

Dare to be first.



Water Resources Agency Annual Board Mtg. FY2012

November 3, 2011

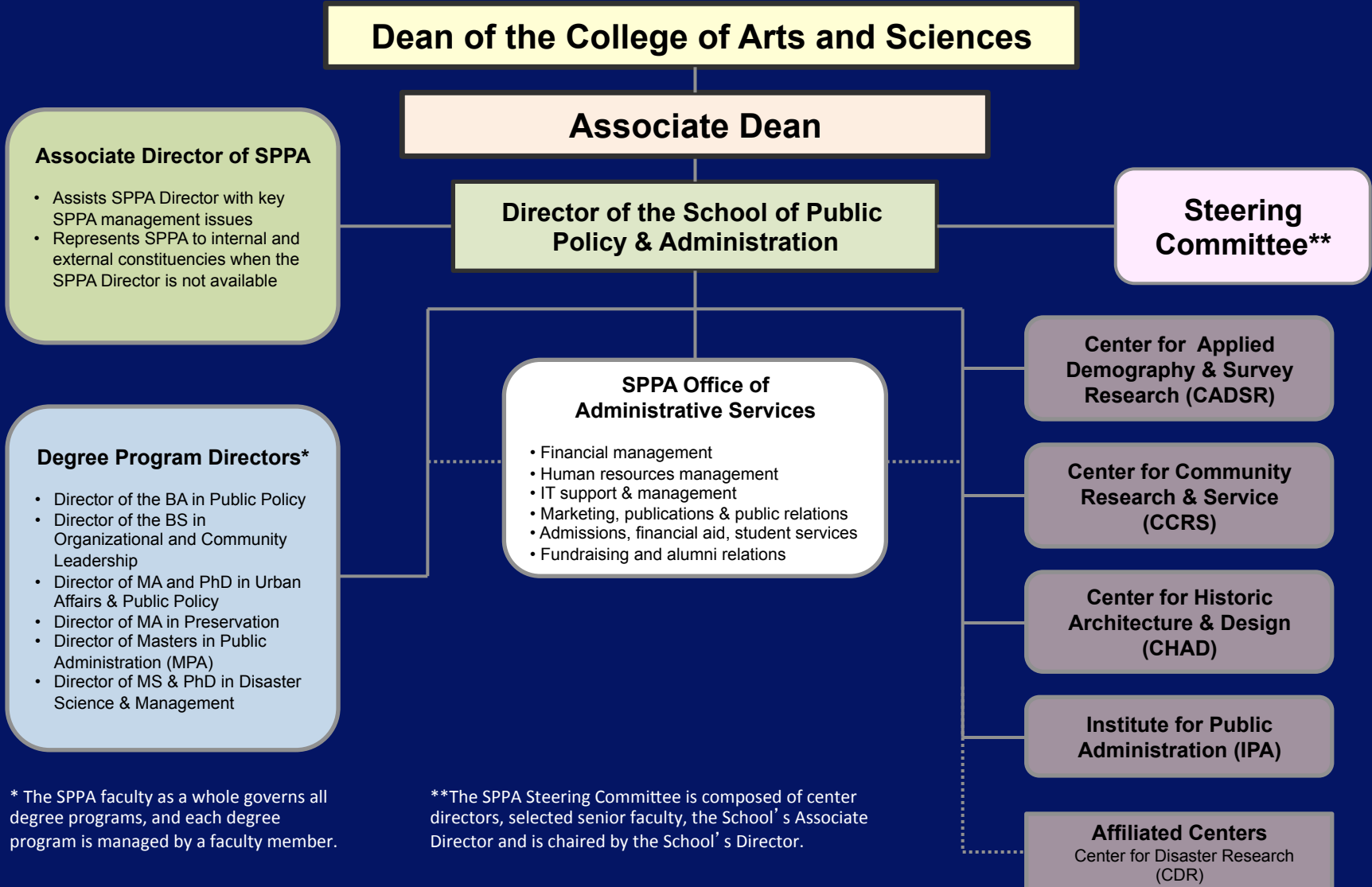
a cooperative program of

**University of Delaware • State of Delaware
New Castle County • City of Newark • City of Wilmington**

WRA Mission

“To provide regional, intergovernmental water resources science and policy assistance to governments in Delaware and the Delaware Valley through the land grant (1) public service, (2) education, and (3) research role at the University of Delaware.”

School Organizational Chart



* The SPPA faculty as a whole governs all degree programs, and each degree program is managed by a faculty member.

**The SPPA Steering Committee is composed of center directors, selected senior faculty, the School's Associate Director and is chaired by the School's Director.

WRA FY12 Budget

- **DNREC (40%)**
- **AGF (41%)**
(New Castle County, Newark, Wilmington)
- **Grants (19%)**
(National Park Service, Fish America Foundation, Del. Center for Transportation, Partnership for Delaware Estuary, Sustainable Coastal Community Initiative, National Science Foundation)

Faculty/Policy Scientists

Jerome L. Lewis

Gerald J. Kauffman

Martin W. Wollaston

Martha B. Narvaez

Andrew R. Homsey

Nicole M. Minni

IPA Director

WRA Director

Policy Scientist

Associate Policy Scientist

Associate Policy Scientist

Assistant Policy Scientist

Research Assistants

Eric Connelly

Sarah Taylor

Steve Thorp

Chelsea Halley

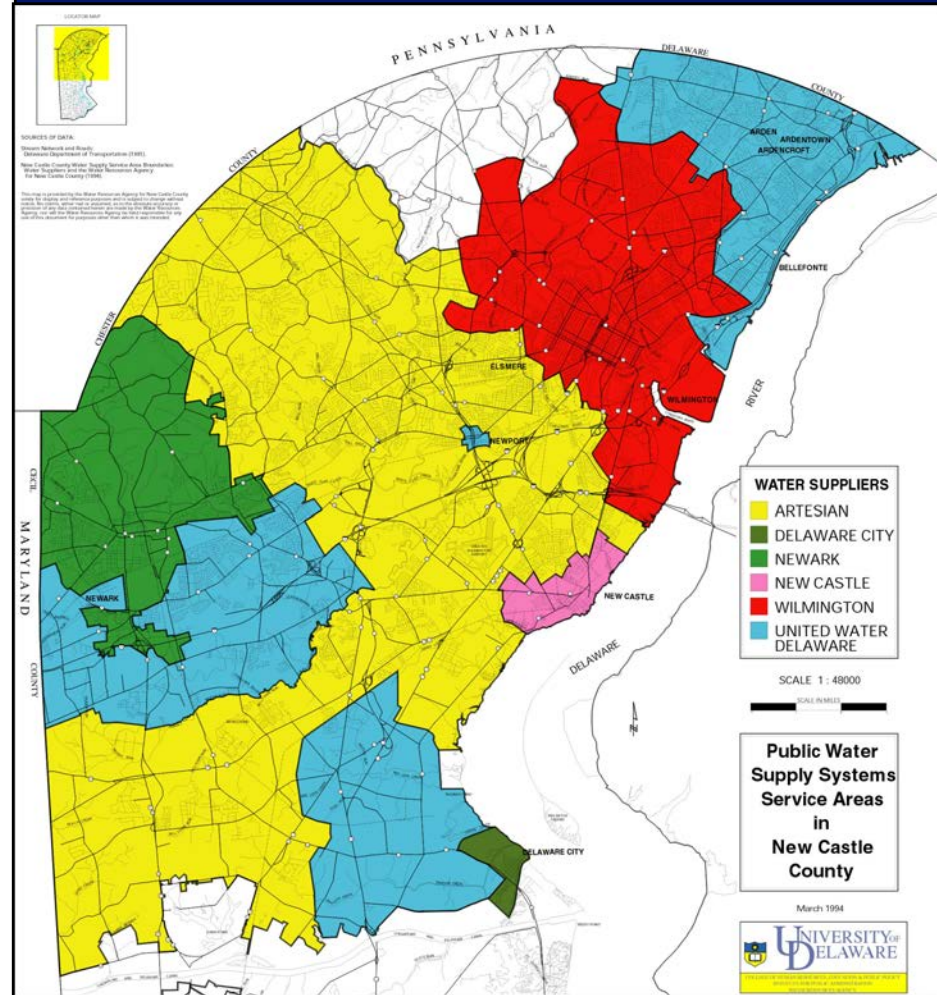
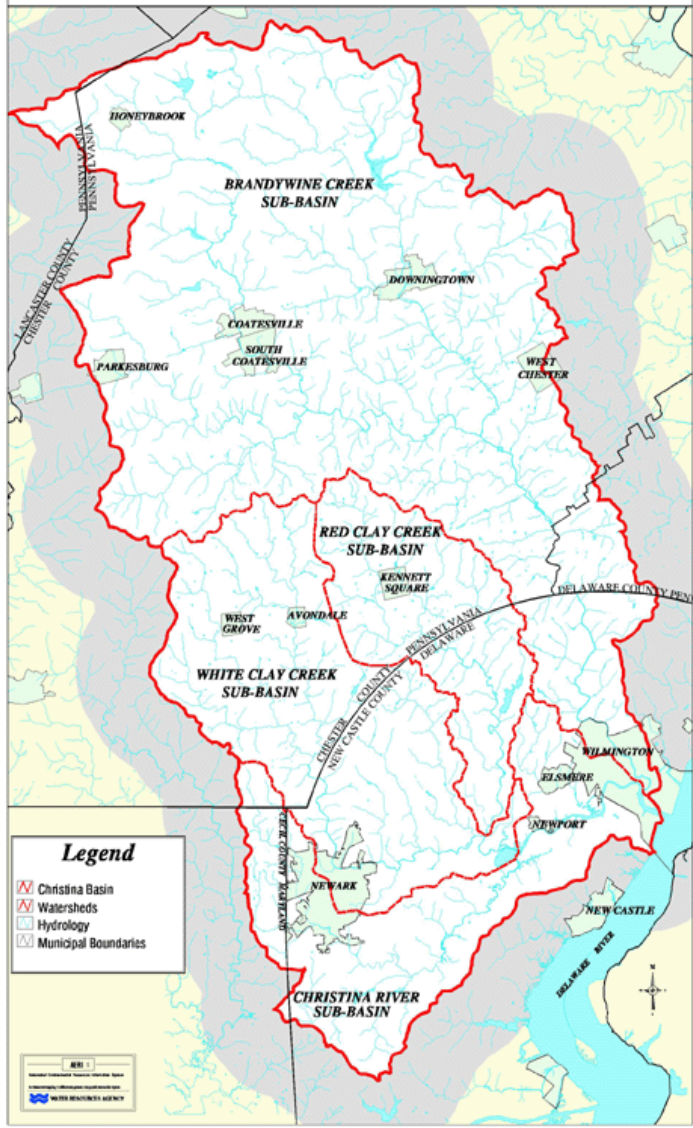
Graduate Research

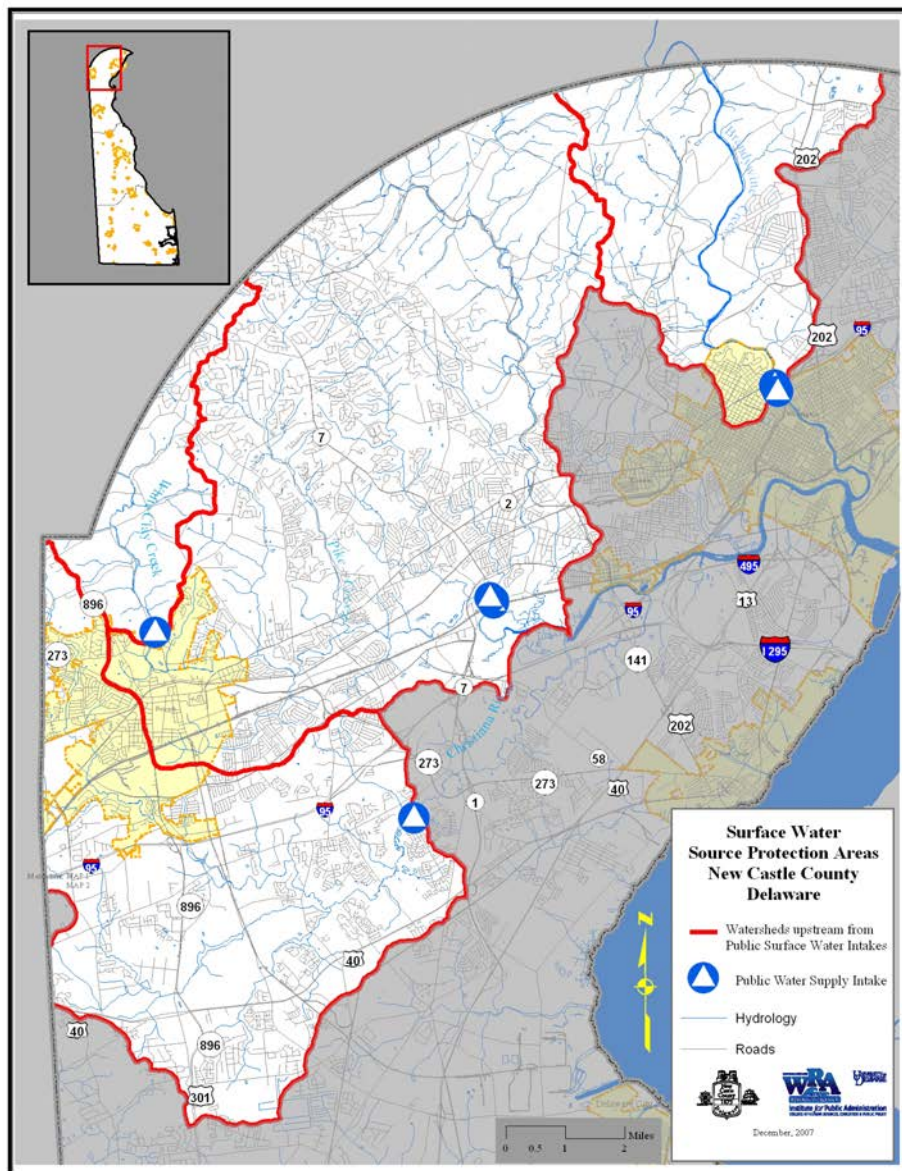
Graduate Research (Spring 2012)

Graduate Research

Undergraduate Research

Christina Basin Water Quality Management Strategy Base Map





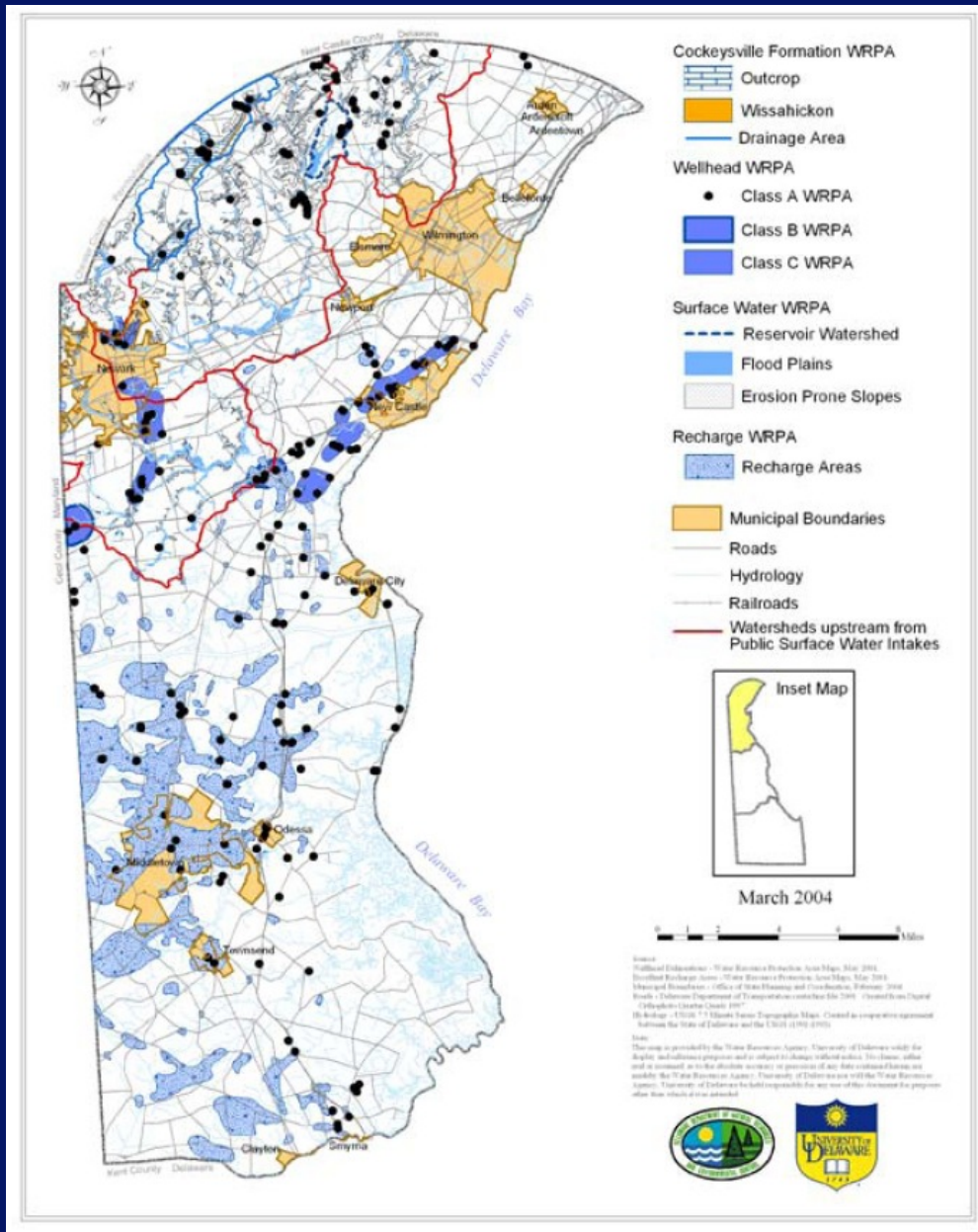
60% of Delaware's drinking water is from streams and wells in the Christina Basin.

- Brandywine Creek
- Red Clay Creek
- White Clay Creek
- Christina River

New Castle Co. Water Supply

Northern NCCo:
 surface water,
 94 mgd (66%)
 groundwater,
 33 mgd (23%)

Southern NCCo:
 groundwater,
 15 mgd (11%)



WRA FY12 Work Plan

State of Delaware

- **Water Supply Coordinating Council**
- **Christina Basin Pollution Control Strategy**
- **Watershed Tributary Action Teams**
- **Source Water Protection Program**
- **Wetlands/Habitat**
- **Watershed Economic Studies**

City of Wilmington

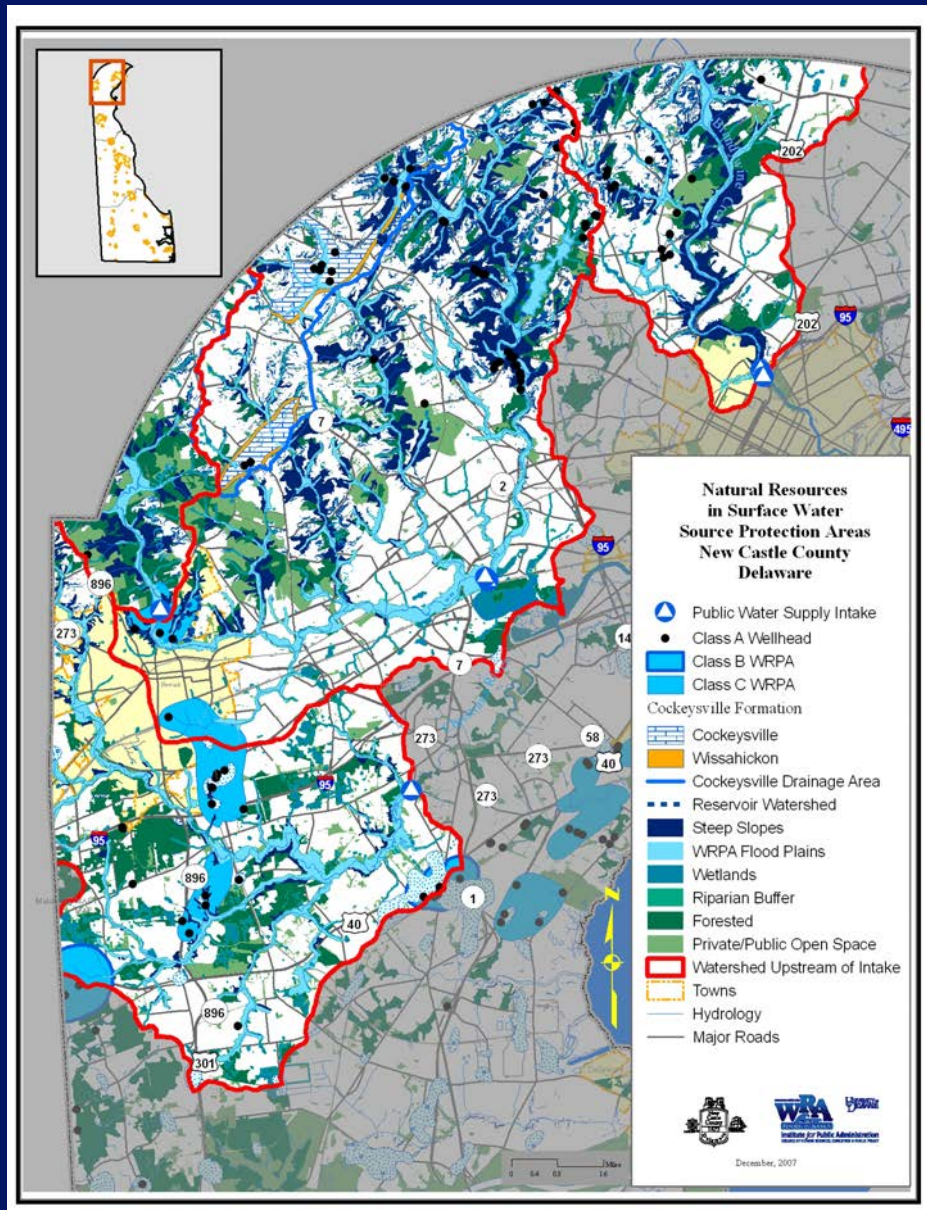
- **Brandywine/Hoopers Source Water Protection**
- **Combined Sewer Overflow Abatement**
- **Water/Wastewater Response Network (WARN)**
- **Green Infrastructure to Mitigate CSO Events**
- **Wilmington Green Jobs for Youth Program**

City of Newark

- **City of Newark GIS Basemap**
- **Upper Christina River Stream Restoration**
- **White Clay Creek Water Supply Intake**
- **White Clay Creek Realtime Warning System**
- **Water Distribution Model**

New Castle County

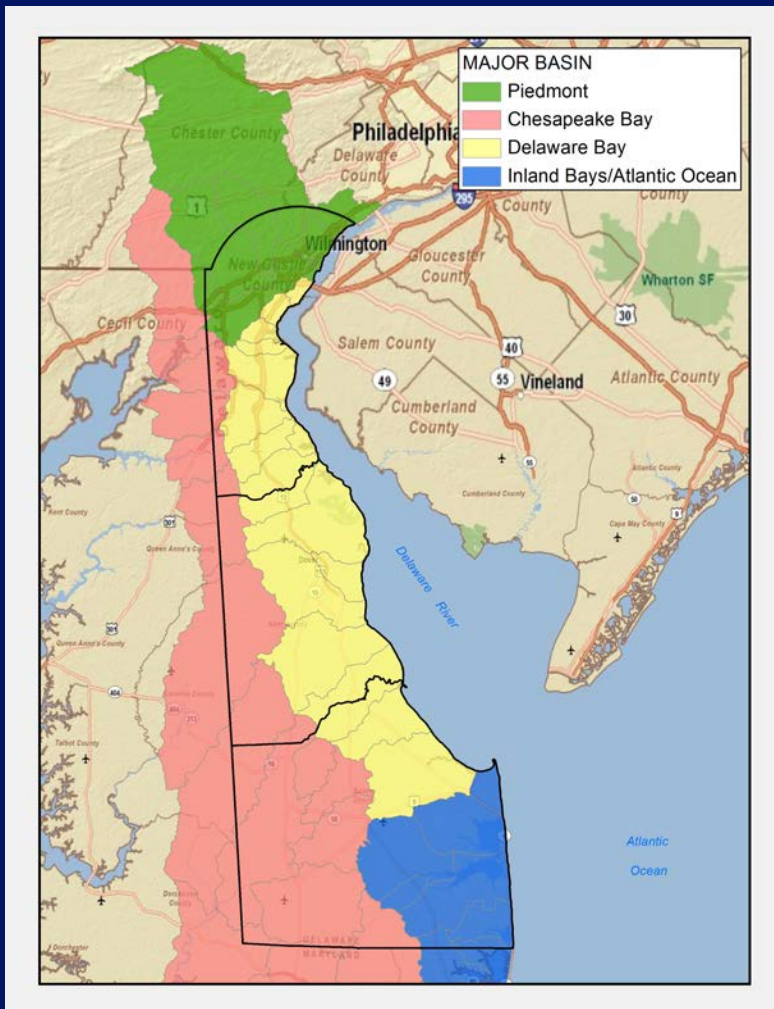
- **Water Resource Protection Area Program (Mapping and RPATAC)**
- **Municipal Separate Storm Sewer MS4 NPDES Permit**
- **White Clay Creek Wild and Scenic River Watershed Committee**
- **Pike Creek Watershed Retrofit Project**



**Source water—
protection ordinances
and protected open
space protect 54% of
the drinking water
watersheds.**

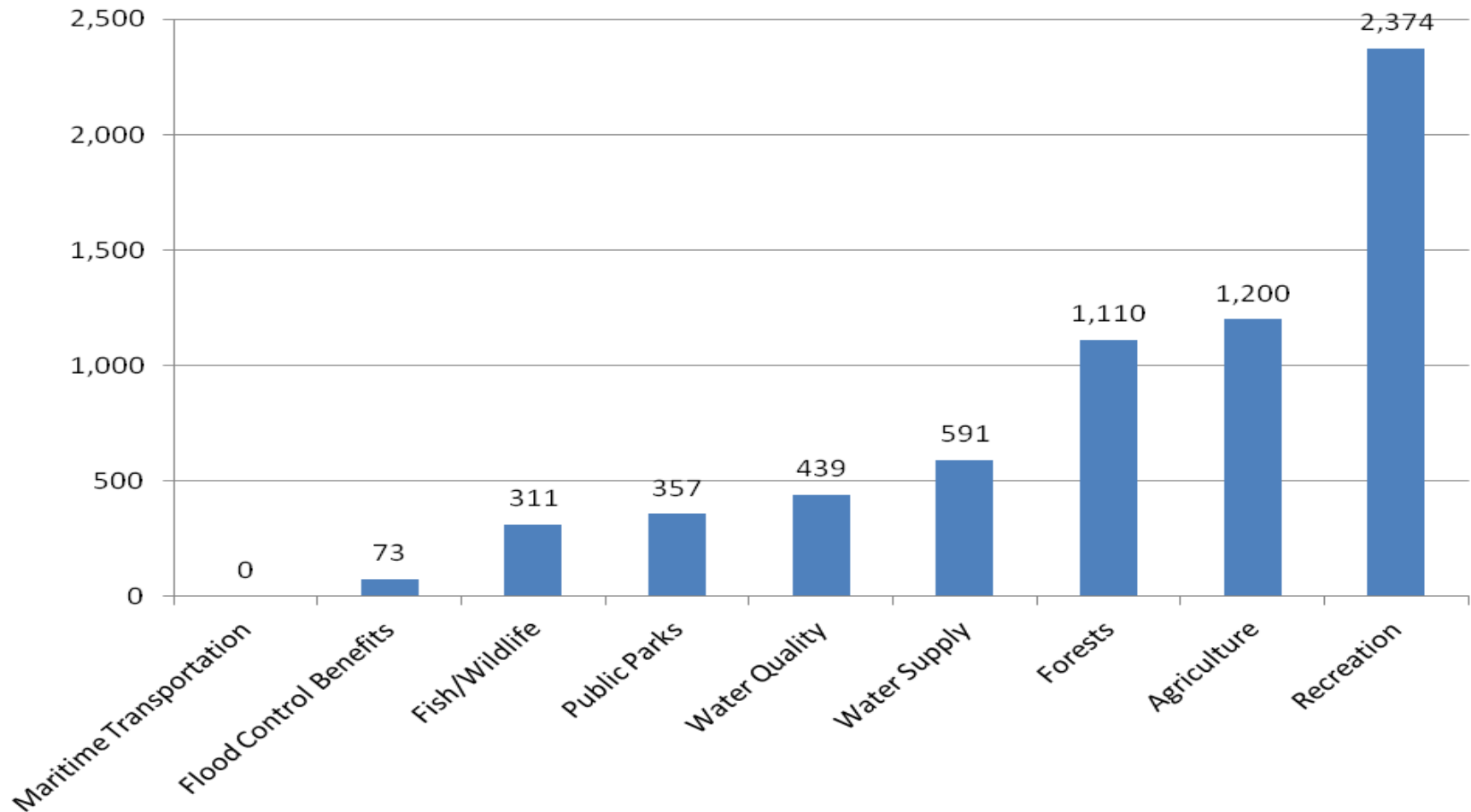
- **Brandywine Cr. (46%)**
- **White/Red Clay (59%)**
- **White Clay Newark (75%)**
- **Christina River (45%)**

Economic Value of Delaware Watersheds (Draft)

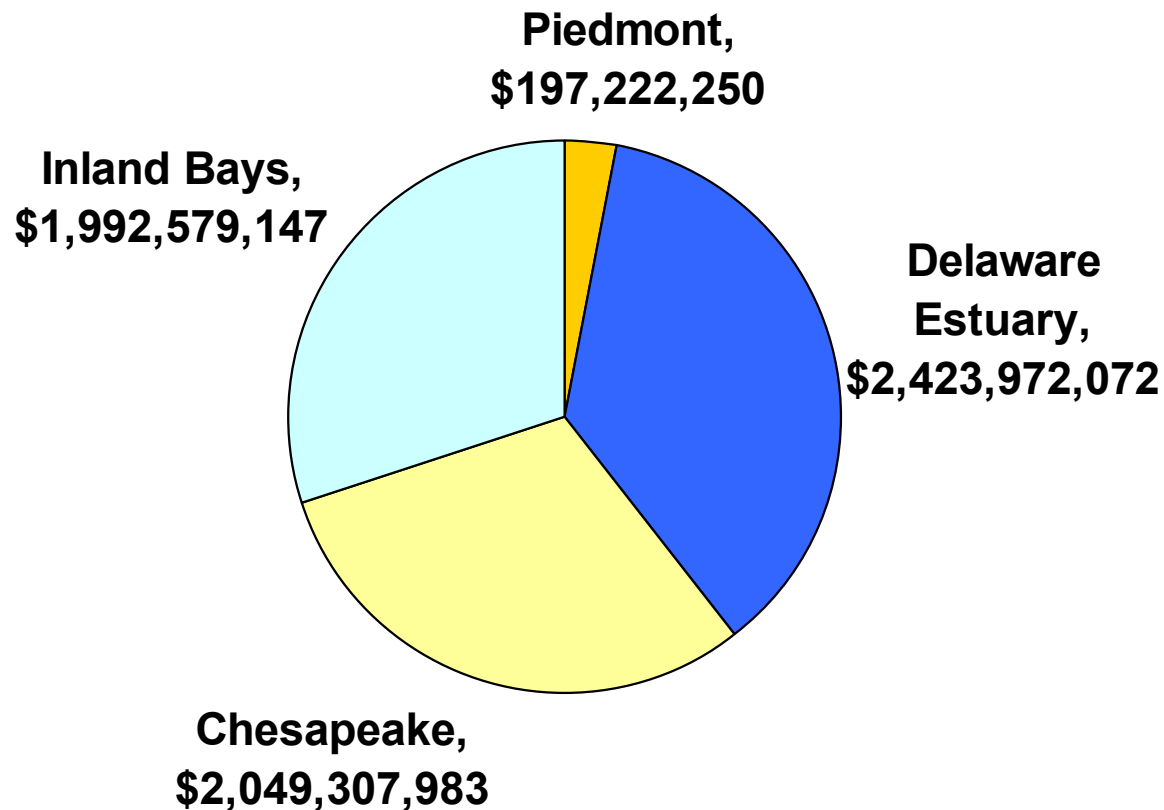


- **Annual Economic Activity (> \$5 billion)**
- **Ecosystem Services (\$6.7 billion)**
- **Jobs (>75,000)**
- **Wages (>\$2 billion)**

Annual Economic Value of Delaware Watersheds (\$ million)



Ecosystem Services Value Watersheds in Delaware



Value = \$6.7 billion (\$2010), NPV = \$216.6 billion @ 3% annually

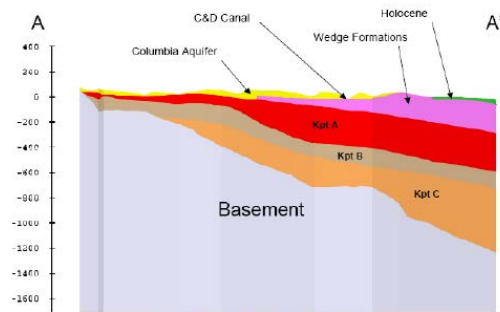
Water Supply Coordinating Council

TENTH REPORT TO THE GOVERNOR AND THE GENERAL ASSEMBLY

Regarding the Progress of the

DELAWARE WATER SUPPLY COORDINATING COUNCIL

Almost 2 billion gallons of water storage implemented since the drought of 1999



DGS hydro-geologic cross-section

April 28, 2008

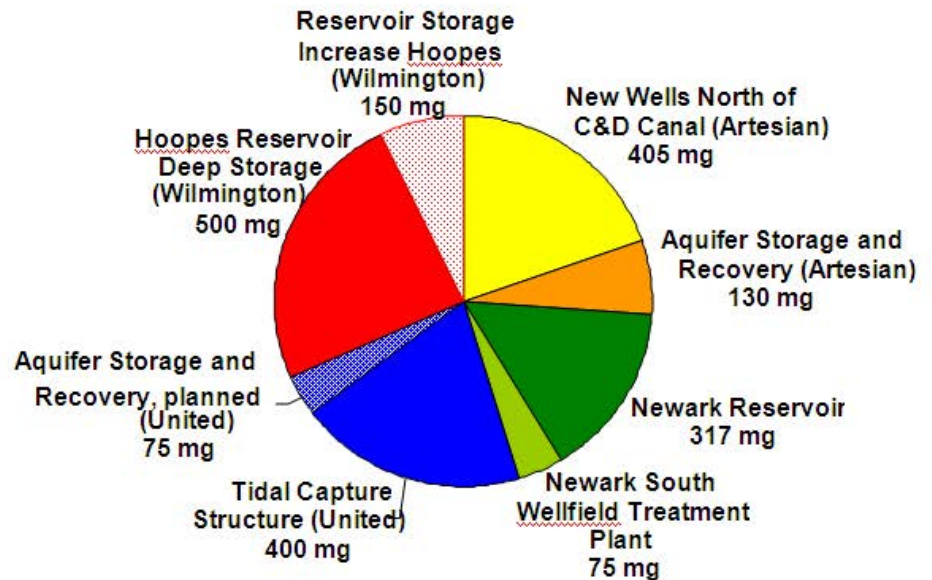
Prepared by the

Delaware Department of Natural Resources and Environmental Control

Delaware Geological Survey

University of Delaware, College of Human Services, Education, and Public Policy
Institute for Public Administration – Water Resources Agency

Water Supply Storage since Drought of 1999 Northern New Castle County, Delaware



Water Supply Coordinating Council

ELEVENTH REPORT TO THE GOVERNOR AND GENERAL ASSEMBLY

Regarding the Progress of the

DELAWARE WATER SUPPLY COORDINATING COUNCIL

Estimates of Water Supply & Demand for Kent County and Sussex County through 2030



June 14, 2011

Prepared by the

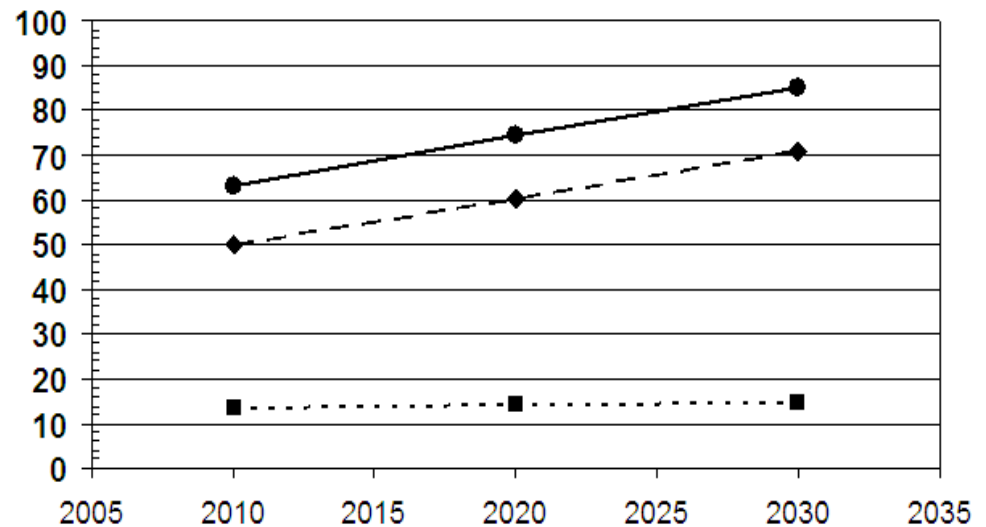
Delaware Department of Natural Resources and Environmental Control
Division of Water

Delaware Geological Survey

University of Delaware
Institute for Public Administration - Water Resources Agency



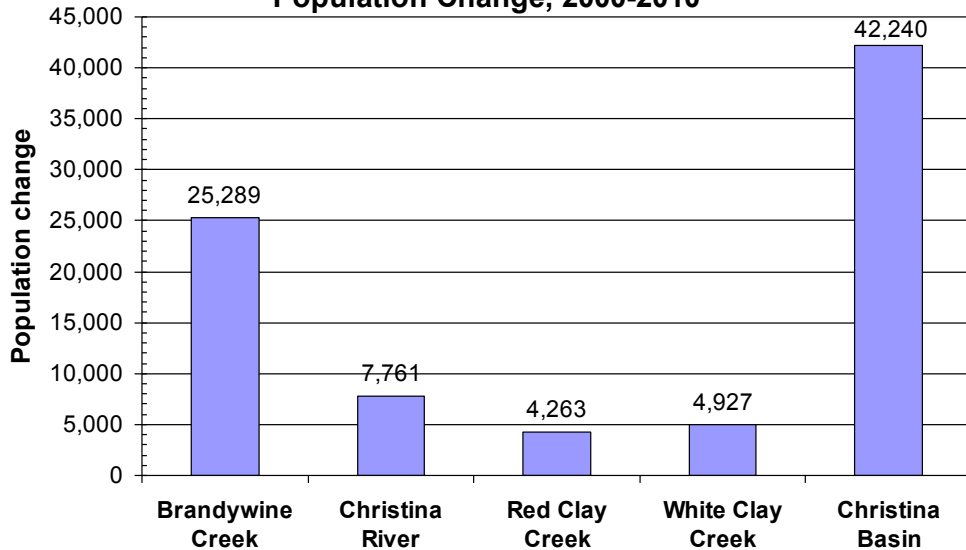
Future Water Demand Kent County and Sussex County



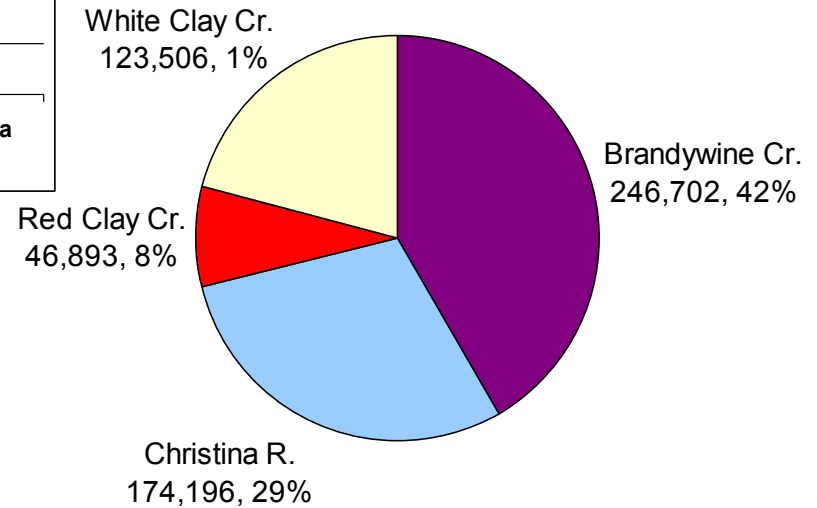
—◆— Public Water Demand - ■ - Individual Wells —●— Total Potable Demand

Christina Basin Trends

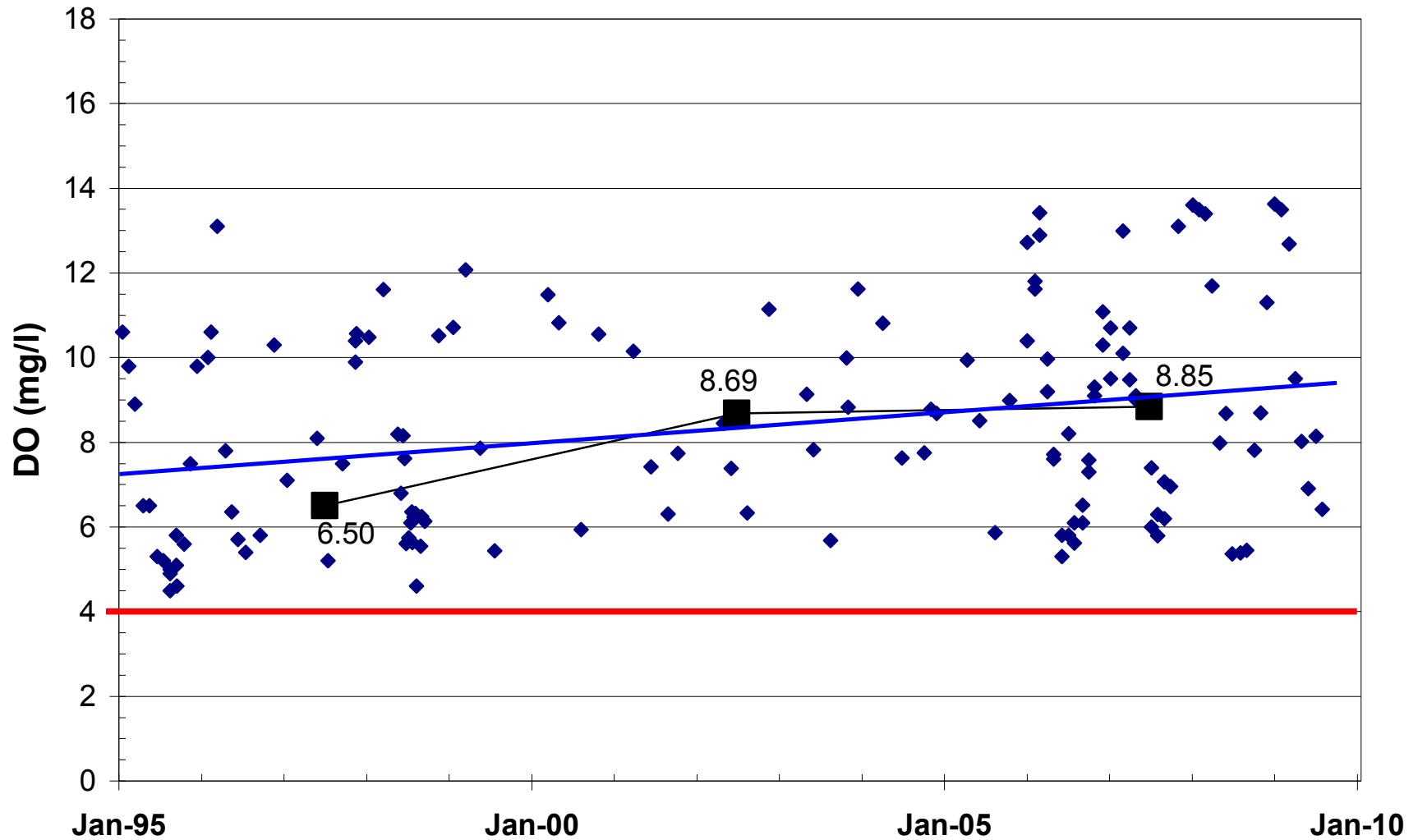
**Christina Basin
Population Change, 2000-2010**



Christina Basin Population, 2010



Christina River at 3rd St. Rt 13 Bridge Wilmington, DE

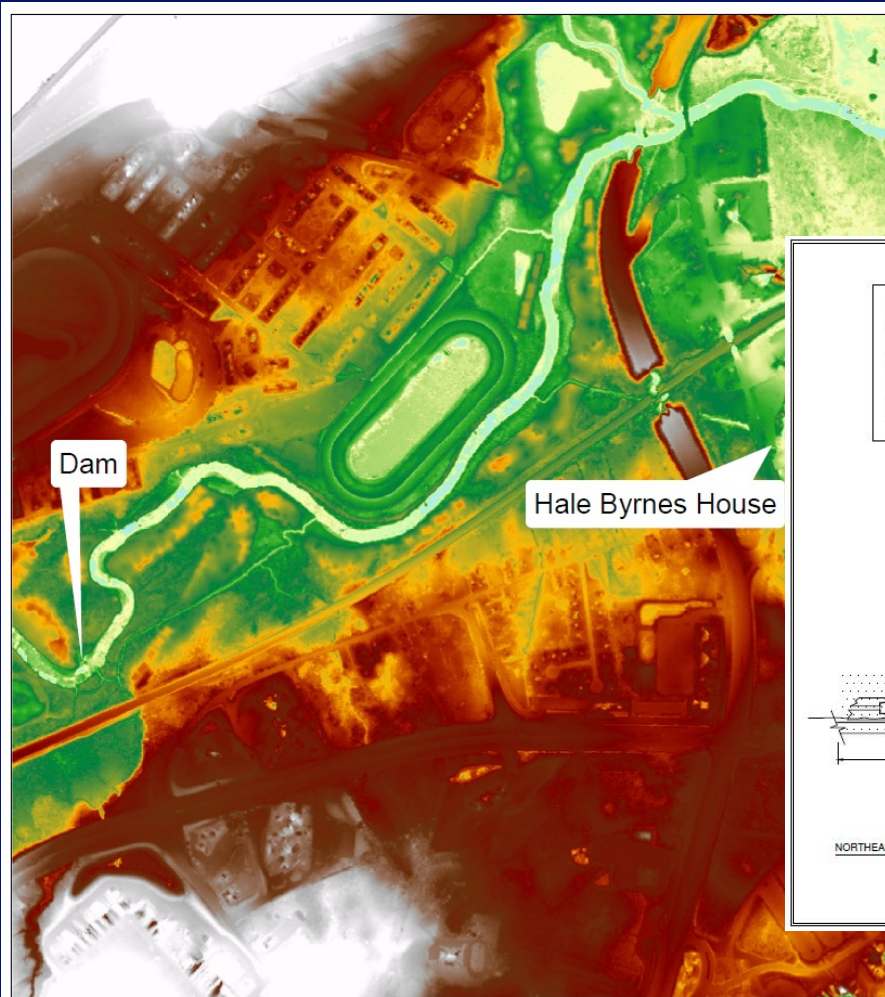


White Clay Creek Shad Restoration

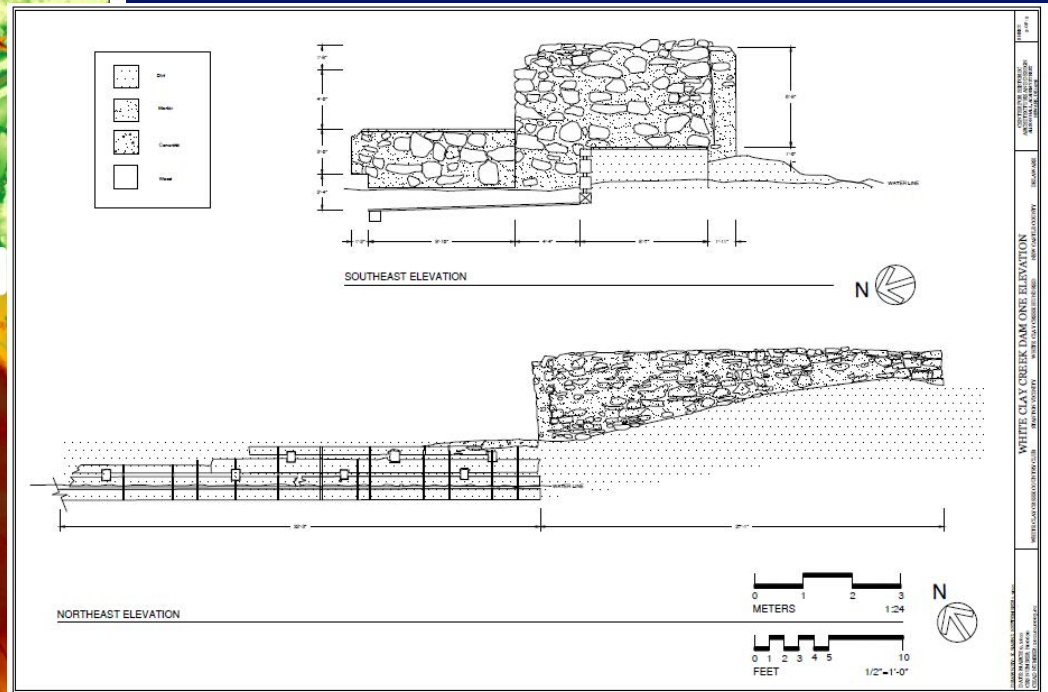
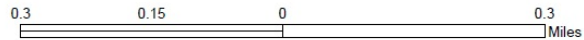


White Clay Creek Shad Restoration



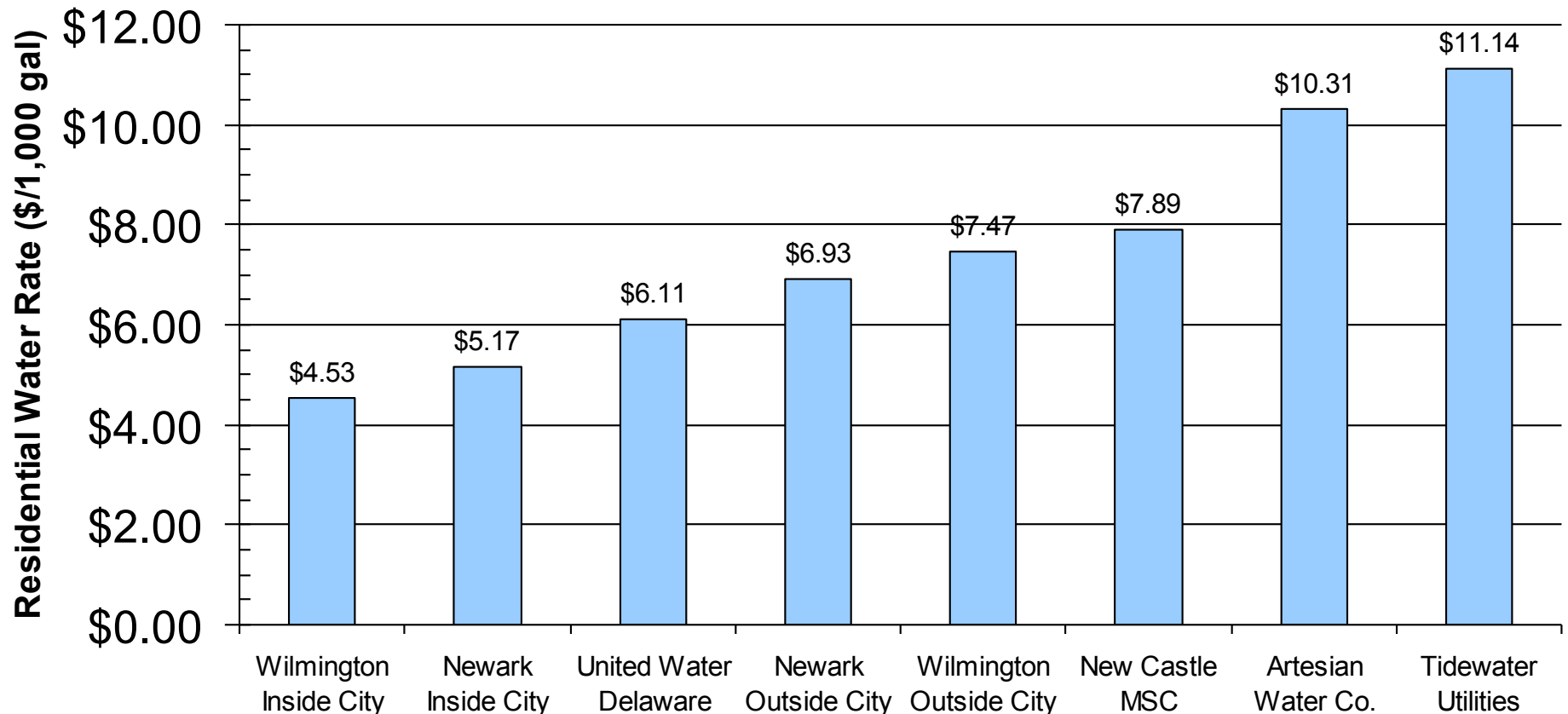


Delaware Park Dam to Hale Byrnes House
2007 LIDAR



Water Rate Survey

Synthesis of Water Rates in Delaware (Sep 2011)



Watershed-Restoration Income Tax Checkoff

2010 DELAWARE RESIDENT FORM 200-01, PAGE 2

COLUMNS: Column A is reserved for the spouse of those couples choosing filing status 4. (Reconcile your Federal totals to the appropriate individual. See Page 9 worksheet.) Taxpayers using filing statuses 1, 2, 3, or 5 are to complete Column B only.

13. Federal earned income credit from Federal Form 1040, Line 64a; Form 1040A, Line 41a; Form 1040 EZ, Line 9a.....	13		00
14. Delaware EITC Percentage (20%).....	14	.20	
15. Multiply Line 13 by Line 14.....	15		00
16. Enter the Smaller of Line 12 or Line 15 above. Enter here and on EZ Return, Line 11 or Resident Return, Line 14.....	16		00

See the instructions on Page 8 for ALL required documentation to attach.

DE SCHEDULE III - CONTRIBUTIONS TO SPECIAL FUNDS

See Page 13 for a description of each worthwhile fund listed below.

17. A. Non-Game Wildlife		00	E. Organ Donations		00	I. Juv. Diabetes Fund		00
B. U.S. Olympics		00	F. Diabetes Educ.		00	J. Mult. Sclerosis Soc.		00
C. Emergency Housing		00	G. Veteran's Home		00	K. Ovarian Cancer Fund		00
D. Breast Cancer Educ.		00	H. DE National Guard		00	L. 21st Fund for Children		00

Enter the total Contribution amount here and on EZ Return, Line 19 or Resident Return, Line 23..... 17

Watersheds of Delaware

- **This site is in partnership with DNREC and the Water Resources Agency**
- **Resides on WRA's server**
- **Content Management System - Drupal**

Watersheds of Delaware

- This site is a partnership between DNREC and the University of Delaware Water Resources Center
- Resides on WRA's server
- Content Management System - Drupal

The Watersheds of Delaware

Login | Register

HOME | **PIEDMONT** | DELAWARE BAY & ESTUARY | INLAND BAYS | CHESAPEAKE BAY

BRANDYWINE CREEK (Piedmont Basin)
 CHRISTINA RIVER
 NAAMANS CREEK
 RED CLAY CREEK
 SHELLPOT CREEK
 WHITE CLAY CREEK

Watershed News

- [Shad Restoration](#)
- ["Rain Gardens for the Bays" campaign](#)
- [Appoquinimink River Association 2011 Photo Contest](#)
- [Race for Our Rivers 2011](#)

What is a watershed?

A watershed is all of the land that water moves across or under while flowing to a specific body of water. A watershed includes the land and the water in it as well as the plants, animals and humans who live and work there. Every area of the earth in which water falls on land is a watershed; so no matter where you live, you live in a watershed! This website was designed by the University of Delaware, Water Resources Agency and the Department of Natural Resources and Environmental Control to help you learn more about the Delaware watershed in which you live.

We're hoping that by learning about what's going on in your backyard you'll become a vehicle to help protect, preserve, and enhance the quality of our water resources. We encourage visitors to this site to contact us with news, events, technical information, publications, and other information so that the website continues to be a dynamic online library resource which provides access to Delaware watershed information.

[Read more](#)

Learn More

[You Can Help](#) | [Publications](#) | [Find Your Watershed Address](#) | [Resources](#) | [Glossary](#) | [Calendar](#) | [Contacts](#)

DELAWARE

Delaware Bay & Estuary Vital Statistics

Size: 793 square miles

Population: 285,887

Source: U.S. Census

Land Use:



Source: NOAA
Center for Science and Analysis
Cover data from Landsat 30m

State: DE

Counties:

- DE: N and S

Delaware Bay & Estuary Watershed Publications

Publications by Watershed

Delaware Bay & Estuary Watershed Partners

- Appoquinimink F Association
- Blackbird Creek
- Bombay Hook N Wildlife Refuge
- Delaware River I Commission
- Forest Service S Forests
- Friends of the D Bay
- Partnership for t Delaware Estua
- Primehook Natic Wildlife Refuge
- The Nature Con

Delaware Watersheds

Login | Register

HOME | PIEDMONT | DELAWARE BAY & ESTUARY | INLAND BAYS | CHESAPEAKE BAY

Delaware Bay & Estuary Publications by Watershed

Delaware Bay and Estuary

- Delaware Bay and Estuary Assessment Report

Appoquinimink River

- Total Maximum Daily Load for Nutrients and Dissolved Oxygen for the Appoquinimink River

Army Creek

- Delaware Bay and Estuary Assessment Report Total Maximum Daily Loads (TMDLs) Analysis for the Watersheds of Army Creek, Red Lion Creek and Dragon Run Creek, Delaware

Blackbird Creek

- Blackbird Creek Watershed Proposed TMDLs

Broadkill River

- Broadkill River Watershed Proposed TMDLs

C & D Canal East

- Chesapeake & Delaware (C&D) Canal Watershed

Cedar Creek

- Bacteria, Nutrient, and Dissolved Oxygen TMDL Development for Mispillion River and Cedar Creek, Delaware

Dragon Run

- Total Maximum Daily Loads (TMDLs) Analysis for the Watersheds of Army Creek, Red Lion Creek, and Dragon Run Creek, Delaware

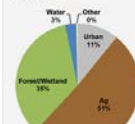
Delaware Watersheds

HOME | PIEDMONT | DELAWARE BAY & ESTUARY | ISLAND BAYS | CHESAPEAKE BAY

Delaware Bay & Estuary Vital Statistics

Size: 793 square miles
 Population: 285,887
 Source: U.S. Census

Land Use:



Home > Delaware Bay & Estuary

The Delaware Bay & Estuary Basin

Watersheds of the Delaware Bay & Estuary
 Appoquinimink River | Army Creek | Blackbird Creek | Broadkill River |
 C&D Canal East | Cedar Creek | Delaware Bay | Delaware River |
 Dragon Run Creek | Leipsic River | Little Creek | Mispillion River |
 Murderkill River | Red Lion Creek | Smyrna River | St. Jones River

Map



Delaware Bay & Estuary Wildlife



- White-tail Deer
- Beaver
- Wild Turkey
- Canada Goose
- Northern Bobwhite Quail
- Great Blue Heron
- Great Egret
- Little Blue Heron
- Snowy Egret
- Cattle Egret
- Yellow-Crowned Night Heron
- Glossy Ibis
- Green Heron
- Cinnamon Woodpecker
- Barred Owl
- Red-shouldered Hawk
- Pileated Woodpecker
- Blue-faced Meadowlark
- Blackwater Bluebird
- Blue Jay
- Delmarva Fox Squirrel
- Bald Eagle
- Red Knot
- Ruddy Turnstone
- Semipalmated Sandpiper
- Horseshoe Crab
- Bottlenose Dolphin
- Diamondback Terrapin

Photos by: Chris Bennett

Delaware Bay & Estuary Environmental Concerns



- Animal Operations
- Combined Sewer Overflows
- Dredge Spoils (Confined Disposal Facilities)
- Hazardous Waste Generators
- Landfills and Dumps
- Large On-Site Septic Systems
- National Pollutant Discharge Elimination System (NPDES) outfalls
- Pesticide Loading, Mixing, and Storage Facilities
- Salvage Yards
- Site Investigation and Restoration Branch (SIRB) State and Federal Superfund Sites
- Sludge Application Fields
- Spray Irrigation Fields
- Tire Piles
- Toxics Release Inventory (TRI) Locations
- Underground Storage Tank (UST) Facilities

This site in partnership with Delaware Department of Natural Resources and Environmental Control and University of Delaware, Water Resources Agency.



Themes by Chesapeake and Delaware Photos: Images licensed by Shutterstock

Delaware Bay & Estuary Wildlife



Delaware Bay & Estuary Environmental Concerns



- Animal Operations
- Combined Sewer Overflows
- Dredge Spoils (Confined Disposal Facilities)
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- Site Investigation and Restoration Branch (SIRB) State and Federal Superfund Sites
- Sludge Application Fields
- Spray Irrigation Fields
- Tire Piles

Background

The Delaware Bay & Estuary Basin is located in eastern New Castle, Kent, and Sussex counties, and drains runoff from the Delaware Bay and Delaware Estuary. The basin drains approximately 520,960 acres, or 814 square miles, and encompasses the following watersheds: Delaware River, Army Creek, Red Lion Creek, Dragon Run Creek, Chesapeake & Delaware Canal East, Appoquinimink River, Blackbird Creek, Delaware Bay, Smyrna River, Leipsic River, Little Creek, St. Jones River, Murderkill River, Mispillion River, Cedar Creek, and Broadkill River.

Land Uses

Wildlife and Fisheries

Contaminants

Geology and Soils

Recreational Opportunities

The Watersheds of Delaware

Login | Register

HOME | PIEDMONT | DELAWARE BAY & ESTUARY | INLAND BAYS | CHESAPEAKE BAY

Watershed News

Home » Find Your Watershed Address

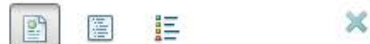
Shad Restoration

Find Your Watershed Address

ArcGIS Watersheds of Delaware

New Map | ArcGIS Home | Help

Details | Add | Edit | Basemap | Save | Share | Print | Measure | Bookmarks | Find address or place



Watersheds of Delaware

Web Map by nmini (last modified: August 15, 2011)

0 ratings, 91 views, 0 comments

More Details...

Open this map in: ArcGIS Explorer Online

Make your own map | Add to this map | Make a new map



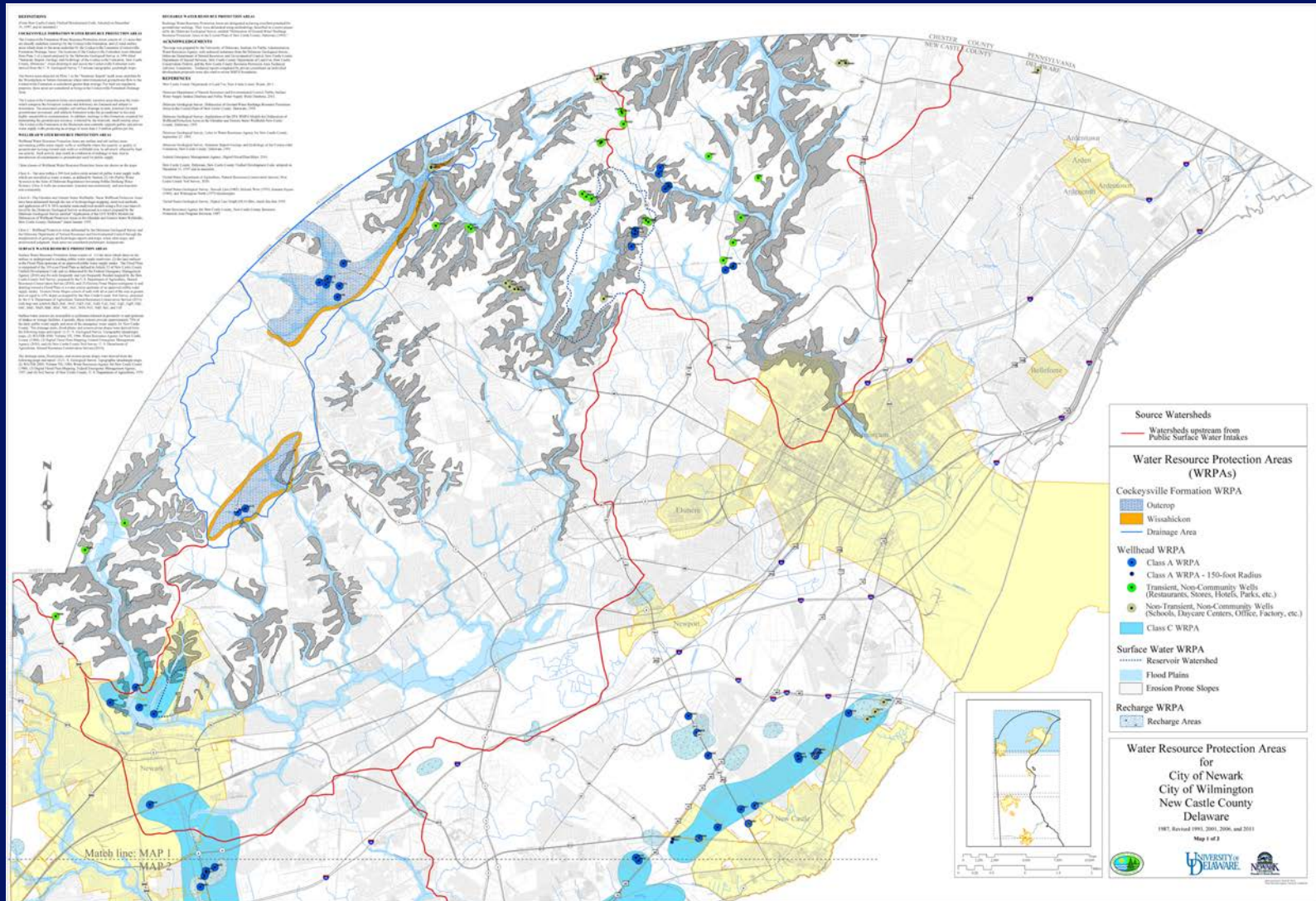
Esri.com | Terms of Use | Privacy | Contact Us | Report Abuse

Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, AND, USGS, NRCAN, Kadaster NL, IGN, and the GIS User Community

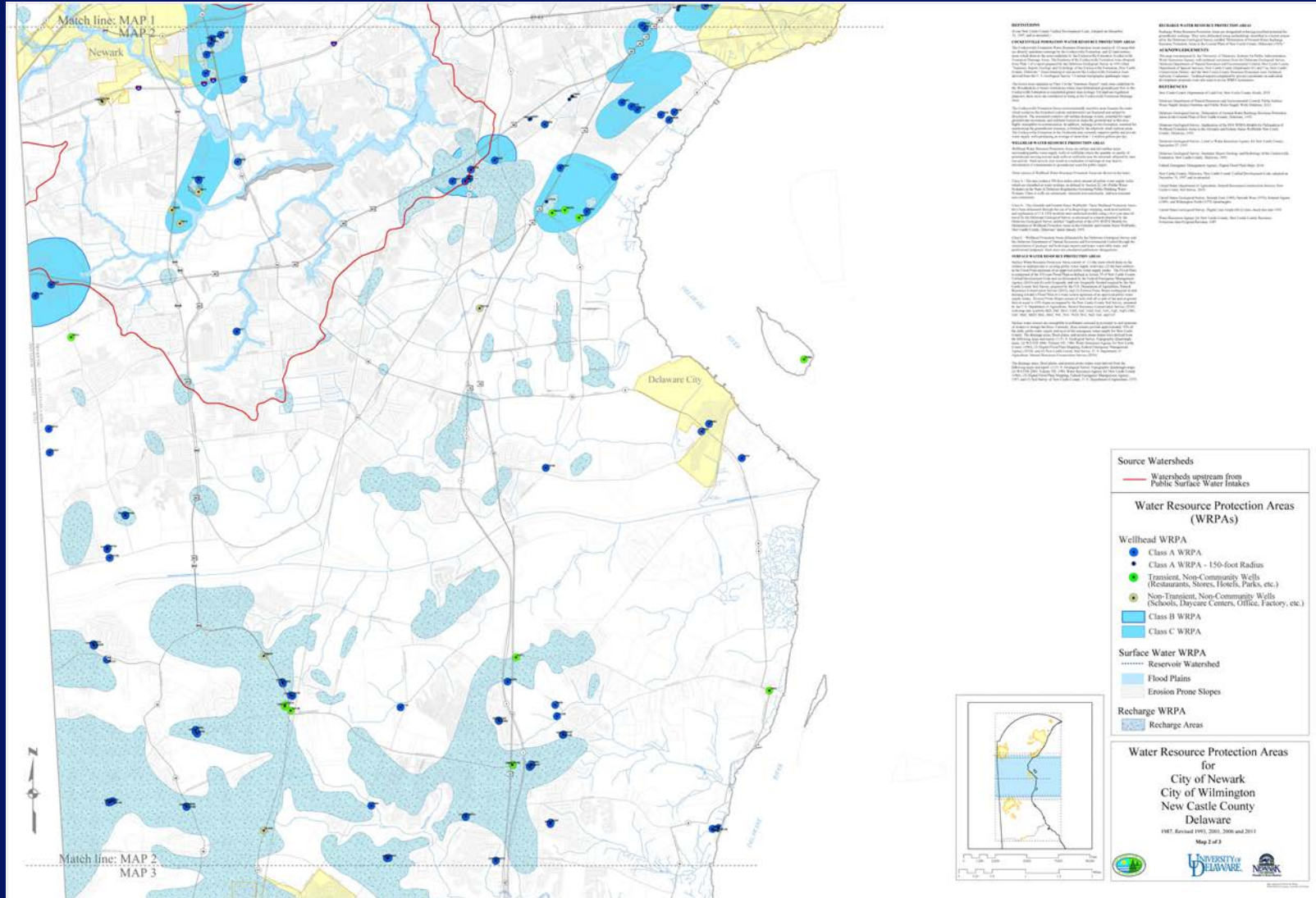
New Castle County Water Resource Protection Area Program

- Update to the NCCo Water Resource–
Protection Area Maps
- Draft out for review
- Can be found on our website at
[www.wra.udel.edu/publicservice/
waterquantity-waterquality/nccwrpamapping](http://www.wra.udel.edu/publicservice/waterquantity-waterquality/nccwrpamapping)

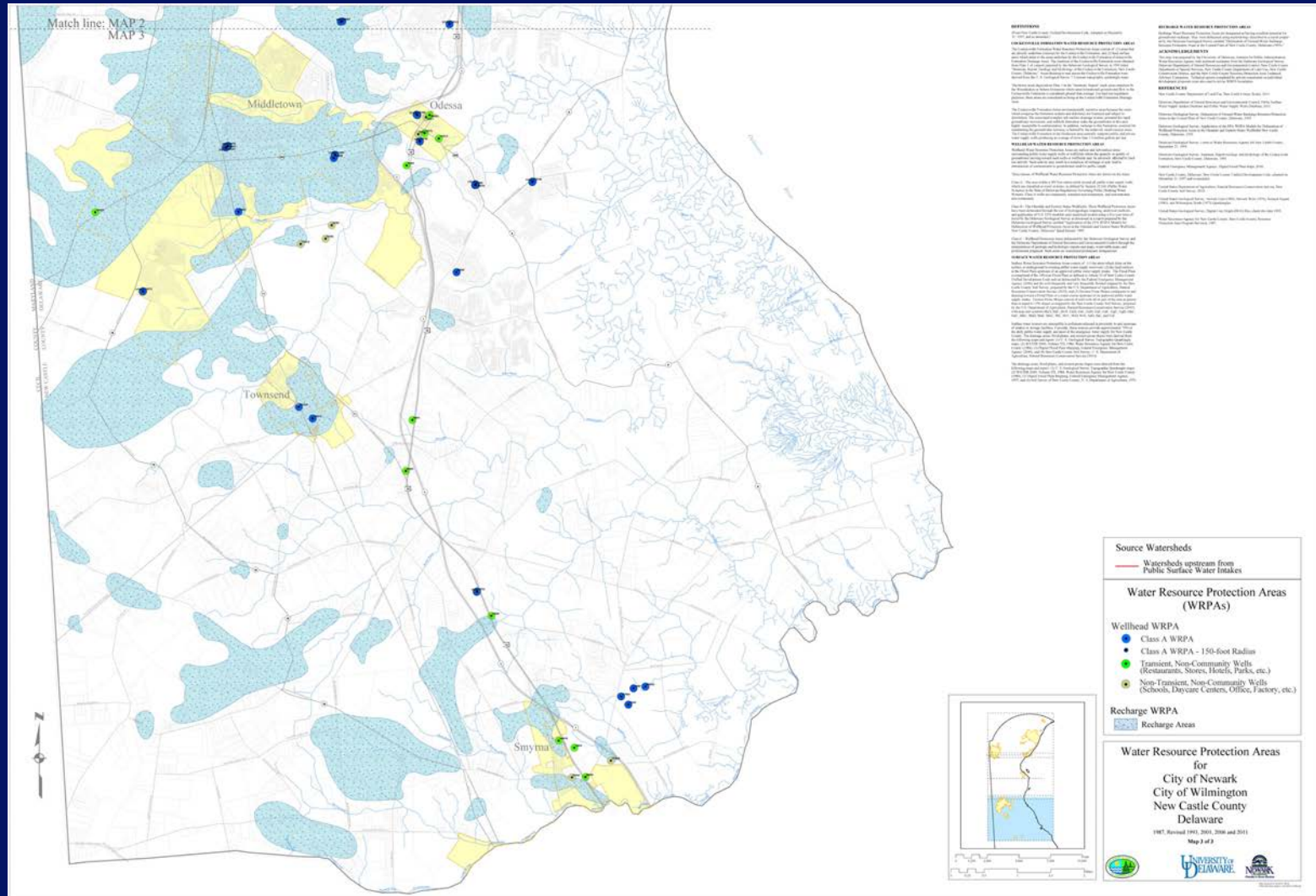
Map 1 – Northern New Castle County



Map 2 – Central New Castle County



Map 3 – Southern New Castle County



Delaware's Impaired Waters

- **Phase I—Compile GIS layers of the impaired (and unimpaired) waters list—303 (d) of the CWA.**
- **Use the latest USGS National Hydrography Dataset.**
- **Create a seamless dataset for the state, including separate layers for Delaware only and for waters in surrounding states.**
- **Ability to report out stats by watershed or state**

Delaware's Impaired Waters

- **Phase II—Create a comprehensive database containing relevant information (listing date, impairments, TMDLs, delisting information, etc.).**
- **This will assist in the reporting efforts of the state under section 305 (b) of the CWA.**
- **Linking Delaware IDs to EPA's Reach Codes**
- **Searchable and linked to the spatial GIS data**

USGS The National Map NHD

Search [?] Download Data Clear | Show Toolbox

Overlays Selection Cart **Standard** Advanced Annotation **Active Tool: Identify**

Results Identify Layers

Last Results X All Results X

Hydrography (NHD): Flowline - High [v] X

Showing 1 - 1 out of 1 from last results.

A Null
Hydrography (NHD) > Flowline - High
Zoom To More v

1

Null

Layer:	Flowline - High Resolution
ComID:	125992440
FDate:	7/29/2010 7:54:42 PM
GNIS ID:	Null
Length (Km):	2.447
Reach Code:	02080109008307
Flow Direction:	WithDigitized
FType:	CanalDitch
FCode:	33600

Zoom To More v

Press down to start and let go to finish

HUC 12-020801 090408

0 100.1 0.2mi

Cursor Position 38° 42' 51.252" N 75° 28' 00.173" W Scale 1:18,056

Mifflin Ditch

The National Map

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WATERS

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You are here: [EPA Home](#) » [WATERS](#) » My WATERS Mapper

My WATERS Mapper

MyWATERS Mapper dynamically displays snapshots of EPA Office of Water program data. This version of MyWATERS Mapper depicts the status of NPDES permits for each State; summary information from the Clean Watershed Needs Survey; and water quality assessments. Future versions will include other Office of Water Program Snapshots. MyWATERS Mapper also contains water-related geographic themes such as 12-digit watersheds, the national stream network known as the National Hydrography Dataset, and other water-related map layers. MyWATERS Mapper enables you to create customized maps at national and local scales.

EPA MyWATERS Mapper

Back Home Forward

Streets Imagery Topography

Go To: DE240-005_00 Go

Assessed Waters

Latitude: 38.7224 Longitude: -75.4724

Layer Details

Features at this Location

There is 1 feature at this location.

Zoom in Closer

Assessed Waters Line: DE240-004_00

Feature ID: DE240-004_00

Subwatershed (HUC 14): 02060008000721

Cycle Year: 2004

More Details: [Get More Details on this Feature](#)

Water Program Snapshots

Click on a button below to view a state-wide snapshot.

Pollutant Discharge Permit Status

Water Infrastructure Needs

Water Quality Assessment Information

Drinking Water Information

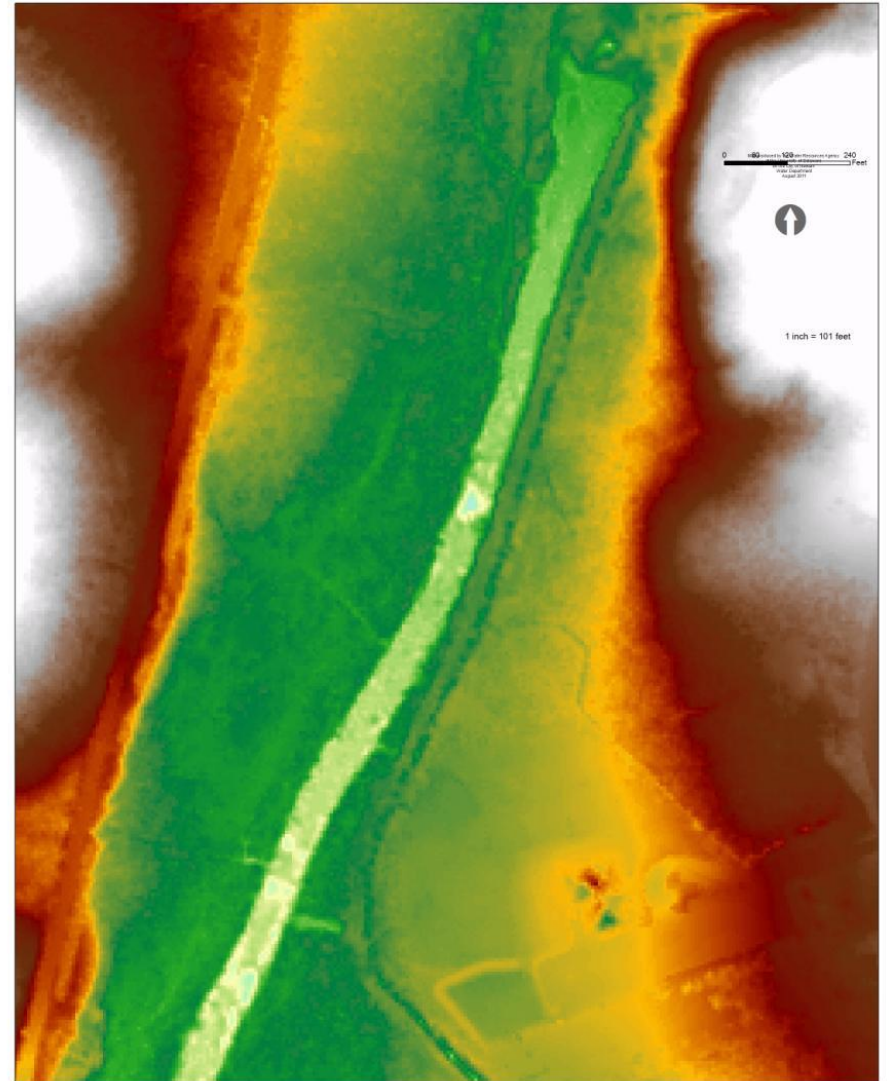
Water Impairments

Water Monitoring Data

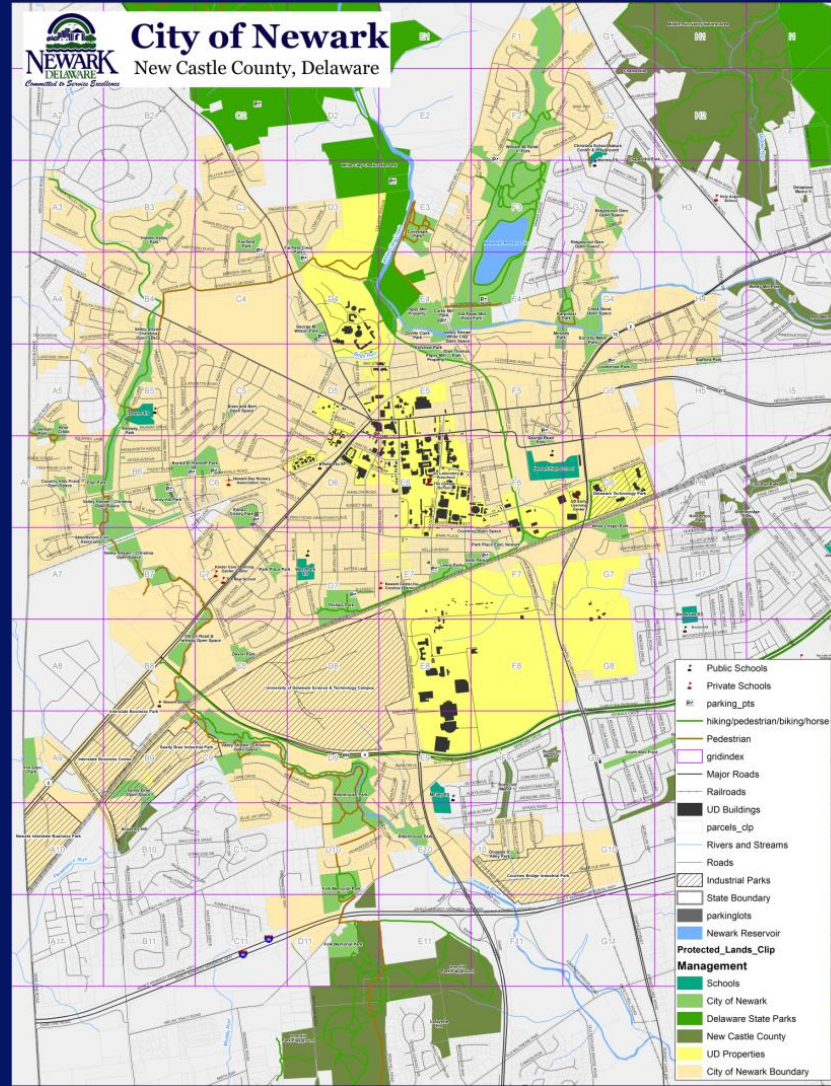
Other EPA Water Data

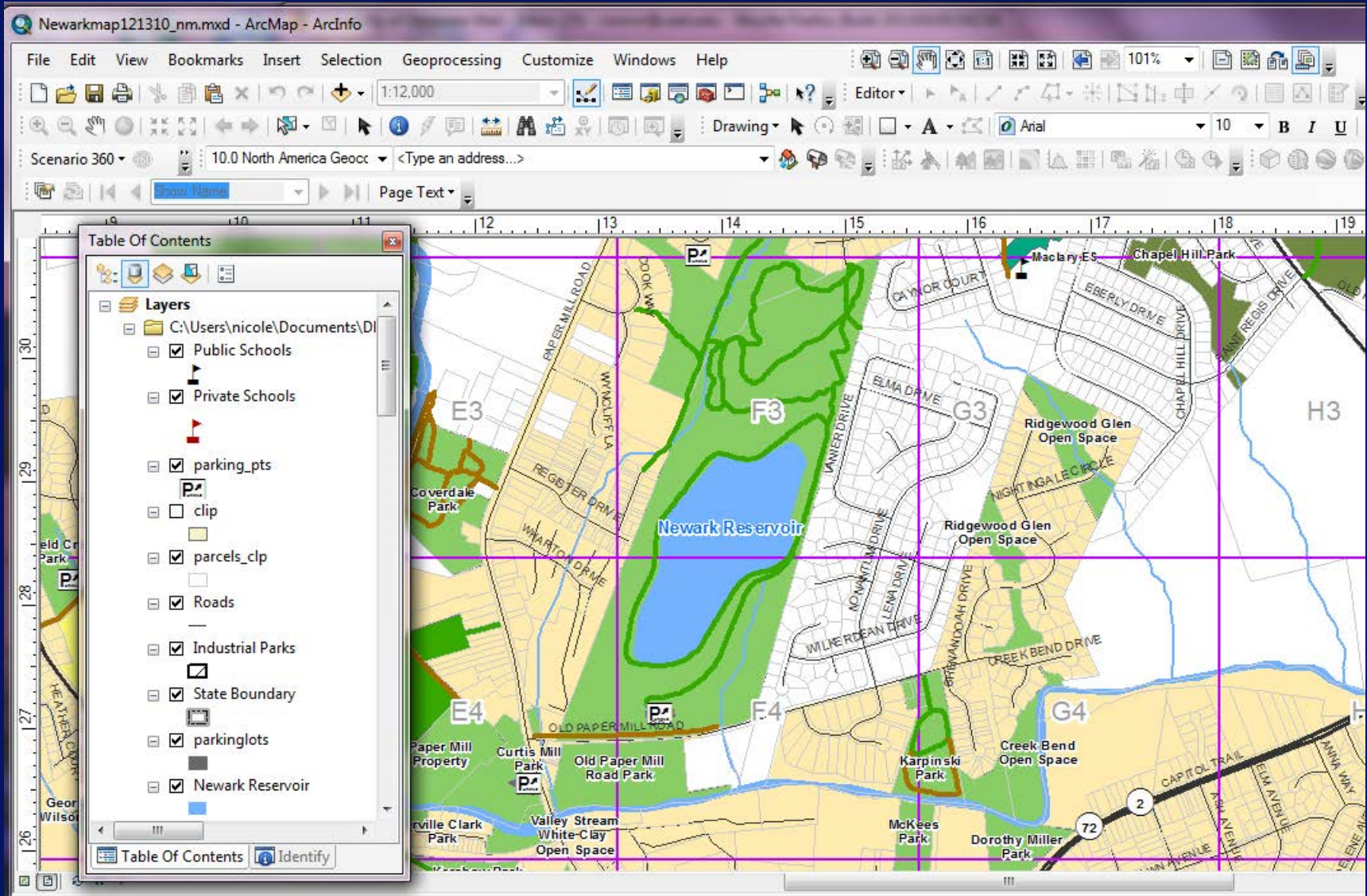
Newark Intake-Dam Study

- **Assist with GIS**
- **Mapping of topography and generation of transects**



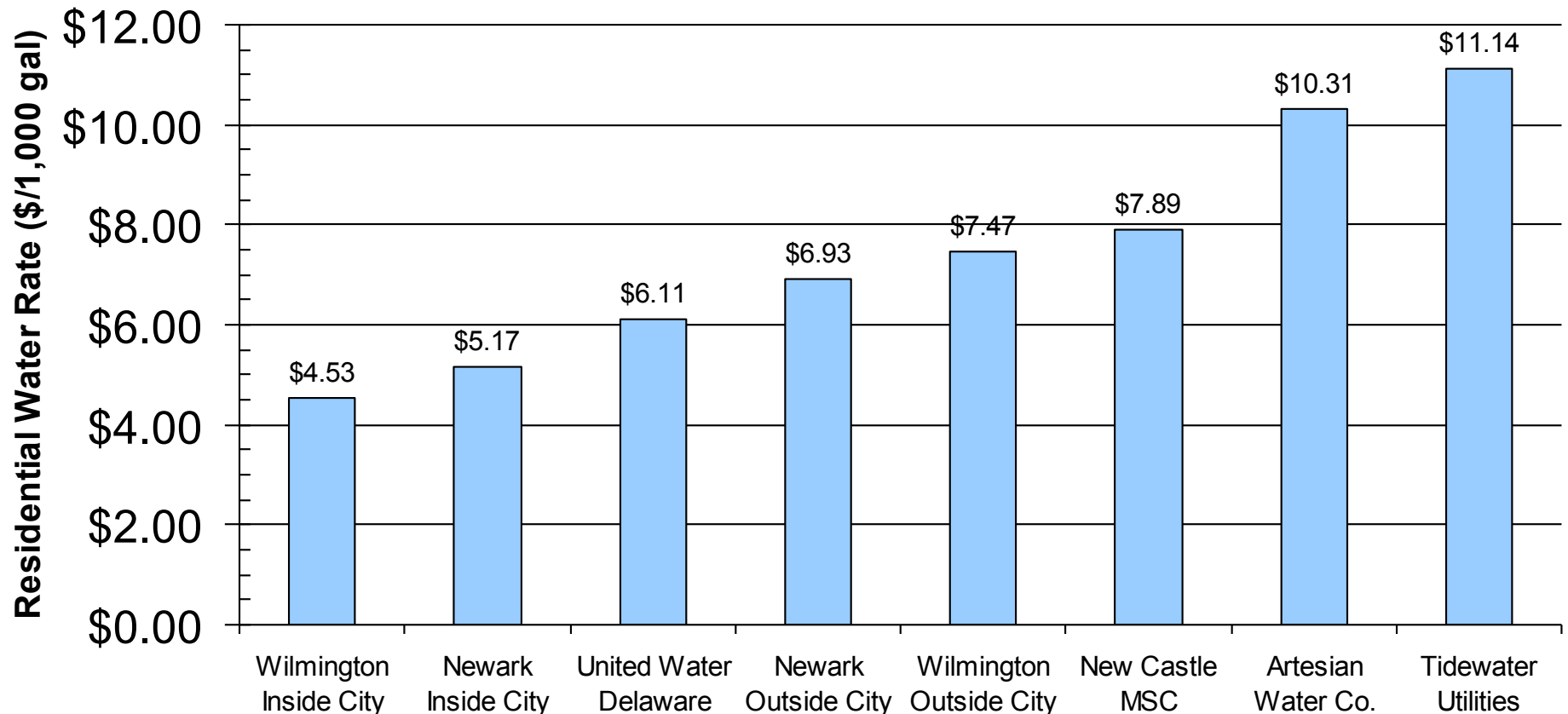
Newark's Base Map





Water Rate Survey

Synthesis of Water Rates in Delaware (Sep 2011)



Watershed-Restoration Income Tax Checkoff

2010 DELAWARE RESIDENT FORM 200-01, PAGE 2

COLUMNS: Column A is reserved for the spouse of those couples choosing filing status 4. (Reconcile your Federal totals to the appropriate individual. See Page 9 worksheet.) Taxpayers using filing statuses 1, 2, 3, or 5 are to complete Column B only.

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DE SCHEDULE III - CONTRIBUTIONS TO SPECIAL FUNDS

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B. U.S. Olympics		00	F. Diabetes Educ.		00	J. Mult. Sclerosis Soc.		00
C. Emergency Housing		00	G. Veteran's Home		00	K. Ovarian Cancer Fund		00
D. Breast Cancer Educ.		00	H. DE National Guard		00	L. 21st Fund for Children		00

Enter the total Contribution amount here and on EZ Return, Line 19 or Resident Return, Line 23..... 17

	00
--	----



GRADUATE PROGRAM IN WATER SCIENCE AND POLICY

[HOME](#) | [PROGRAM DESCRIPTION](#) | [HOW TO APPLY](#) | [COURSES](#) | [FACULTY](#) | [CONTACTS](#)



Our Curriculum

[Doctoral Programs](#) | [Master's Program](#) | [Special Features](#) | [Career Paths](#)

Our interdisciplinary program capitalizes on existing strengths of University of Delaware faculty from many departments across four colleges:

- College of Agriculture and Natural Resources
- College of Earth, Ocean, and Environment
- College of Engineering
- College of Arts and Sciences

As a student in the program, you may be advised by any of the **faculty affiliated with the program**. Upon completing the program, your degree will be granted by the college in which your adviser is housed.

The Water Science & Policy Program offers three degree options:

- A Ph.D. with a water science concentration (36 credits),
- A Ph.D. with a water policy concentration (36 credits), and
- A Master of Science with thesis (30 credits)

For both the Ph.D. and the M.S. degrees, you must take courses across five categories, which include the following:

- a. Physical science
- b. Chemical/biological science
- c. Policy

WRA Strategic Plan

- **Diversify funding**
- **Broaden water science and policy research**
- **Expand water curriculum**
- **Embrace new college—College of Arts & Sciences**
- **Formalize WRA Board?**
- **Water Resources Academy?**

Wilmington Wins 2011 BVA Clayton Hoff Award

