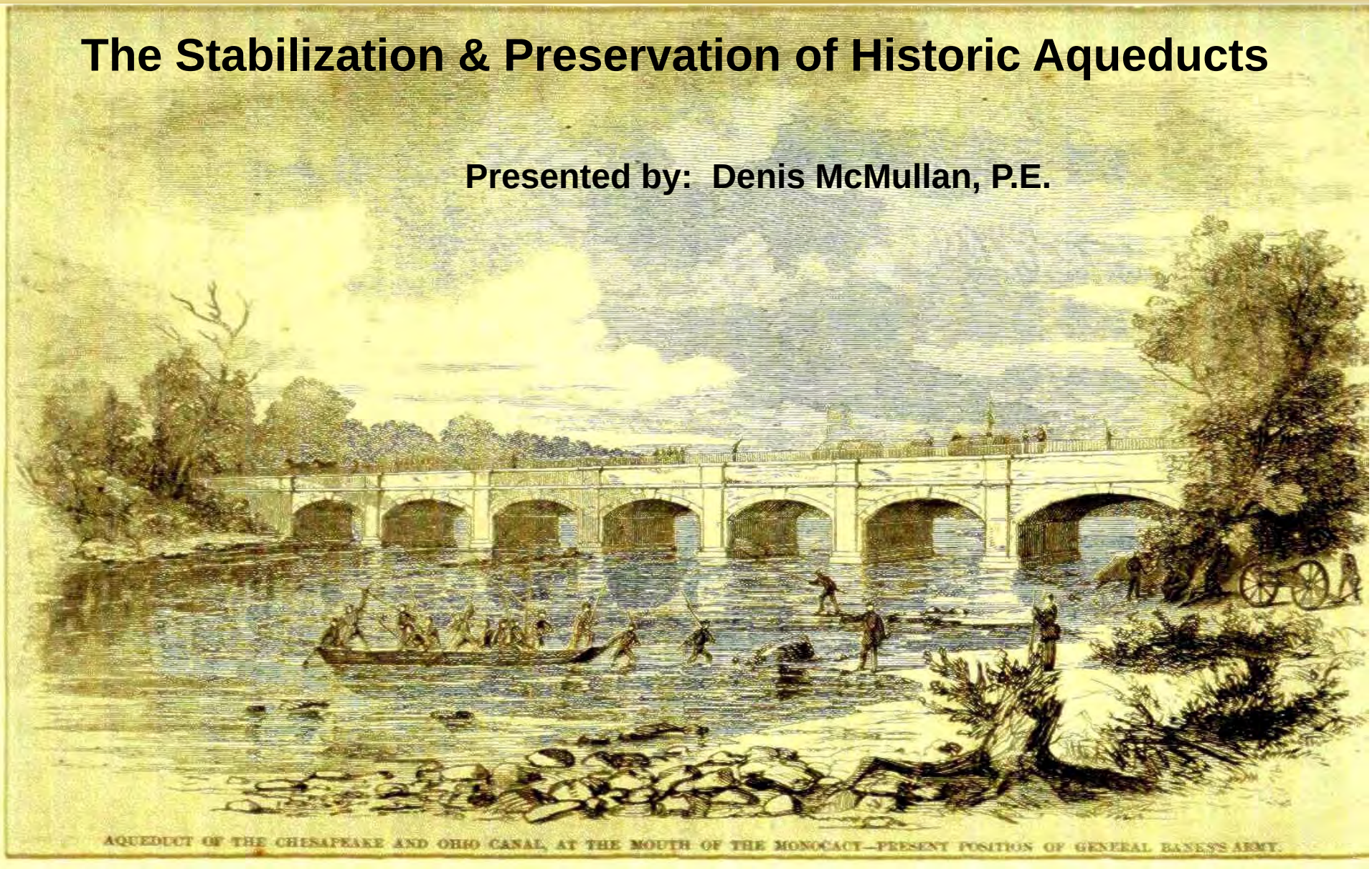
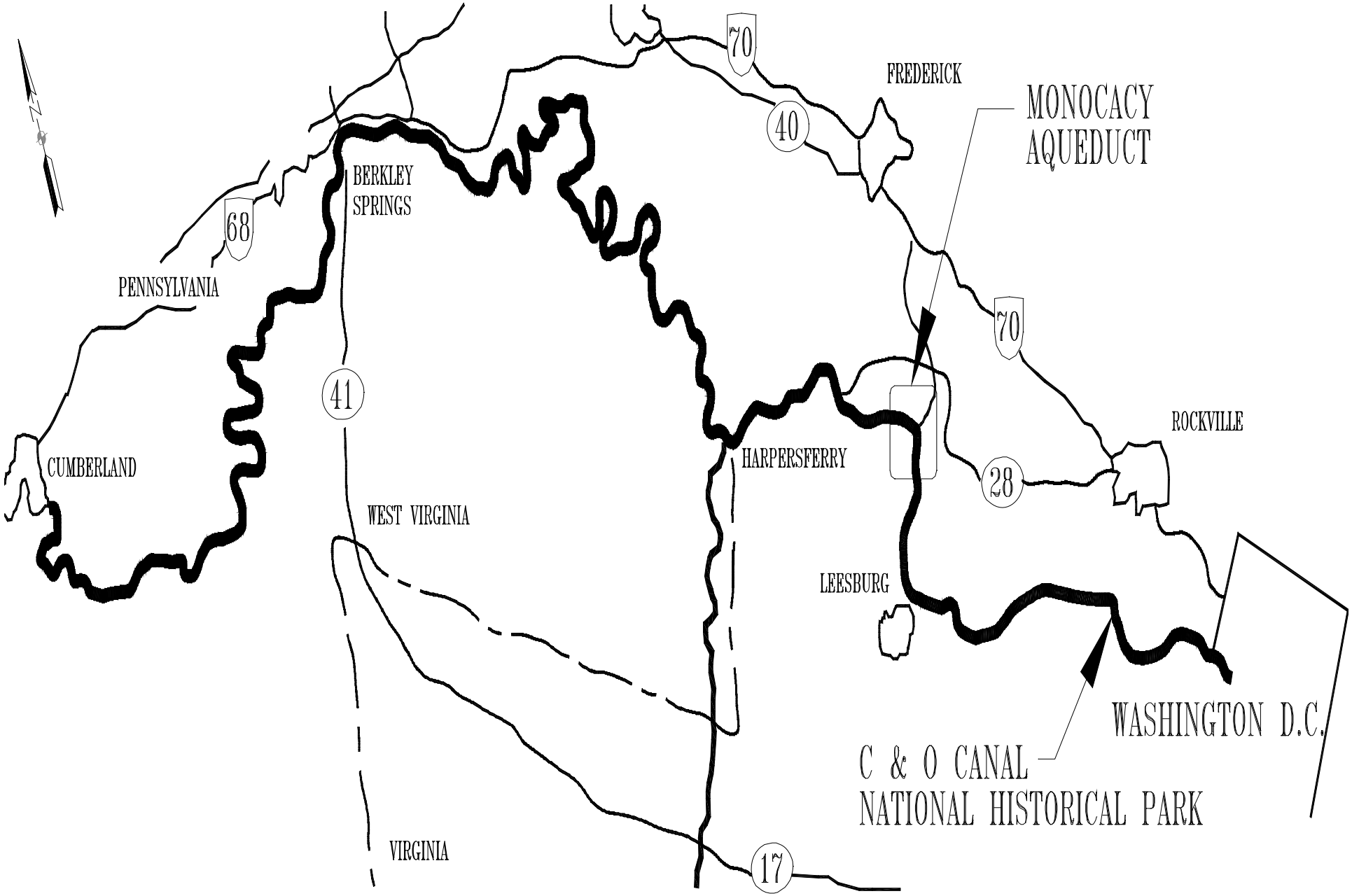
McMullan & Associates, Inc.

2006 World Canals Conference

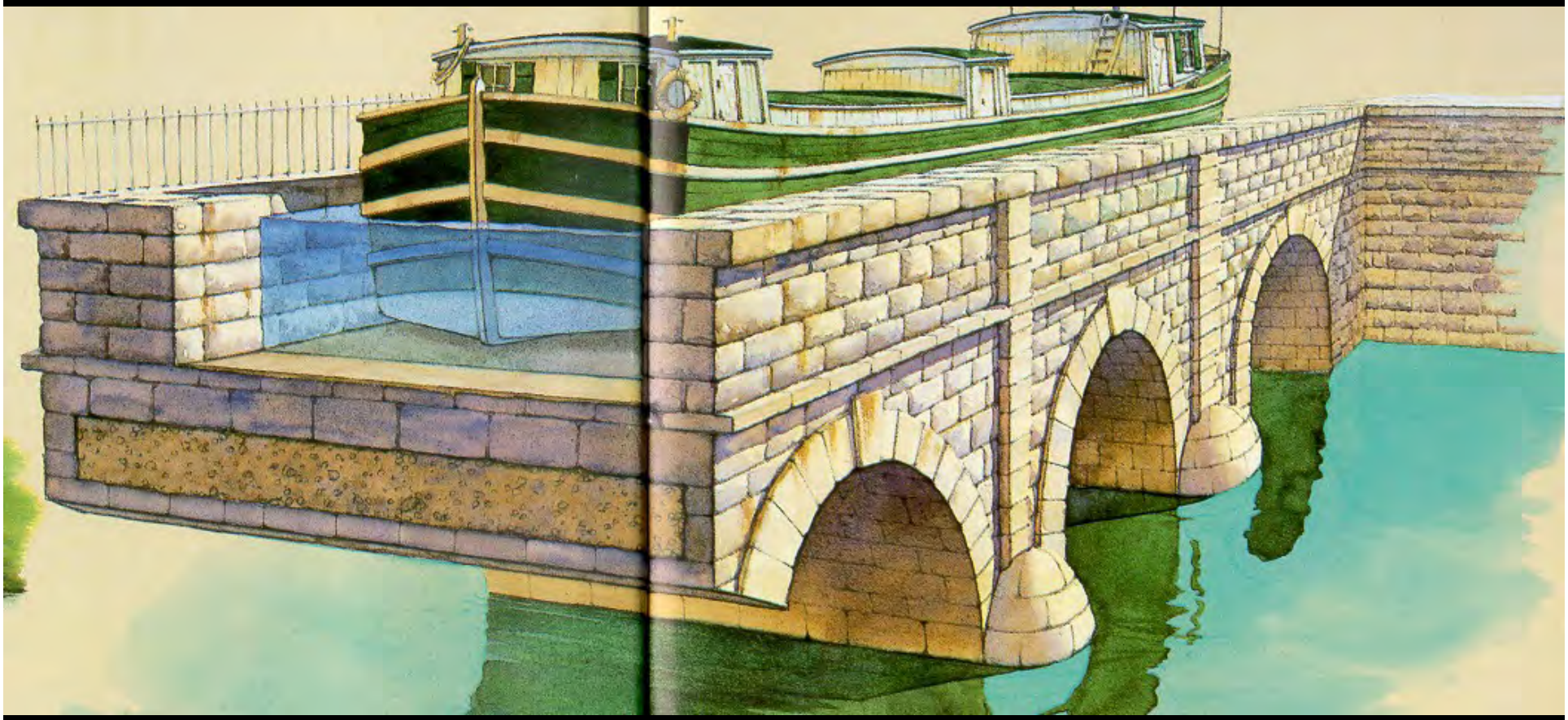
The Stabilization & Preservation of Historic Aqueducts

Presented by: Denis McMullan, P.E.





Aqueduct Location



Conococheague Aqueduct in Mid-1990's

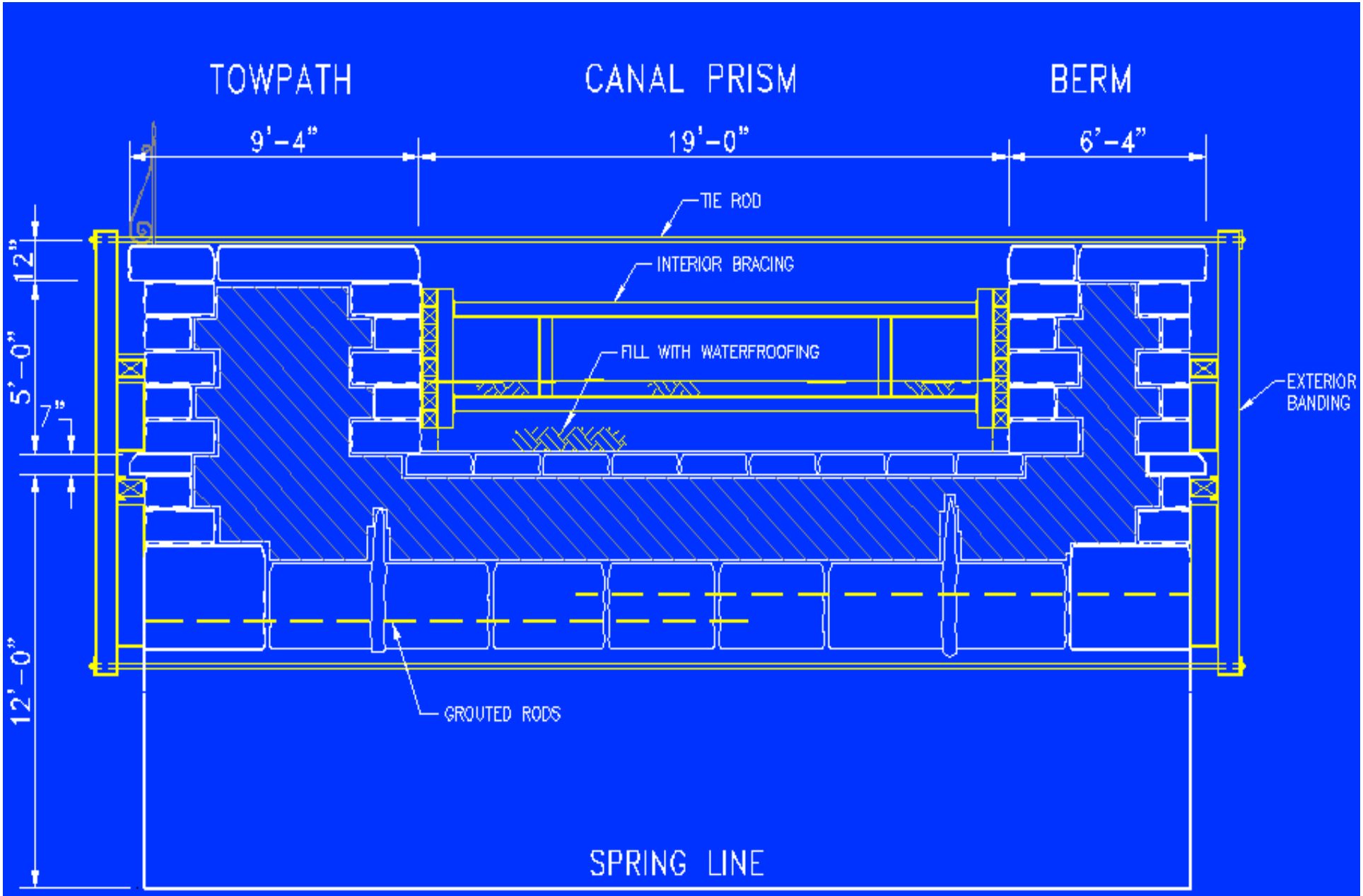
Monocacy Aqueduct Prism Condition in 1938

Monocacy Aqueduct Flooded

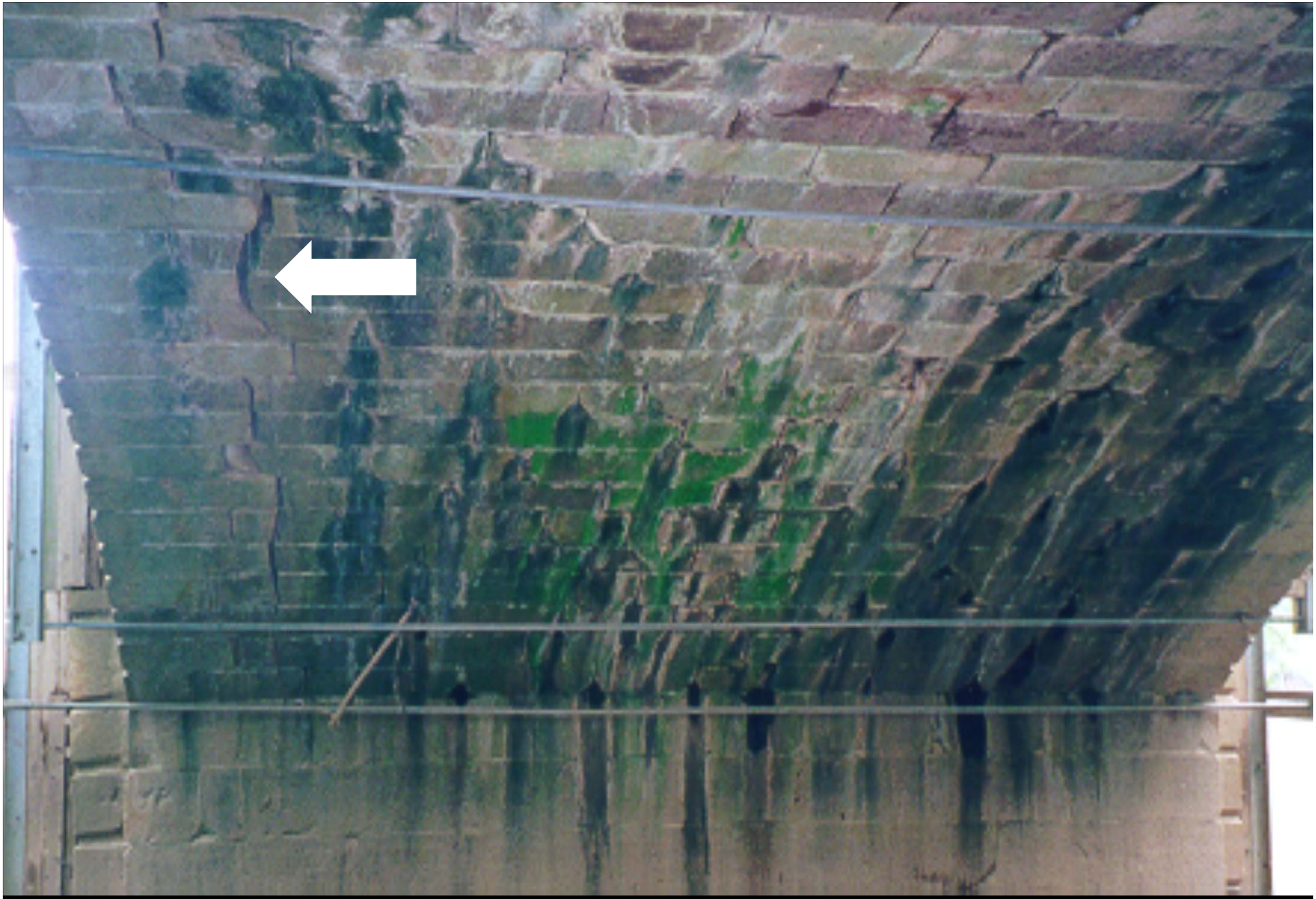
Flooded Debris on the Aqueduct

Monocacy

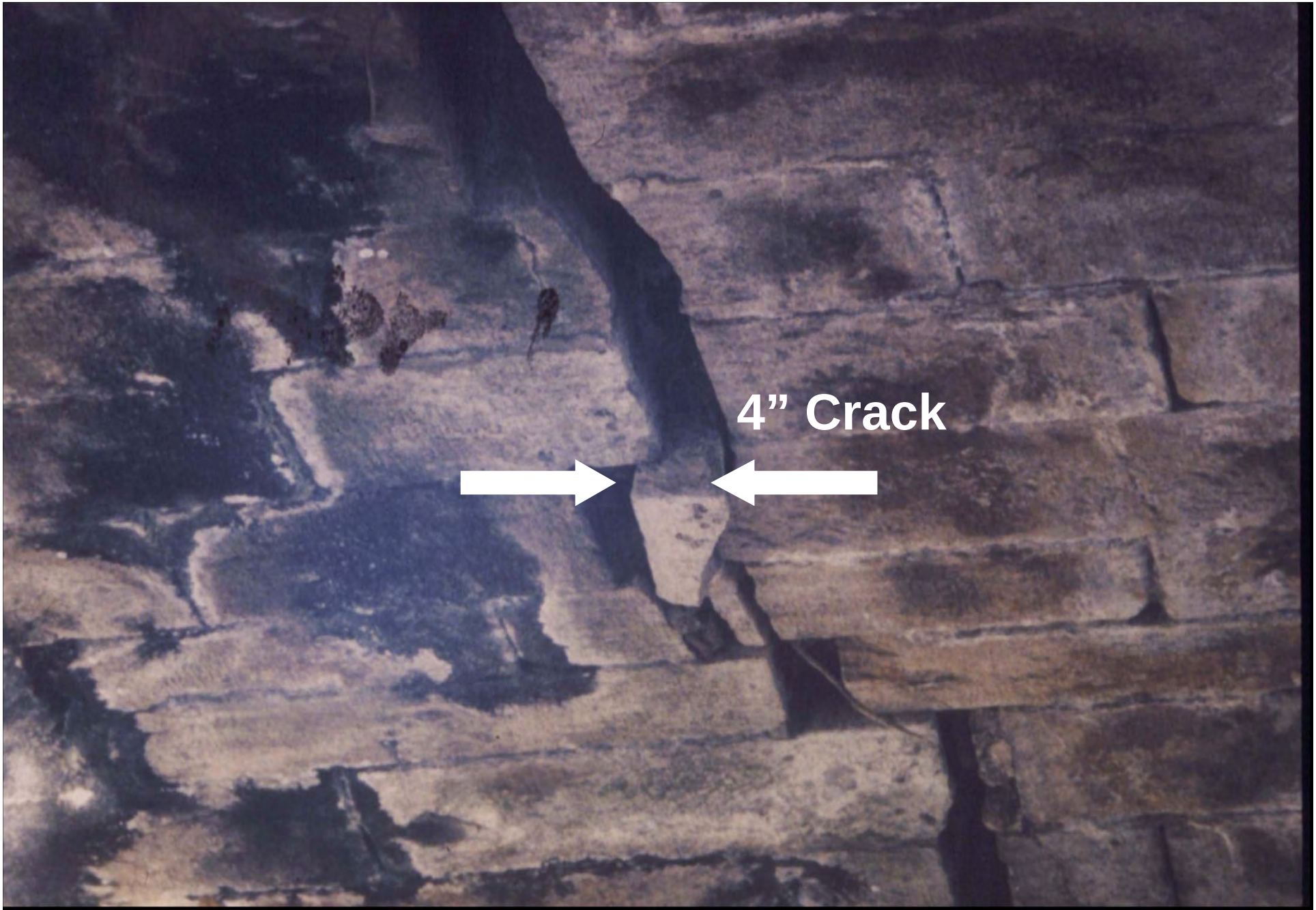
Steel Tie Rods and Bracing in Prism Installed in 1975



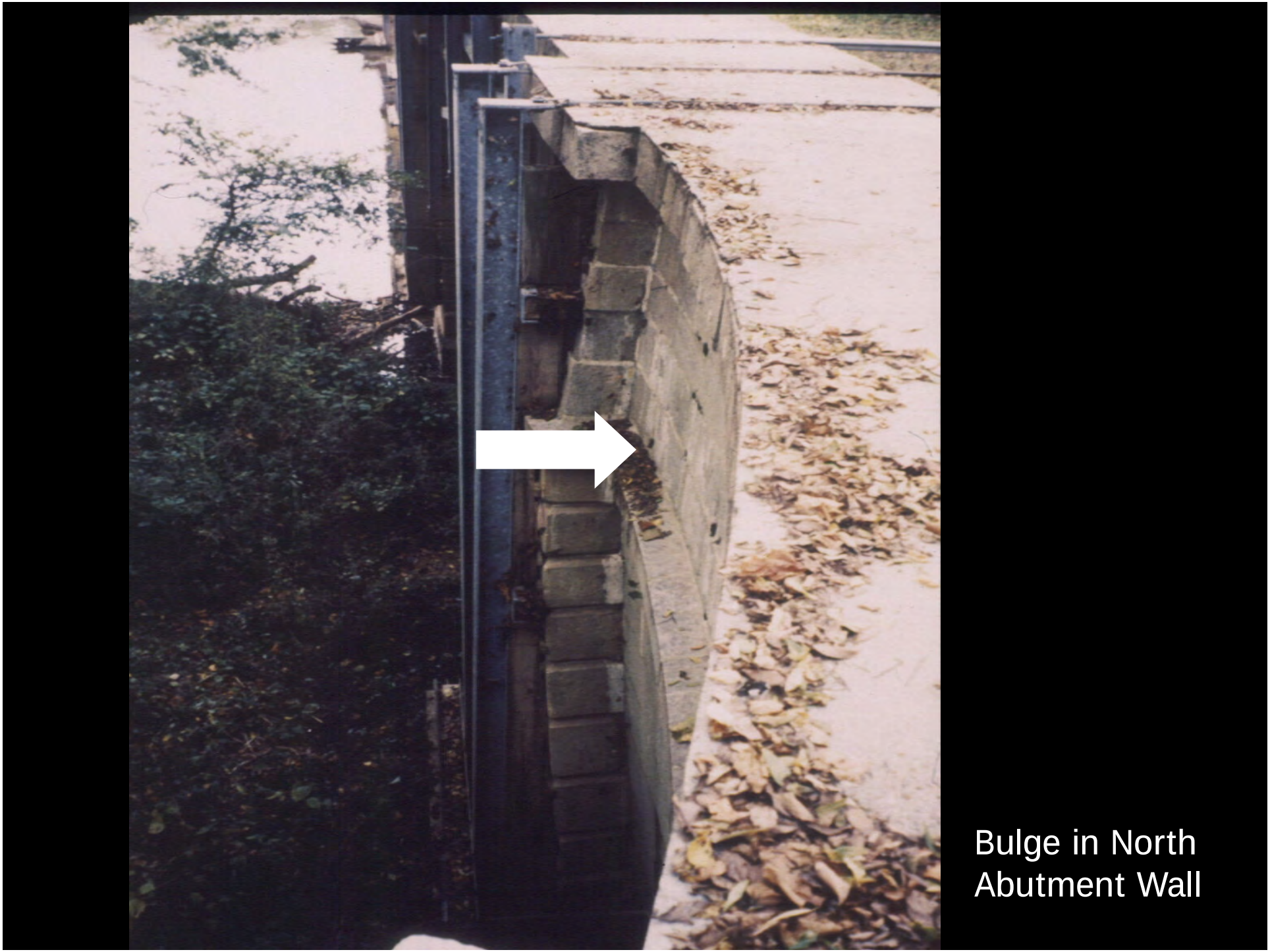
1975 Temporary Stabilization



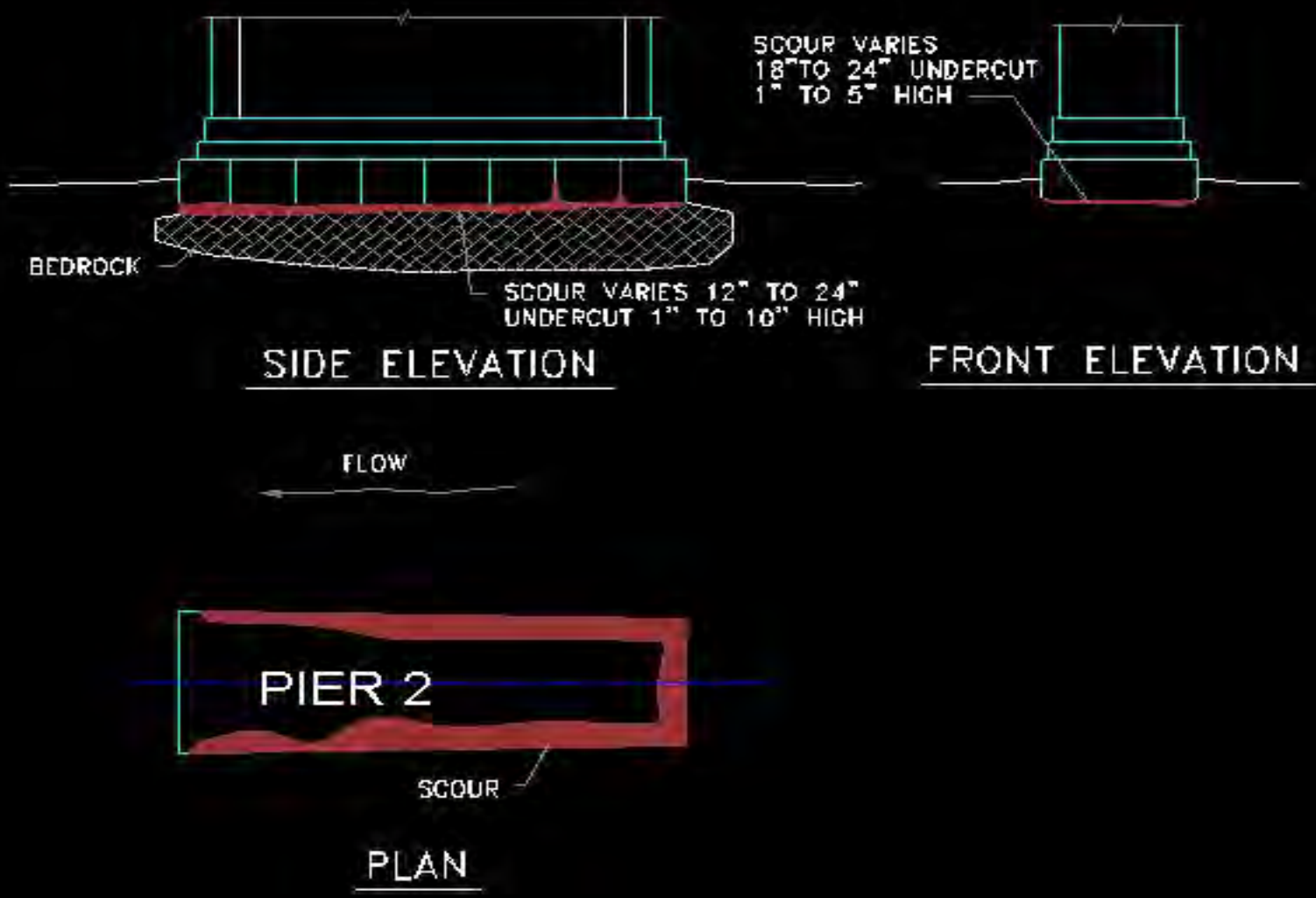
Cracks in Arch Soffit



Large Crack Widths



Bulge in North
Abutment Wall


SCOUR VARIES
18"TO 24" UNDERCUT
1" TO 5" HIGH
BEDROCK
SCOUR VARIES 12" TO 24"
UNDERCUT 1" TO 10" HIGH
SIDE ELEVATION
FRONT ELEVATION
FLOW
PIER 2
SCOUR
PLAN

Ice Formation in the Arch Barrel

Test Pits and Compression Testing of Arch Stone

Condition of Existing Reinforcing - Corrosion Testing

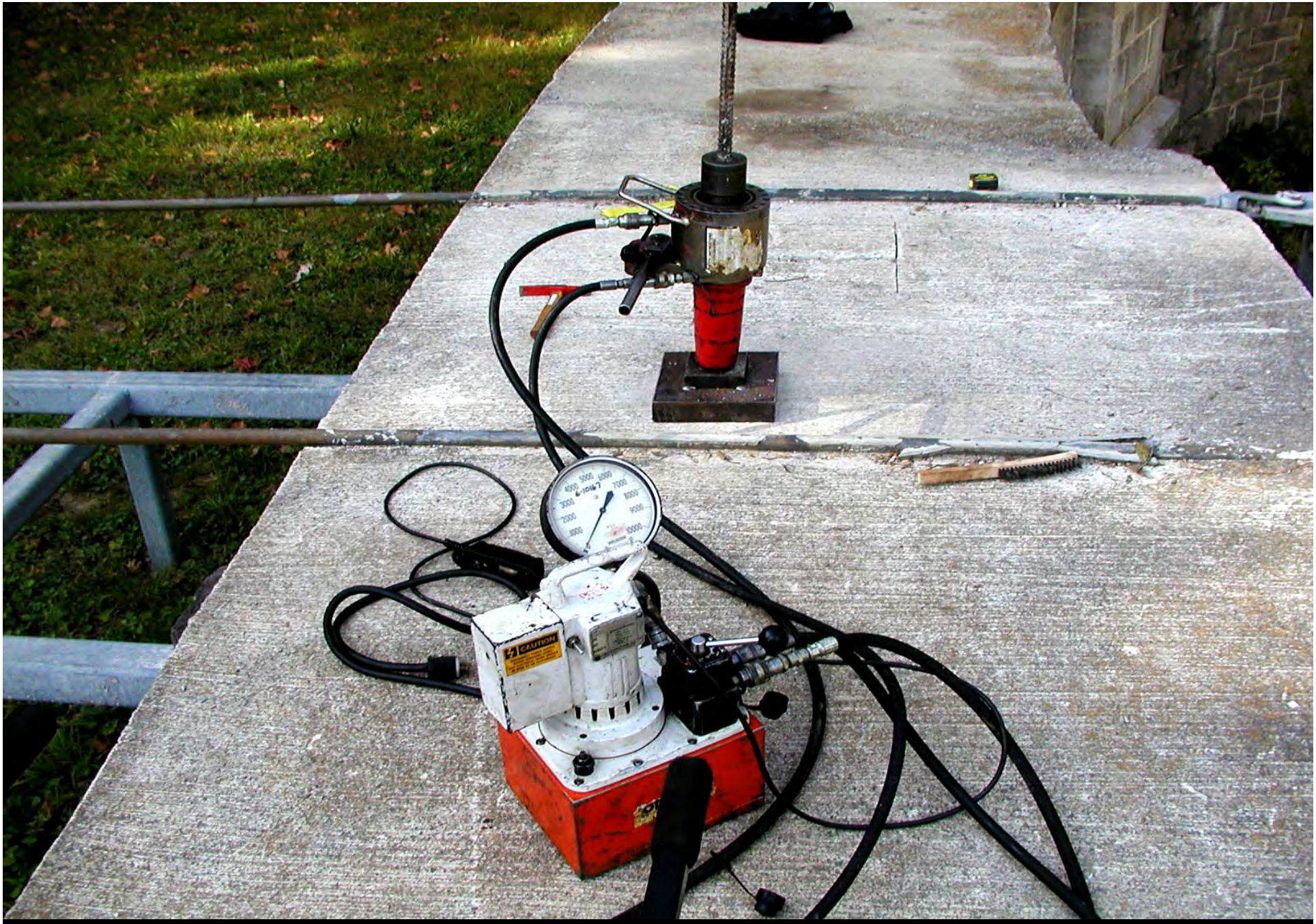
Contact with Rebar End for Half Cell Potential Measurements

Half Cell Potential and Corrosion Rate Testing

Investigation of Voids in the Parapet

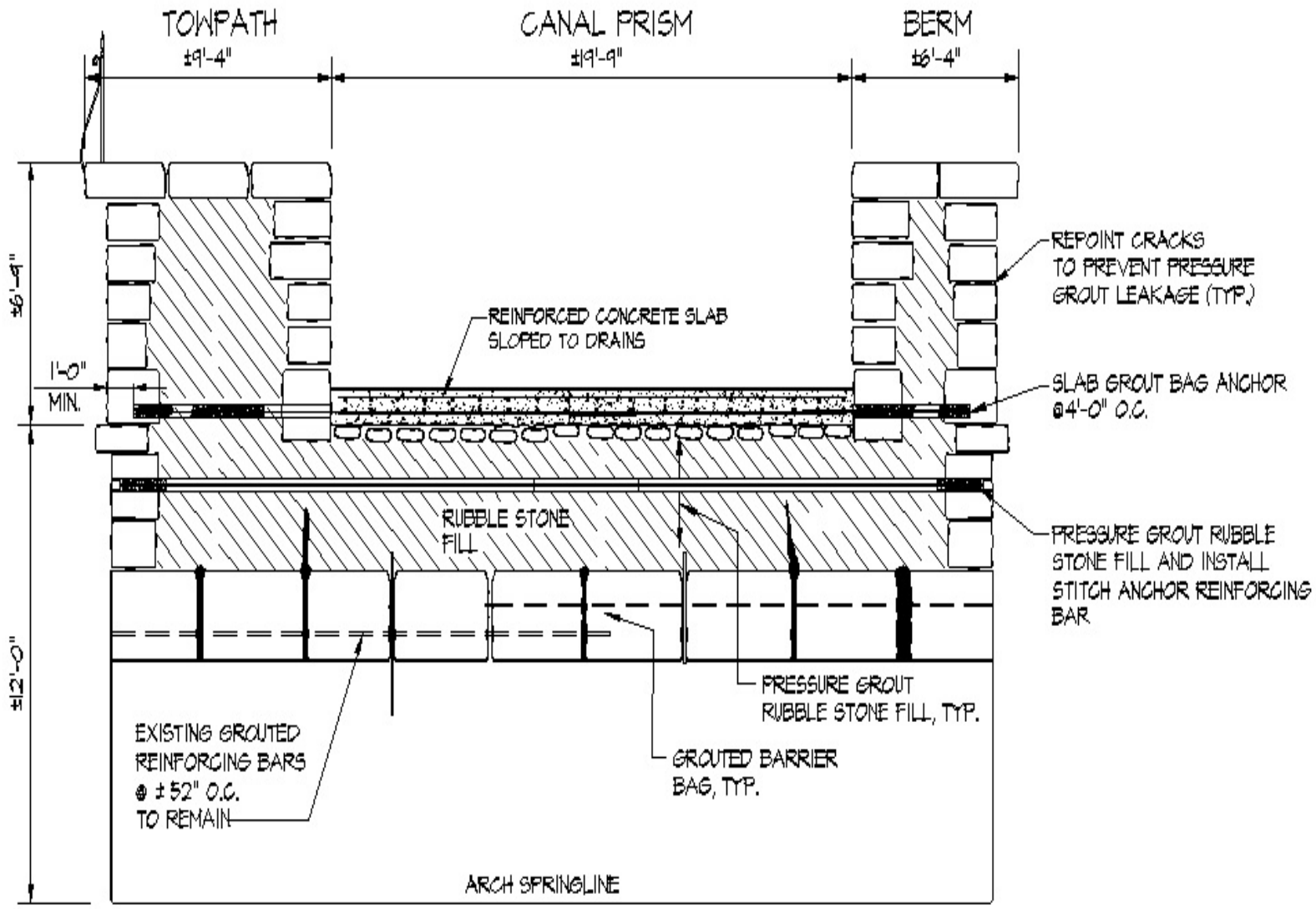
Borings in Parapet Wall

Water Testing for Permeability by ECO Grouting Consultants

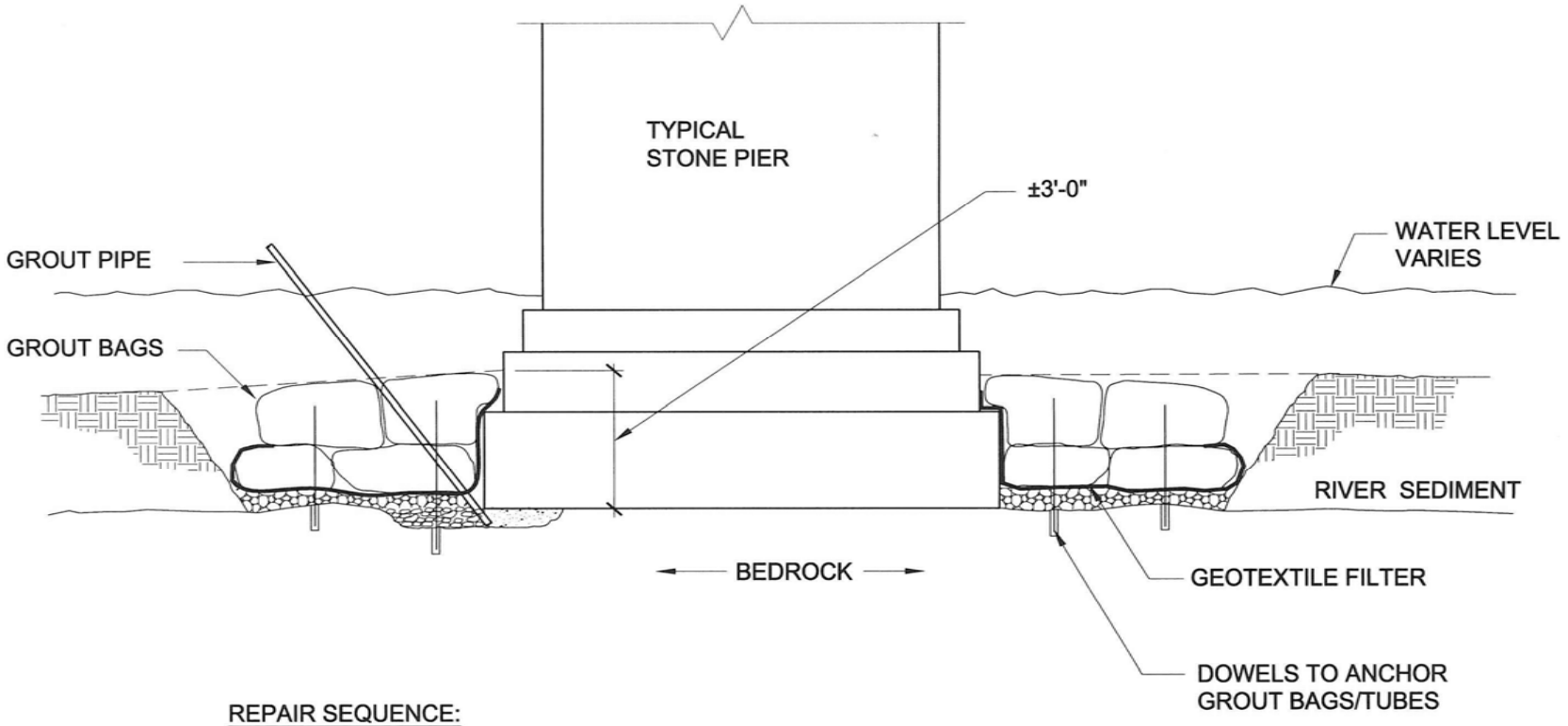


Anchor Bar Testing

National Historic Trust Listing Led to Political Involvement and Project Funding



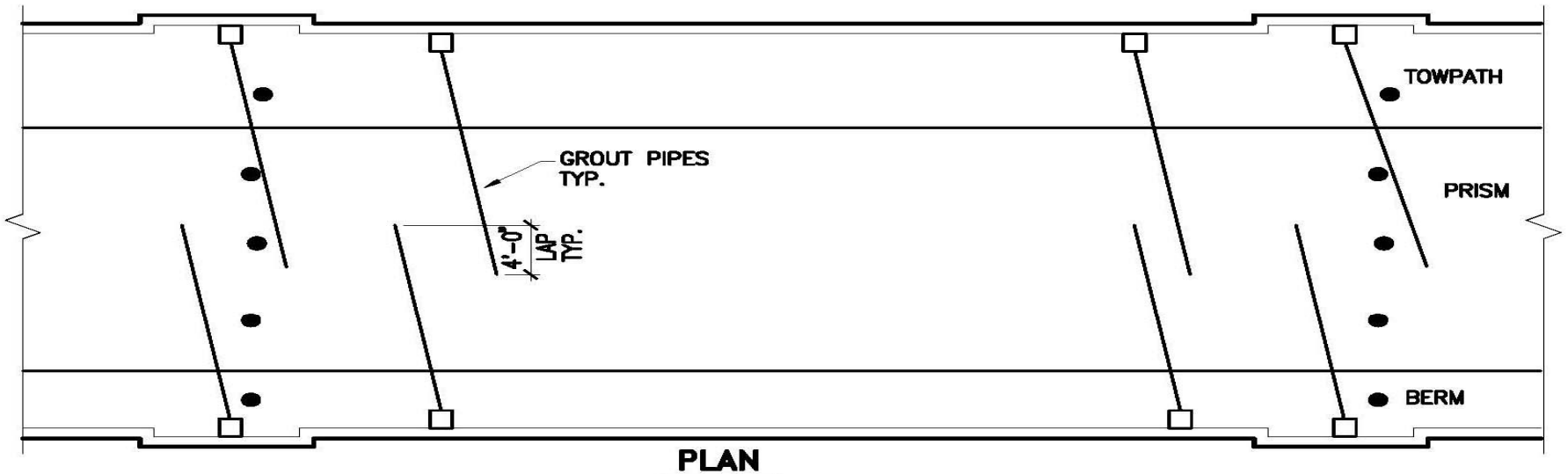
STABILIZED AQUEDUCT



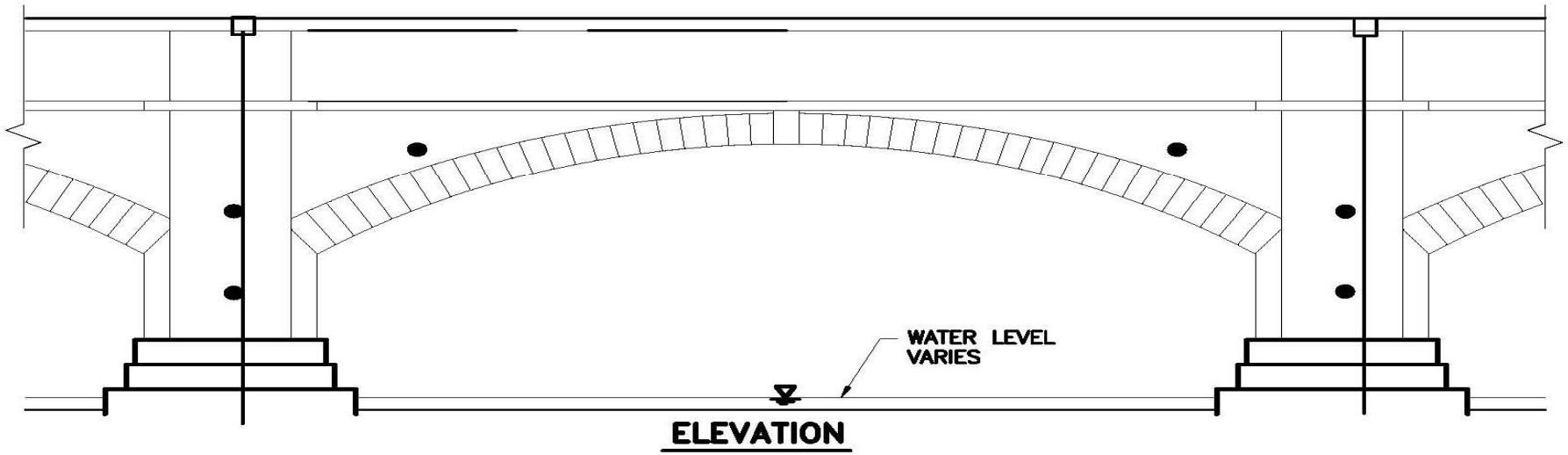
REPAIR SEQUENCE:

1. REMOVE RIVER SEDIMENT ADJACENT TO PIER
2. PLACE CRUSHED STONE, GEOTEXTILE FILTER, AND DOWELS.
3. PLACE GROUT BAGS AND GROUT PIPES.
4. INJECT GROUT THROUGH GROUT PIPES INTO VOIDS UNDER AND BETWEEN FOUNDATION STONES.

SCOUR REPAIR DETAIL



PLAN



ELEVATION

GROUT HOLE LAYOUT FOR TYP. SPAN

Pointing the Masonry Walls

Drilling of Vertical Grout Holes

Installation of Slab Anchors

Flow Grouting of Prism

Slab Anchored to Parapet Wall

Simulated Wood Planking

Aqueduct with Banding Removed

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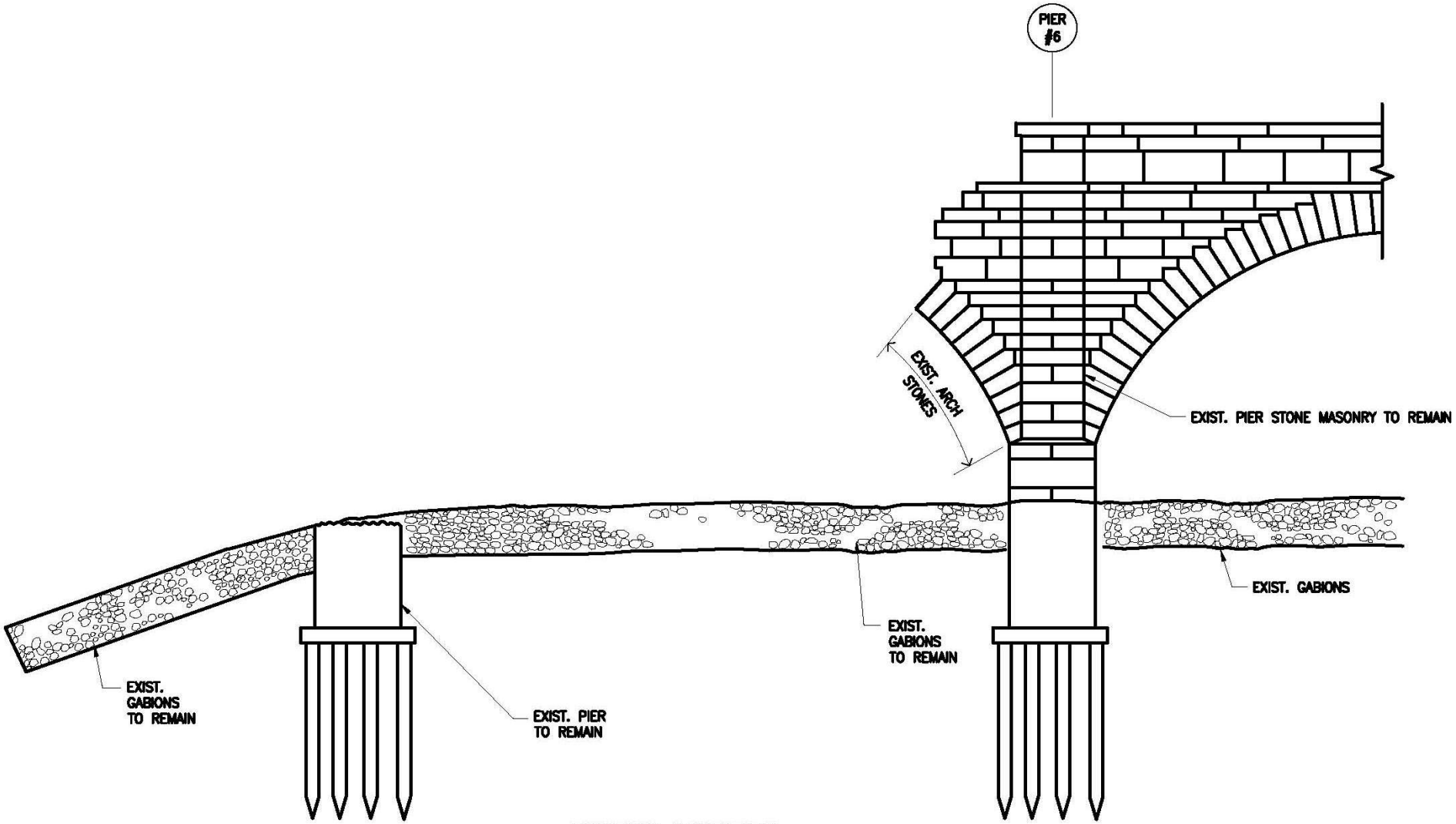
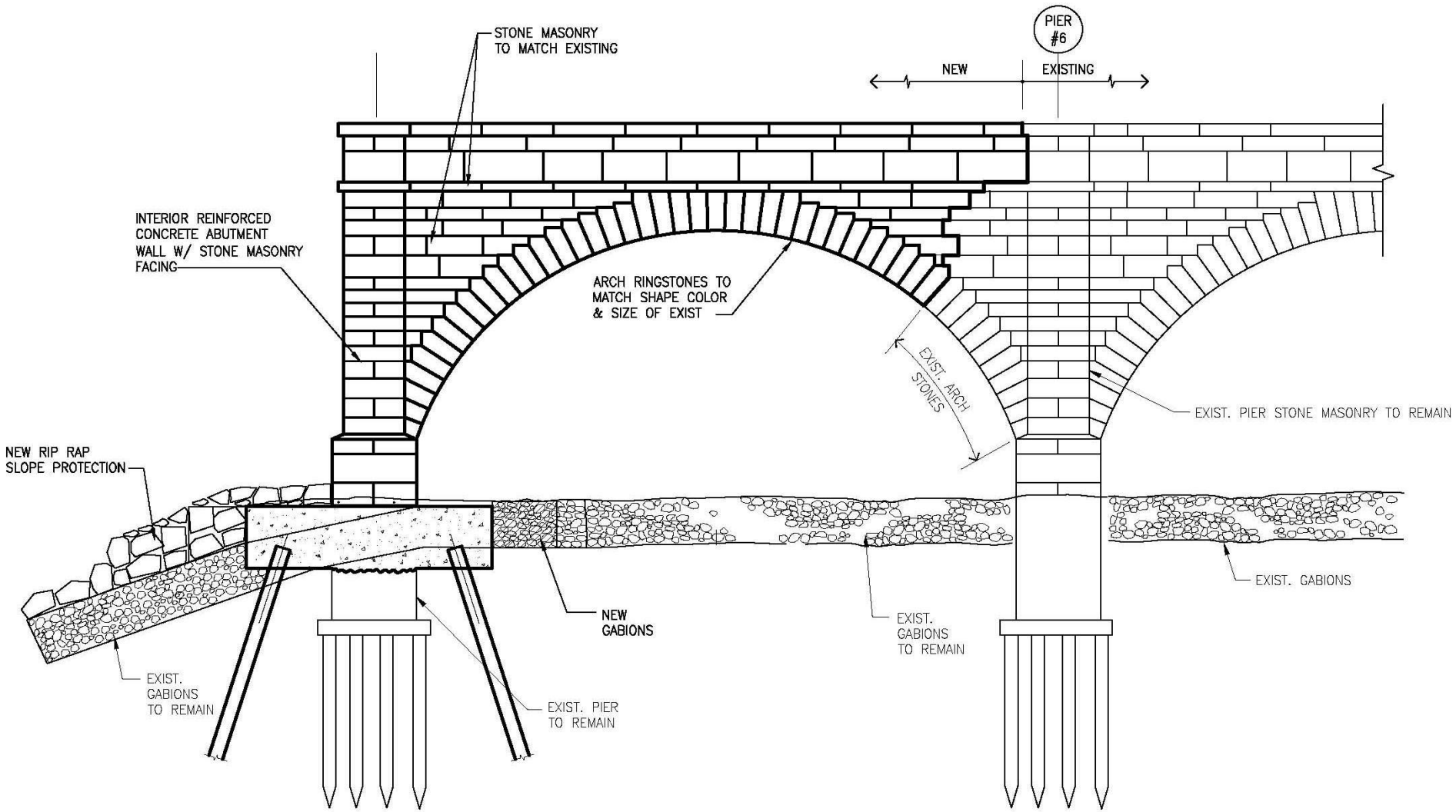
Stabilization of Schoharie Aqueduct, Erie Canal

49
HAER NJ-6



EXISTING CONDITION


PIER
#6
NEW
EXISTING
STONE MASONRY
TO MATCH EXISTING
INTERIOR REINFORCED
CONCRETE ABUTMENT
WALL W/ STONE MASONRY
FACING
ARCH RINGSTONES TO
MATCH SHAPE COLOR
& SIZE OF EXIST
EXIST. ARCH
STONES
EXIST. PIER STONE MASONRY TO REMAIN
NEW RIP RAP
SLOPE PROTECTION
NEW
GABIONS
EXIST.
GABIONS
TO REMAIN
EXIST. GABIONS
EXIST.
GABIONS
TO REMAIN
EXIST. PIER
TO REMAIN

ARCH 7

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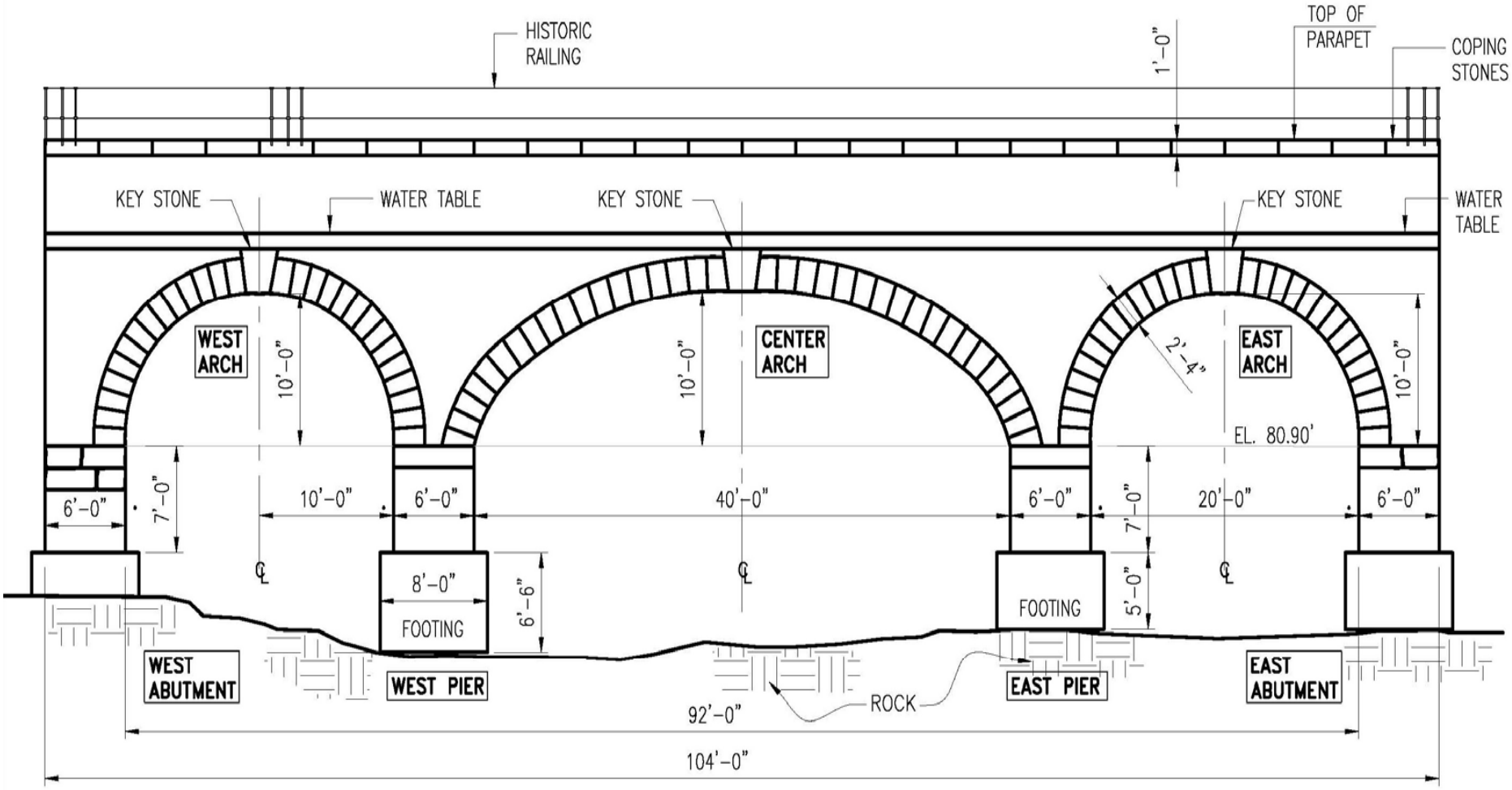
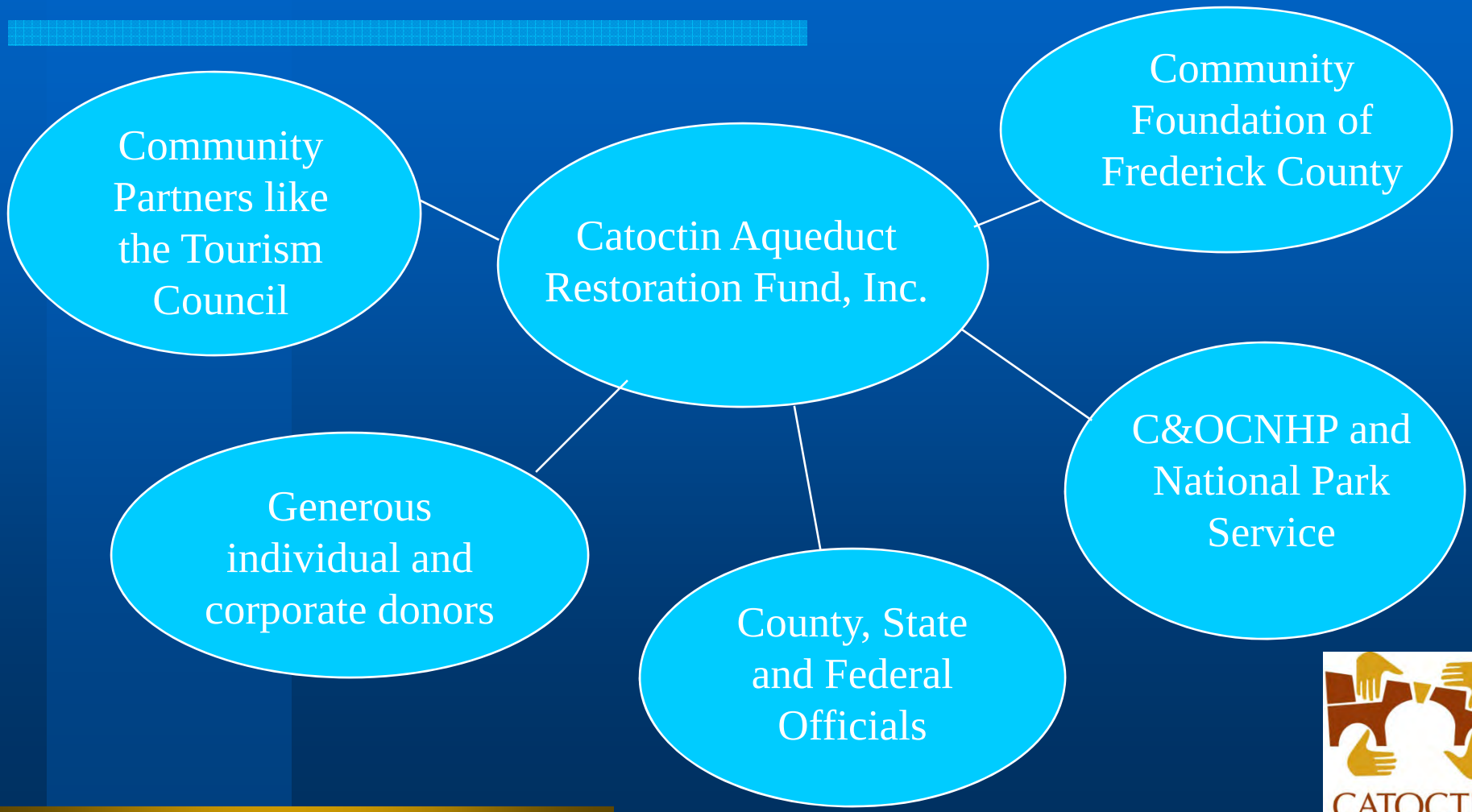
The Restoration of the Catoctin Aqueduct, Frederick County, MD


HISTORIC RAILING
1'-0"
TOP OF PARAPET
COPING STONES
KEY STONE
WATER TABLE
KEY STONE
KEY STONE
WATER TABLE
WEST ARCH
10'-0"
CENTER ARCH
10'-0"
2'-4"
EAST ARCH
10'-0"
EL. 80.90'
6'-0"
7'-0"
10'-0"
6'-0"
40'-0"
6'-0"
7'-0"
20'-0"
6'-0"
8'-0"
FOOTING
6'-6"
FOOTING
5'-0"
WEST ABUTMENT
WEST PIER
ROCK
EAST PIER
EAST ABUTMENT
92'-0"
104'-0"

Our Partners in Success



www.catoctinaqueduct.org

CATOCTIN AQUEDUCT
HISTORY IS IN YOUR HANDS