Reinvigoration of the Christina Basin Clean Water Partnership

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Proposal

We propose to reinvigorate the Christina Basin Clean Water Partnership to meet our goals of restoring the waters of the Brandywine, Red Clay, White Clay, and Christina Creeks in Delaware and Pennsylvania to fishable, swimmable, and potable status by 2015. To do this, we recommend that the partnership:

1. Implement the Christina Basin Pollution Control Strategy in Delaware.
2. Employ a full time watershed governance structure.
3. Raise funds for restoration through sustainable watershed financing.
4. Develop a water quality trading bank.

Since 1994, the two States, the U. S. Environmental Protection Agency, and Delaware River Basin Commission and the Christina Basin Clean Water Partnership have been working together to restore interstate streams in the Christina Basin to Clean Water Act standards. The Christina Basin is one of only two watersheds in the entire Delaware River Basin that share the boundaries of more than one state. In 2006, the USEPA and the two states negotiated Total Maximum Daily Loads (TMDL) for impaired streams in the Christina Basin. In February 2008 at a legislative briefing in Kennett Square, the partnership announced the completion of a $1 million grant as part of the USEPA Targeted Watershed Initiative as the No. 1 rated application out of 170 watersheds in the USA. Chester County, PA has developed watershed plans for the Brandywine, Red Clay, and White Clay. Delaware has completed a Pollution Control Strategy for its portion of the basin. Stream water quality is improving in the Christina Basin particularly for dissolved oxygen, phosphorus, and sediment while nitrogen is degrading and bacteria levels are too high. The economic value of the Christina Basin approaches $270 million annually.

The Christina Basin Clean Water Partnership employs the following phased approach:

Phase	Tasks	Milestones
I	DRBC/USEPA Mediation/Problem Assessment	1994 - 1996
II	GIS Watershed Characterization	1997 - 1998
III	Water Quality Monitoring/Implementation	1999 - 2000
IV	TMDL Modeling/Implementation	2001 - 2003
V	TMDL Promulgation and Implementation	2004 - 2005
VI	Targeted Watershed Grant Implementation	2004 - 2007
VII	Implementation of Pollution Control Strategy	2008 - 2015

Christina Basin

The Christina Basin has unique water supply, ecological, recreational, and historic attributes including:

- The recipient of a $1 million Targeted Watershed Initiative Grant, the top ranked application in the USA out of 170 watersheds evaluated by the USEPA.

- One of only two interstate watersheds in the entire 13,000 sq mi Delaware River Basin.

- Watershed with the upper 2/3 in PA and the lower 1/3 is in DE with a small sliver in MD. The Christina River is the only stream in DE that flows through 3 states.

- Includes 4 watersheds - the Brandywine, Red Clay, White Clay Creeks, and Christina River.

- Contains the White Clay Creek in DE and PA which is a National Wild and Scenic River designated by the President and Congress and is the only wild and scenic river in the USA designated on a watershed basis as opposed to a river segment basis.

- Have streams that are getting cleaner. Water quality is improving for dissolved oxygen, phosphorus and sediment but declining for nitrogen

- Provides 100 million gallons per day of drinking water for over half million people.

- Is the largest drinking water source in DE, providing water supply for 60% of Delaware's population.

- Has dozens of miles of high quality of cold water trout streams in PA and is the home of the only 6 trout streams in Delaware.

- Provides habitat for protected species: bald eagle, brook trout (state fish of PA), cerulean warbler, and bog turtle.

- Has water supply, ecological, and recreational value that approaches $300 million annually.

- Has a growing ecotourism industry with canoe and kayak liveries along the Brandywine River.

- Within commuting distance of Wilmington, West Chester, and Philadelphia. The real estate industry designated the rolling Piedmont valleys as one of the top 10 markets in the USA.

- Stream valleys that are the inspiration for the Brandywine of art style popularized by Pyle and the Wyeth's.

- The site of the first permanent European settlement in the Delaware Valley in 1638 at the mouth of the Christina River at present day Wilmington.

- Historic rivers hosted the largest battle in War for Independence along the Brandywine and First State's only battle of the Revolution along Christina at Cooches Bridge during 1777 invasion of Delaware.

- Brandywine Valley Association formed the USA's first small watershed organization in 1945.

- Has the largest concentration of mushroom farms in USA at Hockessin, DE and Kennett Square, PA.

- Wilmington along Christina R. is largest U.S. banana port, importing 1 million tons per year.

- In 1802 DuPont mills along Brandywine with total hydropower head exceeding height of Niagara Falls.

- International headquarters of DuPont, Gore, Disney incorporated in Wilmington by DE banking laws.

Christina Basin Pollution Control Strategy

Although significant water quality improvements have been achieved over the past 15 years, significant impairments still remain from agricultural, urban/suburban and industrial runoff. Estimates of at least $80 million will be needed over the next 10 years to achieve total water quality restoration from non-point pollutant sources. In order to build upon the current progress, the Christina Basin Partnership continues to pursue sources of long-term funding for Phase VII.

The University of Delaware Water Resources Agency presented the Christina Basin Clean Water Partnership's Policy Committee with some future scenarios in the basin for consideration to meet their goal of all waters being "clean" by 2015. The Partnership may continue their interstate collaboration through Memorandums of Understandings while continuing a broad application of best management practices to address the goal of achieving restored water quality by 2015.

Phase VII Implementation would involve development of a Scope of Work and additional funding. Focusing on five key areas of action:
• Stormwater
• Open Space
• Wastewater
• Agriculture
• Education

1. Stormwater
Stormwater best management practices for the Christina Basin include many actions that require a coordinated effort to engage local municipality participation in the Christina Basin CWS as well as the potential of expanding the role of non-government collaboration through numerous community groups. Examples of the types of projects considered include:

- Increasing urban tree canopy
- Design and implementation of stormwater BMPs in line with TMDLs
- Limiting addition of new impervious cover
- Advance Low Impact Development practices
- Creating consistency within stormwater ordinances
- Convene a Christina Basin group to review new development applications
- Implement a stormwater utility

- Retrofit stormwater BMPs

2. Open Space

Open Space tasks would include not only agency and non-profit actions, but private interests. Open space projects that enhance water quality and are conductive to passive water quality management practices include:

- Mapping an inventory existing open space areas
- Prioritization of high value water resource areas for protection
- Installation of vegetated buffers
- Requirements for open space management plans for community and Homeowners Associations
- Implementation of new stream restoration plans
- Acquisition of open space and easements
- Conservation programs for existing open space
- Reforestation of watersheds and headwaters

3. Wastewater

Wastewater best management practices would need to address complex regulatory, engineering and enforcement programs, along with municipal, utility and private sector coordination. The high costs of wastewater BMPs would require serious consideration to the establishment of a formal revenue generating mechanism that can handle the complex nature of wastewater related strategies. Targeted actions would include:

- Installation of performance standards, and conduct inspections and pump-outs of onsite wastewater treatment systems
- The elimination of cesspools and seepage pits
- Connection of onsite wastewater treatment systems to existing wastewater treatment plants.
- Elimination of combined sewer overflows
- Continued inspection, repair, and elimination of unpermitted discharges
- Remediation of contaminated waste sites

4. Agriculture

Agricultural best management practices currently being implemented should be continued. The existing programmatic and project institutional "know how" allows for effective and efficient on-site installation. Appropriate pre-and post monitoring would provide accurate records to be kept on the following practices:

- Nutrient management plans
- Cover crops
- Pasture stream fencing
- Grassed filter strips and buffers
- Grassed waterways
- Riparian forested buffers
- Pasture and hay planting

5. Education

Education and outreach efforts are essential for a broad range of practices that impact water quality through individual behavior. Individual efforts to improve water quality and conserve water resources can result accumulatively in a measurable improvement in a watershed's water quality plus, strengthen

popular support for water quality programs and policies. Education and outreach efforts that can enhance the efforts of the Christina Partnership include:

- Targeting individual behavior change through social marketing
- Highlighting alternative stormwater management practices (i.e. nutrient management plans for turf fields at education facilities)
- Encourage golf course managers to decrease nutrient application and stormwater runoff and erosion
- Educate pet owners on cleaning up pet waste
- Educate homeowners on residential stormwater BMPs
- Integrate education into state and local permitting processes
- Encourage corporate environmental stewardship programs
- Coordinate nonprofit organizations throughout the Basin
- Support water conservation to reduce nutrients leaving a site
- Provide education programs on lawn and garden BMPs

Watershed Governance

During 2009, we propose to reenergize and reinvigorate the Christina Basin Clean Water Partnership to restore the streams to fishable, swimmable, and potable status by 2015. Employ a full time watershed governance structure coordinated by the University of Delaware - Water Resources Agency in Delaware and the Chester County Conservation District/Chester County Water Resources Authority/Brandywine Valley Association in Pennsylvania. The UDWRA proposes to contribute $50,000 annually to this effort for the next 6 years. Proposed watershed governance initiatives include:

- Bimonthly progress meetings in West Chester, PA and Newark, DE

- Quarterly progress reports from stakeholders on implementation of reforestation, restoration, agriculture conservation and pollution control projects.

- Stepped up public education and outreach program.

- Finalize interstate watershed restoration plan merging the DE Pollution Control Strategy and the Chester County watershed plans.

- Sign an interstate watershed MOU between Delaware and Pennsylvania.

- Hold a Christina Basin Caucus in 2009 for chief executives from over 60 municipal, county, and states governments in the Christina Basin.

- Fold the CBCWP into the structure of the Partnership for the Delaware Estuary

Watershed Financing

The economic value of the Christina Basin approaches $270 million per year with net present benefits up to $5.4 billion over 30 years. Significant investments are needed protect this invaluable resource.

Economic value of the Christina Basin.

Benefit	***Present Value ($ million/yr)***	***Net Present Value ($ million) n = 30 yrs, i = 3%***
Drinking Water Supply	36.1	744.0
Warm Water Fishery	6.2	127.3
Recreation (Boating)	6.6	135.3
Ecotourism (kayaking)	0.8	16.5
Trout Fishing	4.3	88.9
Motor Boating	10.5	217.1
Wetlands	10.0 to 38.1	206.9 to 784.9
Forest	159.7	3,290.1
Total	**224.2 to 262.3**	**4,619.2 to 5,404.0**

Obtain dedicated annual financing to fund watershed restoration projects. Dedicated financing is needed to replace the grant to grant approach that has worked reasonably well over the last 15 years but will not get us to the finish line in 6 years. The funds would be collected in a Christina Basin Fund and distributed to parties such as the CCCD, BVA, Brandywine Conservancy, Partnership for the Delaware Estuary, Delaware Nature Society, DNREC, PADEP and others who work to get projects in the ground. The annual goal could be $1,000,000 or it could be more or less. All of these funding options have large regulatory, political, logistical concerns as Delaware has a county based form of government different from the Pennsylvania municipal based local government. The MS4 stormwater permit program is municipal based and TMDLs are watershed based. Types of innovative watershed financing options include:

- Water rate surcharge – Assuming $5/customer/year for 200,000 customers in the Christina Basin could raise $1 million annually for source water protection.

- Water allocation fees – Assuming $0.03/1000 gal to be included in DRBC dockets and by States would raise $1.1 million annually if water purveyors provide 100 mgd in Christina Basin.

- Stormwater utilities - Wilmington is the first municipality in Delaware to adopt one and New Castle County, DE is considering a stormwater utility.

- Wastewater discharge fee – small surcharge imposed as portion of the permit to be placed in the Christina Basin Fund.

- PA Water and Sewer Systems Assistance Act ($400 million bond) – voters to consider on Nov 4, 2008.

- Clean Water Act violation penalties

- Local corporations, foundations, and stakeholders

- Local government pooled fund – Local governments would contribute their percentage (a few thousand per year) annually to the Christina Basin Fund and the CBCWP would implement the restoration projects as a way to meet their MS4 permit obligations. Townships and cities in Delaware and Pennsylvania would contribute into the Christina Basin Fund based on a combination of the following formulas:

- % of MS4 separate storm sewer area
- % of sediment TMDL allocation
- % of phosphorus TMDL allocation
- % of nitrogen TMDL allocation
- % of urban/suburban land
- % of agricultural land
- % of urban plus agricultural land

For instance, the following table compares the possible contributions from governments in the Red Clay Creek watershed based on the various formulae.

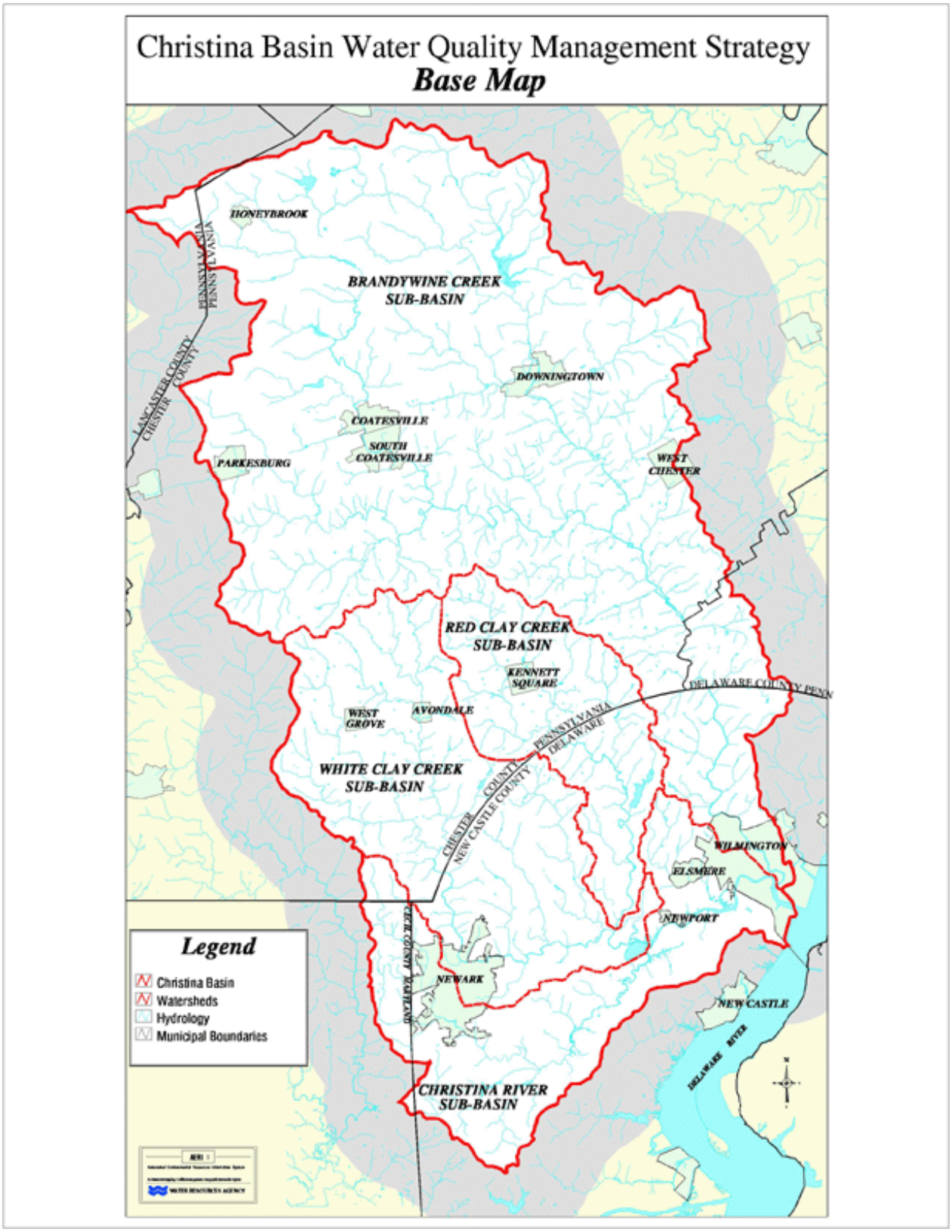
Funding Contribution as % of Red Clay Creek Watershed

Municipality	MS4 Separate Sewer	Sediment Allocation	Nitrogen Allocation	Phosphorus Allocation	% Urban	% Agriculture	% Urban + Agriculture
Pennsbury Twp	0.9%		1.3%	0.6%	1.4%	0.6%	1.0%
Kennett Square Boro	2.0%	4.0%	2.3%	1.2%	4.1%	1.3%	2.6%
New Garden Twp	10.5%	21.1%	12.4%	17.1%	5.4%	18.4%	12.2%
East Marlborough Twp	20.8%	41.8%	22.1%	8.2%	13.1%	34.7%	24.5%
Kennett Twp	26.0%	33.0%	31.9%	21.8%	22.4%	28.9%	25.8%
New Castle Co, DE	39.8%		30.0%	50.0%	53.5%	16.2%	33.9%

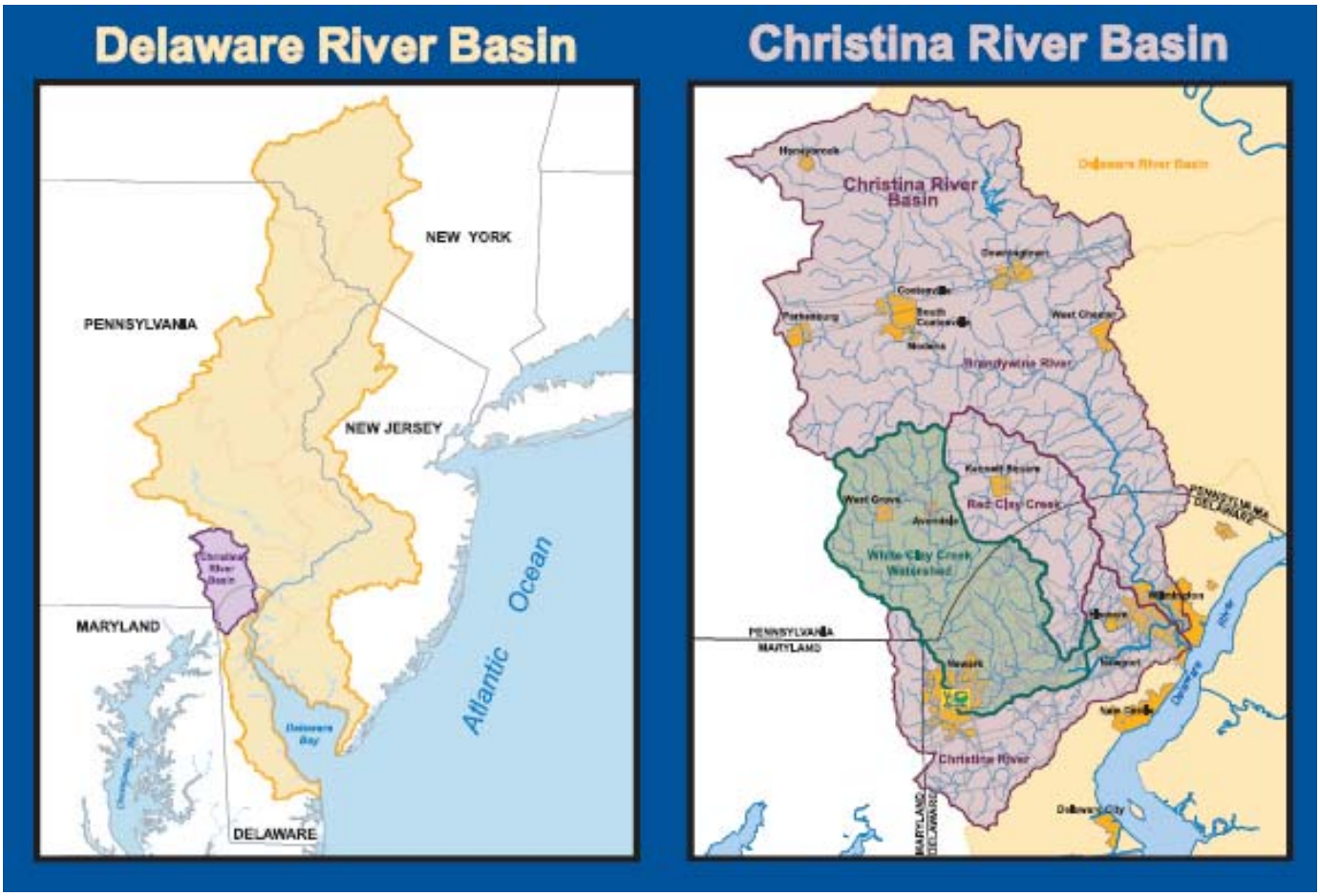
Water Quality Trading

Establish a formal Christina Basin water quality trading bank whereby stakeholders may fund upstream improvements. Wilmington is participating with upstream farms in Chester County as part of their source water program. Governments may choose to fund improvements in other portions of the watershed in lieu of spending less cost effective funds on projects within the town.

The National Academy of Sciences recently released a report that recommended that the USEPA base stormwater discharge and wastewater permits on watershed boundaries instead of political boundaries. The revised watershed based permitting structure includes market based trading of credits among stormwater dischargers to achieve compliance. A pilot program is recommended that will allow the USEPA to work through the watershed based permitting approach. We recommend that the Christina Basin Clean Water Partnership become the USEPA pilot program for watershed based stormwater permitting.


Christina Basin Water Quality Management Strategy
Base Map
HONEYBROOK
PENNSYLVANIA
LANCASTER COUNTY
CHESTER COUNTY
BRANDYWINE CREEK
SUB-BASIN
DOWNINGTOWN
COATESVILLE
SOUTH
COATESVILLE
PARKESBURG
WEST
CHESTER
RED CLAY CREEK
SUB-BASIN
KENNETT
SQUARE
DELAWARE COUNTY PENN
WEST
GROVE
AVONDALE
PENNSYLVANIA
DELAWARE
WHITE CLAY CREEK
SUB-BASIN
CHESTER
COUNTY
NEW CASTLE COUNTY
WILMINGTON
ELSMERE
NEWPORT
NEWARK
NEW CASTLE
DELAWARE RIVER
CHRISTINA RIVER
SUB-BASIN
Legend
Christina Basin
Watersheds
Hydrology
Municipal Boundaries

GROUP	**Christina Basin Clean Water Partnership**
Policy Committee	Pennsylvania Department of Environmental Protection Delaware Department of Natural Resources and Environmental Control Delaware River Basin Commission U.S. Environmental Protection Agency, Region III
Local Co-Coordinators	Chester County Water Resources Authority, Pennsylvania University of Delaware, Institute for Public Administration, Water Resources Agency Chester County Conservation District, Pennsylvania Delaware Nature Society
Partners	U.S. Department of Agriculture, Natural Resources Conservation Service U.S. Department of Interior, National Park Service U.S. Department of Interior, U.S. Geological Survey Chester County Board of Commissioners, Pennsylvania New Castle County Executive and Dept. of Planning, Delaware New Castle Conservation District, Delaware Brandywine Valley and Red Clay Valley Associations White Clay Watershed Association Christina Conservancy



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B17
R1
R2
R3
R4
R5
W1
W2
W3
W4
W5
W6
W7
W8
W9
W10
C1
C2
C3
C4
C5
C6
Legend
NPDES Discharges
Public Surface Water Intakes
Water Quality Impairments
Pennsylvania
Organic Enrichment / Low Dissolved Oxygen
Nutrient
Delaware
Low Dissolved Oxygen
Nutrient
Toxics
Locator Map
N
January 1998

Christina Basin Clean Water Partnership Awards Ceremony:
A Celebration of Success
February 29, 2008
Red Clay Room • Kennett Square, Pennsylvania

10:00 AM **REGISTRATION**

COFFEE, TEA, AND JUICE WILL BE SERVED

10:30 AM **PROGRAM**

MASTER OF CEREMONIES

ROBERT STRUBLE, EXECUTIVE DIRECTOR, BRANDYWINE VALLEY ASSOCIATION AND RED CLAY VALLEY ASSOCIATION

WELCOME AND INTRODUCTIONS

DELAWARE RIVER BASIN COMMISSION

ROBERT TUDOR, DEPUTY EXECUTIVE DIRECTOR

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, REGION III

JON CAPACASA, DIRECTOR, WATER PROTECTION DIVISION

RESULTS OF THE TARGETED WATERSHED GRANT

CHESTER COUNTY CONSERVATION DISTRICT

CHOTTY SPRENKLE, WATERSHED COORDINATOR/SPECIALIST

DELAWARE DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL

STEVE WILLIAMS, ECOLOGICAL RESTORATION COORDINATOR

DELAWARE NATURE SOCIETY

JOHN HARROD, BACKYARD HABITAT COORDINATOR

PRESENTATION OF AWARDS

U.S. REPRESENTATIVE MICHAEL CASTLE (DELAWARE)

DELAWARE AWARD RECIPIENTS:

NICK AND HUGO IMMEDIATO, THREE LITTLE BAKERS GOLF COURSE
THE INDEPENDENCE SCHOOL
MARY ANN CAPRIA

U.S. REPRESENTATIVE JAMES GERLACH (PENNSYLVANIA)
U.S. REPRESENTATIVE JOSEPH PITTS (PENNSYLVANIA)

PENNSYLVANIA AWARD RECIPIENTS:

JOSEPH AND DYANNE DELANEY
MATT BALMER, M. BALMER EXOTICS

THE LAFFEY FAMILY, GLENVILLE FARMS

FUTURE PLANS

PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION

CATHY CURRAN MYERS, DEPUTY SECRETARY

DELAWARE DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL

DAVID SMALL, DEPUTY SECRETARY

ADJOURN AND ACKNOWLEDGEMENTS

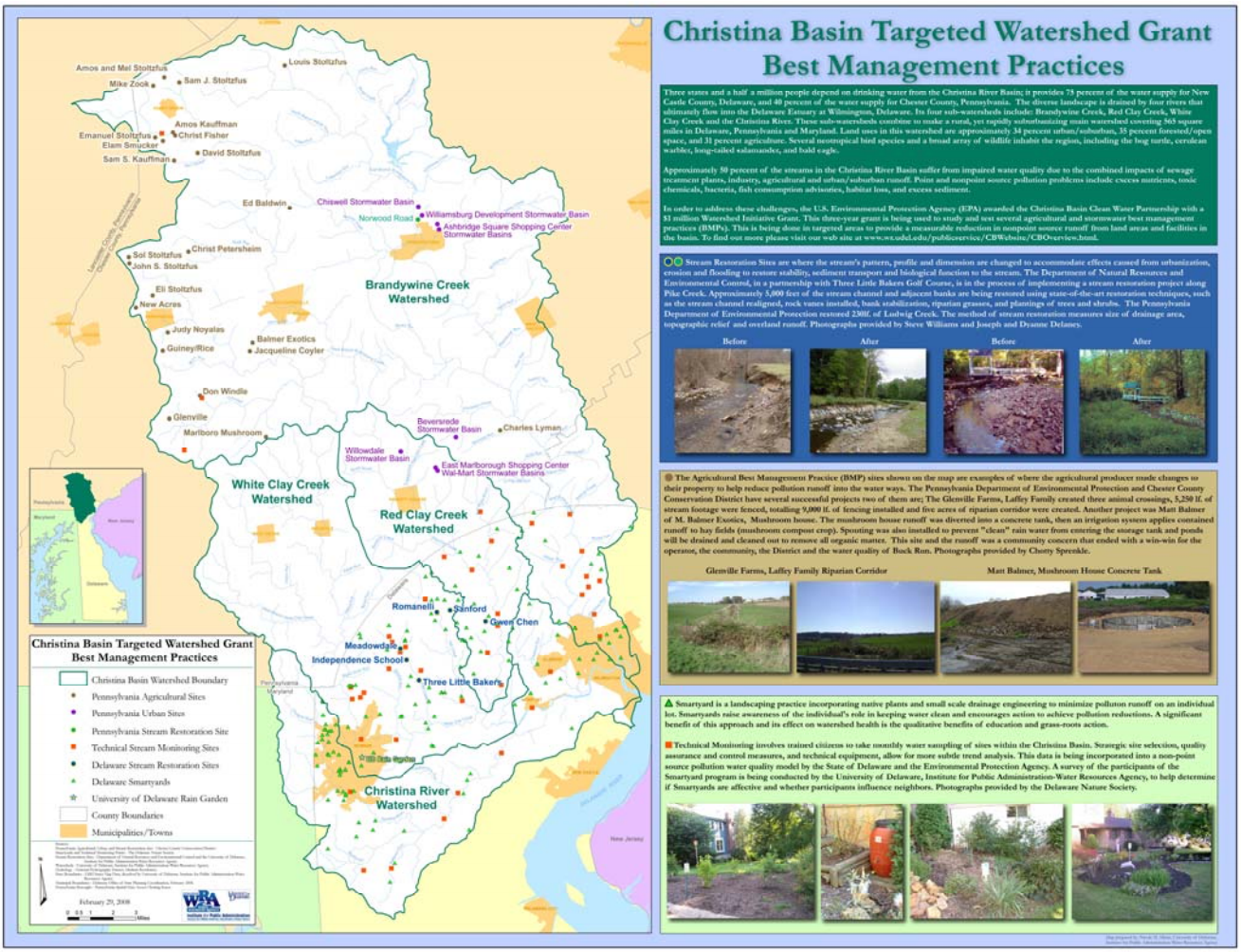
DELAWARE RIVER BASIN COMMISSION

ROBERT TUDOR, DEPUTY EXECUTIVE DIRECTOR

12:00 PM LUNCH

Hosted by the
Christina Basin Clean Water Partnership

Brandywine Conservancy
Brandywine Valley Association (BVA)
Chester County Conservation District (CCCD)
Chester County Planning Commission
Chester County Water Resources Authority (CCWRA)
Christina Conservancy
City of Newark
City of Wilmington
Delaware Department of Natural Resources and Environmental Control (DNREC)
Delaware Nature Society
Delaware River Basin Commission (DRBC)
New Castle Conservation District (NCCD)
Pennsylvania Department of Conservation and Natural Resources (PA DCNR)
Pennsylvania Department of Environmental Protection (PA DEP)
Red Clay Valley Association (RCVA)
United States Department of Agriculture, Natural Resources Conservation District (USDA-NRCS)
United States Environmental Protection Agency (USEPA)
United States Geological Survey (USGS)
University of Delaware, Institute for Public Administration-Water Resources Agency (IPA-WRA)
White Clay Creek Watershed Association
White Clay Creek Wild and Scenic Watershed Management Committee


Christina Basin Targeted Watershed Grant
Best Management Practices
Three states and a half a million people depend on drinking water from the Christina River Basin; it provides 75 percent of the water supply for New Castle County, Delaware, and 40 percent of the water supply for Chester County, Pennsylvania. The diverse landscape is drained by four rivers that ultimately flow into the Delaware Estuary at Wilmington, Delaware. Its four sub-watersheds include: Brandywine Creek, Red Clay Creek, White Clay Creek and the Christina River. These sub-watersheds combine to make a rural, yet rapidly suburbanizing main watershed covering 565 square miles in Delaware, Pennsylvania and Maryland. Land uses in this watershed are approximately 34 percent urban/suburban, 35 percent forested/open space, and 31 percent agriculture. Several neotropical bird species and a broad array of wildlife inhabit the region, including the bog turtle, cerulean warbler, long-tailed salamander, and bald eagle.
Approximately 50 percent of the streams in the Christina River Basin suffer from impaired water quality due to the combined impacts of sewage treatment plants, industry, agricultural and urban/suburban runoff. Point and nonpoint source pollution problems include excess nutrients, toxic chemicals, bacteria, fish consumption advisories, habitat loss, and excess sediment.
In order to address these challenges, the U.S. Environmental Protection Agency (EPA) awarded the Christina Basin Clean Water Partnership with a $1 million Watershed Initiative Grant. This three-year grant is being used to study and test several agricultural and stormwater best management practices (BMPs). This is being done in targeted areas to provide a measurable reduction in nonpoint source runoff from land areas and facilities in the basin. To find out more please visit our web site at www.wr.udel.edu/publ&service/CBWebsite/CBOverview.html.
Stream Restoration Sites are where the stream's pattern, profile and dimension are changed to accommodate effects caused from urbanization, erosion and flooding to restore stability, sediment transport and biological function to the stream. The Department of Natural Resources and Environmental Control, in a partnership with Three Little Bakers Golf Course, is in the process of implementing a stream restoration project along Pike Creek. Approximately 5,000 feet of the stream channel and adjacent banks are being restored using state-of-the-art restoration techniques, such as the stream channel realigned, rock vanes installed, bank stabilization, riparian grasses, and plantings of trees and shrubs. The Pennsylvania Department of Environmental Protection restored 230lf. of Ludwig Creek. The method of stream restoration measures size of drainage area, topographic relief and overland runoff. Photographs provided by Steve Williams and Joseph and Dyanne Delaney.
Before
After
Before
After
The Agricultural Best Management Practice (BMP) sites shown on the map are examples of where the agricultural producer made changes to their property to help reduce pollution runoff into the water ways. The Pennsylvania Department of Environmental Protection and Chester County Conservation District have several successful projects two of them are; The Glenville Farms, Laffey Family created three animal crossings, 5,250 lf. of stream footage were fenced, totalling 9,000 lf. of fencing installed and five acres of riparian corridor were created. Another project was Matt Balmer of M. Balmer Exotics, Mushroom house. The mushroom house runoff was diverted into a concrete tank, then an irrigation system applies contained runoff to hay fields (mushroom compost crop). Spouting was also installed to prevent "clean" rain water from entering the storage tank and ponds will be drained and cleaned out to remove all organic matter. This site and the runoff was a community concern that ended with a win-win for the operator, the community, the District and the water quality of Buck Run. Photographs provided by Chotty Sprenkle.
Glenville Farms, Laffey Family Riparian Corridor
Matt Balmer, Mushroom House Concrete Tank
Smartyard is a landscaping practice incorporating native plants and small scale drainage engineering to minimize pollution runoff on an individual lot. Smartyards raise awareness of the individual's role in keeping water clean and encourages action to achieve pollution reductions. A significant benefit of this approach and its effect on watershed health is the qualitative benefits of education and grass-roots action.
Technical Monitoring involves trained citizens to take monthly water sampling of sites within the Christina Basin. Strategic site selection, quality assurance and control measures, and technical equipment, allow for more subtle trend analysis. This data is being incorporated into a non-point source pollution water quality model by the State of Delaware and the Environmental Protection Agency. A survey of the participants of the Smartyard program is being conducted by the University of Delaware, Institute for Public Administration-Water Resources Agency, to help determine if Smartyards are affective and whether participants influence neighbors. Photographs provided by the Delaware Nature Society.
Amos and Mel Stoltzfus
Louis Stoltzfus
Mike Zook
Sam J. Stoltzfus
Amos Kauffman
Emanuel Stoltzfus
Christ Fisher
Elam Smucker
David Stoltzfus
Sam S. Kauffman
Ed Baldwin
Chiswell Stormwater Basin
Norwood Road
Williamsburg Development Stormwater Basin
Ashbridge Square Shopping Center Stormwater Basins
Sol Stoltzfus
Christ Petersheim
John S. Stoltzfus
Eli Stoltzfus
New Acres
Judy Noyales
Guiney/Rice
Balmer Exotics
Jacqueline Coyler
Brandywine Creek Watershed
Don Windle
Glenville
Marlboro Mushroom
Beversrede Stormwater Basin
Charles Lyman
Willowdale Stormwater Basin
East Marlborough Shopping Center Wal-Mart Stormwater Basins
White Clay Creek Watershed
Red Clay Creek Watershed
Romanelli
Sanford
Owen Chen
Meadowdale
Independence School
Three Little Bakers
Christina River Watershed
Christina Basin Targeted Watershed Grant
Best Management Practices
Christina Basin Watershed Boundary
Pennsylvania Agricultural Sites
Pennsylvania Urban Sites
Pennsylvania Stream Restoration Site
Technical Stream Monitoring Sites
Delaware Stream Restoration Sites
Delaware Smartyards
University of Delaware Rain Garden
County Boundaries
Municipalities/Towns
February 29, 2008
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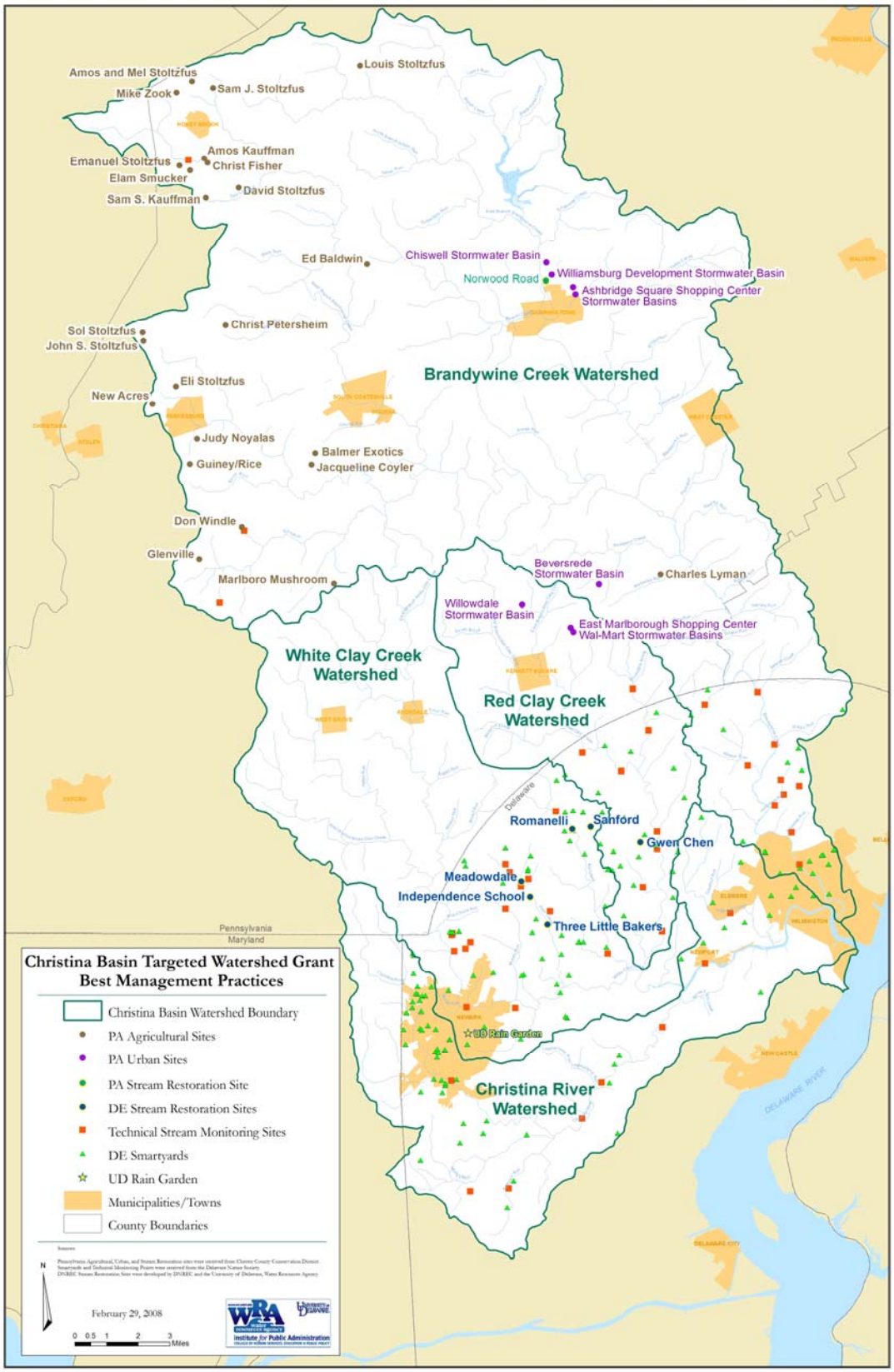
New Jersey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David Stoltzfus
Sam S. Kauffman
Ed Baldwin
Chiswell Stormwater Basin
Williamsburg Development Stormwater Basin
Norwood Road
Ashbridge Square Shopping Center Stormwater Basins
Sol Stoltzfus
John S. Stoltzfus
Christ Petersheim
Brandywine Creek Watershed
Eli Stoltzfus
New Acres
Judy Noyalas
Balmer Exotics
Jacqueline Coyler
Guiney/Rice
Don Windle
Glenville
Beversrede Stormwater Basin
Charles Lyman
Marlboro Mushroom
Willowdale Stormwater Basin
East Marlborough Shopping Center Wal-Mart Stormwater Basins
White Clay Creek Watershed
Red Clay Creek Watershed
Delaware
Romanelli
Sanford
Gwen Chen
Meadowdale
Independence School
Three Little Bakers
Pennsylvania
Maryland
☆UD Rain Garden
Christina River Watershed
DELAWARE RIVER
Christina Basin Targeted Watershed Grant
Best Management Practices
Christina Basin Watershed Boundary
PA Agricultural Sites
PA Urban Sites
PA Stream Restoration Site
DE Stream Restoration Sites
Technical Stream Monitoring Sites
DE Smartyards
UD Rain Garden
Municipalities/Towns
County Boundaries
N
February 29, 2008
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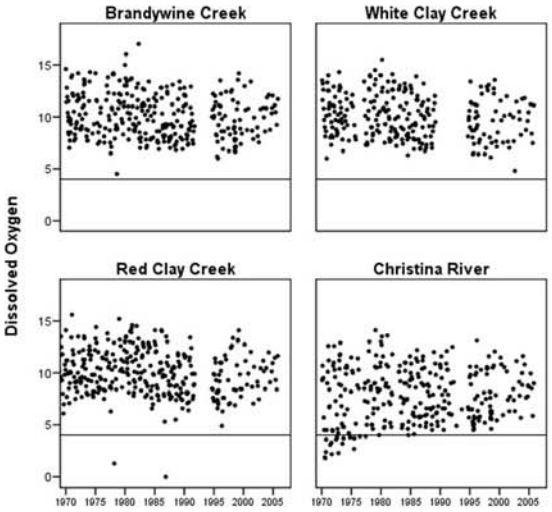
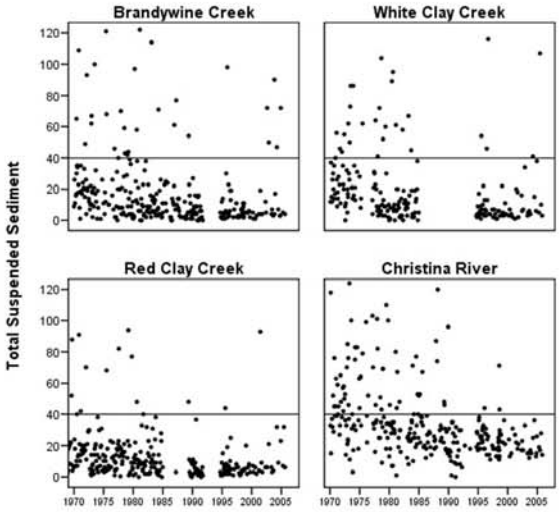
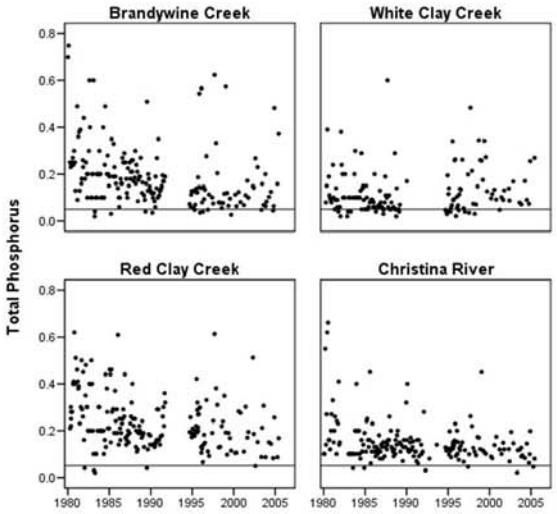
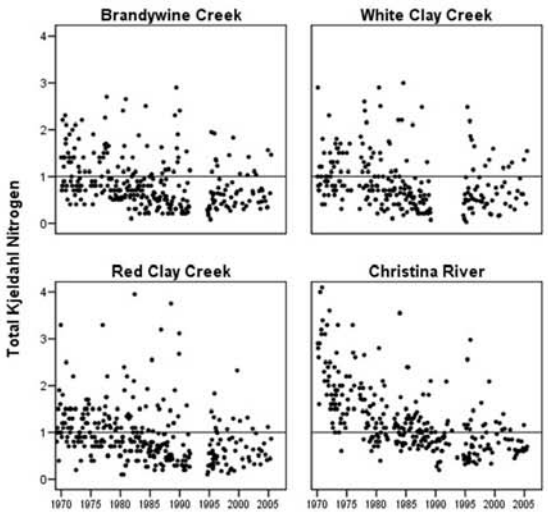
Miles
Institute for Public Administration

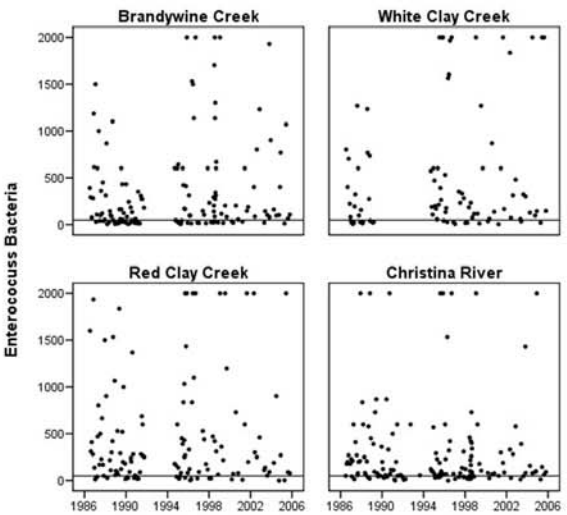
Christina Basin Targeted Watershed Initiative Grant Tasks	Required Deliverable	Final Result
Watershed Coordination and Oversight	Continuous	Continuous
Grant Administration – Financial	Continuous	Continuous
1.2B Grant Administration – Semi-Annual Reporting	8 Reports	8 Reports
1.3 Annual Conference	Conference	Conference
1.4 Final Report		
2.1 GIS Clearinghouse and Website Maintenance	Continuous	Continuous
2.2A Christina Basin Task Force Meetings	12 Meetings/Conference Calls	7 Meetings/ 16 Conference Calls
2.2B Annual Bus Tour	4 Tours	4 Tours
2.2C Storm Drain Stenciling	Continuous	Continuous
2.2D Outreach Publications	Continuous	Continuous
2.2E Phase VI Completion Public Event		Public Event
3.1A Nutrient Management Control Plans	10 Plans	10 Plans
3.1B Nutrient Management Control Systems	7 Systems	7 Systems
3.1C Soil Conservation Practices	500 Acres	+725 Acres
3.1D Waterway Diversions	2,000 Feet	2,250 Feet
3.1E Water Control Structures	4 Structures	6 Structures
3.1F Stream Fencing	1,000 Feet	8025 Feet
3.1G Stream Reforestation	6,000 Feet	9,148 Feet
3.2 Smartyards and Rain Barrels	150 Rain Barrels	204 Rain Barrels
4.1 DE Stream Bank Restoration/Reforestation	5000 Feet	8,920 Feet
5.1A Project Administration	Continuous	Continuous
5.1B PA Storm Water Outfall Retrofit	1 Retrofit	1 Retrofit
5.1C PA Storm Water Basin Retrofits	2 Retrofits	2 Retrofits
5.2 DE Storm Water Wetland Retrofits	6 Retrofits	6 Retrofits
6.1 Chester County Monitoring	Annual Data Summary	4 Data Summaries
6.2 New Castle County Monitoring	Annual Data Summary	4 Data Summaries

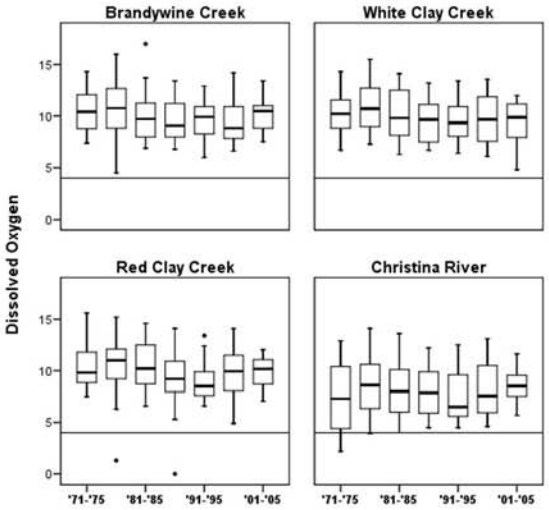

Brandywine Creek
White Clay Creek
Red Clay Creek
Christina River
Dissolved Oxygen

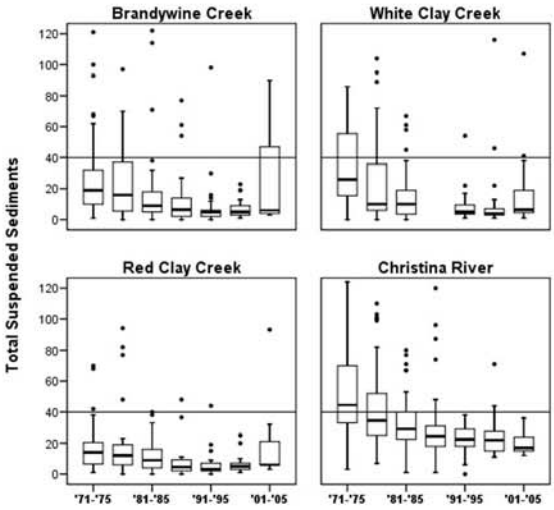

Brandywine Creek
White Clay Creek
Red Clay Creek
Christina River
Total Suspended Sediment

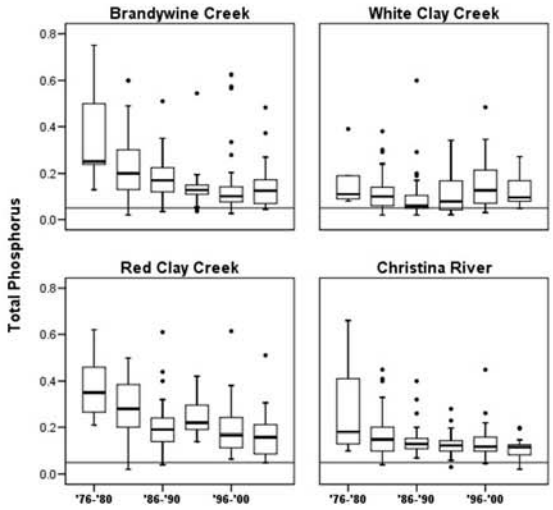

Brandywine Creek
White Clay Creek
Red Clay Creek
Christina River
Total Phosphorus

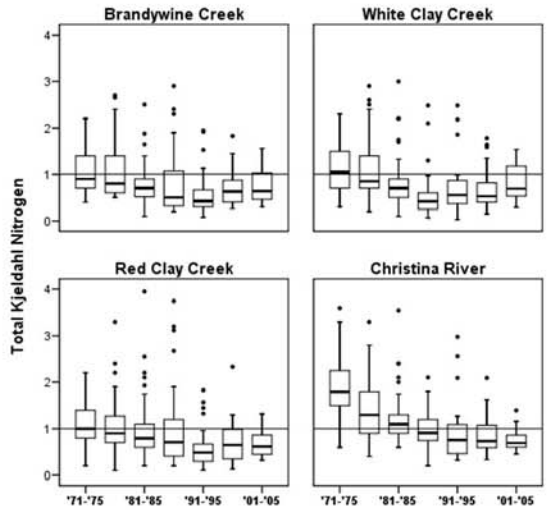

Brandywine Creek
White Clay Creek
Red Clay Creek
Christina River
Total Kjeldahl Nitrogen

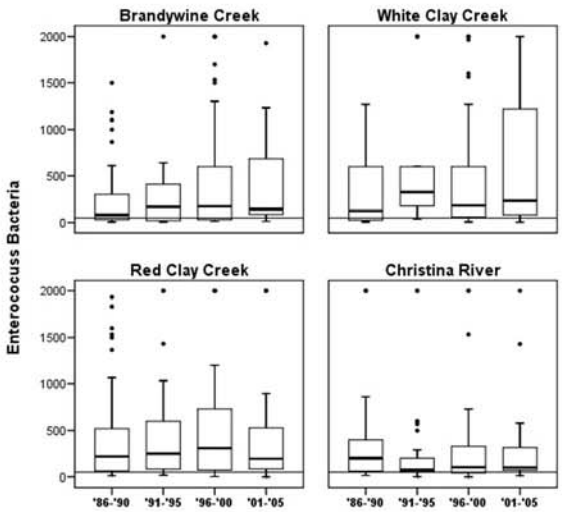

Brandywine Creek
White Clay Creek
Red Clay Creek
Christina River
Enterococuss Bacteria


Brandywine Creek
White Clay Creek
Red Clay Creek
Christina River
Dissolved Oxygen
'71-'75
'81-'85
'91-'95
'01-'05


Brandywine Creek
White Clay Creek
Red Clay Creek
Christina River
Total Suspended Sediments
'71-'75
'81-'85
'91-'95
'01-'05


Brandywine Creek
White Clay Creek
Red Clay Creek
Christina River
Total Phosphorus
'76-'80
'86-'90
'96-'00


Brandywine Creek
White Clay Creek
Red Clay Creek
Christina River
Total Kjeldahl Nitrogen
'71-'75
'81-'85
'91-'95
'01-'05


Brandywine Creek
White Clay Creek
Red Clay Creek
Christina River
Enterococuss Bacteria
'86-'90
'91-'95
'96-'00
'01-'05

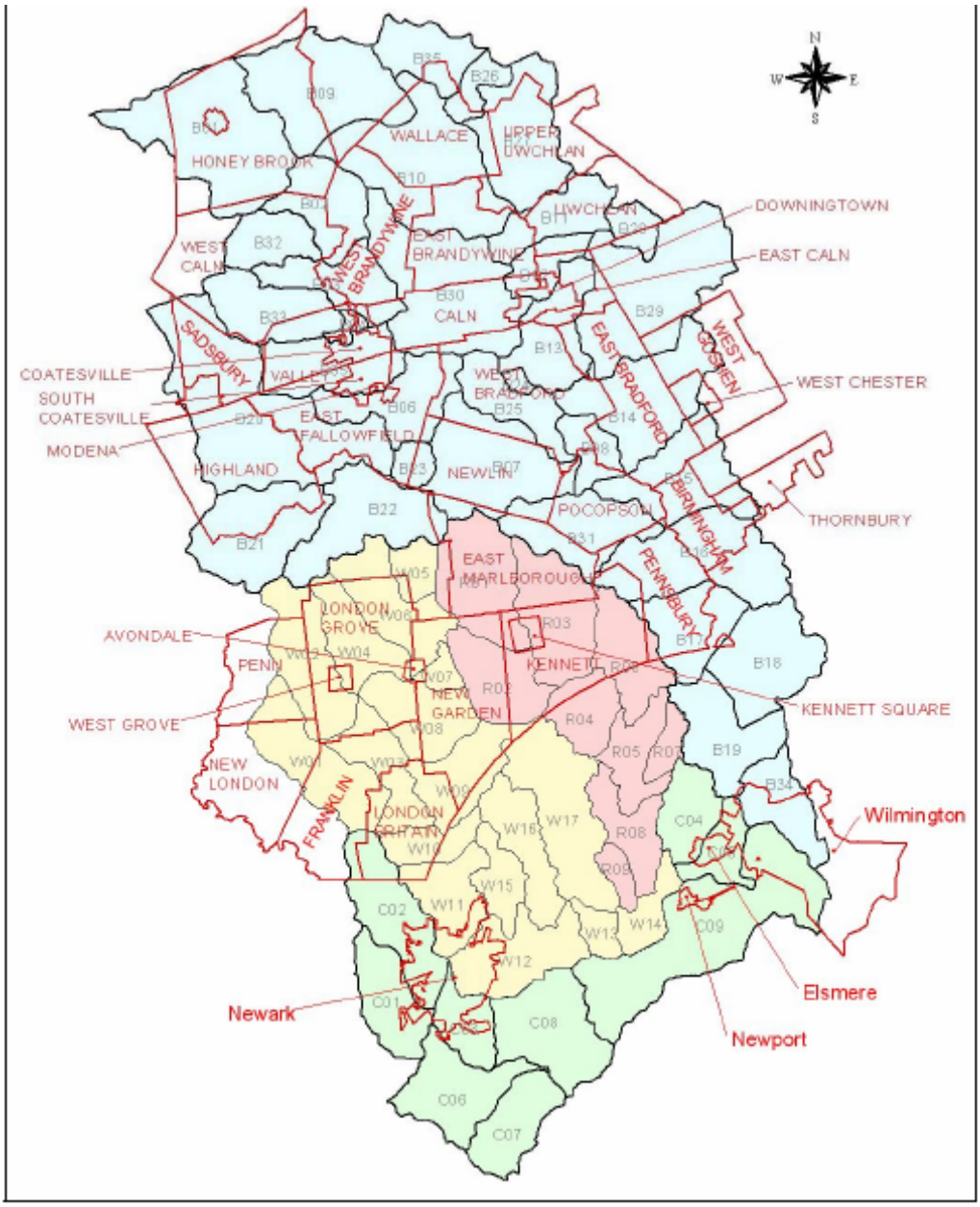
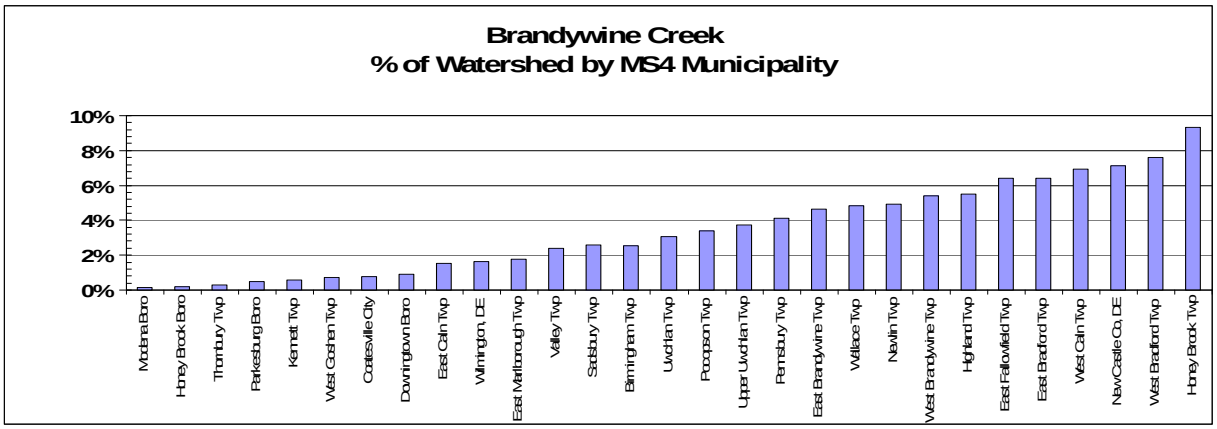
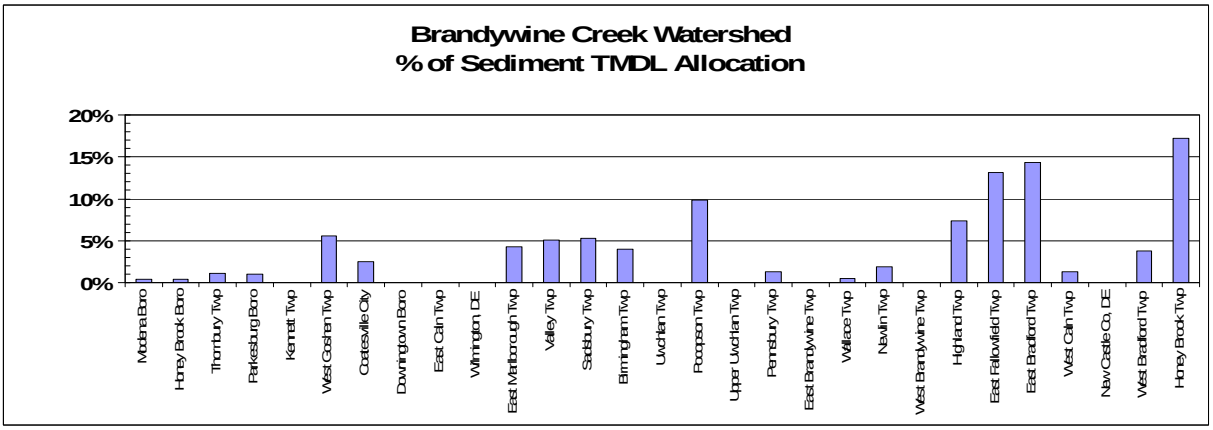
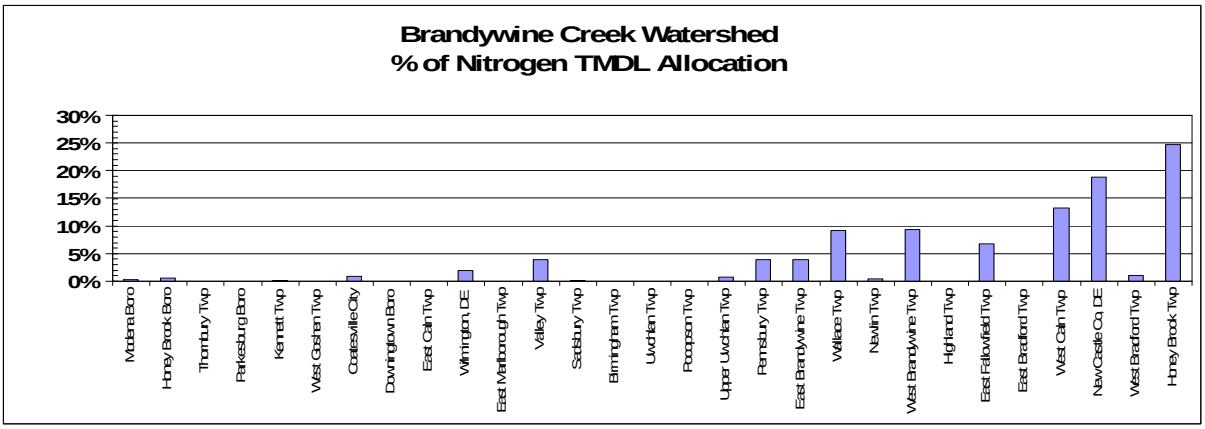
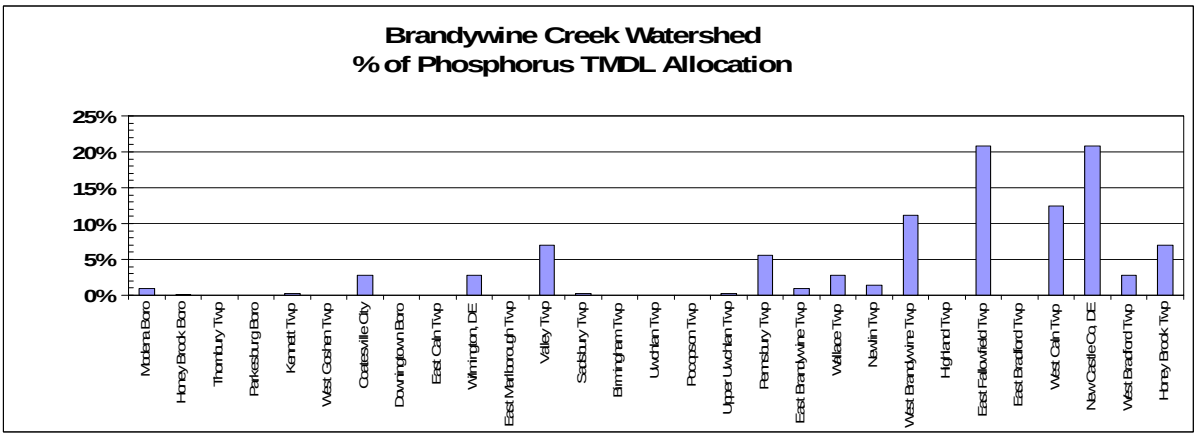


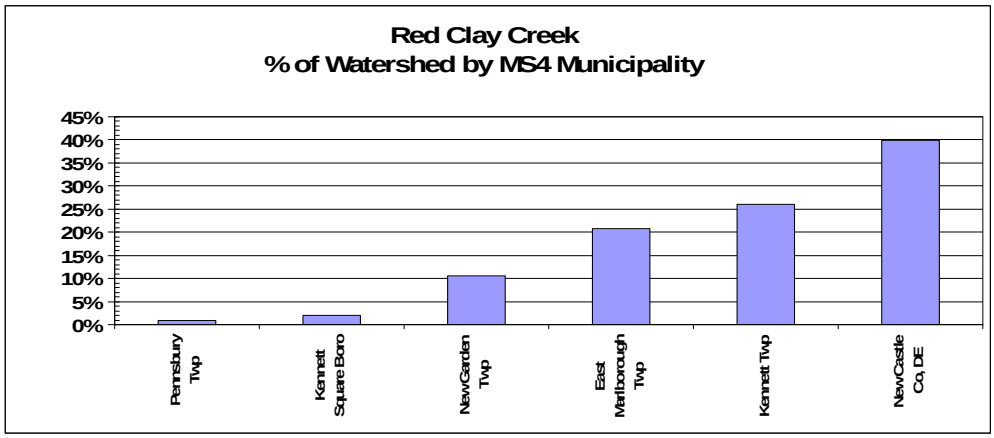
Figure 2-2. Municipalities with MS4 permits in Christina River Basin

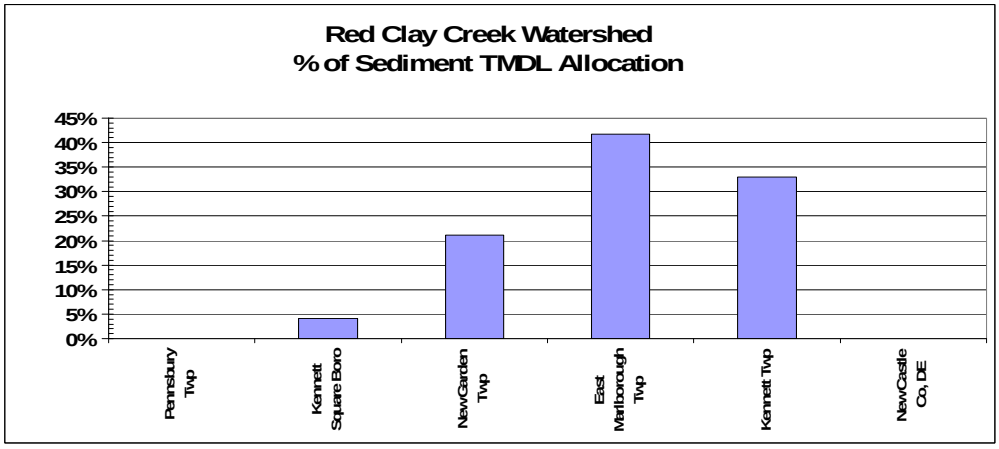

Brandywine Creek
% of Watershed by MS4 Municipality
10%
8%
6%
4%
2%
0%
Modena Boro
Honey Brook Boro
Thornbury Twp
Parkesburg Boro
Kennett Twp
West Goshen Twp
Coatesville City
Downingtown Boro
East Caln Twp
Wilmington, DE
East Marlborough Twp
Valley Twp
Sadsbury Twp
Birmingham Twp
Uwchlan Twp
Pocopson Twp
Upper Uwchlan Twp
Pennsbury Twp
East Brandywine Twp
Wallace Twp
Newlin Twp
West Brandywine Twp
Highland Twp
East Fallowfield Twp
East Bradford Twp
West Caln Twp
New Castle Co, DE
West Bradford Twp
Honey Brook Twp

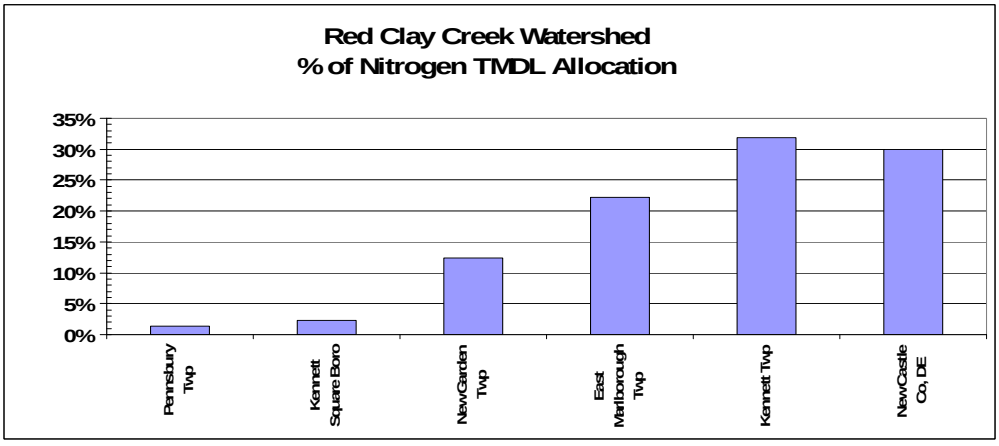

Brandywine Creek Watershed
% of Sediment TMDL Allocation
20%
15%
10%
5%
0%
Modena Boro
Honey Brook Boro
Thornbury Twp
Parkesburg Boro
Kennett Twp
West Goshen Twp
Coatesville City
Downingtown Boro
East Caln Twp
Wilmington, DE
East Marlborough Twp
Valley Twp
Sadsbury Twp
Birmingham Twp
Uwchlan Twp
Pocopson Twp
Upper Uwchlan Twp
Pennsbury Twp
East Brandywine Twp
Wallace Twp
Newlin Twp
West Brandywine Twp
Highland Twp
East Fallowfield Twp
East Bradford Twp
West Caln Twp
New Castle Co, DE
West Bradford Twp
Honey Brook Twp

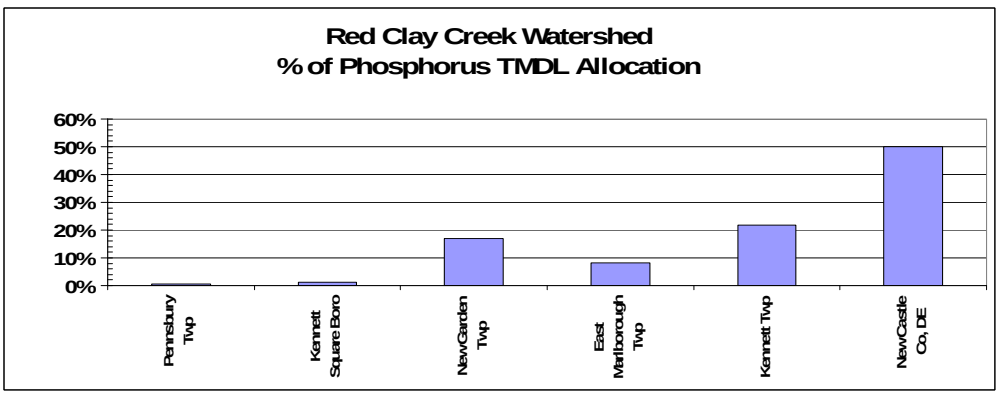

Brandywine Creek Watershed
% of Nitrogen TMDL Allocation
30%
25%
20%
15%
10%
5%
0%
Modena Boro
Honey Brook Boro
Thornbury Twp
Parkesburg Boro
Kennett Twp
West Goshen Twp
Coatesville City
Downingtown Boro
East Caln Twp
Wilmington, DE
East Marlborough Twp
Valley Twp
Sadsbury Twp
Birmingham Twp
Uwchlan Twp
Pocopson Twp
Upper Uwchlan Twp
Pennsbury Twp
East Brandywine Twp
Wallace Twp
Newlin Twp
West Brandywine Twp
Highland Twp
East Fallowfield Twp
East Bradford Twp
West Caln Twp
New Castle Co, DE
West Bradford Twp
Honey Brook Twp

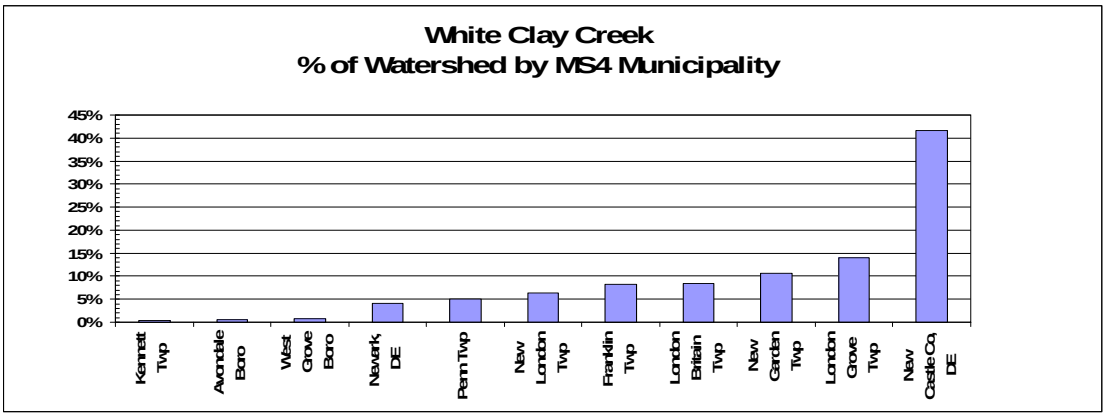

Brandywine Creek Watershed
% of Phosphorus TMDL Allocation
25%
20%
15%
10%
5%
0%
Modena Boro
Honey Brook Boro
Thornbury Twp
Parkesburg Boro
Kennett Twp
West Goshen Twp
Coatesville City
Downingtown Boro
East Caln Twp
Wilmington, DE
East Marlborough Twp
Valley Twp
Sadsbury Twp
Birmingham Twp
Uwchlan Twp
Pocopson Twp
Upper Uwchlan Twp
Pennsbury Twp
East Brandywine Twp
Wallace Twp
Newlin Twp
West Brandywine Twp
Highland Twp
East Fallowfield Twp
East Bradford Twp
West Caln Twp
New Castle Co, DE
West Bradford Twp
Honey Brook Twp

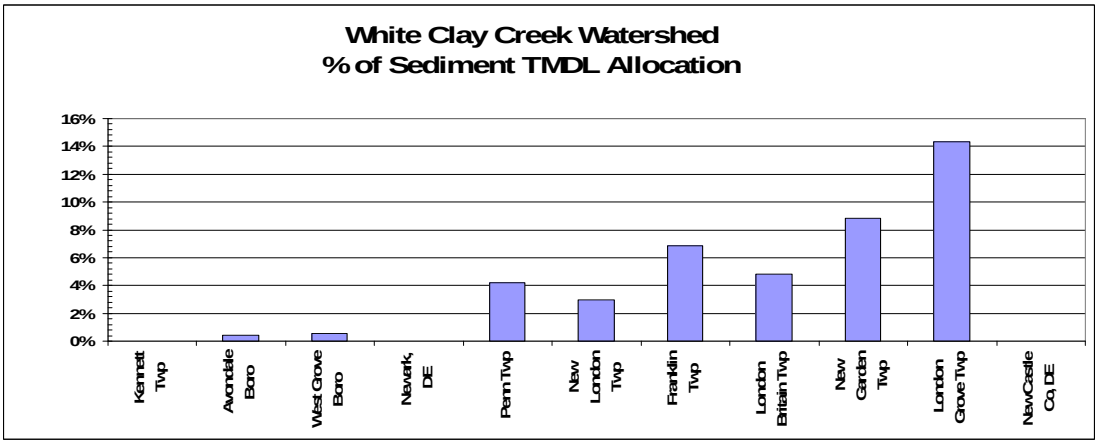

Red Clay Creek
% of Watershed by MS4 Municipality
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
Pennsbury Twp
Kennett Square Boro
NewGarden Twp
East Marlborough Twp
Kennett Twp
NewCastle Co, DE

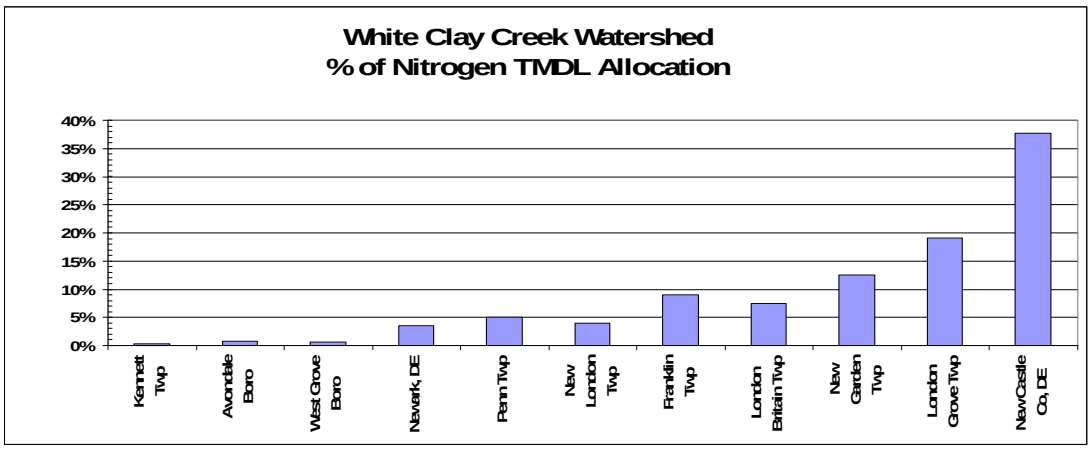

Red Clay Creek Watershed
% of Sediment TMDL Allocation
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
Pennsbury Twp
Kennett Square Boro
NewGarden Twp
East Marlborough Twp
Kennett Twp
NewCastle Co, DE

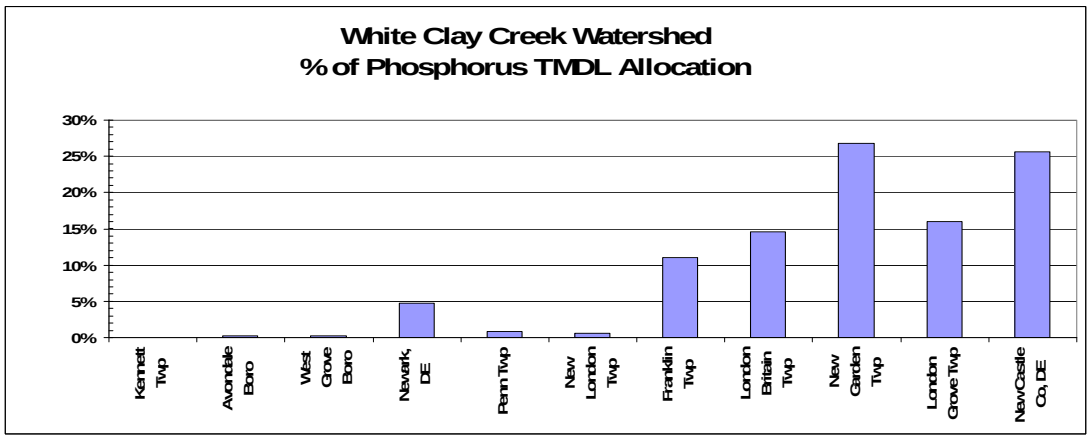

Red Clay Creek Watershed
% of Nitrogen TMDL Allocation
35%
30%
25%
20%
15%
10%
5%
0%
Pennsbury Twp
Kennett Square Boro
NewGarden Twp
East Marlborough Twp
Kennett Twp
NewCastle Co, DE

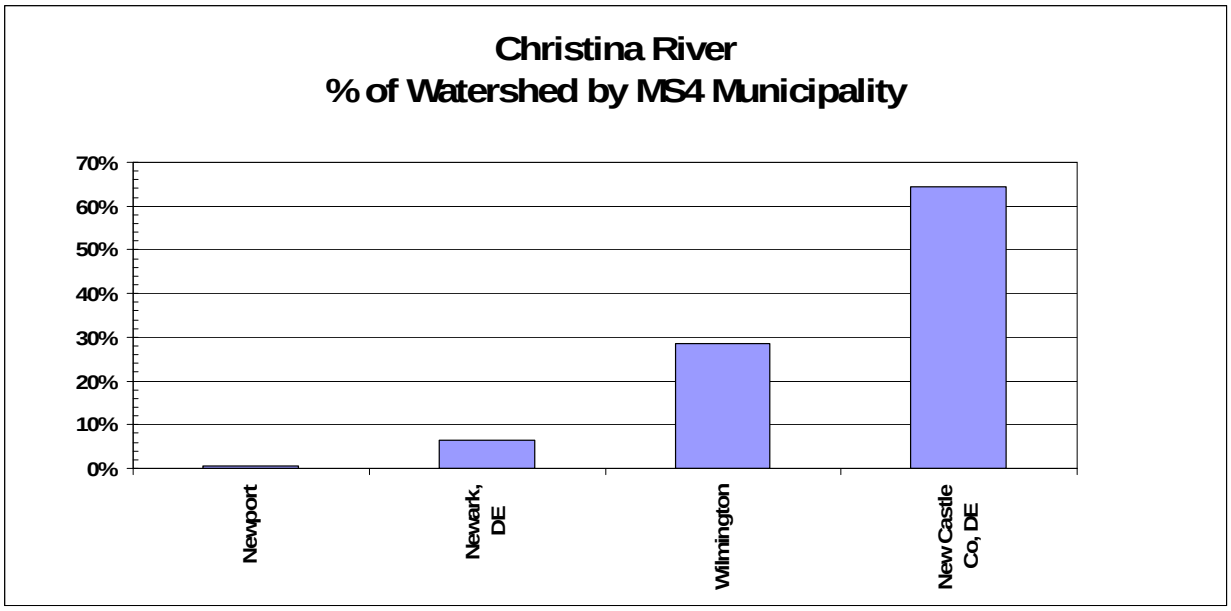

Red Clay Creek Watershed
% of Phosphorus TMDL Allocation
60%
50%
40%
30%
20%
10%
0%
Pennsbury Twp
Kennett Square Boro
NewGarden Twp
East Marlborough Twp
Kennett Twp
NewCastle Co, DE

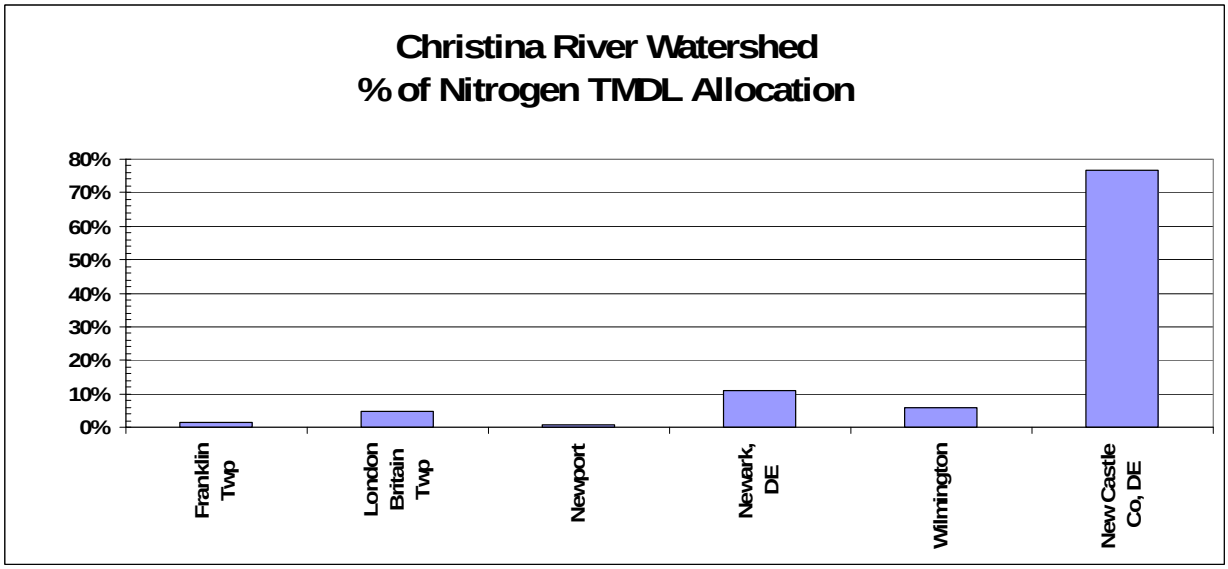

White Clay Creek
% of Watershed by MS4 Municipality
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
Kennett Twp
Avondale Boro
West Grove Boro
Newark, DE
Penn Twp
New London Twp
Franklin Twp
London Britain Twp
New Garden Twp
London Grove Twp
New Castle Co, DE

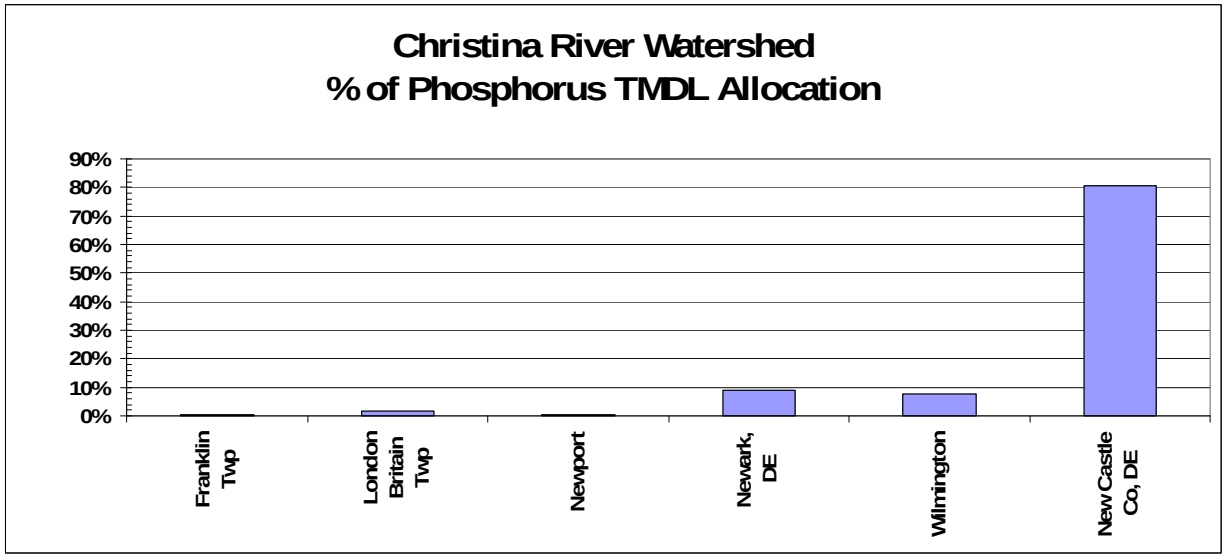

White Clay Creek Watershed
% of Sediment TMDL Allocation
16%
14%
12%
10%
8%
6%
4%
2%
0%
Kennett Twp
Avondale Boro
West Grove Boro
Newark, DE
Penn Twp
New London Twp
Franklin Twp
London Britain Twp
New Garden Twp
London Grove Twp
NewCastle Co, DE

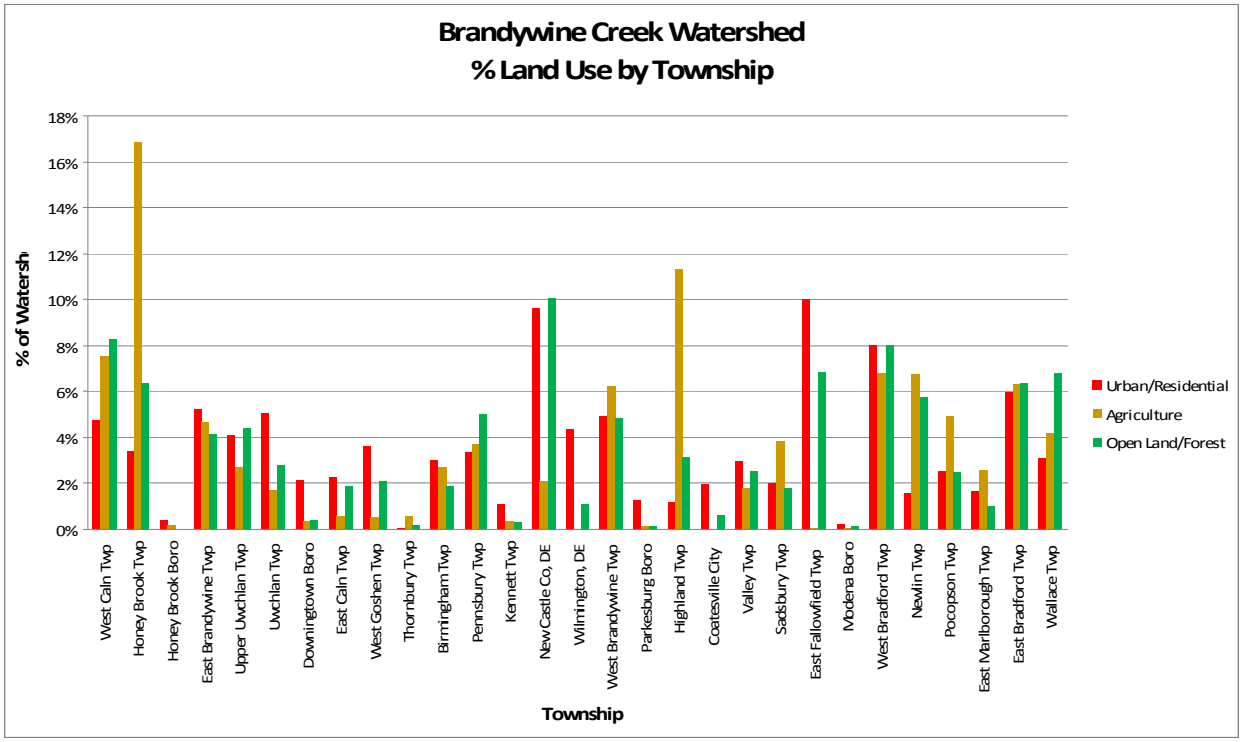

White Clay Creek Watershed
% of Nitrogen TMDL Allocation
40%
35%
30%
25%
20%
15%
10%
5%
0%
Kennett Twp
Avondale Boro
West Grove Boro
Newark, DE
Penn Twp
New London Twp
Franklin Twp
London Britain Twp
New Garden Twp
London Grove Twp
NewCastle Co, DE

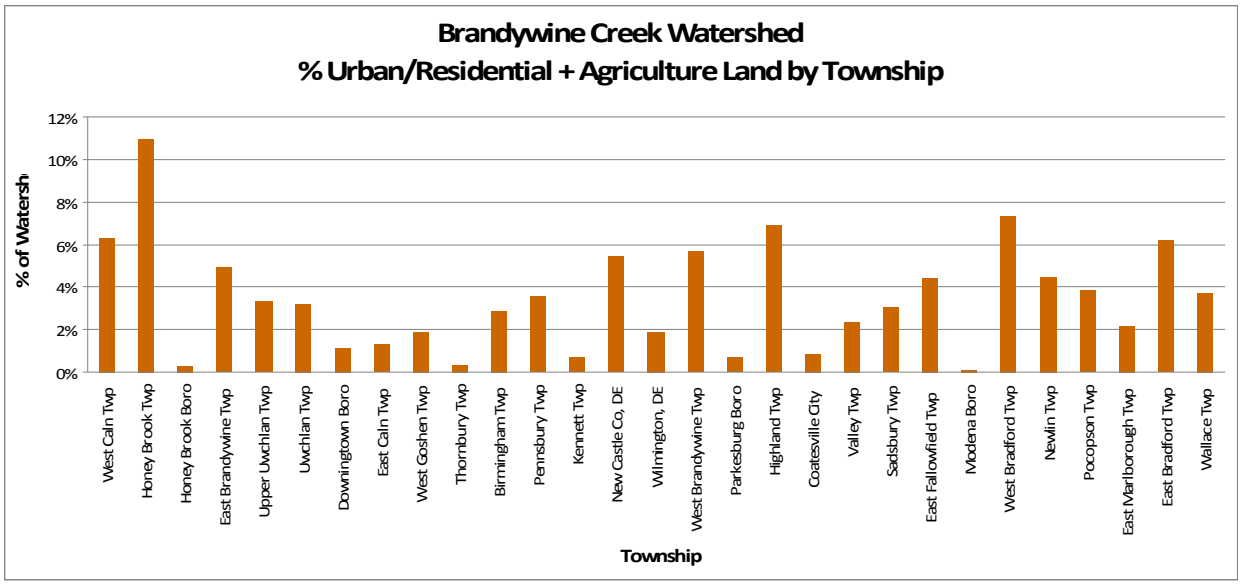

White Clay Creek Watershed
% of Phosphorus TMDL Allocation
30%
25%
20%
15%
10%
5%
0%
Kennett Twp
Avondale Boro
West Grove Boro
Newark, DE
Penn Twp
New London Twp
Franklin Twp
London Britain Twp
New Garden Twp
London Grove Twp
NewCastle Co, DE

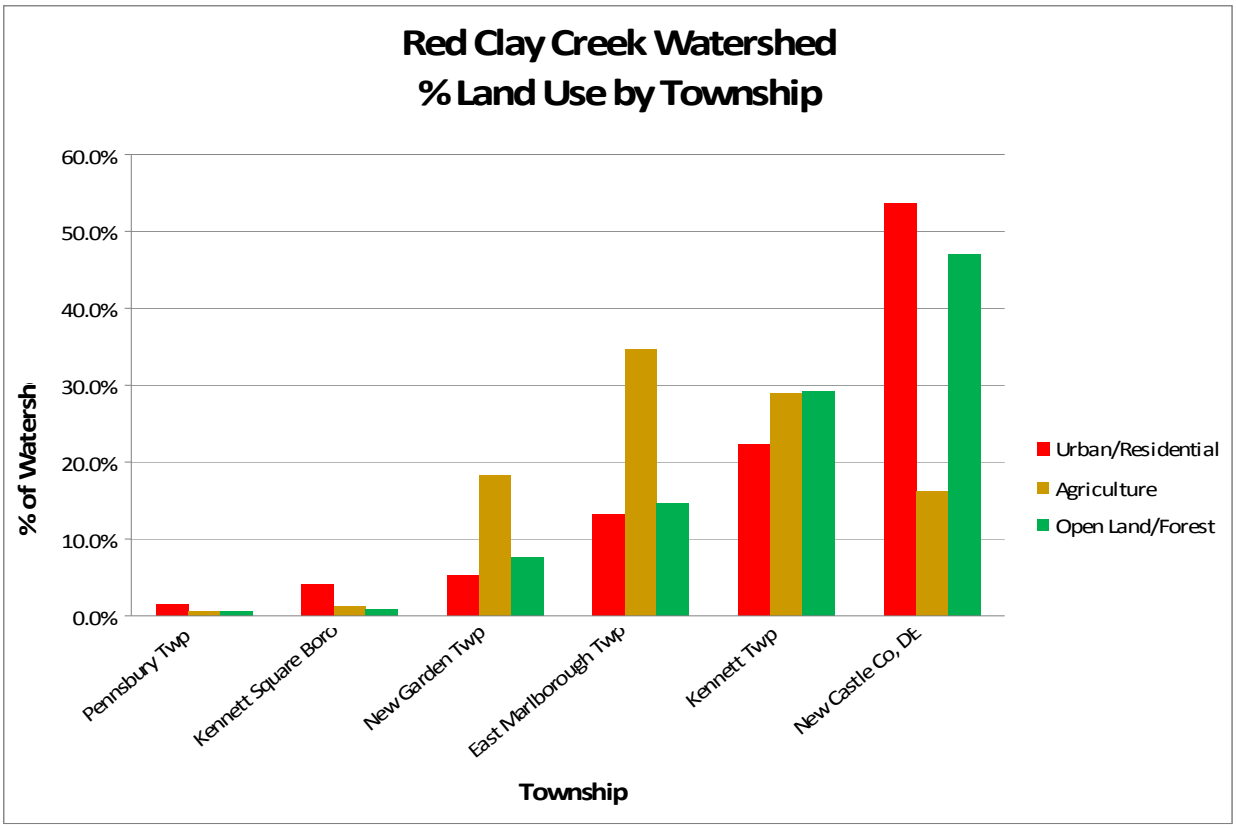

Christina River
% of Watershed by MS4 Municipality
70%
60%
50%
40%
30%
20%
10%
0%
Newport
Newark, DE
Wilmington
New Castle Co, DE

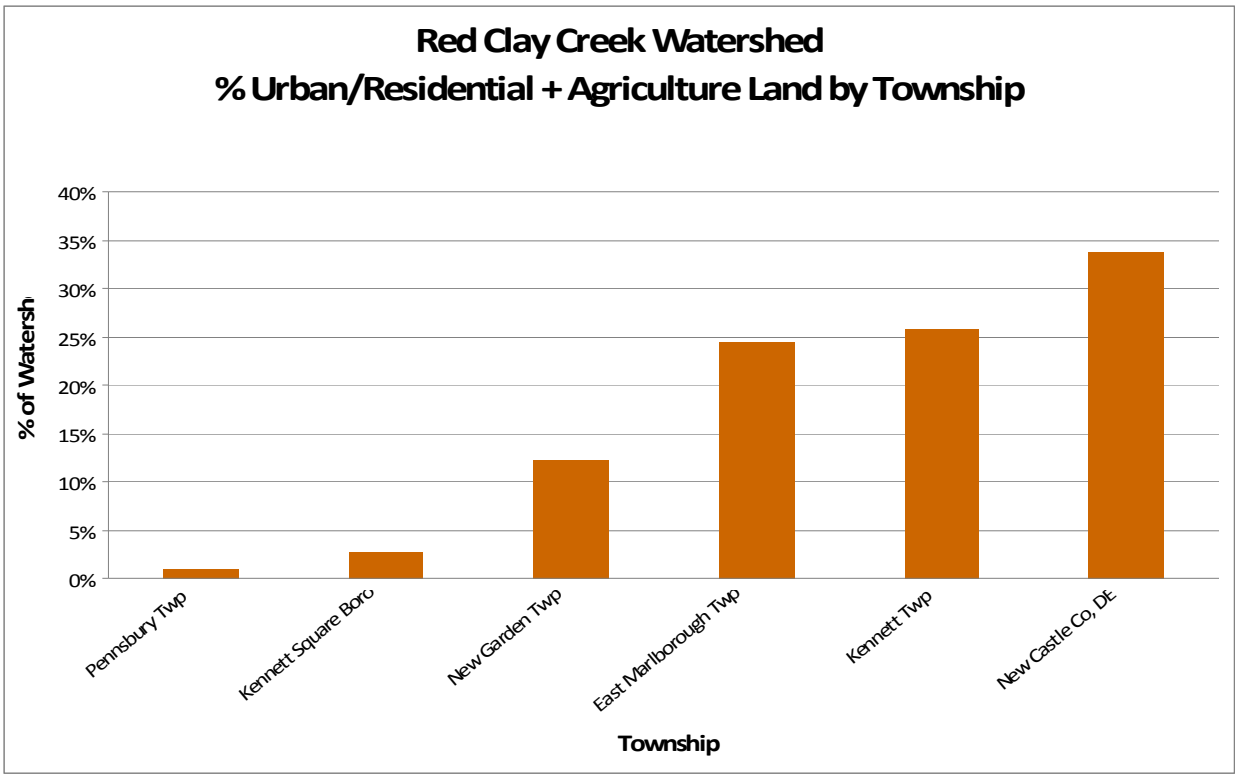

Christina River Watershed
% of Nitrogen TMDL Allocation
80%
70%
60%
50%
40%
30%
20%
10%
0%
Franklin Twp
London Britain Twp
Newport
Newark, DE
Wilmington
New Castle Co, DE

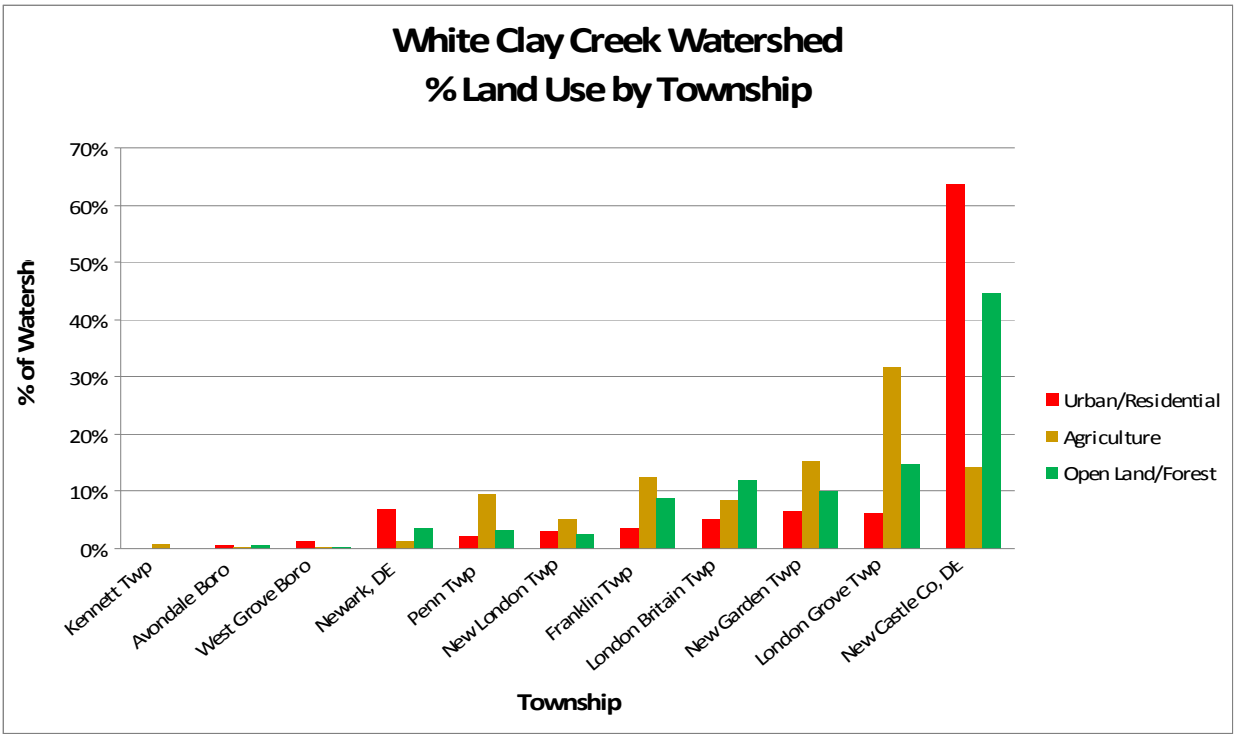

Christina River Watershed
% of Phosphorus TMDL Allocation
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Franklin Twp
London Britain Twp
Newport
Newark, DE
Wilmington
New Castle Co, DE

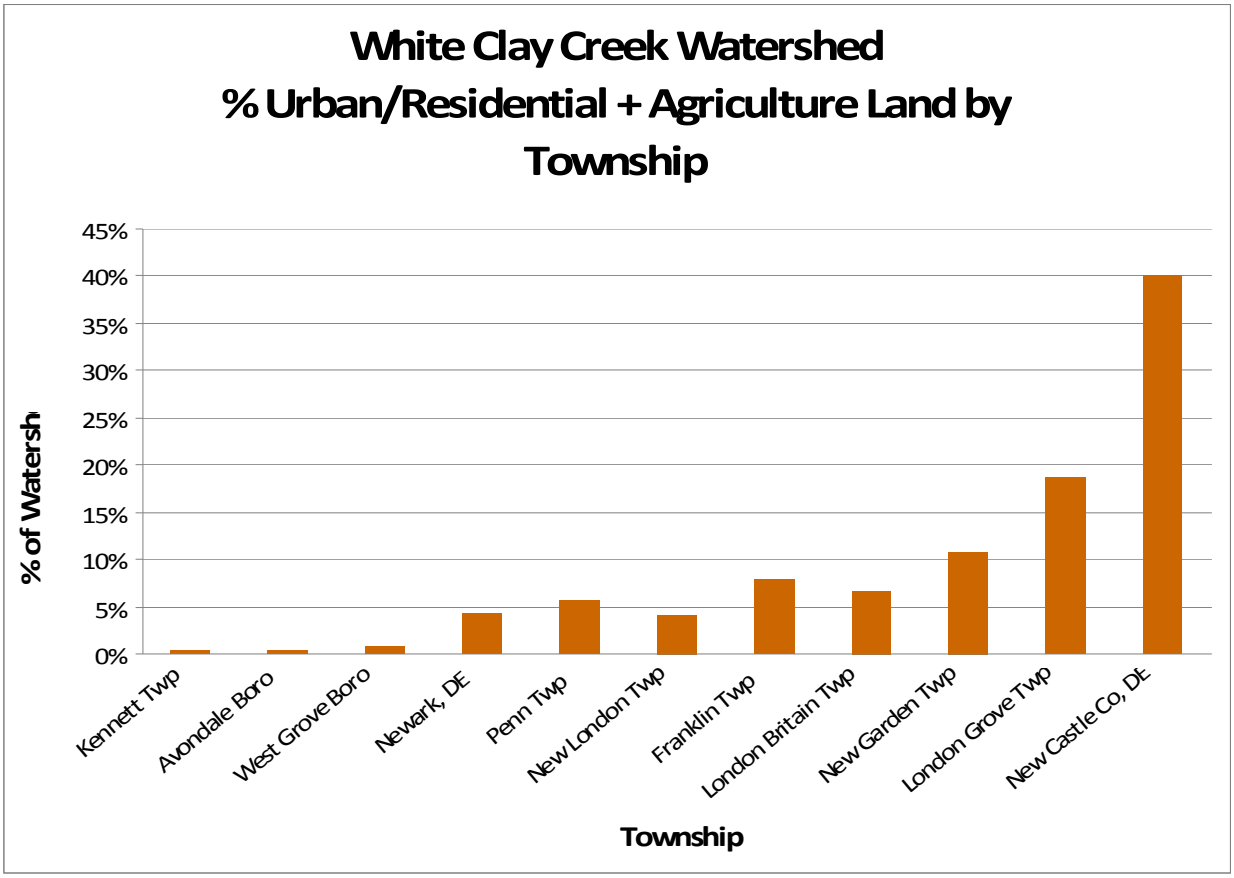

Brandywine Creek Watershed
% Land Use by Township
% of Watersh
18%
16%
14%
12%
10%
8%
6%
4%
2%
0%
West Caln Twp
Honey Brook Twp
Honey Brook Boro
East Brandywine Twp
Upper Uwchlan Twp
Uwchlan Twp
Downingtown Boro
East Caln Twp
West Goshen Twp
Thornbury Twp
Birmingham Twp
Pennsbury Twp
Kennett Twp
New Castle Co, DE
Wilmington, DE
West Brandywine Twp
Parkesburg Boro
Highland Twp
Coatesville City
Valley Twp
Sadsbury Twp
East Fallowfield Twp
Modena Boro
West Bradford Twp
Newlin Twp
Pocopson Twp
East Marlborough Twp
East Bradford Twp
Wallace Twp
Township
Urban/Residential
Agriculture
Open Land/Forest

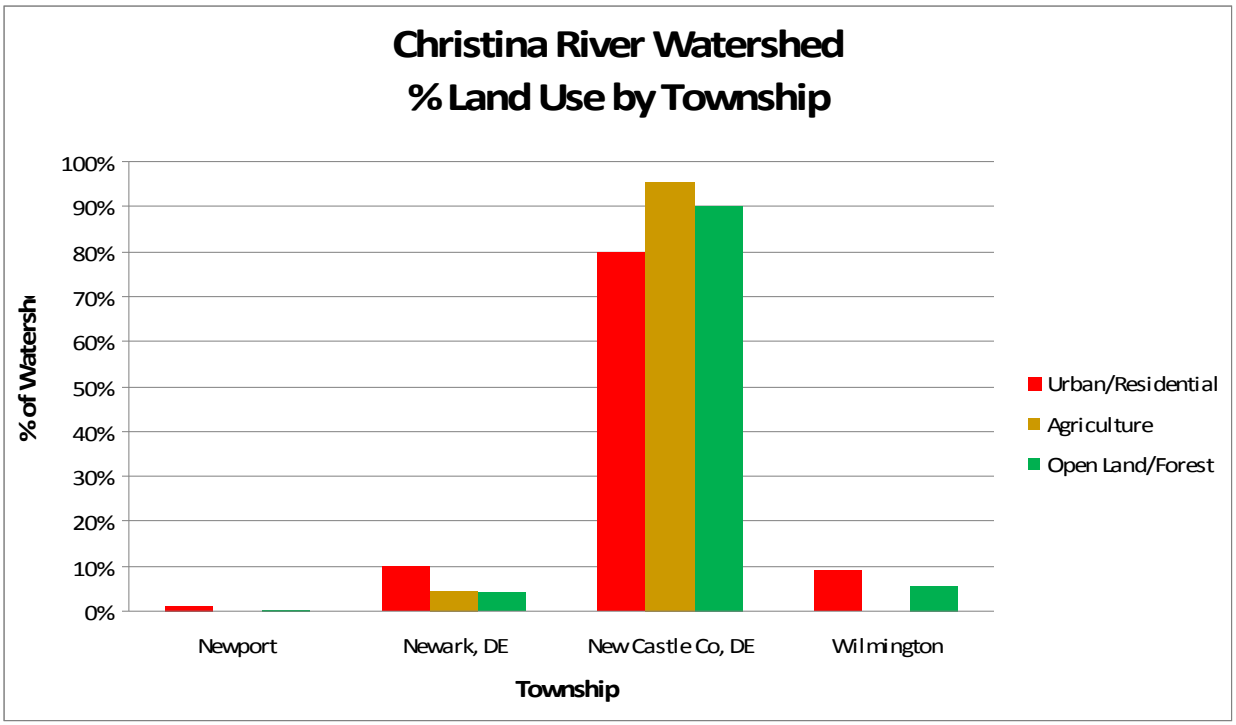

Brandywine Creek Watershed
% Urban/Residential + Agriculture Land by Township
% of Watersh
12%
10%
8%
6%
4%
2%
0%
West Caln Twp
Honey Brook Twp
Honey Brook Boro
East Brandywine Twp
Upper Uwchlan Twp
Uwchlan Twp
Downingtown Boro
East Caln Twp
West Goshen Twp
Thornbury Twp
Birmingham Twp
Pennsbury Twp
Kennett Twp
New Castle Co, DE
Wilmington, DE
West Brandywine Twp
Parkesburg Boro
Highland Twp
Coatesville City
Valley Twp
Sadsbury Twp
East Fallowfield Twp
Modena Boro
West Bradford Twp
Newlin Twp
Pocopson Twp
East Marlborough Twp
East Bradford Twp
Wallace Twp
Township


Red Clay Creek Watershed
% Land Use by Township
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
% of Watersh
Pennsbury Twp
Kennett Square Boro
New Garden Twp
East Marlborough Twp
Kennett Twp
New Castle Co, DE
Township
Urban/Residential
Agriculture
Open Land/Forest


Red Clay Creek Watershed
% Urban/Residential + Agriculture Land by Township
40%
35%
30%
25%
20%
15%
10%
5%
0%
% of Watersh
Pennsbury Twp
Kennett Square Boro
New Garden Twp
East Marlborough Twp
Kennett Twp
New Castle Co, DE
Township


White Clay Creek Watershed
% Land Use by Township
70%
60%
50%
40%
30%
20%
10%
0%
% of Watersh
Kennett Twp
Avondale Boro
West Grove Boro
Newark, DE
Penn Twp
New London Twp
Franklin Twp
London Britain Twp
New Garden Twp
London Grove Twp
New Castle Co, DE
Township
Urban/Residential
Agriculture
Open Land/Forest


White Clay Creek Watershed
% Urban/Residential + Agriculture Land by Township
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
% of Watersh
Kennett Twp
Avondale Boro
West Grove Boro
Newark, DE
Penn Twp
New London Twp
Franklin Twp
London Britain Twp
New Garden Twp
London Grove Twp
New Castle Co, DE
Township


Christina River Watershed
% Land Use by Township
100%
90%
80%
70%
60%
50%
40%
30%
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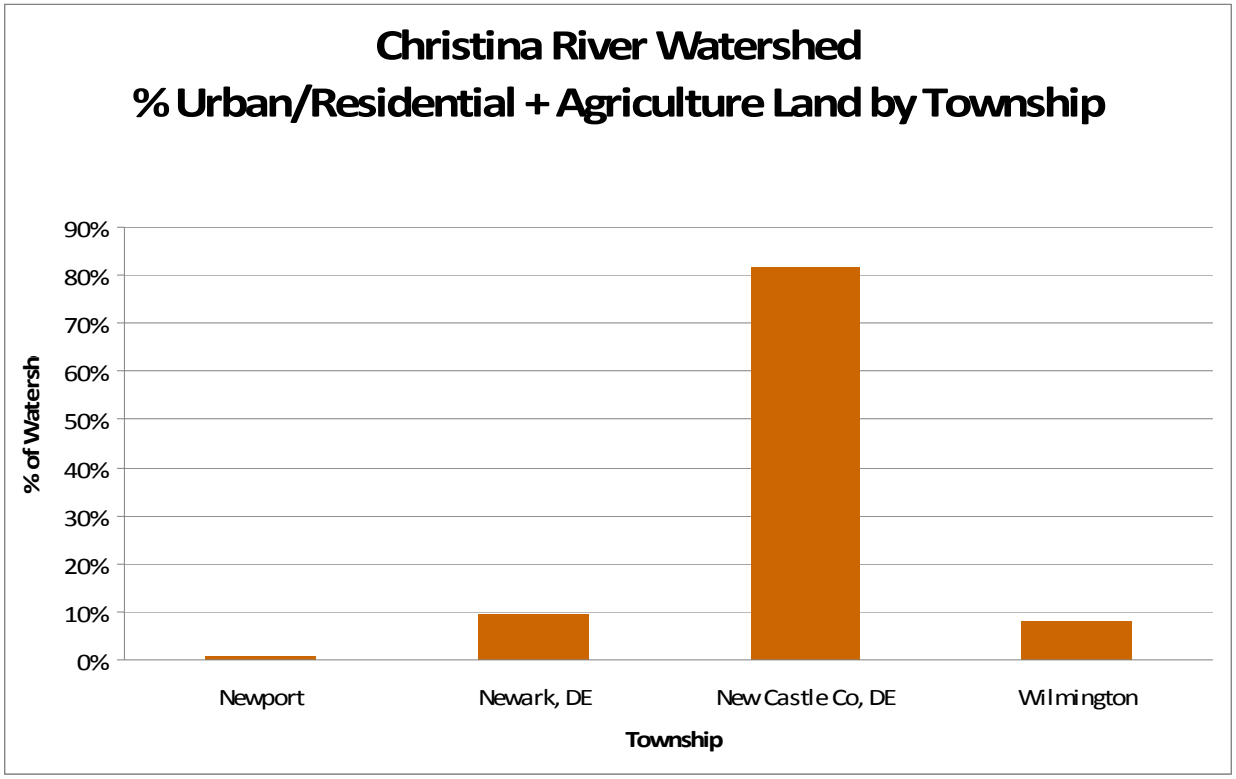
Newport
Newark, DE
New Castle Co, DE
Wilmington
Township
Urban/Residential
Agriculture
Open Land/Forest


Christina River Watershed
% Urban/Residential + Agriculture Land by Township
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
% of Watersh
Newport
Newark, DE
New Castle Co, DE
Wilmington
Township

MEMORANDUM OF AGREEMENT

AMONG

The Delaware River Basin Commission, the United States Environmental Protection Agency, the State of Delaware, the State of Pennsylvania, Chester County, the Town of Coatesville, the Town of Downingtown, the Borough of West Chester, New Castle County, the City of Newark, the City of Wilmington, the Delaware Nature Society, the Brandywine Valley Association/Red Clay Valley Association, the Chester County Water Resources Authority, the Chester County Conservation District, and the University of Delaware Institute for Public Administration-Water Resources Agency

REGARDING

Bi-state Integrated Efforts to Meet the National Total Maximum Daily Load Goals Set for the Christina Basin to Meet the Fishable, Swimmable, and Potable Standards by 2015

WHEREAS, the Christina Basin contains 565 square miles of land in its watershed that spans three states, Delaware, Maryland, and Pennsylvania; and,

WHEREAS, the headwaters begin in Pennsylvania and Maryland and flow through the Piedmont hills of northern New Castle County in Delaware to the Delaware River at Wilmington; and,

WHEREAS, the waters in the Christina Basin are the source of public surface water supply for over half million people in the Basin with over 75 percent of the population served in New Castle County and most of the water supply withdrawals in Chester County; and,

WHEREAS, the waters of the Christina Basin provide many recreational, cultural, and ecological opportunities as well as important habitat for wildlife, aquatic life, and plant life; and,

WHEREAS, since 1993 the United States Environmental Protection Agency, the Delaware River Basin Commission, and the two states have worked together and developed an integrated framework for coordination through the Christina Basin Water Quality Management Committee to resolve water quality problems involving the waters of the Christina Basin in Delaware and Pennsylvania; and,

WHEREAS, in 2001 the Christina Basin Water Quality Management Committee, now known as the Christina Basin Clean Water Partnership, received the USEPA's Targeted Watershed Initiative Grant for $1 million and demonstrated its ability to work collectively to implement over $1 million in best management practices and education efforts throughout the Basin; and,

WHEREAS, despite the ongoing efforts, and bearing in mind there have been improvements in water quality, the waters of the Christina Basin remain on the Clean Water Act list of impaired waters thereby requiring a total maximum daily load set in April 2005; and,

NOW, THERFORE, we, the undersigned executives representing the municipal, county, state, regional, federal, private, and nonprofit entities agree that we will:

- Work toward a bi-state integrated approach to meet the total maximum daily loads in the Christina Basin in an attempt to remove these waters from the Clean Water Act list of impaired waters.
- Collectively, as well as individually, seek new ideas, aim to use the most cost-effective solutions, and remain committed to the goal of achieving the nutrient, bacteria, and sediment goals set for the waters of the Christina Basin.
- Maintain an open and public-oriented process, with the intent to encourage public participation at all times.
- Carry on the past commitments and efforts of the federal, regional, state, and county agencies, the nonprofit organizations, and other groups.

BY this agreement, we formalize the ongoing collaborative, fair, and equitable multi-agency effort to improve the water quality in the Christina Basin among the Delaware River Basin Commission, the United States Environmental Protection Agency, the State of Delaware, the State of Pennsylvania, Chester County, the Town of Coatesville, the Town of Downingtown, the Borough of West Chester, New Castle County, the City of Newark, the City of Wilmington, the Delaware Nature Society, the Brandywine Valley Association/Red Clay Valley Association, the Chester County Water Resources Authority, the Chester County Conservation District, and the University of Delaware Institute for Public Administration-Water Resources Agency. We agree to remain committed to the common goal of a swimmable, fishable, and potable Christina Basin.

SIGNATORIES

Federal

For the United States
Environmental Protection Agency _____

Regional

For the Delaware River Basin Commission _____

Delaware

For the State of Delaware _____

For New Castle County _____

For the University of Delaware's
Institute for Public Administration-
Water Resources Agency _____

For the City of Wilmington _____

For the City of Newark _____

Pennsylvania

For the State of Pennsylvania _____

For Chester County _____

For the Chester County
Water Resources Authority _____

For the Chester County Conservation District _____

For the Town of Coatesville _____

For the Town of Downingtown _____

For the Borough of West Chester _____

Nonprofit Entities

For the Delaware Nature Society _____

For the Brandywine Valley Association/
Red Clay Valley Association _____

For the Christina Conservancy _____

SUMMARY TABLE OF RECOMMENDED BMPS FROM THE DELAWARE POLLUTION CONTROL STRATEGY AND THE PENNSYLVANIA WATERSHED ACTION PLANS

Recommended BMP	DE	PA	Recommended Implementer(s)
Stormwater			
Complete implementation of High Flow TMDLs		X	USEPA, DRBC, PA DEP, DNREC
Require urban tree canopy.	X		DNREC (Watershed Assessment Section), NCC, municipalities, Delaware Center for Horticulture, developers
Require stormwater BMPs be designed to reduce nutrients according to the TMDLs.	X		DNREC (Division of Water Resources and Division of Soil and Water Conservation)
Limit addition of new impervious cover to less than 20 percent of the watershed above public water supply intakes.	X		Developers, City of Wilmington, City of Newark, NCC
Promote LID in new construction and redevelopment.	X		Developers
Implement comprehensive stormwater management ordinances.	X	X	Local engineers, White Clay Creek Wild and Scenic Management Committee, Christina Basin Clean Water Partnership, RCVA, BVA, City of Wilmington, City of Newark, NCC, CC Planning Agencies, CCWRA, CCCD
Expand the role of RPTAC to create a Christina Basin group responsible for reviewing new development applications.	X		NCC
Implement a stormwater utility.	X		Municipalities, NCC, DNREC
Maintain BMPs.	X		Municipalities, NCC, DNREC
Reduce and manage existing impervious cover.	X		Municipalities, NCC, DNREC
Identify areas where stormwater retrofits would effectively reduce sediment and nutrients.	X		NCC, NC Conservation District
Implement pilot urban stormwater runoff improvement projects within or downstream of developed area to reduce impacts of urban runoff (2 RC, 4 BC, 4 WC)		X	Kennett Square, Kennet, , RCVA, municipality where project is located, CCCD, PA DEP, NCC municipality where project is located, UD IPA-WRA, NCCD, DNREC
Implement suburban runoff retrofit projects to reduce peak rate and/or volume of runoff and reduce nonpoint source pollutant runoff (2 RC, 4 BC, 2 RC).		X	Kennett Square, Kennett Township, RCVA, Chester County municipality where project is located, Chester County Conservation District, PA DEP, NCC municipality where project is located, UD WRA, NCCD, DNREC
Establish an expanded Watershed Watch program throughout the watershed.		X	BVA
Implement NPDES Phase II requirements in regulated PA municipalities		X	PA municipalities, conservation districts, PA DEP

Recommended BMP	DE	PA	Recommended Implementer(s)
Open Space			
Map, inventory, and prioritize existing wooded open space areas.	X		UD IPA-WRA, nonprofit and government organizations in the Basin with existing data
Protect existing wooded/vegetated open space areas.	X		NCC, DNREC (Division of Parks and Recreation), municipalities, private and nonprofit conservancies
Require management plans for community and HOA open space areas.	X		DNREC (Watershed Assessment, Urban Nutrient Management)
Require forested riparian buffers of adequate and proper widths sufficient to reduce or eliminate nonpoint source pollution for all new development abutting all waters of the state—including private/state/county land. Encourage establishing and restoring forested riparian buffers on existing development abutting all waters of the state—including private/state/county land. (PA, specifically first order streams with 15%of streams goal (for new buffers) and protection for 30% of streams (for existing buffers) and an overall priority on establishing buffer networks)	X	X	USDA NRCS, nongovernmental land conservancies, county conservation districts, RCVA, municipalities, county agencies, land conservancies,
Implement stream restoration projects.	X		DNREC (Division of Soil and Water Conservation)
Implement pilot geomorphology based stream restorations for several degraded stream reach to restore instream flow regime and habitats (1 RC, 6BC, 2 WC).		X	Chester County, municipalities, BVA, NCCD, DNREC, CCCD
Acquire/conserve additional open space and retain conservation easements.	X		DNREC (Division of Parks and Recreation), State of Delaware Open Space Council, NCC (Department of Special Services), City of Newark (Department of Parks)
Focus open space land preservation in the drainage areas of first order streams and water supply reservoirs and intakes; wellhead protection zones; woodlands; and floodplains.		X	Nongovernmental land conservancies, land owners, developers, County planning agencies
Reforest watersheds and headwaters.	X		Delaware Department of Agriculture, Delaware Nature Society, NCCD

Recommended BMP	DE	PA	Recommended Implementer(s)
Wastewater			
Require OWTS performance standards, and conduct inspections and pump-outs.	X		DNREC (Division of Water Resources and Groundwater Discharges Section)
Eliminate cesspools and seepage pits.	X		DNREC (Division of Water Resources and Groundwater Discharges Section), NCC (Department of Special Services)
Remove OWTS through connection to centralized WWTP.	X		NCC (Department of Special Services)
Prohibit new OWTS drainfields within 100 feet of wetlands, tidal waters, perennial streams, perennial ditches, and ponds in-line with perennial watercourses.	X		DNREC (Division of Water Resources and Groundwater Discharges Section), NCC (Department of Special Services)
Implement City of Wilmington CSO Remediation Plan	X	X	State of Delaware, City of Wilmington, USEPA
Continue sewer repair projects and conduct regular inspections.	X		NCC (Department of Special Services), City of Newark (Water and Wastewater Department), City of Wilmington (Public Works Department)
Eliminate runoff from and remediate contaminated substance sites.	X	X	DNREC (Division of Air and Water Management), USEPA, property owners, UD IPA-WRA

Recommended BMP	DE	PA	Recommended Implementer(s)
Agriculture			
Nutrient management plans.	X		USDA-NRCS, NCCD, Delaware Department of Agriculture, PA USDA-NRCS, UD IPA-WRA,
Cover crops.	X		USDA-NRCS, NCCD, Delaware Department of Agriculture, PA USDA-NRCS, UD IPA-WRA,
Pasture stream fencing and cattle crossings.	X	X	USDA-NRCS (PA and DE), NC and CC Conservation Districts, Delaware Department of Agriculture, UD IPA-WRA, agriculture land operators
Grassed filter strips.	X		USDA-NRCS, NCCD, Delaware Department of Agriculture, PA USDA-NRCS, UD IPA-WRA,
Grassed waterways.	X		USDA-NRCS, NCCD, Delaware Department of Agriculture, PA USDA-NRCS, UD IPA-WRA,
Forested riparian buffers.	X	X	USDA-NRCS (PA and DE), NC and CC Conservation Districts, Delaware Department of Agriculture, UD IPA-WRA, agriculture land operators
Pasture and hay planting.	X		USDA-NRCS, NC Conservation District, Delaware Department of Agriculture, PA USDA-NRCS, UD IPA-WRA,
Prepare, update, and implement soil and water conservation plans and practices on all crop farm lands.		X	USDA-NRCS (PA), CC Conservation Districts, Delaware Department of Agriculture, UD IPA-WRA, agriculture land operators
Implement manure management plans and facilities to eliminate runoff from barnyards to streams or infiltration to groundwater and to avoid winter spreading of manure (10 WC, 20 BC, 5 RC)		X	NRCS, NC and CC Conservation Districts, agricultural land operators

Recommended BMP	DE	PA	Recommended Implementer(s)
Education			
Educate Christina Basin stakeholders on nonpoint source pollution and their role in reducing it, specifically targeting behavior change.	X		Nonprofit, private, government entities
Encourage nutrient management plans for turf fields at education facilities.	X		Nonprofit, private, government entities
Encourage golf course managers to decrease nutrient application, stormwater runoff, and erosion.	X		Nonprofit, private, government entities
Educate pet owners on cleaning up pet waste.	X		Nonprofit, private, government entities
Educate homeowners and implement programs for residential stormwater BMPs, BMP maintenance, and nutrient reduction.	X	X	Nonprofit, private, government entities, NC and CC Conservation districts, BVA, UD IPA-WRA
Integrate education into state and local permitting processes.	X		Nonprofit, private, government entities
Encourage corporate environmental stewardship programs.	X		Nonprofit, private, government entities
Coordinate nonprofit organizations throughout the basin.	X		Nonprofit, private, government entities
Support and encourage water conservation and water quality measures to reduce nutrients leaving a site.	X		Nonprofit, private, government entities
Work with organizations to provide education programs on lawn and garden BMPs.	X		Nonprofit, private, government entities
Advise DNREC to research nutrient reductions related to bacteria counts and BMPs.	X		Nonprofit, private, government entities

Recommended BMP	DE	PA	Recommended Implementer(s)
Monitoring			
Establish a Long-Term Water Quality and BMP monitoring program to monitor progress and identify problems in the watershed.	X	X	PA DEP, DNREC, USGS, DRBC, CCWRA, NC and CC Conservation Districts

Recommended BMP	DE	PA	Recommended Implementer(s)
Water Supply/Wastewater Planning and Protection			
Prepare and implement Integrated Water Resources Plans (IWRPs) (for Chester County portion of watershed (RC), 3 growth regions including East Branch Brandywine Creek above Downingtown, Honey Brook, West Branch Brandywine below Coatesville).		X	Municipalities, county agencies, purveyors
Complete Source Water Assessment underway for surface water intake, and prepare Source Water Protection Plan (6 in BC)		X	PA DEP, DNREC, water suppliers, county agencies, UD IPA-WRA
Complete wellhead protection plans for groundwater based public water supply systems in PA (4 in RC, wells addressed in Rivers Conservation Plan in BC, 5 in WC)		X	Utilities, public water supply well owner, municipality where well is located, county agencies, BVA, RCVA
Complete wellhead protection plan for Honey Brook Borough Water Authority		X	Honey Brook Borough Water Authority, Honey Brook Township, PA DEP
Develop and implement lake management plan and water quality monitoring program (if they do not exist) (for Hoopes Reservoir in RC, 4 water supply reservoirs in BC)		X	Reservoir owners, City of Wilmington
Provide groundwater budget information and data to municipalities for use in decision making		X	CCWRA, BVA, RCVA
Protect stream water quality and ground water recharge through conversion of point source discharges of treated effluent to land application systems.		X	PA DEP, County agencies, BVA, RCVA