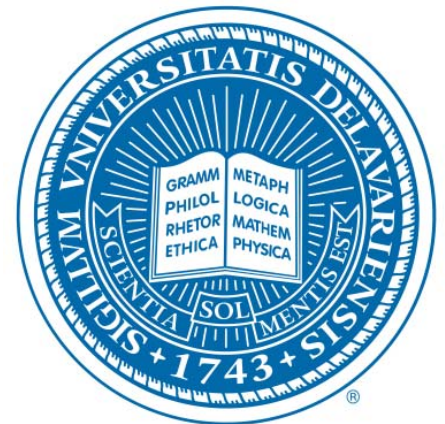
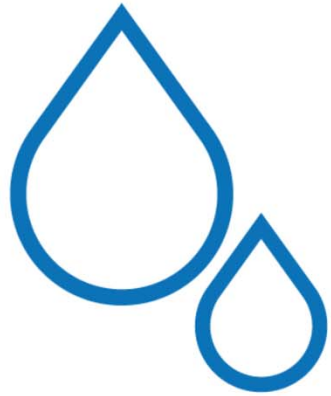


Brandywine Christina: America's Most Historic Small Watershed

May 3, 2018

Gerald J. Kauffman
University of Delaware
Water Resources Center
Newark, Del.





Clean Water

A Bi-State Solution

May 3, 2018 | Mendenhall, PA

1967



BRANDYWINE
CONSERVANCY

1945



Brandywine
Red Clay Alliance

1953



Natural
Lands

The Nature
Conservancy



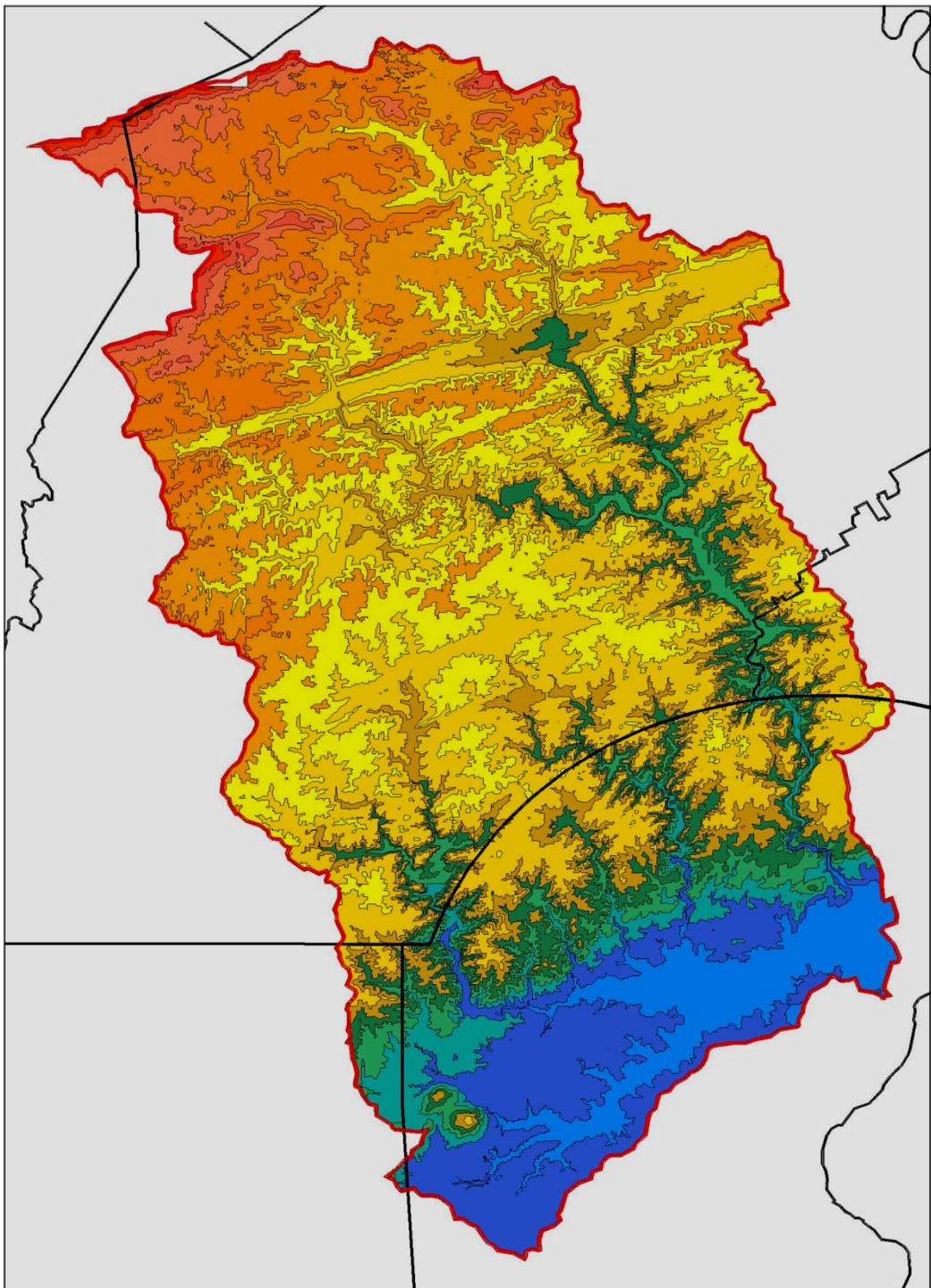
1951

STROUD
WATER RESEARCH CENTER

1967

UNIVERSITY OF
DELAWARE

1743



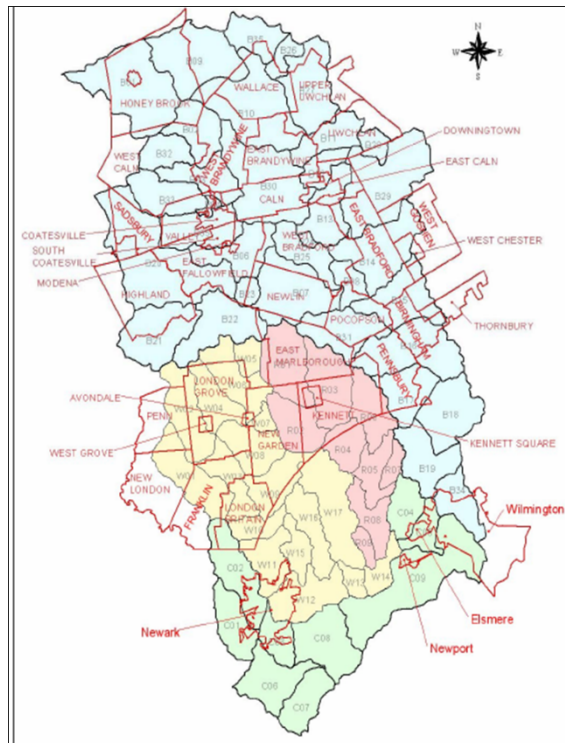
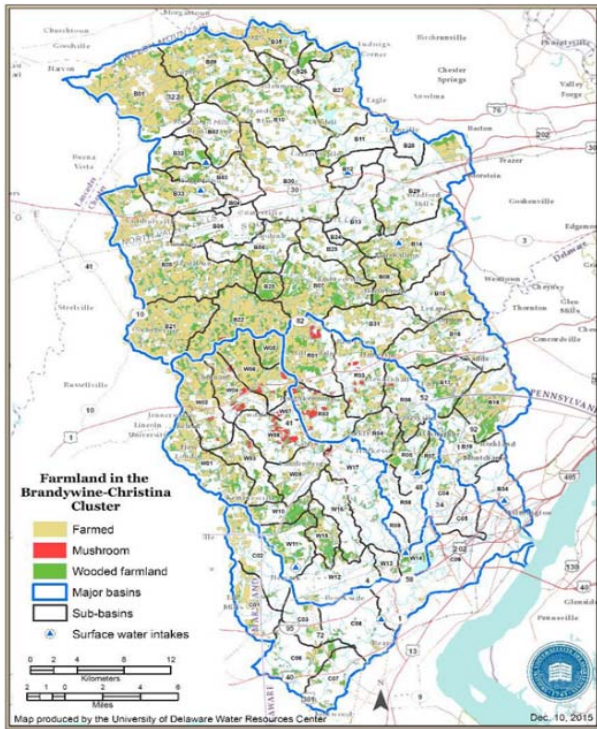


Figure 2-2. Municipalities with MS4 permits in Christina River Basin

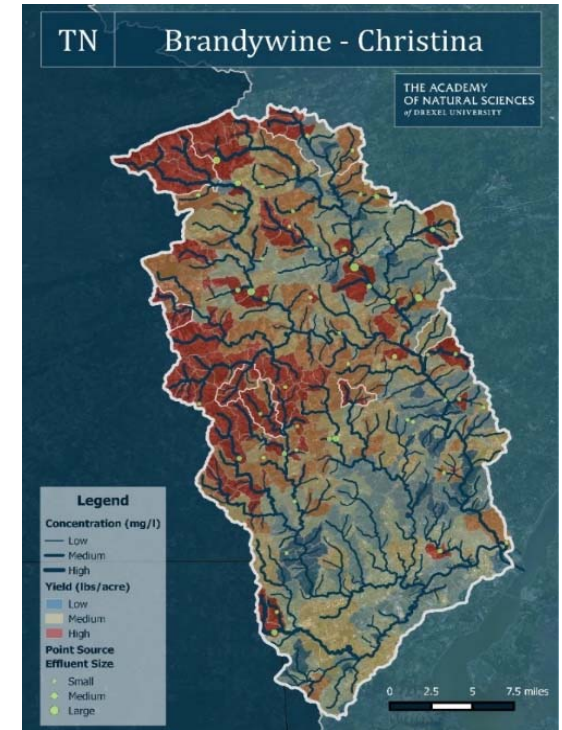
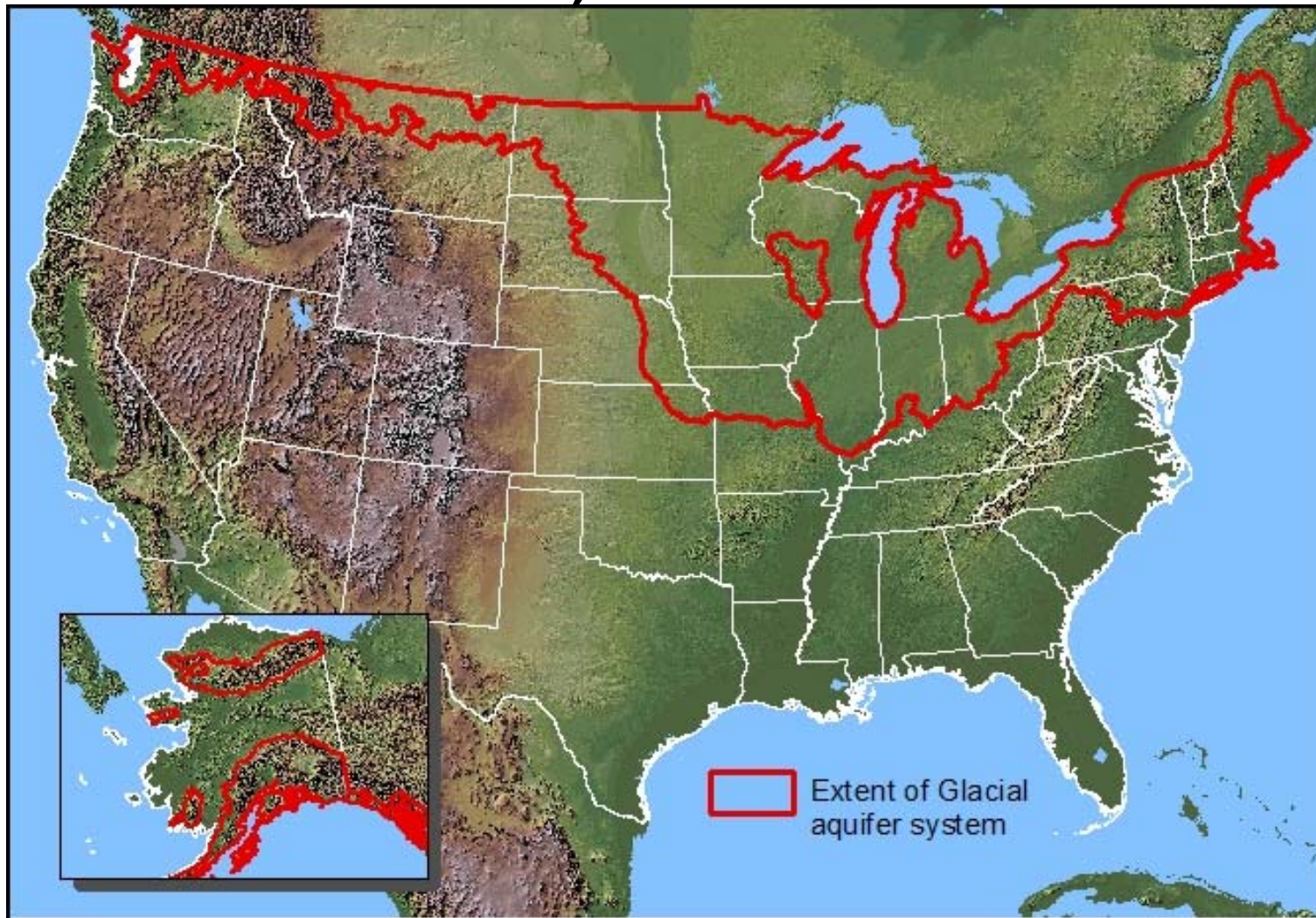


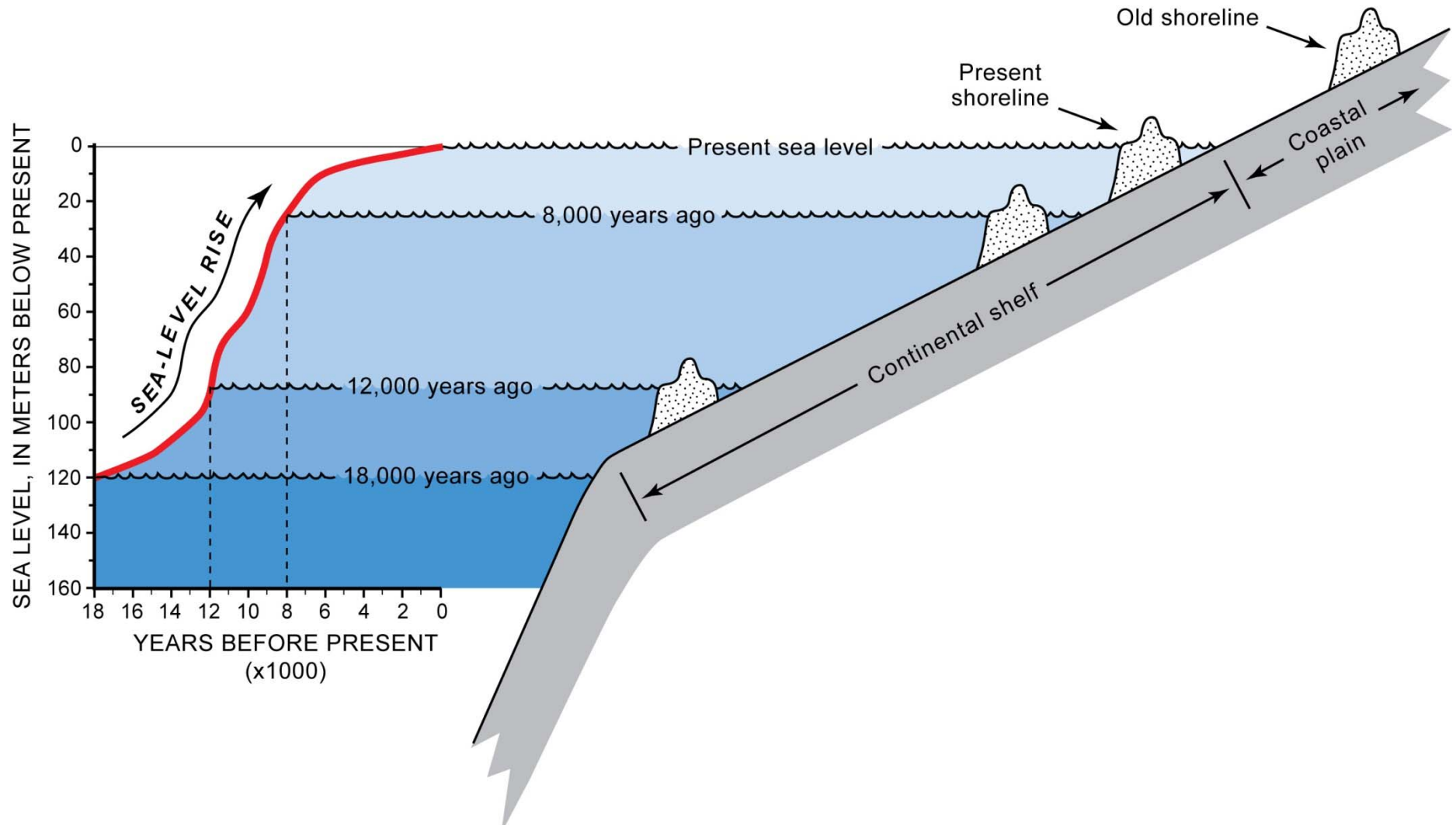
Table 1. Economic value of agricultural operations in Chester County, Pennsylvania.
(Chester County Agricultural Development Council, USDA National Agricultural Statistics Service)

Industry	Economic Value	Rank
Dairy farming	\$73 million	6 th in PA
Horse farming	\$5.2 million	22 nd in U.S.
Nursery, greenhouse, floriculture	\$79 million	1 st in U.S.
Row crops	\$8.7 million	7 th in PA
Mushroom farming	\$412 million	1 st in U.S.

Glaciers melt 16,000 BC

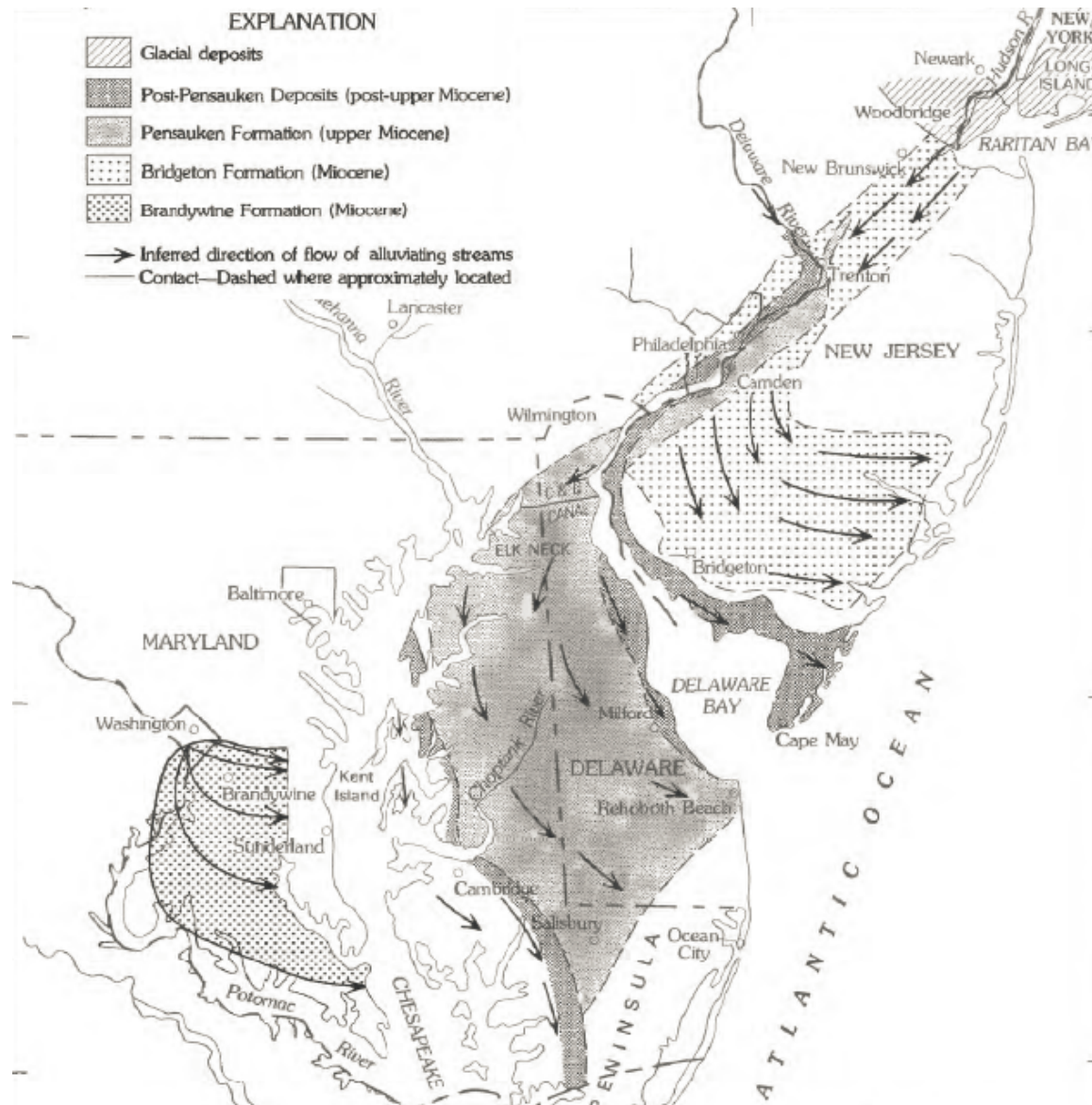


Sea levels rise 10000 BC



Alluviating Streams

8000 BC

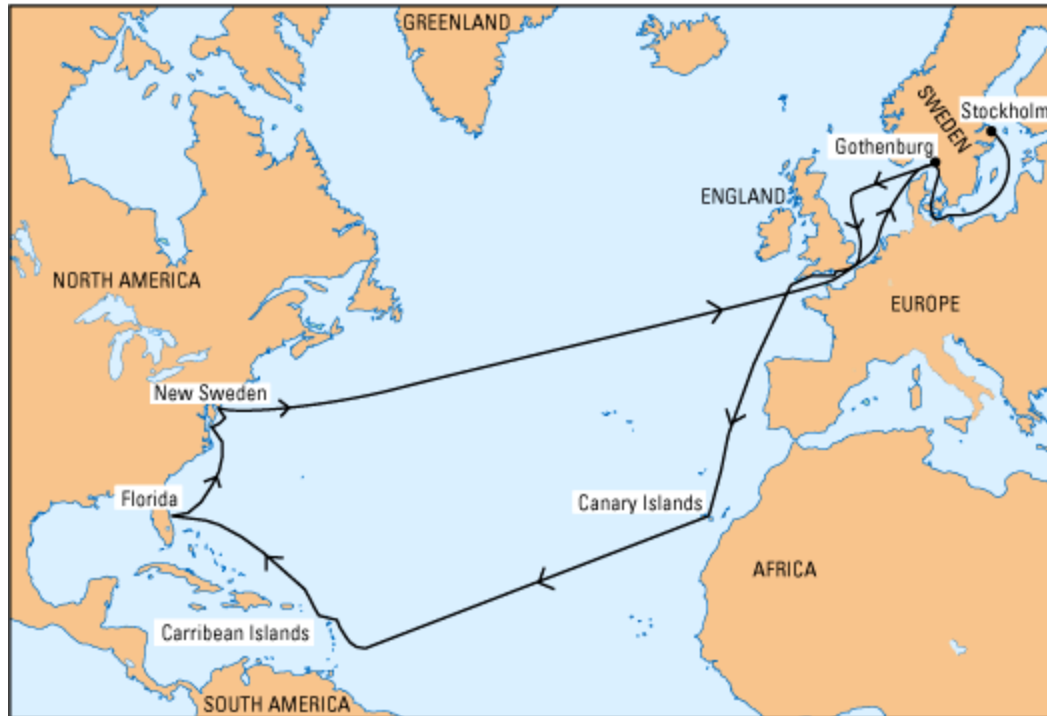


Vikings visit North America, Lief Erikson 1000 AD



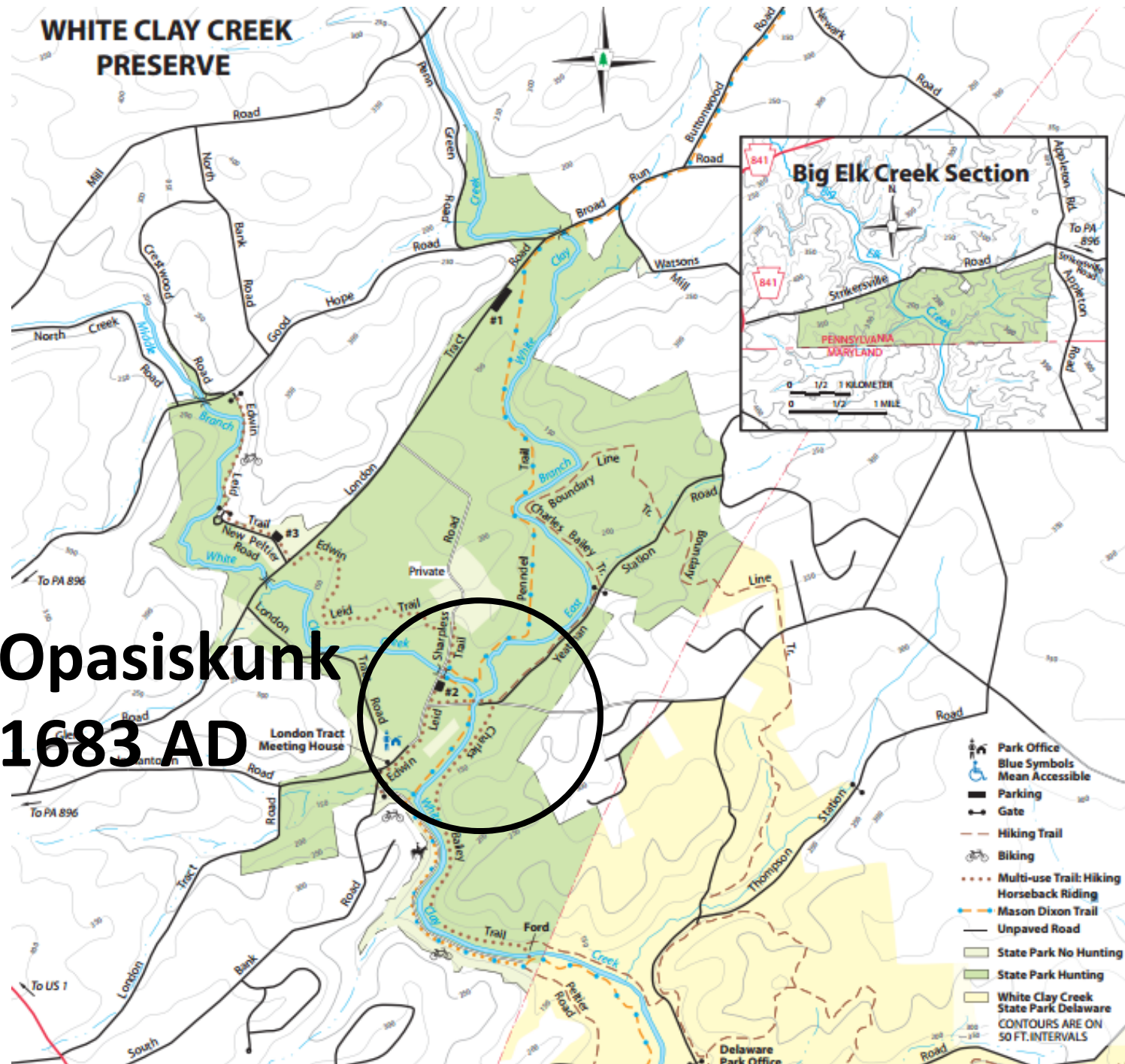
New Sweden, first permanent European settlement in Delaware and Delaware Valley

1638 AD



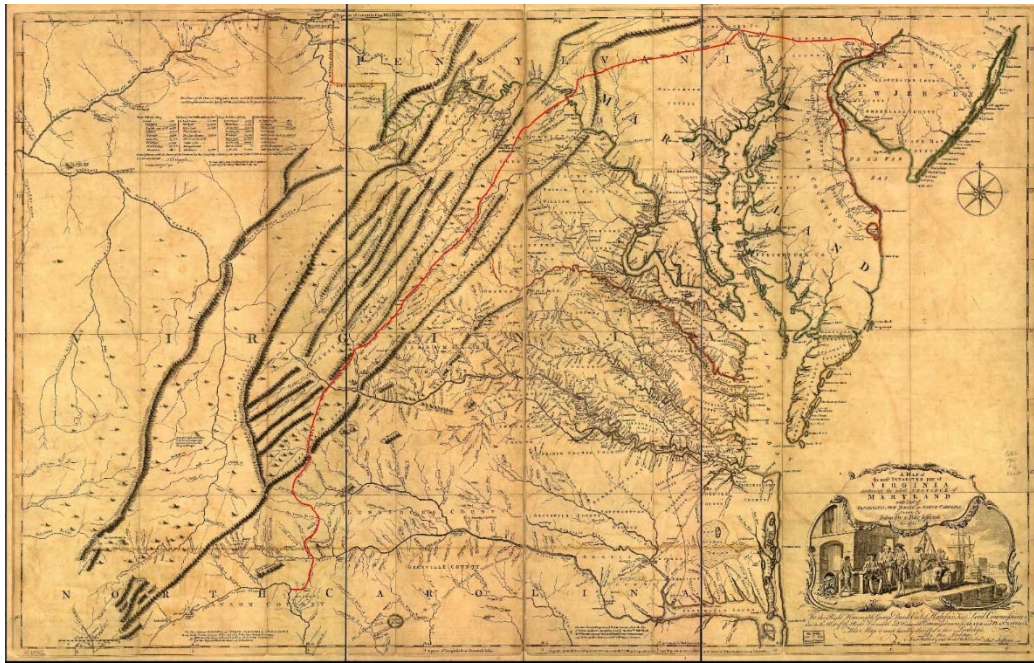


Swedes settle at mouth of Christinakill
1638 AD





3 Lower Counties of Pennsylvania 1749 AD



Great Conestoga Wagon Road
1751 AD





“Nation Makers”

H. Pyle

Battle of the Brandywine

1777 AD



Villages
Tavernes
Batailles &
Escarmouches



ici se fit le combat de l'Armée des
Rebelles fut battue le 26^{me} de
Sept. venant à la pointe du jour
attaquer notre ligne & le Quartier
Général, le quel étant dans le tems
à Germantown.

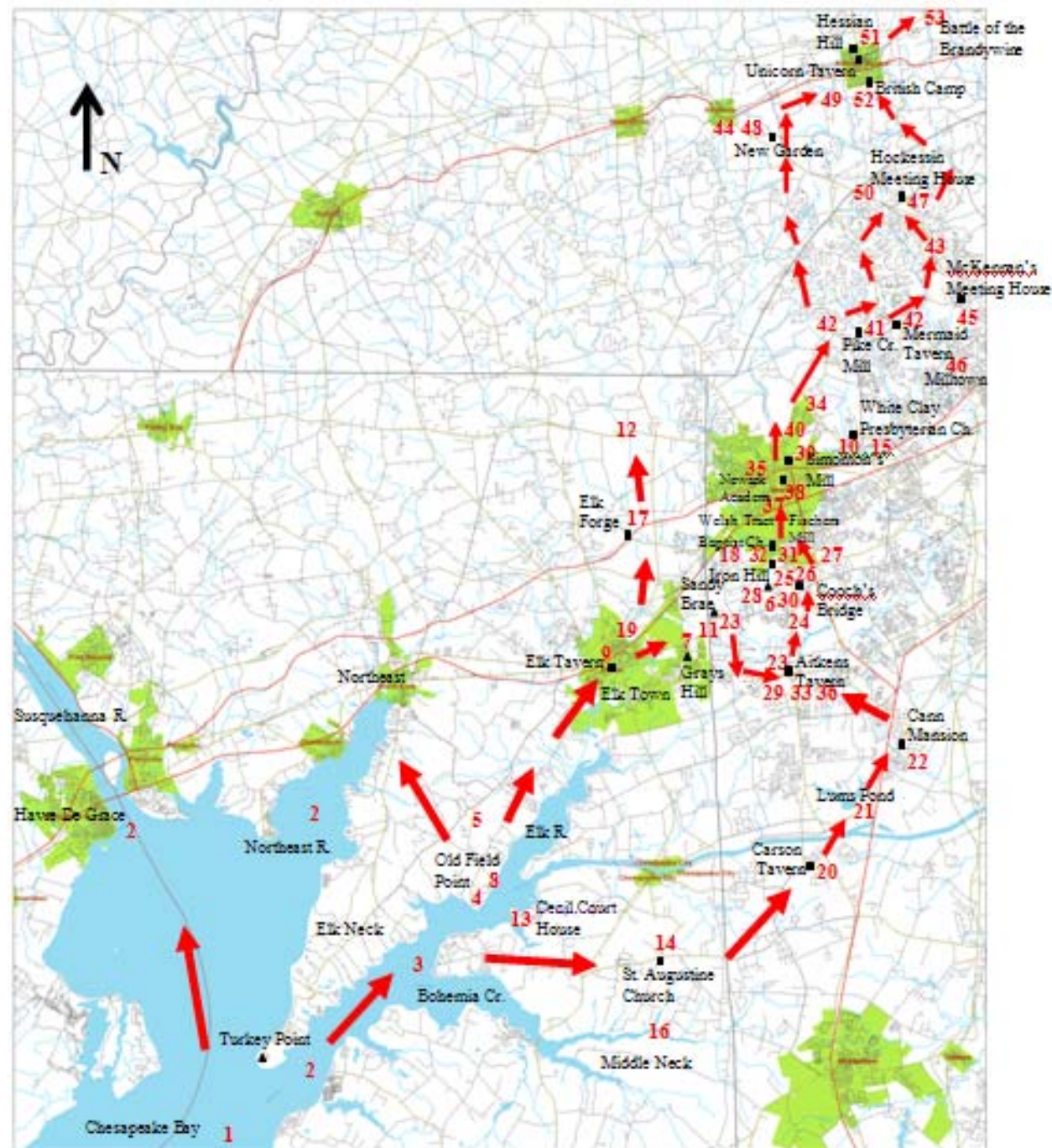
L'ont surpris avec 1500
Grenades Angloises & les prisonniers
de Philadelphie le 26^{me}
Sept. 1777.

Le 11^{me} d'Octobre Anglois marcha à Wilmington le 13^{me} au Sept.
& le Colonel de Boose le suivit, avec une brigade de hussards
pour protéger le Transport de Provisions, Bagages &c. que nous recevions
par notre flotte, la quelle y avait ancré, ayant fait une Ronde, en des-
cendant de Chesapeake. après la Descente des Troupes & montant
la Rivière de Delaware jusqu'à là.

NEW
JERSEY

OPERATIONS

de l'Armée royale en North. Amérique, sous les ordres
du Général en Chef Sir William Howe Chevalier
de l'Ordre de Bath. Depuis la Descente à Elk-
ferry, le 26^{me} d'Oct. jusqu'ayant pris Philadelphie
le 26^{me} de Sept. 1777.
Contre les Rebelles américains, commandés par
Monsieur Washington & d'autres Com-
mandeurs. Dessinée par l'enseigne de Cöhenhauser



British Invasion of Delaware, August – September 1777

Hessians at Unicorn Tavern

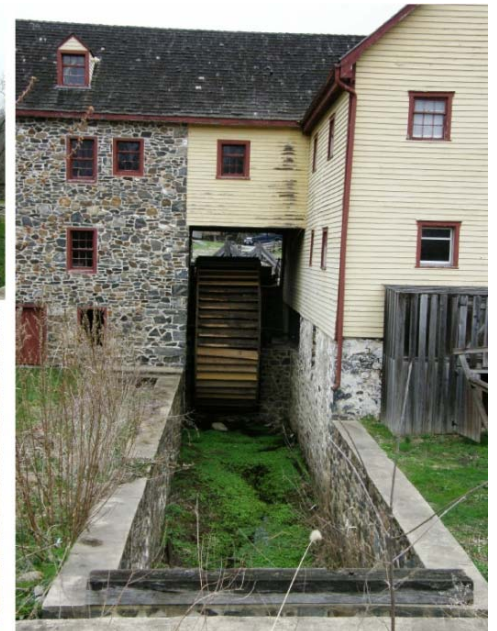
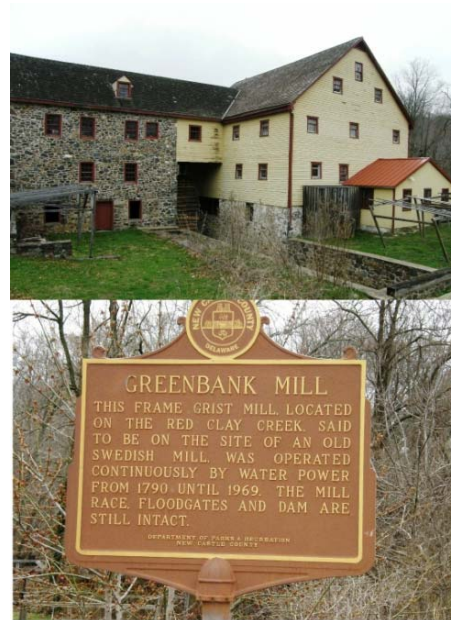


How the old Unicorn Inn might have appeared when the British and Hessian troops prepared to march to Chadds Ford for the Battle of the Brandywine. The Inn was the headquarters of Baron Wilhelm von Knyphausen when the Hessians camped in Kennett Square. (Oil on gesso painting entitled "Early Morning at Kennett Square, September 11, 1777," by Barclay Rubincam and owned by Southeast National Bank.)





Greenbank Mill
Red Clay Creek
1790 AD



DuPont Mills

1802 AD

Lee, Mass. Nov. 3-1905



Powder Mill on Brandywine near Wilmington, Del.

*These blow
up occasion-
ally and
then?*





Brandywine Falls are higher than Niagara Falls

Underground Railroad on the Christina River at Wilmington, Harriet Tubman 1830-1865 AD



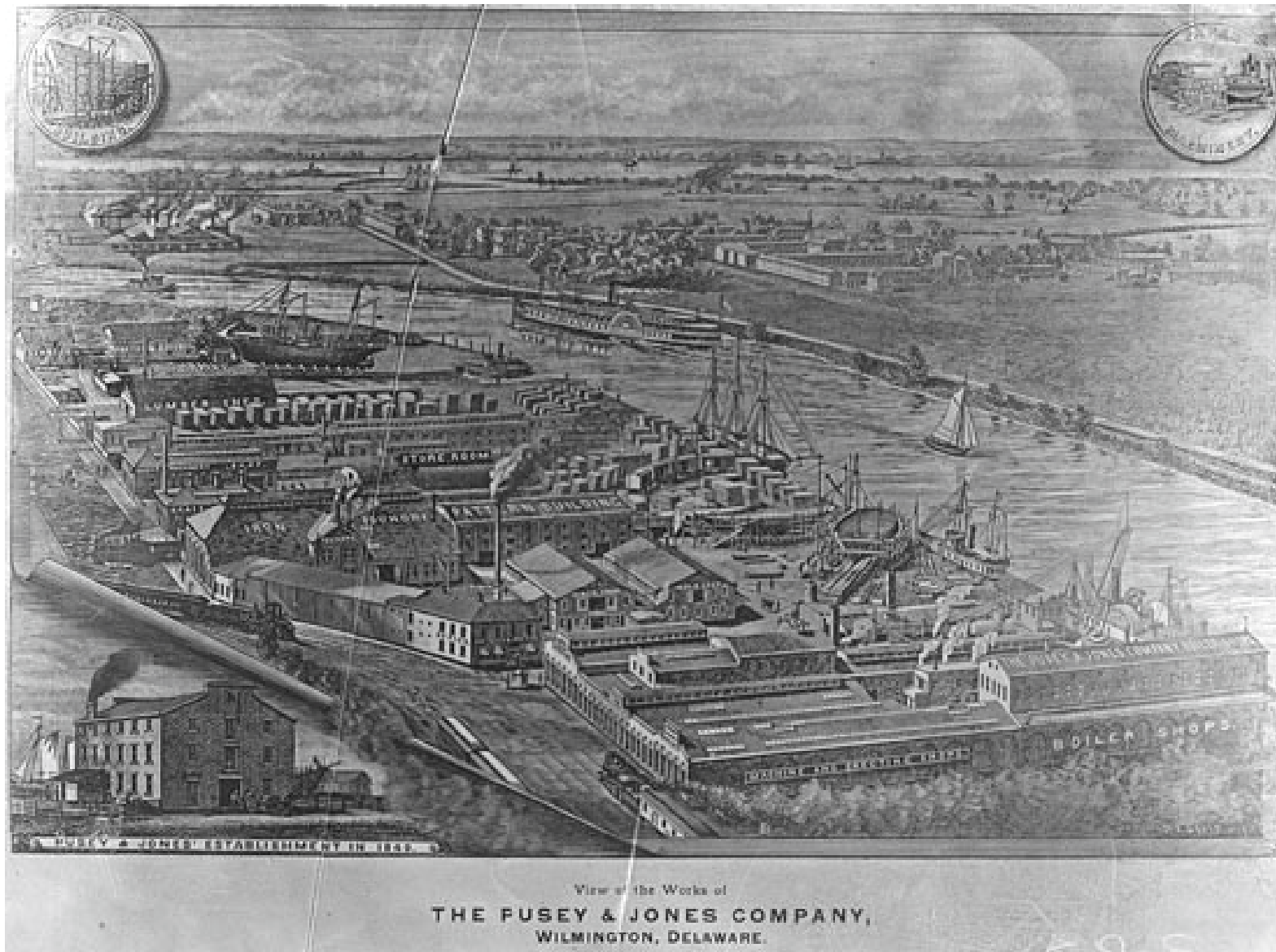
Wilmington

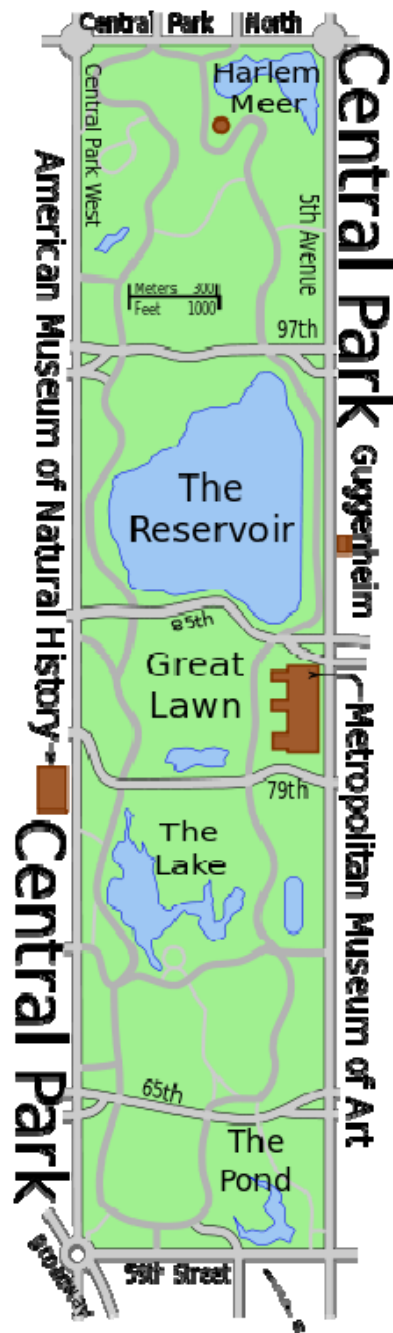
1874 AD



Bird's-eye view of Wilmington, H. H. Bailey, 1874.

Pusey and Jones Shipyard 1887 AD





Frederick Law Olmsted designed Central Park in NYC and Brandywine Park in Wilmington, Del. during the 19th century



Brandywine Plant 1929 AD



Brandywine Plant from the air, 1929.

Hoopes Reservoir

1931 AD



Hoopes Reservoir under construction, 1931.

Christiana River Tunnel

1931 AD



"It's quittin' time!"



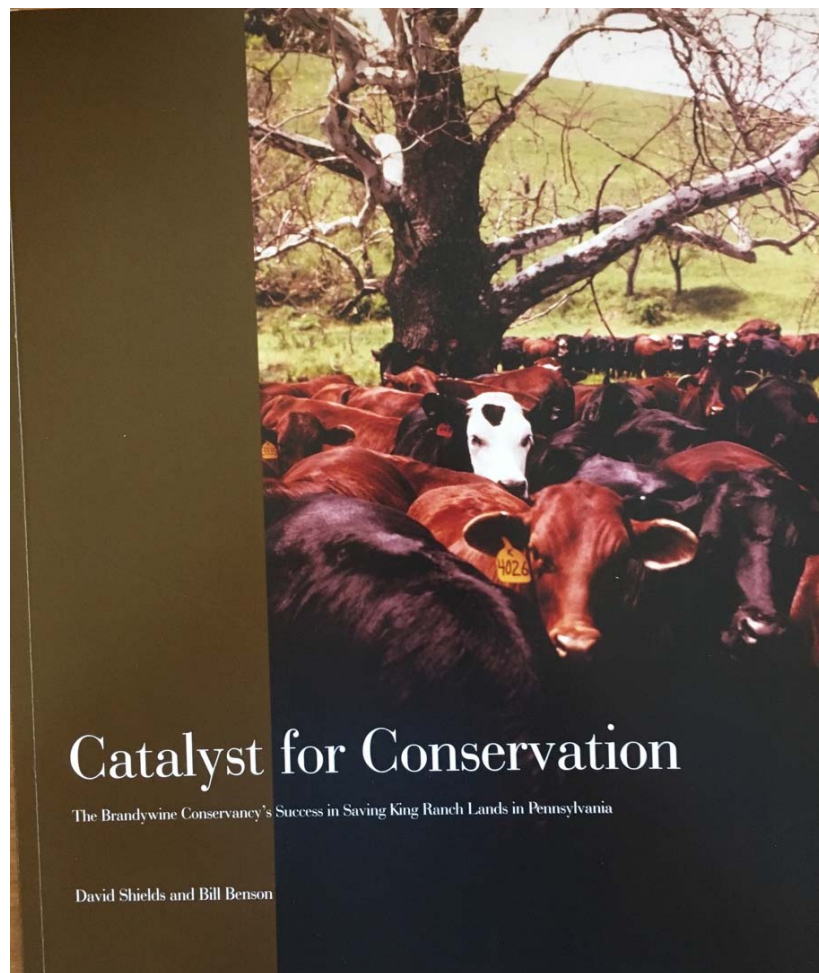
CHRISTIANA RIVER TUNNEL
#2 8:00 A.M. SHIFT COMING OFF BETT, 9-1931

Hoopes Reservoir

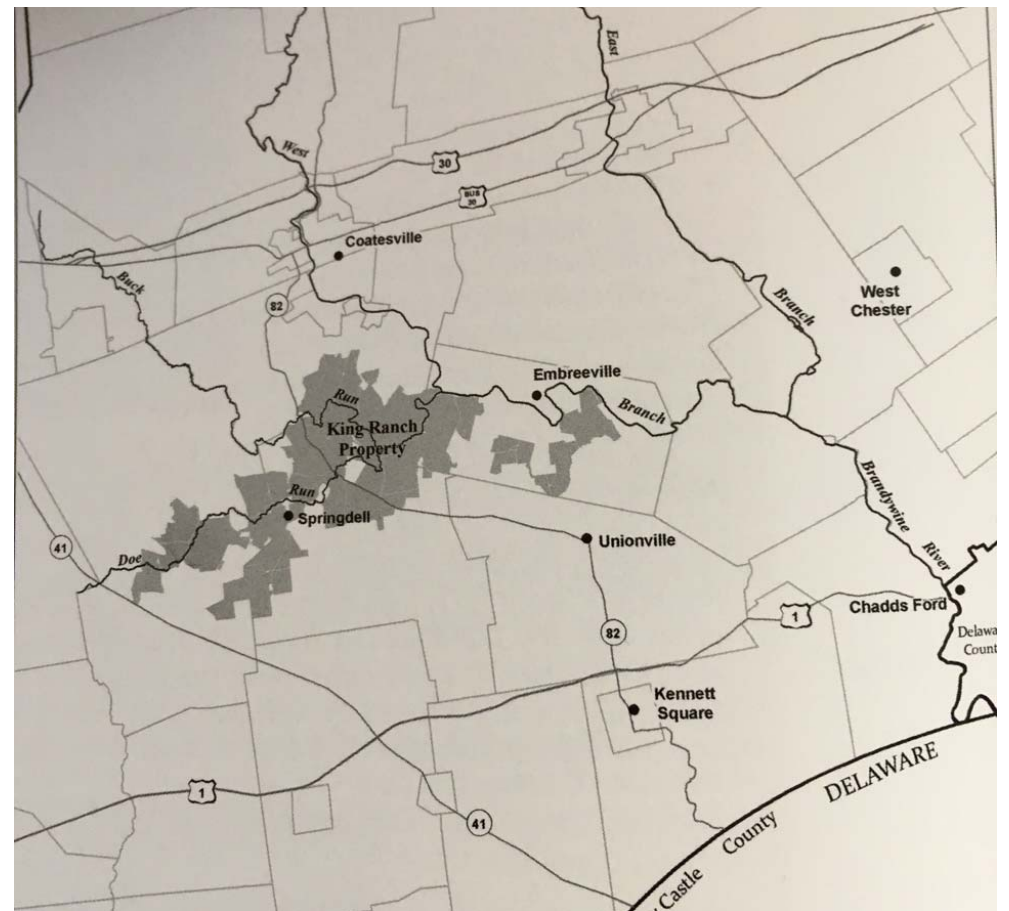
1932 AD



Hoopes Reservoir, Dam, and Pumping Station from the air, ca. 1932.



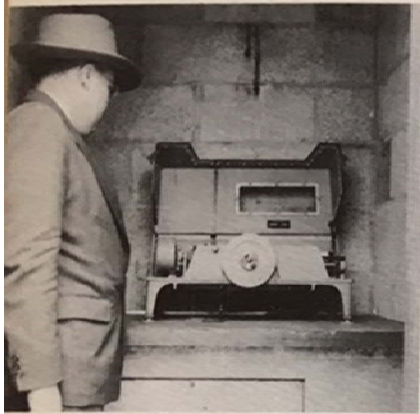
Brandywine Conservancy conserves King Ranch 1984 AD



Brandywine Creek 1940 AD



Brandywine Creek above city dam, 1940.



FLOW GAUGE installed on lower Brandywine measures and records volume of water going down the stream. These data help in compiling topsoil loss.



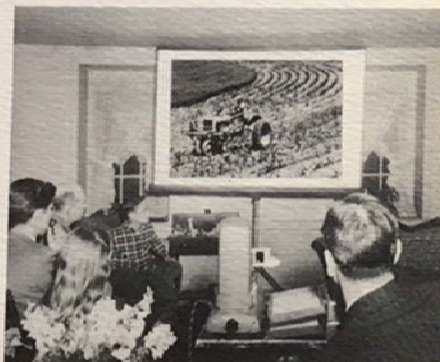
TWELVE RAINFALL GAUGES, like one above, record precipitation at various locations in the Valley.

THE WORK OF THE BRANDYWINE VALLEY ASSOCIATION

STATE FARM FORESTER, working with Brandywine Valley Association staff member, explains wood-lot management to class in agriculture.



ASSOCIATION staff member shows slides of conservation methods to family group in farm home.



FARM PONDS provide water for farm animals, fish, and fire protection; help retard flood water run-off. Soil conservation technicians look on while check is made of growth rate of stocked fish.

COUNTY AGENTS and Association representatives (*below*) conduct farm tours to observe and study conservation practices.



Brandywine Valley Association, America's first small watershed association, est. 1945 AD

Newark Reservoir

1960 AD

6

Water Supply: The History of Newark's Life Source



Figure 3. Schematic of proposed Newark Reservoir and Christiana Reservoir (source: U.S. Army Corps of Engineers, 1960)

JFK signs DRBC Compact 1961 AD





Chester County Water Resources Authority

C H E S T E R C O U N T Y ~ P E N N S Y L V A N I A

1961 AD

Gov. Peterson signs Delaware Coastal Zone Act 1971



UD Water Conservation Campaign 1980s AD

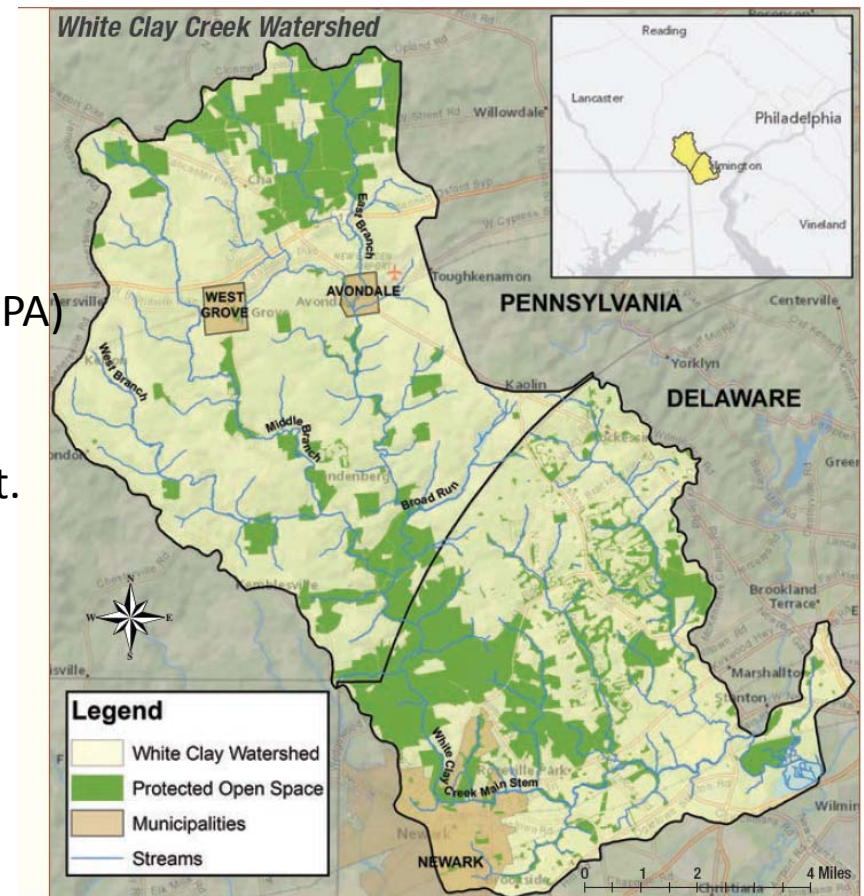


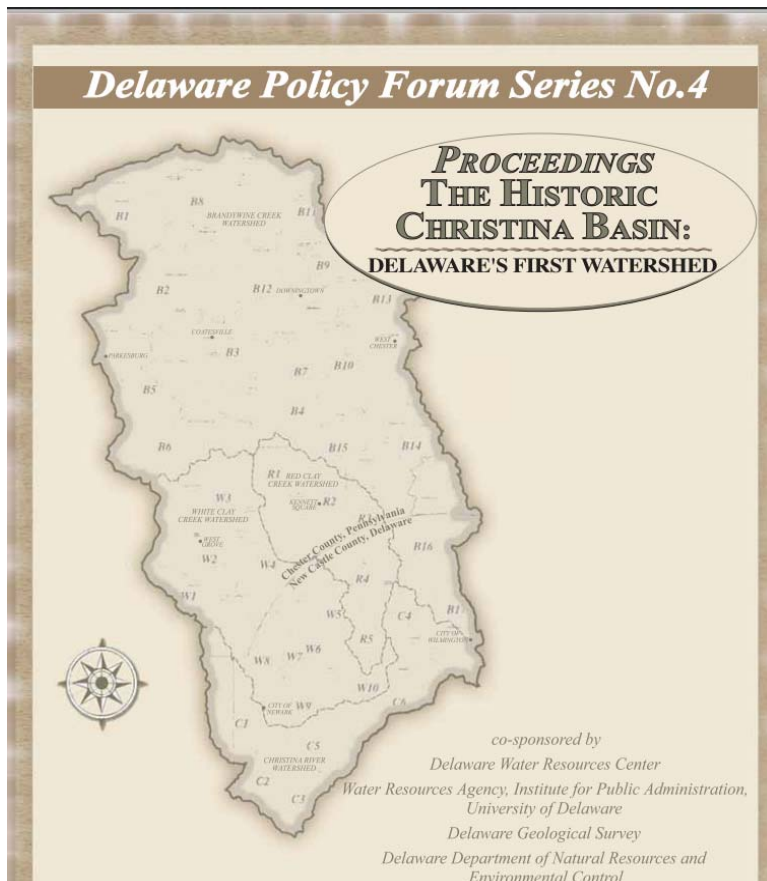
Ten years of the program's accomplishments accompanied by changes in anticipated usage of the creek led to requests for inclusion of these areas. Expanding stream designation within White Clay will extend and help safeguard historical, recreational, and natural resources in addition to protecting the river as a source of drinking water for future generations.

The legislation that designated the White Clay Creek and its tributaries in Delaware and Pennsylvania into the National Wild and Scenic Rivers System was introduced in 2000 Congress by Congressmen Michael Castle (DE) and Joseph Pitts (PA); and by Senators Joseph Biden (DE), William Roth (DE), Rick Santorum (PA), and Arlen Specter (PA). This legislation, P.L. 106-357, was passed by both houses of Congress and signed into law by President William Clinton on October 24, 2000.

The White Clay Wild & Scenic Expansion Act was reintroduced in 2014 and sponsored by Delaware Senator Chris Coons, co-sponsored by Delaware Senator Tom Carper, and Pennsylvania Representative Joseph Pitts and co-sponsored by Delaware Representative John Carney and Pennsylvania Senator Robert Casey.

Congressmen Michael Castle (DE) and Joseph Pitts (PA) and Senators Joseph Biden, William Roth (DE), Rick Santorum (PA), and Arlen Specter (PA) introduce White Clay Creek Wild & Scenic Rivers Act. Signed by President William Clinton 2000 AD





2004 AD



Edward (Ned) W. Cooch Jr. provides a historical account of the Battle of Cooch's bridge.

Newark Reservoir

2004 AD



Newark Reservoir

2006 AD



Figure 23. Dedication of the newly opened Newark Reservoir on May 24, 2006, including (left to right) Assistant City Manager Carol Houck, Councilman Kevin Vonck, Councilman Jerry Grant, Councilman Karl Kalbacher, Former Mayor Ron Gardner, State Senator Joe Miro, Councilman David Athey (behind Miro), Mayor Vance Funk (back row, partially obscured), Councilman Frank Osborne, State Senator Liane Sorenson, Councilman Jerry Clifton, Lt. Gov. John Carney (third from the right), and City Manager Carl Luft (far right). (source: M. W. Wollaston, 2006)

Newark chartered in 1758 by King George II
250th Anniversary Parade
2008 AD





UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION III- OFFICE OF PUBLIC AFFAIRS

1650 Arch Street Philadelphia, Pennsylvania 19103-2029

Phone - 215/814-5100 Fax - 215/814-5102

EPA Environmental News

Contact: David Stenberg (215) 814-5548, stenberg.david@epa.gov

Report Shows Progress Exceeding Plans in Christina River Basin

(PHILADELPHIA, February 5, 2009) – The U.S. Environmental Protection Agency announced today that the Christina River Basin Clean Water Partnership in Pennsylvania and Delaware has made significant progress in reducing pollution from storm water runoff to the Christina River basin.

A recent report by the University of Delaware and the Delaware River Basin Commission shows that, throughout the past four years, the Partnership, with the assistance of a \$1 million EPA grant, has implemented numerous projects to reduce the harmful effects of stormwater runoff pollution on drinking water supplies, recreation, fisheries, and wildlife.

For every federal dollar invested in the project, the Partnership leveraged more than two dollars, allowing them to exceed the original goals, some by more than 50 percent.

Congressman Joe Pitts (PA)
presents award at
Christina Basin TWG event,
Feb 29, 2008



Congressman Mike Castle (DE)
presents award at
Christina Basin TWG event,
Feb 29, 2008

Figure 16. Christina Basin Targeted Watershed Grant legislative event, February 29, 2008

Table 15. Christina Basin Targeted Watershed Grant implementation project deliverables

Task	Action	Original Deliverable	Final Result
3.1C	PA Soil Conservation Practices	500 acres	>725 acres
3.1D	PA Waterway Diversions	2,000 feet	2,250 feet
3.1E	PA Water Control Structures	4 structures	6 structures
3.1F	PA Stream Fencing	1,000 feet	8,025 feet
3.1G	PA Stream Reforestation	6,000 feet	9,148 feet
3.2	DE Smartyards and Rain Barrels	150 rain barrels	204 rain barrels
4.1	DE Stream Restoration/Reforestation	5,000 feet	8,920 feet

Wilmington's Matt Miller receives BVA award 2011 AD



[illegible]

Revised 6.20.07 • JOHN M. LEWIS PHOTOGRAPHY

Woodlawn Trustees provide land for First State National Monument along Brandywine River, 2013 AD



| PHOTO OF THE DAY | TV | PERPETUAL PLANET | LATEST STORIES

TELEPHOTO ZOOM
CAPTURE IT THE WAY YOU WANT IT



Delaware Gets Its First National Monument

The National Park System finally reaches all 50 states.



A lone sycamore tree stands at Woodlawn, the heart of Delaware's newly declared national monument.

PHOTOGRAPH BY MICHAEL MELFORD, NATIONAL GEOGRAPHIC

By **Brad Scriber**, [National Geographic News](#)

PUBLISHED MARCH 27, 2013

Shortly after noon on Monday, with a declaration from President Obama designating the First State National Monument, the [National Park Service](#) welcomed Delaware into its fold for the first time. (Related: "[Obama Declares Monuments to Preserve Pieces of U.S. Heritage](#).")

President Obama created the monument along with four other national monuments in an Oval Office ceremony alongside Vice President [Joe Biden](#) and Secretary of the Interior [Ken Salazar](#), using powers designated under the Antiquities Act of 1906 to recognize historically significant

2013 AD



First State National Monument

2014 AD

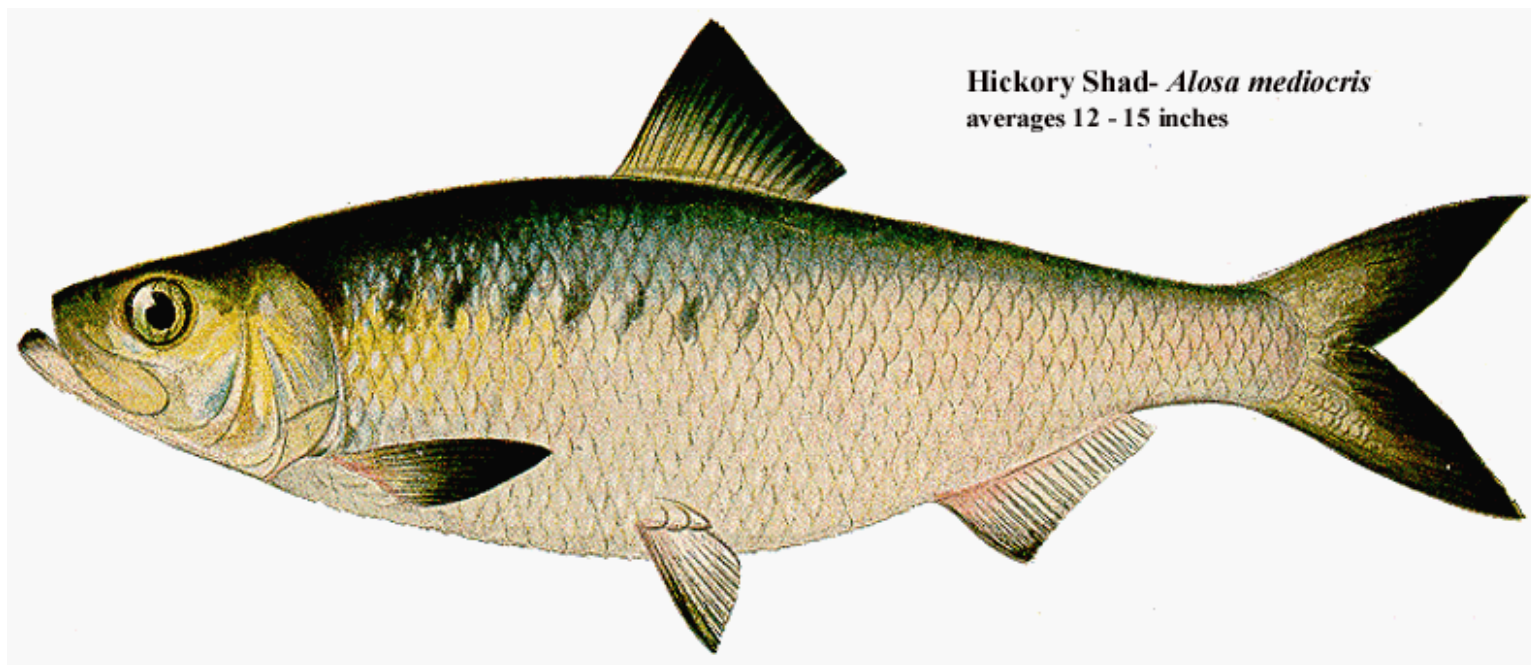


Martha Narvaez Voted President-Elect of American Water Resources Association 2015 AD





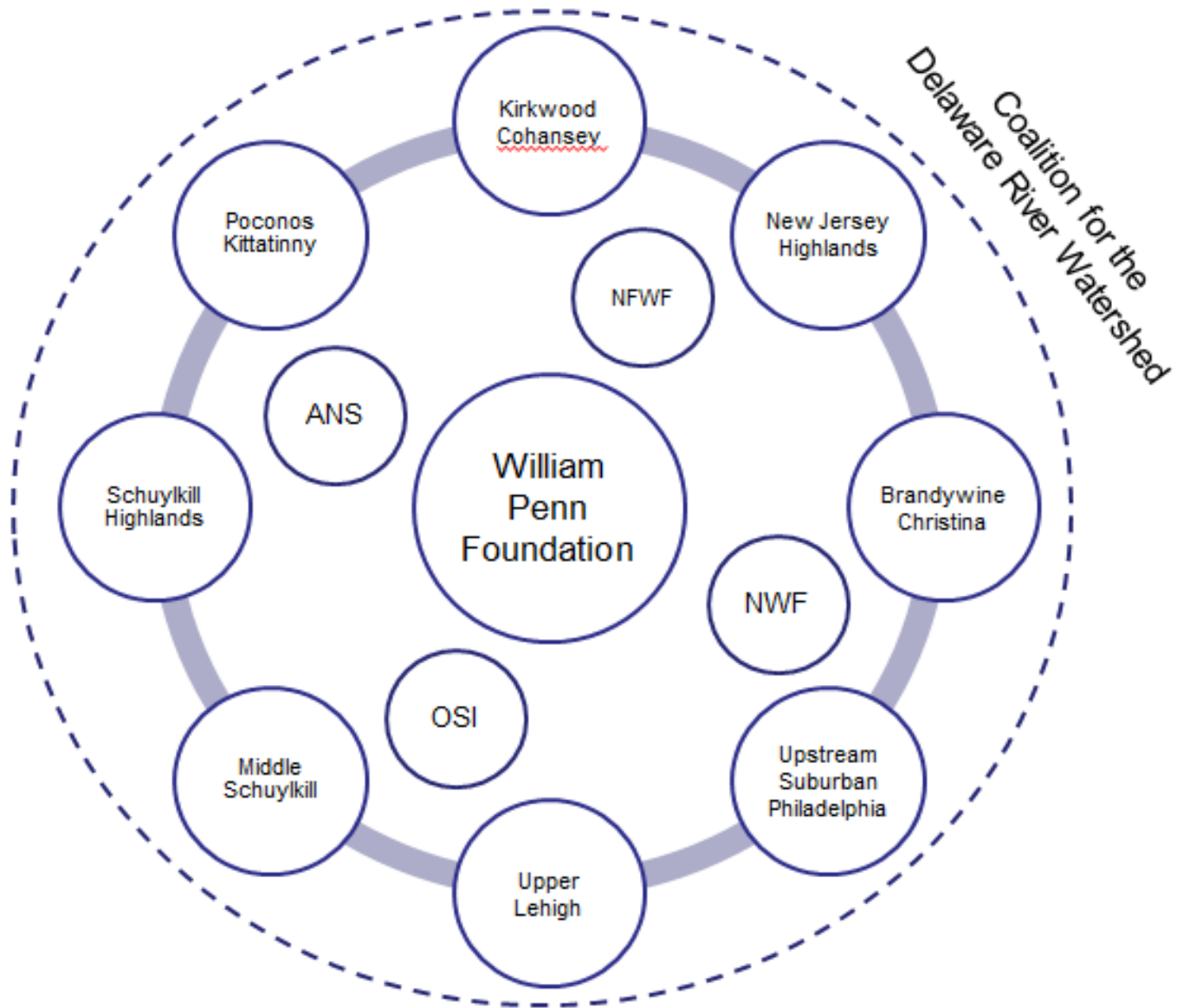
America's Founding Fish





"Sixteen Delicious, Buzzy
Craft Beers..."
Feb. 16, 2011





William Penn Foundation unveils
Delaware River Watershed Initiative
2013 AD

Questions?

