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*White Clay Creek Wild and Scenic River  
Management Plan Implementation*

*Five-Year Performance Report (2014-2018)*

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# **White Clay Creek Wild and Scenic River Management Plan Implementation**

*Five-Year Performance Report (2014-2018)*

## **WHITE CLAY CREEK CONTEXT AND BACKGROUND**

**Land:** In 2000, the United States Congress designated the entire 107 -square - mile [more than 69,000 acres drainage] White Clay Creek watershed, including 190 stream miles, in Southeastern Pennsylvania and Northern Delaware as part of the National Wild and Scenic Rivers system. In 2014, nine more stream miles were added to the designation thanks to the passing of the White Clay Creek Expansion Act bringing the total stream miles to 199. The White Clay Creek's outstandingly remarkable historic, cultural, and natural resources led to it becoming the Nation's first National Wild and Scenic River to be protected on a watershed basis. The White Clay Watershed Association, in partnership with the White Clay Creek Wild and Scenic Steering Committee and National Park Service, are charged with implementing the White Clay Creek Management Plan and promoting the long-term protection of the watershed.

The White Clay watershed is one of only a few relatively intact, unspoiled and ecologically functioning river systems remaining in the highly congested and developed corridor linking Philadelphia, Pennsylvania, with Newark, Delaware. About 130,000 people live within its boundaries, which includes portions of Chester County in southeast Pennsylvania and New Castle County in northwest Delaware. The Chester County portion is largely rural with a few small towns and villages and some suburban clusters. It includes the East, Middle, and West branches and the headwaters of the mainstem. The White Clay then flows into Delaware and is joined by Middle Run, Pike, and Mill creeks before emptying into the Christina River. The East Branch, West Branch, Middle Branch, Middle Run, Pike Creek, and Mill Creek are all federally designated tributaries of the White Clay Creek National Wild & Scenic River. The Delaware portion includes the City of Newark and is characterized by suburbanization, but several very large tracts of public open space flank the river as well.

**Water Facts:** Normal rainfall averages 44 inches per year; the watershed includes the Cocksylvia aquifer, which is an important source of drinking water and supplies continuous and relatively high base flows in the stream. The creek itself also serves as a major drinking water source for much of northern Delaware.

**Outstanding Resources:** Lime Kilns and 19th century mills; neotropical migrant birds, including the Cerulean Warbler; the federally listed endangered Bog Turtle; the most extensive mature Piedmont forests remaining in the State of Delaware; and the Cocksylvia marble formations, an exceptional aquifer.

**Open Space and Recreation:** About 29% of the watershed is protected open space including the 5000+ acre bi-state White Clay Creek Preserve which is maintained as a nature area accommodating passive recreation. The White Clay Creek is one of the few and most heavily stocked trout streams and thus a popular fly--fishing

destination. Other recreational opportunities in the watershed include hiking, jogging, bird watching, picnicking, horseback riding, biking, cross country skiing, swimming, and limited deer hunting.

### ***MISSION***

The White Clay Creek Wild and Scenic Program (WCWSP) promotes and supports the preservation, protection, restoration, and enhancement of natural and cultural resources, in addition to encouraging a balance of recreational enjoyment of the White Clay Creek watershed in Pennsylvania and Delaware. The Program and its members are responsible for implementation of the White Clay Creek and Its Tributaries Watershed Management Plan dated May 1998 (amended Summer 2001).

The White Clay Watershed Association (WCWA) is the umbrella organization that is responsible for the Program's financial accounting and coordination of the White Clay Creek Wild & Scenic Steering Committee activities. The WCWA is a 501(C)(3) organization incorporated in the Commonwealth of Pennsylvania (EIN 23--7116453). The WCWA is a non-profit community organization dedicated to the protection and improvement of the environmental quality of the White Clay Creek and valley.

### ***PROGRAM GOALS & OBJECTIVES***

The Wild and Scenic Steering Committee works with our federal, state, county, and municipal agencies and private organizations to: improve and conserve water quality and water quantity; conserve open space, woodlands, wetlands and geologic features; protect native plant and animal species; preserve cultural, historical and archaeological sites; enhance outdoor recreation opportunities; and encourage environmental education and outreach throughout the White Clay Creek watershed.

The following objectives support the mission and goals of the White Clay Creek Watershed Management Plan:

1. Maintain stream flow and maintain or improve water quality to revitalize fisheries and enhance recreational and scenic qualities, while accommodating legitimate demands for water supply, waste assimilation, commercial, industrial and agricultural uses.
2. Foster the protection, enhancement and stewardship of the natural, cultural and recreational resources of the watershed for the benefit and enjoyment of present and future generations.
3. Encourage coordination and consistency among existing levels of government, businesses, organizations and individuals to facilitate implementation of the management plan, without creating a new regulatory agency.
4. Promote public recognition of the White Clay Creek watershed as a place with its own identity, continuing history and a future to be shaped by its residents.
5. Manage growth to protect the watershed's special qualities, while emphasizing the rights of property owners and existing local control.

## **WATERSHED MANAGEMENT CONCERNS**

The primary concern for White Clay Creek is the protection and improvement of water quality and stream habitat. Urbanization along with years of agriculture in the upper watershed has contributed to both states designating more than 75% of the stream miles as “impaired.” Increased storm water volume and high nutrient (nitrates and phosphates), sediment, and bacterial levels currently account for much of the water quality impairment. Much of the work of the 2014-2018 NPS-WCWA Cooperative Agreement focused on investigating and addressing the sources of these impairments, targeting projects to improve them, and creating new programming aimed at finding a niche for the Wild and Scenic Program not currently filled by other organizations working in our area. Our overall management strategy takes a holistic approach involving public outreach and education, stream monitoring, restoration, and land preservation to improve water quality in White Clay watershed.

## **PROGRAM IMPACTS AND MAJOR ACCOMPLISHMENTS (2014-18)**

### **COMMUNITY OUTREACH**

Throughout the year the White Clay Wild and Scenic River Program hosts, co-hosts, and supports several education and outreach activities. Our programs increase general awareness of the watershed and its issues, and raise awareness and appreciation for the natural, cultural and recreational resources of the watershed. Our largest outreach event, the annual White Clay Creek Fest hosted at White Clay Creek State Park, is a four-hour outdoor celebration that brings members of the community, local nonprofits, and local private businesses together to share information and celebrate the natural resources of the watershed. This event is supported by SUEZ (a local water purveyor), Delaware State Parks, and Mushroom Growers of Pennsylvania. Fest goers can attend several hikes and activities offered throughout the event, and enjoy live music, local food and live entertainment while learning about the watershed. Attendance at this event has grown annually from its inception in 2008 from 200 to 1600 in 2018. In addition to increased event attendance, we also have the on-going support of 32 local nonprofit, county and state exhibitors who participate each year to make the event a success.

In addition to our largest outreach event, the White Clay Wild and Scenic Program hosts several smaller workshops for watershed residents and township officials on Best Management Practices for the White Clay. We also contribute articles regularly to municipal newsletters. Through smaller workshops and personalized newsletter articles we hope to increase awareness and appreciation for the natural resources of the White Clay by providing a sense of place and practical advice that can be applied by watershed residents and employers alike, such as conservation landscaping and property management tips. Finally, in 2015, we updated and moved the [Whiteclay.org](http://Whiteclay.org) website to the Squarespace platform combining the WCWA and WCWS programs into one cohesive site. The website is continually updated and used to disperse watershed information.

### **List of Presentations (2014-2018):**

*Cleaning Water with Native Plants: Successful Detention Basin Retrofits*, co-presented with Claudia West, Society for Ecological Restoration Mid-Atlantic Chapter's 10<sup>th</sup> Annual Conference. (2015)

*White Clay Creek Wild and Scenic Program*, Gardening Lecturer Series at the Osher Lifelong Learning Institute at the University of Delaware, Wilmington. (2016)

*White Clay Creek Wild and Scenic Program Strategic Issues Planning*, University of Delaware Nonprofit Management Certificate Course. (2016)

*White Clay Bacteria Monitoring Research*, Christina Basin Task Force Meeting. (2016)

*Catch the Rain: Using Green Infrastructure to Clean Water*, co-presented with the Brandywine Conservancy. (multiple workshops, 2016-18)

*White Clay Bacteria Research and Source Tracking*, Chester County Watersheds Roundtable. (2017)

*White Clay Creek Partnership Wild and Scenic River Model*, Brandywine Christina Watershed Conference. (2018)

*White Clay Creek Volunteer Opportunities*, Chester County Master Watershed Stewards Program. (2018)

### **List of publications:**

*White Clay Wild and Scenic River Program Annual Updates (2014-2018)*. Also posted online at <http://whiteclay.org/reports/>.

Co-produced educational videos with Delaware Nature Society and The University of Delaware Water Resource Center entitled: *Christina Connections: What is a watershed and Christina Connections: Why does clean water matter to you?* (2014-15) Also published online at <http://whiteclay.org/videos-wcl/>.

*What's in Your Watershed?* (2014, New Garden and London Grove Township Newsletters)

*Open Space and Water Quality: Partners for Life*. (2014, New Garden Township Newsletter)

*What's your Watershed IQ?* (2014, New Garden and London Grove Township Newsletters)

*Is a Low Salt Diet in Order for the White Clay?* (2015, New Garden and London Grove Township Newsletters)

*Partnership Wild and Scenic Rivers: A Win-Win for River Management - Case Study: White Clay Creek, DE/PA* (2015, American Rivers Guest Blog)

*A win-win for White Clay Creek in New Garden Township: 7 stream miles gain protection!* (2015, New Garden Township Newsletter)

*How to Keep Our Water Safe from Hidden Germs*. (2015, New Garden Township Newsletter)

*What's Happening in New Garden Park? Improved Land Practices Promote Healthy Streams.* (2015, New Garden Township Newsletter)

*How Can Parks Improve Water Quality?* (2015, London Grove Township Newsletter)

*Planting for Improved Habitat: Curtis Mill Park.* (2015, City of Newark Newsletter)

*Landenberg Junction Trail.* (2015, New Garden Newsletter)

*White Clay Creek State of the Watershed Report.* (2016, University of Delaware Water Resources Center)

*Can't cut calories? Try a pollution diet instead.* (2016, New Garden and London Grove Newsletters)

*Catch the Rain! Get Creek Wise in White Clay.* (2016, New Garden and London Grove Township Newsletters, Brandywine Conservancy Newsletter)

*Municipalities in the White Clay Creek Watershed Agree to Collaborate on Water Quality* (2016, New Garden Township Newsletter; 2017, London Grove Township Newsletter)

*Join the Friends of New Garden Trails and other local groups for a fulfilled day at the White Clay Creek Fest!* (2017, New Garden Newsletter)

*Avon Grove Intermediate School Students Engage in Experiential Learning on White Clay Creek.* (2017, London Grove Township Newsletter)

*Learn how to Catch the Rain.* (2017, Chester County Press)

*Monitoring for Road Salt Pollution: Mill Creek* (2018, Delaware Nature Society Blog)

*Local Residents Engage in Helping the Environment One Measurement at a Time.* (2018, New Garden and London Grove Township Newsletters)

*Stormwater and Streams: Middle Run.* (2018, Delaware Nature Society Blog)

*Beautify your Neighborhood, Save Money and Help the Environment!* (2018, London Grove Township)

## **SCHOOL PROGRAMS**

White Clay Wild & Scenic River Program provides environmental education awards, which include funding for programming and transportation, to provide school children with the means and opportunity to learn about the watershed in a fun, hands--on way by immersing them in studies on watershed flora and fauna, history, and ecological functions. Over the past five years we have partnered with Stroud Water Research Center to provide varied opportunities for local school children grades 4-12 to explore, enjoy and experience the White Clay.

## Overview of School Programming (2014-2018)

Year	# Students Served	WCWS Cost	Match	Total Program Cost	Total Cost / Student	WCWS Cost / Student
2014	66	\$ 1,420	\$ -	\$ 1,420	\$ 22	\$ 22
2015	31	\$ 700	\$ 225	\$ 925	\$ 30	\$ 23
2016	849	\$ 3,833	\$ 11,850	\$ 15,683	\$ 18	\$ 5
2017	856	\$ 2,860	\$ 11,200	\$ 14,698	\$ 17	\$ 3
2018	824	\$ 2,118	\$ 13,230	\$ 15,348	\$ 19	\$ 3
<b>Totals</b>	<b>2626</b>	<b>\$ 10,931</b>	<b>\$ 36,505</b>	<b>\$ 48,075</b>	<b>\$ 18</b>	<b>\$ 4</b>

Post-secondary students benefit from participating in our summer intern program. This program began in 2013 and has continued through 2018 with assistance from both the Delaware Nature Society and Stroud Water Resource Center. To date, the program has provided relevant work experience to eight college students. Students gain hands-on experience in watershed science and management and are tasked to conduct our summer water quality sampling. This involves both field and lab work as well as some data management and analysis. The students return to their respective colleges prepared to share what they have learned with other students and to embark on a potential career pathway towards the environmental sciences.


### ***INTERPRETIVE SIGNAGE***

Finally, throughout the 2014-18 period we worked with a graphic designer to create new interpretive signage for specific watershed projects as well as generic 'best management practices' signs that could easily be placed as needed throughout the watershed to identify green stormwater infrastructure. Interpretive signage was developed for Curtis Mill Park (2014, Newark, DE), Goddard Park Rain Basin (2015, London Grove Township, PA), Hunt at Louviers Stormwater Basin Retrofits (2015, Newark, DE), and the Newark Reservoir (2017, Newark, DE). The BMP marker signage has been utilized by New Garden Township at their Township Park and community trails, and at the Franklin Township Building rain garden.


## Streamside Buffer

**This buffer will help to slow runoff and let it soak into the ground.**

**Streamside buffers reduce flooding, replenish groundwater and remove pollutants that would otherwise flow to local waters. Streamside buffers also provide food and shelter for insects, birds, and animals.**



**WHITE CLAY CREEK**  
National Wild & Scenic River  
Ours to Enjoy Ours to Protect.




[www.whiteclay.org](http://www.whiteclay.org)


## No Mow Zone

**This no mow zone will help to slow runoff and let it soak into the ground.**

**No mow zones reduce erosion, replenish groundwater and remove pollutants that would otherwise flow to local waters. Properly managed no mow zones provide food and shelter for insects, birds, and animals.**



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Three examples of our BMP Marker signs (top row). These signs are available for any of our partners to use throughout the watershed at locations approved by the watershed management coordinator. Site specific interpretive signage (bottom) located at Newark Reservoir, Newark, DE.



Vandalized and weather worn road signs throughout the watershed were also updated and replaced following a road sign inventory completed by one of our student interns. All existing sign locations were located and mapped to create the inventory. Photos were taken and sign replacements were prioritized based on current status and provided to watershed municipalities. New signs were designed and distributed to each municipality for replacement throughout 2016.



*Vandalized and weathered road side signage (above). New signage (below) – Note these were designed to replace outdated road signs, but in this case the sign was also used in the White Clay Creek State Park adjacent to a trail entrance along the main stem.*

## **RESTORATION**

### **Water Quality Monitoring**

Pathogenic bacteria are a potential issue in White Clay streams. To understand the extent of this impairment the Wild and Scenic Program initiated a recreational season bacteria sampling program utilizing summer interns. The program was initiated in 2012 at 5 sites in the Pennsylvania portion of the watershed using volunteers and funding and technical assistance from PA DEP. Initial data indicated high levels of bacteria throughout the watershed and correlated with USGS sampling in the White Clay Creek Preserve. Following 3 seasons of sampling (2012- 2014), 67 stream miles were added to the Pennsylvania Department of Environmental Protection impaired streams list for exceeding water quality standards for bacteria.

We continued our bacteria sampling in 2015 and added more upstream locations. We also partnered with the University of Delaware Water Resource Center to create land use maps for catchment basins at all of our sampling sites to gain a better understanding of what could be contributing to this impairment. Finally, in 2016 we began working with Stroud Water Resource Center to conduct microbial source tracking on select samples. The land use maps helped locate potential sources of fecal contamination (for example: dairy, equine, human, geese, mushroom compost) upstream of our sampling locations. Throughout 2016-2018 we collected fecal matter from areas in the watershed that could be contributing to the high counts and ran several analyses on our samples using qPCR and DNA fingerprinting techniques to determine the presence or absence of suspected bacterial sources and their relative abundance. We hope that as we gather more data we will be able to more accurately pinpoint predominant sources and more effectively target outreach and restoration to those areas/landowners that will be most cost effective in terms of reducing pollutants. Initial results from qPCR indicate human sources of fecal bacteria in all samples tested. This could be from faulty septic and failing sewer infrastructure.

In 2017 we received technical and financial assistance from Stroud Water Research Center to install continuous stream sensors at select locations. As a participant in this citizen science initiative, Stroud provides training and technical assistance to local watershed organizations and their volunteers throughout the year. Three citizen scientists participated in the trainings and helped with sensor deployment in the White Clay. These trained volunteers continue to help with sensor management and troubleshooting, uploading data, taking discharge measurements and collecting grab samples for specific pollutants (Nitrate, orthophosphate, total suspended solids, and chlorides). These data will provide baseline information on streams that haven't been assessed by state agencies and help to detect changing water quality trends over time. Ultimately, this information will inform decisions regarding land use, land management, and land protection – all of which have a significant impact on water quality and stream health.



*Citizen scientists Marion Waggoner and Dave Yake (left); Student volunteer helping to clean sensor stations after storm events (middle); Summer intern with the Delaware Nature Society taking water chemistry measurements along the main stem (right).*

Another citizen scientist is using his background in software engineering to create a stream data analysis program to interpret collected data. This software program is currently being tested by the White Clay Wild and Scenic Program in collaboration with the Delaware Nature Society's Stream Watch Program and The Nature Conservancy Stream Stewards Program. The software program allows for quick and easy reporting of stream data, including identifying water quality trends and water quality issues. Ultimately, this program will the Wild and Scenic Program communicate information and educate others about water quality so they will be more engaged in watershed restoration and protection.

In 2018 we received additional funding to expand and supplement this work from the National Park Foundation and National Park Service Swim Splash Smile grant. This funding will allow us to create a more comprehensive sustainable monitoring program that includes more robust data collection, analysis, and reporting.

#### **Overview of Water Quality Monitoring Program (2012-2018)**

Year	# of monitoring sites	# of monitoring stations	WCWS costs	Leveraged Funds	Total Annual Costs
2012	5	0	\$0	\$1200	\$1200
2013	10	0	\$0	\$2400	\$2400
2014	12	0	\$2000	\$2800	\$4800
2015	12	0	\$2000	\$2800	\$4800
2016	23	0	\$13580	\$19210	\$32790
2017	29	3	\$13580	\$35775	\$49355
2018	30	4	\$13580	\$34806	\$48386
Total Costs			\$44740	\$98991	\$143741

*\*Note this table does not include in kind match from volunteers. 2012 & 2013 were included to show growth.*

## Catch the Rain

The best way to keep pollutants out of the water is to *eliminate or reduce them at the source*. Stormwater washing off land during rain events is the largest source of pollution to the White Clay Creek. In fact, almost all of the rain falling on roofs, driveways, roads, parking lots, mowed lawns, and patios ends up as stormwater runoff. In contrast, rain falling on forests and meadow, natural sponge-like surfaces, soaks gradually into the ground, filtering out pollutants, replenishing groundwater, and keeping streams flowing. Green Stormwater Infrastructure (GSI) practices incorporate the capture and detention of rainfall, simulate natural soil filtering, and reduce stormwater volumes and speeds. Reduced lawn sizes additionally lessen the need for mowing and fertilizer or pesticide applications.

During 2015, the White Clay Wild & Scenic River Program, in partnership with the Brandywine Conservancy, developed a rebate program called Catch the Rain for homeowners in the White Clay watershed who voluntarily install green stormwater practices on their properties. In 2016, we were awarded \$20,000 in funding from the E. Kneale Dockstader Foundation to pilot the program. The program included free educational training to workshop attendees, personalized site visits to program applicants, financial assistance (up to \$2500 rebate per property), and technical support to install voluntary stormwater management practices. Promoted practices include rain barrels, rain gardens, pervious paving retrofits or removal of existing paving, conservation landscape and tree plantings.

Currently, workshops are offered twice a year to suburban homeowners in the White Clay watershed interested in learning more about green stormwater techniques that they could implement on their properties. Program applicants receive on-site individualized homeowner education that culminates in a specialized report with suggested green practices specific to their property. Applicants also receive advice on managing invasive species present on their properties. After the applicant reviews the report and determines what practices they would like to implement, they submit their selected practice(s) to WCWA for final review and approval. Once approved, the practice can be installed by the homeowner or a contractor of their choice. Following inspection, the homeowner signs an agreement to maintain the practice and can apply for a 50% rebate up to \$2,500.

The primary goal of the program is to implement voluntary green stormwater practices on private property where there are outdated or no stormwater controls. The most popular projects to date are tree plantings and rain barrel installation (see table below). In addition to getting more projects in the ground, there is the added value of one on one education that takes place during each site visit. Much like the plant-based practices we are recommending, we are also planting the seeds to help watershed residents take actions to protect our environment. Several applicants have taken advantage of this personalized advice to inform current property management without the need to apply for a rebate.

## Overview of the Catch the Rain Program (2016-2018)

Year	# of Applicants	Rain Barrels Installed	Trees Planted	Rain Gardens Installed	De-paving Projects	Conservation Landscapes Installed	WCWS Funds	Leveraged Funds
2016	12	0	0	0	0	0	\$ -	\$ 19,448
2017	13	8	5	0	0	0	\$ -	\$ 552
2018	22	13	15	0	0	1	\$ 1,794	\$ 370
Total	47	21	20	0	0	1	\$ 1,794	\$ 20,370

### Multi-municipal Water Quality Planning

The White Clay Wild and Scenic River Program is an active member of the Christina Watersheds Municipal Partnership leadership team. The Christina Watersheds Municipal Partnership (CWMP) is a long-term partnership of Chester County Pennsylvania municipalities, County agencies, and watershed conservation organizations that has been active since 2009. The over-arching mission of CWMP is *to facilitate and support engagement and collaboration of municipalities, landowners and other stakeholders to restore and protect the water quality of streams in the Brandywine, Red Clay and White Clay Creek watersheds.*

In 2016 CWMP received funding through a NFWF Delaware River Restoration Fund Innovation Grant that allowed us to focus on 3 pilot areas of multi-municipal collaboration planning in the Brandywine and White Clay Creek watersheds. As the lead facilitator for the White Clay watershed multi-municipal water quality planning effort, we worked cooperatively with municipal engineers and staff to leverage resources and guide pollution reduction planning. Initially, five municipalities in the East Branch of the White Clay watershed agreed to work together: Avondale, Franklin, London Grove, New Garden and West Grove. By participating in the collaboration, the municipalities benefit from direct engagement with the Pennsylvania Department of the Environment and other regulators, gain access to technical experts and guidance in the development of their individual municipal separated storm sewer system (MS4) permit applications, receive assistance in determining viable financing options for permit implementation, and most importantly, use a watershed approach to develop a plan that will meet pollution goals and return streams to a better health. Permits were submitted in September 2017 and to date all 5 municipalities have received initial feedback from PA DEP. We are currently working with the municipalities to edit their permit applications and select projects for this 5-year permit implementation period.

Going forward we will continue to assist MS4 municipalities with their pollution reduction planning to address emerging new DEP expectations and address their own municipal financial and operational constraints related to such planning. The transition from planning to implementation will necessitate flexible and responsive coordination among partners, and effective communication with DEP, to most effectively and expeditiously begin reducing pollution within the Christina watersheds.

**Overview of funds leveraged for the Multi-municipal Water Quality Planning Effort (2016-2018)**

<b>Year</b>	<b>Total Costs</b>	<b>WCWS funds</b>	<b>Leveraged Funds</b>	<b>In-kind Match</b>
2016	\$ 12,315.06	\$ 7,315.06	\$ 5,000.00	\$ 4,680.00
2017	\$ 16,580.76	\$ 6,580.76	\$ 10,000.00	\$ 10,395.00
2018	\$ 13,168.77	\$ 7,168.77	\$ 6,000.00	\$ 2,700.00
<b>Totals</b>	<b>\$ 42,064.59</b>	<b>\$ 21,064.59</b>	<b>\$ 21,000.00</b>	<b>\$ 17,775.00</b>

*\*Note: The in-kind match does not include in-kind match from municipal engineers who participated in the project.*

**Implementation of Best Management Practices**

In addition to working on our own initiatives, the White Clay Wild and Scenic Program supports the work of our local partners to improve water quality and habitat in the White Clay. Below is a chronological list of projects we supported during this cooperative agreement period.

- The first documented dam removal in the state of Delaware took place in December 2014 opening up 3.5 stream miles of the White Clay to anadromous fish in New Castle County, DE. (lead: University of Delaware, 2014)
- Installation of a 9,500 square foot water- tight containment structure for liquid manure storage and a leak-detection line, and improved heavy-use area at a concentrated animal feeding operation in London Grove Township, PA. (Lead: Brandywine Conservancy, Other partners: SUEZ, City of Newark 2014)
- Installation of 1000 linear feet of pasture fence, 470 linear feet of stream bank fencing, 1 stream access, and 0.6 acre of riparian forest buffer to treat runoff from animal manures and reduce *Cryptosporidium* in the water supply at a small dairy farm located along a tributary to the Middle Branch in Franklin Township, PA. (Lead: Chester County Conservation District, Other partners: SUEZ, City of Newark, 2015)
- Installation of grassed waterway, rock chute, and expansion of existing riparian buffer to 5 acres at a dairy farm located in the headwaters of the East Branch in New Garden Township, PA. Land stewardship support of newly planted buffer. (Lead: Chester County Conservation District, Other partners: SUEZ, 2017)
- Installation of grassed waterway and 2.5-acre riparian buffer on a crop farm in Penn Township, PA. Land stewardship support of newly planted buffer. (Lead: Brandywine Conservancy, Other partners: City of Newark, 2017)
- Installation of 1060 linear feet of horse fencing, improved livestock stream crossing, and installation of 1-acre riparian buffer along 600 linear feet of ecologically valuable stream along the upper East Branch in London Grove Township, PA (Lead: Brandywine Conservancy, 2018)

## LAND PRESERVATION AND REFORESTATION

Often times the first step to protecting water is protecting land. Conservation and agriculture easements combined with strong natural resource ordinances have helped to permanently protect over 20,000 acres (or 29% of land) in the White Clay watershed. Our partners, Natural Lands, Brandywine Conservancy, Chester County Planning Commission, and multiple township open space boards are crucial to locating and building relationships with willing landowners to move projects forward

### Overview of land preservation in White Clay watershed (2014-2018)

YEAR	ACREAGE	Total Costs	WCWS Costs
2014	0	\$ 0	\$ 0
2015	0	\$ 0	\$ 0
2016	121.78	\$ 462,322	\$ 69,634
2017	178	\$ 2,300,000	\$ 7,000
<i>Projected 2018-19</i>	<i>381.2</i>	TBD	TBD
<b>TOTALS (2014-18):</b>	<b>299.78</b>	<b>\$ 2,762,322</b>	<b>\$ 76,634</b>

Much of the land we protect is aimed at filling gaps and protecting high quality habitat, or contains or is adjacent to surface waters of the White Clay. Protecting and restoring high quality riparian (or streamside) forest buffers helps keep unwanted stuff (like sediment and pollutants) out of the water. Buffers also improve the quality of the stream habitat. This is important because streams with intact buffers and healthy aquatic habitat can process some of the pollutants that eventually make it into the water thereby preventing them from moving downstream and eventually into the Delaware Bay. In fact, the single most important factor explaining variation in water quality is the percentage of tree cover in each watershed.

In 2015, an inventory of existing streamside gaps in vegetation throughout the watershed was conducted with the help of the Brandywine Conservancy. GIS mapping was completed for each municipality in the watershed to identify gaps in streamside forests. To do this, the stream layer was superimposed on 2013 aerial photography by Chester County, PA and New Castle County, DE and a one hundred-foot-wide riparian buffer zone was digitized, based on a visual assessment of the vegetation as either having an existing forested buffer or as lacking a forested buffer, a riparian gap. The gaps were further defined as any non-forested lands larger than 1 acre on a single parcel or contiguous parcels under the same ownership. These more refined maps will enable us to take a closer look at missing links and their connectivity to surrounding protected lands and critical habitat areas. Reforestation projects would be prioritized to lands under public ownership or permanently protected.

The information learned from this analysis will enable the White Clay Wild & Scenic Program to provide watershed municipalities with detailed maps of priority areas for reforestation that can be included in their municipal pollution reduction (or TMDL) plans, as well as aid in identifying smaller shovel ready projects (i.e. gap of less than 3 acres) that Pennsylvania municipalities or local nonprofits could undertake on their own using the Pennsylvania Horticultural Society's TreeVitalize program.

The gap analysis complements the more scientifically rigorous White Clay Creek Reforestation Plan (2009), but is more action-oriented with the goal of getting more trees into the ground in multiple locations and as quickly as possible. We will continue looking for reforestation opportunities throughout the White Clay, with the ultimate goal, as stated in the White Clay Creek Reforestation Plan, to achieve 40% minimum forest cover to best protect watershed health.

**Riparian buffer implementation in the White Clay Creek watershed supported by Wild and Scenic Funding (2010-2018)\***

<b>Year</b>	<b>Acreage</b>	<b>Trees Planted</b>	<b>Stream Buffer (linear feet)</b>
2014	0.6	100	470
2015	12.7	3105	6180
2016	2.5	2235	1000
2017	7.3	960	2200
2018	0	0	0
<b>Total (2014-18)</b>	<b>23.1</b>	<b>6400</b>	<b>9850</b>
<b>Total since 2010</b>	<b>43.7</b>	<b>12330</b>	<b>15599 (3 miles)</b>

*\*Several other tree plantings supported by our partners (Delaware Nature Center, Stroud Water Resource Center, and Brandywine Conservancy) also occurred in White Clay watershed.*

In addition to planting more trees, we determined during 2016 that it was also important to put some funding into land stewardship. Several of the earlier buffers we supported had low survivorship and it was determined that even just monitoring a site twice a year to remove vines and other encroaching invasive species, checking for deer, vole, and storm damage could improve buffer establishment and help us ensure buffer success. Future plantings are monitored for invasive species, characterization of successful establishment of native species, and to test out different types of installation practices (i.e. tree tube in mowed lanes, tree cages with galvanized fencing, or multiple species enclosures). Currently, we support management of three former buffer plantings and will set aside future funds to continue supporting land stewardship of newly planted buffers with the ultimate goal of educating and encouraging landowners to takeover long-term management responsibilities.

**MONITORING OF DEVELOPMENT PROPOSALS**

The White Clay Wild and Scenic program monitors development proposals that would have an adverse impact on the creek or it's surrounding environment. While several



small projects arise throughout the 5-year cooperative agreement period that receive comment, there were two proposals that required additional time and input.

- Attended multiple meetings with Stroud, Chester County Water Resources Authority, and Save Our Water. Provided comment and suggestions to the Delaware River Basin Commission and Artesian Water Company resulting in a revised monitoring plan for the proposed artesian well located along Broad Run in New Garden Township, PA. To date the well has not been put in to operation. (2015-present)
- Attended multiple zoning hearings and provided testimony on the proposed 135' cell tower located adjacent to the White Clay Creek Preserve on private land in New Garden Township, PA. The outcome of this hearing has not been determined. (2017-present)

## FISCAL OVERVIEW COOPERATIVE AGREEMENT P13AC01266 (2014-18)

### WCWS Funding and In-Kind Assistance/Leveraged Funding Table

Year	2014 (FY13)	2015 (FY14)	2016 (FY15)	2017 (FY16)	2018 (FY17)	Totals 2014-18 CA
In-Kind Support	\$54,538	\$51,834	\$45,293	\$86,000	\$86,000	\$323,665
<b>Total WCWS NPS funding</b>	<b>\$82,000</b>	<b>\$95,000</b>	<b>\$95,000</b>	<b>\$95,000</b>	<b>\$99,000</b>	<b>\$466,000</b>
WCWA funding from NPS	\$49,200	\$55,400	\$95,000	\$95,000	\$99,000	\$393,600
NLT funding from NPS (separate CA FY13 &14)	\$32,800	\$39,600	\$0	\$0	\$0	\$72,400
NPS Funding <b>increase/ decrease</b>	<b>0%</b>	<b>16%</b>	<b>0%</b>	<b>0%</b>	<b>4%</b>	
Grants/Donations	\$74,010	\$32,987	\$33,785	\$43,150	\$29,956	\$213,888
*Other leveraged funds (i.e. open space funds, stroud in-kind, etc)	NA	NA	\$391,148	\$2,347,111	TBD	\$2,738,259
WCRF	\$5,995	\$8,213	\$7,058	\$10,750	\$8,436	\$40,452
DE SECC	\$262	\$219	\$270	\$247	\$338	\$1,336
% in-kind to NPS	67%	55%	48%	91%	TBD	69%
%nonfederal sources of funding to total federal funding	98%	44%	455%	2528%	39%	642%

*\* I do my best to capture all leveraged funds as accurately as possible based on the information I have available. I include anything that isn't cash or volunteer time in this category. I began tracking these costs as more closely in 2016 since it shows the true value of the Partnership River model of management.*

*\*TBD - data is based on the calendar year.*

P13AC01266		Budgeted	Spent	%Change from Total Budget
Admin	Contractual	\$51,832.23	(\$60,448.90)	2.2%
	Indirect	\$6,201.00	(\$5,106.45)	-0.3%
	Other	\$10,151.00	(\$12,513.27)	0.6%
	Personnel	\$159,115.68	(\$162,255.81)	0.8%
	Supplies	\$3,313.58	(\$3,313.58)	0.0%
	Travel	\$7,420.00	(\$6,132.60)	-0.3%
Education	Contractual	\$29,825.81	(\$29,767.11)	0.0%
	Other	\$654.00	(\$494.22)	0.0%
	Supplies	\$1,864.86	(\$1,616.17)	-0.1%
Open Space	Contractual	\$8,358.00	(\$8,595.53)	0.1%
	Land			
	Transactions	\$14,908.00	(\$11,496.68)	-0.9%
Restoration	Travel	\$221.00	(\$75.14)	0.0%
	Contractual	\$70,115.77	(\$68,512.20)	-0.4%
	Other	\$13,012.00	(\$6,774.58)	-1.6%
	Supplies	\$15,707.07	(\$15,597.76)	0.0%
	Travel	\$900.00	(\$900.00)	0.0%
		\$393,600.00	(\$393,600.00)	