit in wooden pipes. Monocacy Creek water entered the building through a sharply angled race and passed back to the stream through a similar tailrace. Wooden pipes still carried the pumped spring water up the bluff 94 vertical feet, 320 feet in all, to a reservoir. Pyramidal in shape, the large cistern stood behind the Married People's House on the site of the present Central Moravian Church. The water flowed from here through wooden pipes to distribution points which by 1786 included the Single Brethren's House, Sisters' House, Sun Inn, and Apothecary Shop. From the Sisters' House other pipes led to four other stations. A short time later, by 1791, the Moravians expanded the system to serve at least six additional structures, including the Widows' House, Girls' School, and Single Sister's Kitchen. Presumably each of these buildings had its own small cistern for storing water when it arrived by pipe.

Over the years additional alterations proved necessary to maintain the water system's ability to supply the community's needs. For example, in 1786 the city fathers began replacing the wooden mains, which frequently burst under pressure or in

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⁶Huetter, The Bethlehem Waterworks, 3-5.

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freezing weather, with lead pipes, and in 1813 they replaced these with pipes of iron. By the 1790's the number of mills competing for water along Monocacy Creek drastically reduced the power available to turn the waterworks wheel, and in 1799 an adjustment of the wheel in its pit failed to correct the problem. As a result, in 1810 the Moravians rebuilt the wheel and pit and realigned the raceway so that both the waterworks and the oil mill shared the same flume. This allowed water to enter the works at a gentler angle with less friction and greater velocity. Even without these latter changes, however, in a 1798 test, pumps were able to force water an additional 28 feet up the bluff to the site chosen for the Central Moravian Church, erected in 1803-6. The 1762 system continued to serve Bethlehem until 1832, when the community built a new pump powered by steam and housed in the adjacent oil mill.

Interest in restoring the original waterworks began in the early 1960's after the city rescued the old Monocacy Creek flood plain industrial area from an automobile junkyard and deeded the 9-acre tract to Historic Bethlehem, Inc., a voluntary, nonprofit, community organization dedicated to restoration. Vincent P. Foley conducted preliminary archeological examinations of the works in 1964, and in 1972 he began preparing it for restoration. The Earl W. Ecker Construction Co., Inc., of Bethlehem restored the pumphouse in 1972-73, and in 1975-76 the National Heritage Corporation drafted plans for reconstruction of the waterwheel and pumps based on circa 1767 mechanical drawings of the original machinery. These documents were found in the Moravian Archives in Herrnhut, East Germany. Eisenhardt Mills, Inc., built the new wheel and associated parts and installed them in 1976, using funds provided largely by the Frederick W. Beinecke Fund and the Laros Foundation.

Today an electric motor turns the wheel, but plans are being developed to restore the raceways and spring water trench so that in the future the waterwheel can once again be powered by Monocacy Creek and turn pumps that will send water up the bluff to the old community buildings. Meanwhile the American Society of Civil Engineers has recognized the Old Waterworks as a Historic Civil Engineering Landmark, and the American Waterworks Association has designated it an American Water Landmark.

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Boundary Justification: The boundary includes approximately 6.2 acres, roughly the southeastern two-thirds of the 9-acre Historic Bethlehem, Inc., Moravian industrial park. This 6.2-acre tract encompasses the Old Waterworks, the site of the now demolished oil mill, and that stretch of Monocacy Creek nearest the waterworks, and is free of other buildings.

Boundary Description: As indicated in red on the accompanying maps [(1) U.S.G.S., 7.5' Series, Pennsylvania, Allentown East Quad., 1964, photorevised 1972; and (2) AASLH Sketch Map, 1977], a line beginning on the east bank of Monocacy Creek directly underneath the north side of Hill-to-Hill Bridge and continuing approximately 300 feet along the plane of the north edge of said bridge to the west side of the right-of-way of Main Street; thence, north approximately 300 feet along the west side of the right-of-way of Main to an unmarked point; thence, due west approximately 600 feet to the east side of the right-of-way of an industrial railway; thence, south approximately 600 feet along the east side of the right-of-way of said railway to a point directly below the north side of Hill-to-Hill Bridge; thence, east approximately 400 feet along the plane of the north side of said bridge to the point of beginning.

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9 MAJOR BIBLIOGRAPHICAL REFERENCES

(See continuation sheet.)

10 GEOGRAPHICAL DATA

ACREAGE OF NOMINATED PROPERTY circa 6.2 acres

UTM REFERENCES

A	1,8	4,6,7	4,9,0	4,4	9,6	4,2,0	B	1,8	4,6,7	6,6,0	4,4	9,6	4,2,0
	ZONE	EASTING		NORTHING			ZONE	EASTING		NORTHING			
C	1,8	4,6,7	6,6,0	4,4	9,6	3,2,0	D	1,8	4,6,7	4,9,0	4,4	9,6	2,4,0
	ZONE	EASTING		NORTHING			ZONE	EASTING		NORTHING			

VERBAL BOUNDARY DESCRIPTION

(See last page of description.)

LIST ALL STATES AND COUNTIES FOR PROPERTIES OVERLAPPING STATE OR COUNTY BOUNDARIES

STATE	CODE	COUNTY	CODE
STATE	CODE	COUNTY	CODE

11 FORM PREPARED BY

NAME / TITLE

George R. Adams, Director, Historic Landmarks Project

ORGANIZATION

American Association for State and Local History

DATE

October, 1977

STREET & NUMBER

1400 Eighth Avenue South

TELEPHONE

615-242-5583

CITY OR TOWN

Nashville,

STATE

Tennessee 37203

12 STATE HISTORIC PRESERVATION OFFICER CERTIFICATION

THE EVALUATED SIGNIFICANCE OF THIS PROPERTY WITHIN THE STATE IS:

NATIONAL

STATE

LOCAL

As the designated State Historic Preservation Officer for the National Historic Preservation Act of 1966 (Public Law 89-665), I hereby nominate this property for inclusion in the National Register and certify that it has been evaluated according to the criteria and procedures set forth by the National Park Service.

STATE HISTORIC PRESERVATION OFFICER SIGNATURE

TITLE

DATE

FOR NPS USE ONLY

I HEREBY CERTIFY THAT THIS PROPERTY IS INCLUDED IN THE NATIONAL REGISTER

DATE

DIRECTOR, OFFICE OF ARCHEOLOGY AND HISTORIC PRESERVATION

ATTEST

DATE

KEEPER OF THE NATIONAL REGISTER

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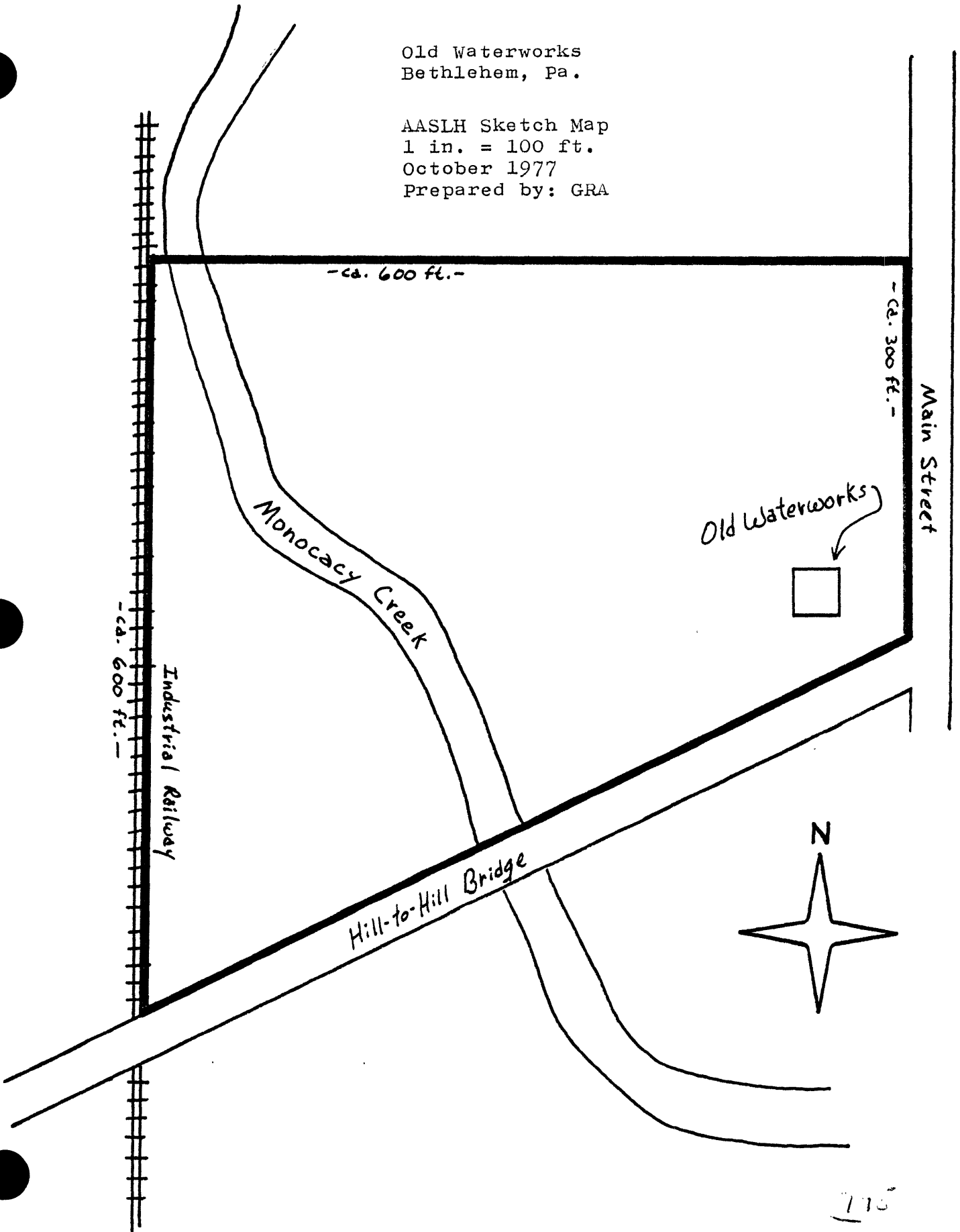
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Old Waterworks
Bethlehem, Pa.

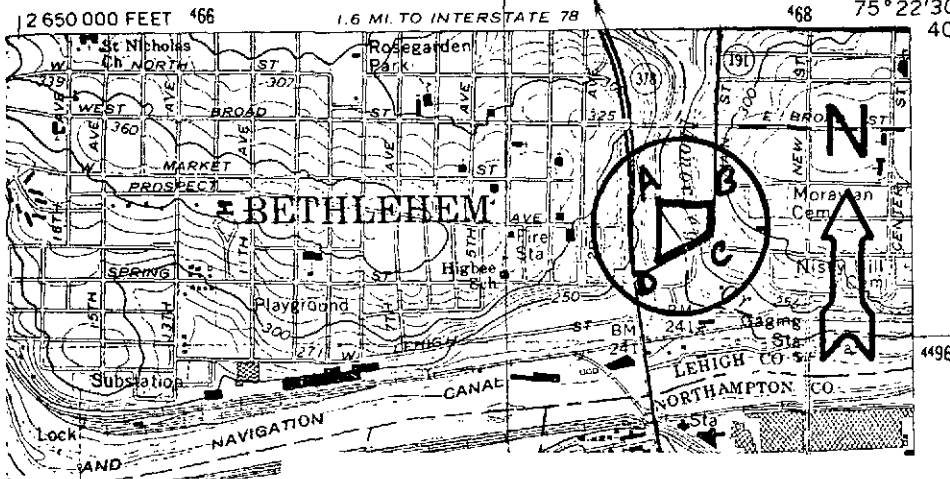
AASLH Sketch Map
1 in. = 100 ft.
October 1977
Prepared by: GRA





ALLENTOWN EAST QUADRANGLE
 PENNSYLVANIA
 7.5 MINUTE SERIES (TOPOGRAPHIC)
 SW/4 ALLENTOWN 15' QUADRANGLE

5985 III NE
 (NAZARETH)



Old Waterworks
 Bethlehem, Pa.
 U.S.G.S. 7.5' Series
 Pa.: Allentown East Quad.
 1964; photorevised 1972

- Zone 18
 A: 467,490/4,496,420
 B: 467,660/4,496,420
 C: 467,660/4,496,320
 D: 467,490/4,496,240

