

📍 **MUNICIPAL CASE STUDY**

Abington Township, Pennsylvania

Because Abington was largely developed before more modern stormwater management practices, the township has long experienced severe flooding events during heavy rains and tropical storms—including some that caused residents to lose their lives. The township has spent approximately \$30 million over the past 15 years addressing runoff and flooding issues. Projects have ranged from large-scale flood abatement (such as the purchase of homes for flood management purposes) to small-scale on-lot grading (to encourage infiltration and channel stormwater).



By: John Gaadt, AICP
 Gaadt Perspectives, LLC.

Background

Abington Township is an inner-ring bedroom community of Philadelphia, predominantly suburban with mixed-use commercial development. The community was largely built before stormwater management and flood control were incorporated into site engineering. The township is 15.5 square miles with a 2015 population of 55,590 (approximately 3,586 persons per square mile). According to township staff, the community is approximately 96 percent developed. Likewise, Delaware Valley Regional Planning Commission 2010 land use data estimates that less than 2 percent of the township’s land area was considered “vacant,” and about 12 percent of its land area was wooded.

Quick Stats

Abington Township

Watersheds: Pennypack, Wissahickon, and Tookany/Tacony-Frankford

Population: 55,590 (2015)

Land area: 15.5 square miles

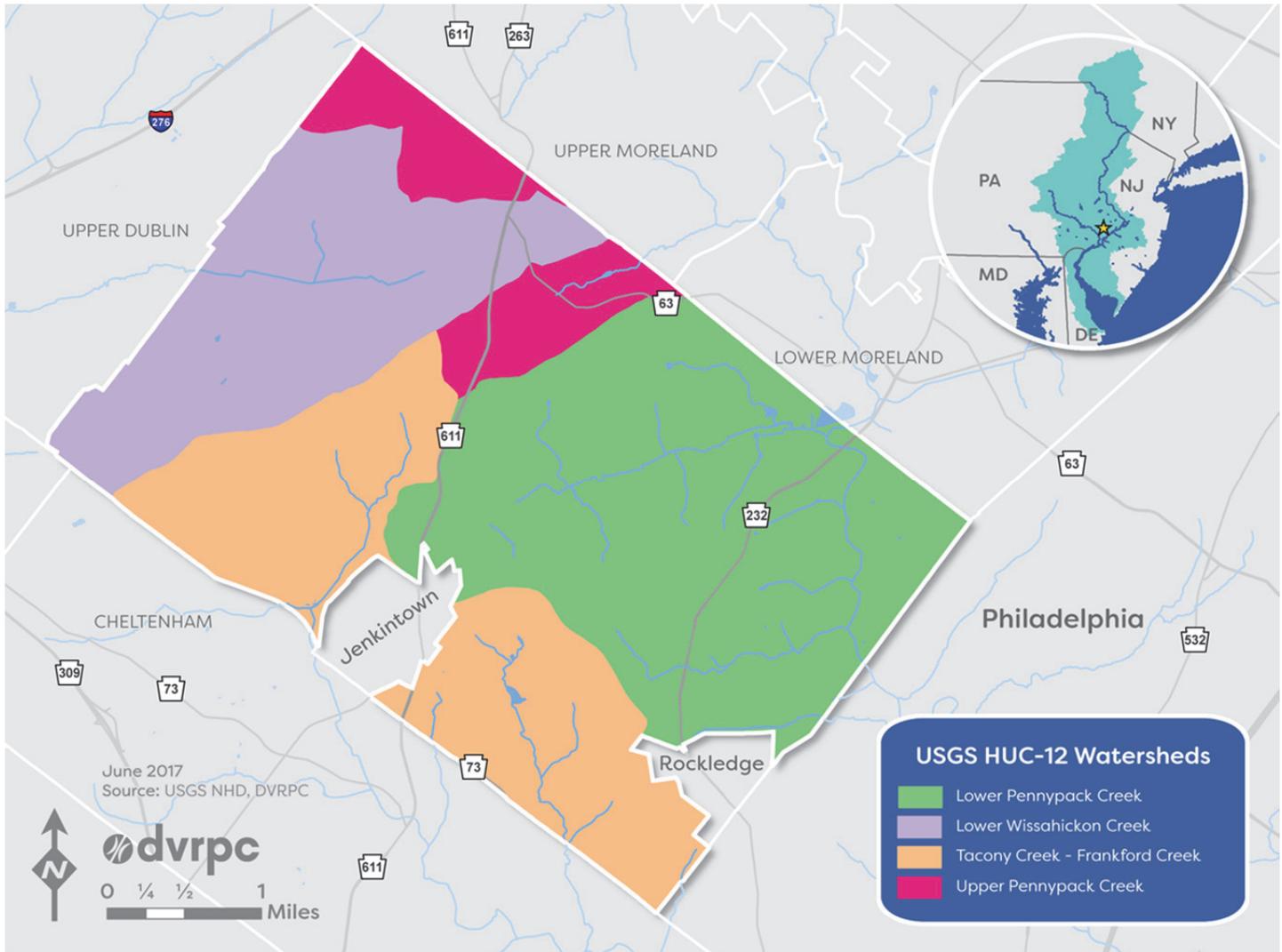
Population density: 3,586 people per square mile

The township falls within three watersheds: the Pennypack Watershed, the Wissahickon Watershed, and the Tookany/Tacony-Frankford (TTF) Watershed. These stream systems provide recreational opportunities and are sources of water supply and wastewater discharge.

Pennypack Watershed

The headwaters of the Pennypack lie in the upper portions of Montgomery County and lower Bucks County; the creek’s middle mainstem traverses through Upper and Lower Moreland townships, as well as Abington, before entering Philadelphia’s Fairmont Park and Pennypack Park and ultimately discharging into a broad mudflat on the Delaware River. Approximately 40 percent of Abington’s land area falls within the Pennypack Watershed. All in all, the stream is approximately 125 linear miles. The Pennypack watershed drains approximately 56 square miles, is approximately 33 percent impervious, and is home to approximately 230,000 people.

Map: Abington Township Watersheds



Wissahickon Watershed

The upper headwaters of the Wissahickon extend from Montgomeryville and the Borough of Lansdale through all or parts of 15 Montgomery County municipalities before draining into the Schuylkill River at Manayunk. The Wissahickon Gorge in the lower watershed has long been preserved as part of Fairmount Park. The stream is approximately 134 linear miles, and its watershed drains approximately 64 square miles. The watershed is approximately 24 percent impervious and is home to approximately 160,000 people. The tributary portion of the Wissahickon Watershed in Abington is referred to as the Sandy Run Creek, and its mainstem begins in the township. Approximately 30 percent of Abington’s land area falls within the Wissahickon (Sandy Run) Watershed.

TTF Watershed

The east stem of the TTF has its headwaters in Abington Township and comprises approximately 30 percent of the township. The creek travels through the communities of Abington, Cheltenham, Jenkintown, Rockledge, and Springfield before entering north Philadelphia on its way to the Delaware River. The stream is

approximately 32 linear miles, and its watershed drains approximately 33 square miles. The creek's watershed is approximately 48 percent impervious and is home to approximately 360,000 people.

Flooding and Stormwater Problems

Because Abington was largely developed before more modern stormwater management practices, the township has long experienced severe flooding events during heavy rains and tropical storms. One of the most significant of these storms claimed the lives of two people in 1996 and resulted in the highest peak rate of flow on the Schuylkill River at Philadelphia since tropical storm Agnes in 1972. Storms during this period and well into the late 1990s would flood upwards of 3,000 homes during any given rainstorm event.

In recent years, the township has also been grappling with stormwater runoff issues and the imposition of the U.S. Environmental Protection Agency's (EPA's) mandated Municipal Separate Storm Sewer System (MS4) program, administered by the Pennsylvania Department of Environmental Protection (PADEP). This program involves the assessment of pollutants in streams throughout the country and charges states and municipalities with making water quality improvements and improving stormwater management. Rivers and creeks that have been assessed by PADEP and the EPA, where warranted, have been assigned restoration goals pursuant to a Total Maximum Daily Load (TMDL), in essence a pollution budget that local jurisdictions must achieve through the treatment of wastewater and management of stormwater before outfall to streams. Where TMDLs do not currently exist, municipalities are charged with developing Pollution Reduction Plans (PRPs) for impaired streams that do not require TMDLs.

In Abington's case the TTF and Pennypack creeks do not currently have TMDL requirements; however, the Wissahickon Creek has TMDLs for sediment and nutrients (established in 2003) and phosphorus (established in 2015). According to township staff, Abington is responsible for developing TMDL reduction plans for the Wissahickon Creek and up to nine PRPs for other subwatershed areas of the township.

Flooding and Stormwater Solutions

In the late 1990s, the township made a significant effort to address its severe flooding issues, starting with the purchase of approximately 40 homes in the floodplain. Of the approximately \$8 million used to purchase the homes, \$7 million was provided by the Federal Emergency Management Agency and \$1 million was provided by the township. These homes were razed and the land

Motivating Factors

Natural disasters: Flooding events in the late 1990s and early 2000s resulted in large-scale flooding in the community and loss of life.

Regulatory: Nutrient and sediment TMDLs of the past, new phosphorus TMDLs, and MS4 permit requirements requiring water quality improvements.

Funding: Federal funding for USACE work, William Penn Foundation grant money for numerous non-profit-sponsored watershed improvements and TMDL alternatives planning for four municipal wastewater treatment plants, Growing Greener funding for the construction of stormwater BMPs, and municipal bond funding for flood abatement and stormwater BMPs.

Local partners: Public outcry over flooding initially led to township action to alleviate impacts; partners over the years have contributed greatly to progress in the township, including the Wissahickon Valley Watershed Association, the Tookany/Tacony-Frankford Watershed Partnership, the USACE, the township EAC and Tree Commission, Temple University's Center for Sustainable Communities, and PADEP.

Unifying issues: Flood losses, including the loss of life; MS4 requirements and the legal obligation to respond.

converted to open space for flood control and parkland. The homes purchased were in all three of the township's watersheds: 18 in the TTF, 13 in the Sandy Run (Wissahickon), and nine in the Pennypack. Because of this effort, flood claims dropped significantly, from 3,000–4,000 to 100–200. This type of work continues today, with the township utilizing federal funds, township municipal funds, and third-party grants to purchase homes for conversion to open space.

In all, the township has spent approximately \$30 million over the past 15 years addressing runoff and flooding issues. Projects have ranged from large-scale flood abatement (such as the purchase of homes for flood management purposes) to small-scale on-lot grading (to encourage infiltration and channel stormwater). The township has created meadows and earthen dams, converted concrete culverts to stone gabions, improved on-site detention facilities, and incorporated bioretention facilities into projects throughout the community. Initially, projects were selected to address flooding issues; lately, the township has been prioritizing projects that meet flooding, MS4, and TMDL requirements.

In recent years the township has issued bonds for \$3–\$4 million every two to three years to address stormwater and flooding issues. This process is largely "resident driven," and the township has not had to seek resident approval or referendums for such work. Citizen complaints ("squeaky wheels") are investigated, and problem areas are incorporated into the township's ongoing floodplain and stormwater work program. The last round of bonds, issued in 2014, was used for 32 projects at a cost of \$3.6 million. The majority of these funds were used to address flooding issues, among them: streambank repairs, pipe-in-ground transport, and flood control. While the township has undertaken in-house design of projects, outside contractors are used for the majority of construction.

One of the reasons the township has been so successful with this approach is that it has little to no debt service and has adequately managed the debt it does have. New bonds are accumulated and paid down over time to address concerns. Over the next year the township intends to issue a new bond to undertake 25 projects ranging in cost from \$25,000 to \$250,000. Projects in the pipeline include additional retention (for larger storms), installation of new storm sewer piping and inlets, streambank stabilization, and additional on-lot grading. Projects aimed at satisfying MS4 requirements include naturalizing (converting) existing stormwater retention basins, constructing infiltration basins, undertaking streambank stabilization, and creating rain gardens, riparian buffers, and meadows in local parks.

The Wissahickon TMDL for phosphorus placed significant burdens on the wastewater treatment plants servicing the townships of Abington, Upper Gwynedd, and Upper Dublin, and the Borough of Ambler. As originally envisioned, the restrictions placed on the treatment facilities by PADEP and the EPA were considered exceptionally onerous, and the municipalities appealed what they saw as the prohibitive cost of meeting the implementation of the prescribed standards. Discussions among the parties led the regulatory agencies to an intergovernmental agreement for the preparation of an alternative plan that binds the municipalities to work together to develop a regional approach to phosphorus reduction. Various grants, in particular a grant through the William Penn Foundation, have allowed this process to proceed in a timely manner.

The costs of meeting TMDL requirements elsewhere in Abington led the township to seek help from Congressman Brendan Boyle, who was able to involve the U.S. Army Corps of Engineers (USACE) in an analysis of and stream restoration for the Sandy Run Creek, a tributary of the Wissahickon Creek.

Another activity that benefitted the township included research undertaken locally by Temple University's Center for Sustainable Communities, which led to the preparation of a Growing Greener grant to construct five Best Management Practices (BMPs), among them rain gardens, infiltration berms, infiltration trenches, and buffer restorations. These projects were undertaken in all three watersheds. Temple has also provided assistance in recent years to the local watershed associations to undertake stream testing.

Abington was one of the first communities in Pennsylvania to be issued an MS4 permit. In addition to the projects mentioned above, the township has undertaken an update of its stormwater ordinance to require controls for small sheds and other structures. Any structure under 250 square feet must utilize two rain barrels or a seepage pit. Structures between 250 and 1,000 square feet must incorporate rain gardens or bioretention cells, and any impact greater than 1,000 square feet must submit a fully engineered plan for review and control of one year and greater storms. The township has long used practices like street sweeping to address contaminants along roadways.

The Township's Environmental Advisory Council (EAC) also contributes by raising awareness of stormwater issues, enhancing participation in stormwater programs, and encouraging citizens and businesses to take action to help mitigate stormwater problems. For example, the EAC has been offering, with township financial support, stormwater educational workshops and rain barrel programs to homeowners and businesses for many years; further, the EAC participates in water quality monitoring projects, actively participates in tree planting and riparian buffer restorations, and recently supported the township's efforts to have the USACE undertake a separate flood study for Abington. In all, the township estimates that 400–600 people have attended the EAC's programs.



Source: Abington Township
Abington Township's Parks and Recreational Department wanted to enlarge the crushed stone parking area near Roslyn Park and decided to add a rain garden on the down slope to assist with drainage and water quality.

The township has also been fortunate in recent years to have had the investment of time and money from several outside organizations. Two watershed associations, the Wissahickon Valley Watershed Association and the Tookany/Tacony-Frankford Watershed Partnership, have provided support in a variety of ways: both provide direct citizen education, and both have worked with the township to identify small stormwater and water quality improvement projects for which the organizations then prepare and administer grants in conjunction with the township. The funded projects include reforestation initiatives, riparian buffer planting, and streambank stabilization projects. Both groups have also worked with local school districts to provide classroom instruction. As part of a larger collaborative effort under the Delaware River Watershed Initiative, these same organizations have been training volunteers to monitor water quality

(both monthly observations and chemical testing). Referred to as "Streamkeepers," these volunteers have been responsible for assessing the effectiveness of restoration and stormwater management projects since

2014. Data generated as part of the overall testing program is housed with the watershed associations and made available to the township and others (regulatory agencies, etc.) upon request.

The projects undertaken by the EAC and the watershed groups have benefitted the township in numerous ways, not least of which is the ability of the township to document this work as partial fulfillment of Municipal Control Measures 1 (Public Education and Outreach) and 2 (Public Involvement and Participation) under its MS4 permit responsibilities.



Progress to Date and Challenges Ahead

The township sees its efforts as successful: stormwater impacts have been reduced, complaints are down, there is less flooding, and the community has seen corresponding improvements in water quality (as evidenced in both the work of the “Streamkeepers” and Temple University). In addition, the township believes its parks, waterways, and trails have benefitted significantly from water quality protection measures. In addition, the township has greatly benefitted from partnerships with other parties and from the research and outreach of local watershed groups and universities.

Source: Abington Township

The township decided to use the property on Hamel Avenue as an underground stormwater detention area. In 2007, the township used capital improvement funds to construct a series of pipes in a stone bed for this purpose. After construction, the township replanted grass to make the area look like open space.



Source: Abington Township

In 2005, Abington Township used federal and state grant money and township funds to purchase this privately owned (40' x 114' +/-) property on Hamel Avenue. The property had been inundated with stormwater during heavy downpours, causing repeated property damage.

According to Township Manager Michael LeFevre, Abington greatly benefits from having an in-house engineer, Michael Powers, who knows the community well and can investigate problems (sometimes identifying the problems before residents even complain), assess impacts, undertake design, manage bidding, and oversee construction. Michael has been with the township for over 37 years and has worked on flooding, sanitary sewer, and stormwater issues throughout his tenure. He has traditionally trained in-house staff himself and has indicated that his major interests lie in finding solutions to the water resources problems he has seen in the township through those years.

While the township has done much to alleviate flooding concerns and manage stormwater, much work remains. Pressure exists to

Key Partners

Abington Township: Township staff and elected officials are very involved in TMDLs and stormwater BMPs in Abington. Abington also greatly benefits from having an in-house engineer, Michael Powers, who has been with the township for over 37 years.

Abington Township EAC: Raises awareness of stormwater issues, enhances participation in stormwater programs, and encourages citizens and businesses to take action to help mitigate stormwater problems. The EAC offers stormwater educational workshops and rain barrel programs to homeowners and businesses, participates in water quality monitoring projects, and plants trees and restores riparian buffers. The township estimates 400–600 people have attended EAC’s programs.

Wissahickon Valley Watershed Association and Tookany/Tacony-Frankford Watershed Partnership: Both provide citizen education and have worked with the township to identify small stormwater and water quality improvement projects and apply for grants to implement them. Both organizations train “Streamkeeper” volunteers to monitor water quality (both monthly observations and chemical testing).

Temple University’s Center for Sustainable Communities: Research undertaken by Temple University’s Center for Sustainable Communities led to the preparation of a Growing Greener grant to construct five BMPs, among them rain gardens, infiltration berms, infiltration trenches, and buffer restorations. Temple has also provided assistance in recent years to the local watershed associations to undertake stream testing.

USACE: The USACE analyzed and participated in a stream restoration for the Sandy Run Creek, a tributary of the Wissahickon Creek. They have also been asked to conduct a separate flooding study.

EPA: Responsible for Clean Water Act enforcement, including issues related to TMDLs and MS4s.

PADEP: The state agency determines the status of water quality impairments and assists communities in meeting regulatory requirements.

implement an increasingly burdensome MS4 program. While the township agrees that the intent of the program is good, it also believes that the ability of Pennsylvania townships and boroughs to achieve success is severely limited by the program’s enormous costs. For example, Abington’s permit obligations continue to expand (e.g., the new phosphorous TMDL for the Wissahickon), and the township will be required to prepare eight to nine new pollution prevention plans for its upcoming permit in 2018.

Further, while many flood control projects and stormwater BMPs have been installed, the facilities’ management and maintenance will place significant burdens on the township in the years to come. Although every facility is evaluated and maintained yearly, the township estimates that approximately 30 percent of these will need capital improvements within the next five years.

One final challenge facing the township involves the commitment of its elected officials to do what is needed to achieve water quality improvements. While various members of the township council have been strong advocates of protecting water quality, commitment has ebbed and flowed, especially at those times when controlling taxes and municipal costs have been the top priorities.

Staff and elected officials, while generally supportive of the MS4 program, view it largely as an unfunded mandate that has transferred the costs of water quality to municipalities. And while those interviewed believe Abington has

risen to the challenge, there was some doubt as to whether the township has really taken “ownership” of its program and whether the township could be doing more.

It should be noted that the individuals interviewed for this case study recognize that the township has greatly benefitted from the work of others and the partnerships it has formed. The future, however, will require the township to understand more about how its actions affect other communities. Furthermore, the township will

need to consider whether its current funding strategy (multi-year bonds for identified projects) will be sufficient to address the stormwater and flooding needs of the future; consideration will likely need to be given to developing a dedicated funding source for future efforts—such as a stormwater utility—both for facility construction and long-term operation and maintenance.

Key Factors in Success

The key factors to Abington’s success are:

1) The township’s tax base has allowed it to secure bonds and pay them down in a timely manner, facilitating the construction of needed stormwater and flood reduction projects.

2) The township has made good use of the partnerships, projects, and research opportunities presented to it (e.g., the efforts of the local watershed associations and the township’s EAC, USACE involvement in multiple studies and restoration efforts, the research of Temple University’s Center for Sustainable Communities, PADEP’s guidance and facilitation with the EPA, William Penn Foundation grants for numerous projects on behalf of the creeks of the township). Clearly, the township has benefitted from a wide assortment of actions taken on behalf of the people and environment of the community.

Important issues to address in the future will be the costs of ensuring water quality and the importance of public education. As Michael Filmyer, engineering consultant to the township, said, “Start at the bottom, educate people about the issues the community is facing and how delicate the ecosystem really is. Get people to recognize that they are part of a watershed, that they are both impacted by the problems created upstream and that they contribute to problems downstream.”

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Published to web: July 12, 2017

📍 **MUNICIPAL CASE STUDY**

Berks County Water and Sewer Association, Pennsylvania

Berks County's county-wide planning in the 1990s and Albright College's established and unbiased leadership set the stage for municipalities, sewer and water authorities, nonprofit organizations, consulting firms, and others to work together under the Berks County Water and Sewer Association to meet different regulatory goals and educational aims to improve the county's water quality.

By: Laura An, *Engagement Planning Intern, DVRPC*

Background

Due to its proximity to Philadelphia, open space, and fertile soil, Berks County experienced both agricultural and industrial development throughout the 19th and 20th centuries. The Schuylkill River served as a crucial transportation route that moved goods from Berks County into Philadelphia. By the second half of the 20th century, parts of Berks County were experiencing the sprawling suburban development patterns of the post-war period; some of this development continues today. Currently, the City of Reading remains the county seat and the largest municipality in Berks County. Berks County is comprised of 29 boroughs and 44 townships.

Berks County includes three major watersheds: the Schuylkill River Basin, the Lehigh River Basin, and the Chesapeake Bay Watershed. Ninety percent of the county is considered to be part of the Schuylkill River Watershed.

Berks County Water and Sewer Association

The Berks County Water and Sewer Association (“the Association”) was created to “advance the theory and practice of the design, construction, maintenance, administration and operation of water and sewer services; disseminate information and share experiences to promote improved practices in water and sewer administration; expand local training opportunities; promote cooperation among water and sewer service providers and the economic development community; and encourage adherence by water and sewer officials to a continually higher standard.”

Quick Stats

Berks County

Major waterbodies:

Schuylkill River, Ontelaunee Lake, Blue Marsh Lake

Population:

415,271 (2015 American Community Survey)

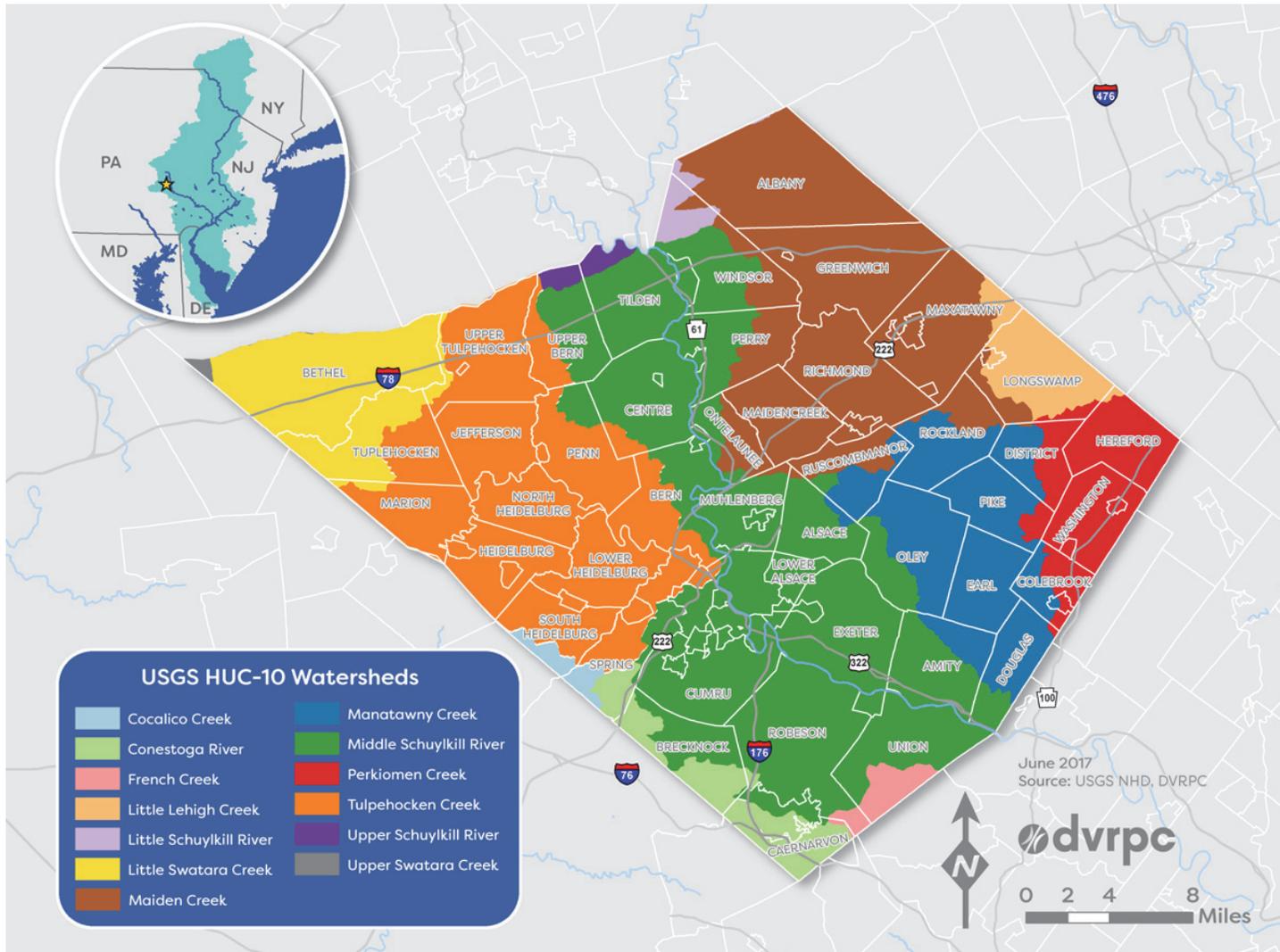
Land area:

857 square miles

Water area:

9.2 square miles, (1.1%)

Map: Berks County Watersheds



Though only formalized in 2013, the Association has developed over a long period of time. In 1998, the Berks County Planning Commission (BCPC) originally conducted a Sewer and Water Regionalization Study to take inventory of water and sewerage systems and look for opportunities to improve them. At the time, there was little support for joint actions since most municipalities preferred to retain control of water and sewer activities occurring within their jurisdictions. However, a few of the smaller municipalities with their own public water and sewer systems began to purchase water services from large water companies that could provide water more reliably.

In 2007, when many of the municipalities were struggling to maintain balanced budgets, some municipalities began to express interest in joint actions and shared services that might reduce overall costs associated with water and sewer. In order to gauge interest, BCPC reached out to Albright College’s Center for Excellence in Local Government, with whom it had had a prior relationship and it thought could act as an unbiased entity, to update the 1998 study.

During the update process, BCPC realized that implementation of the plan would require municipalities to take ownership of sewer and water issues; the county could not implement the plan alone. In order to garner support for the plan, BCPC created a “road show” and presented the plan to its constituents at various locations throughout the county, with an emphasis on the question, “What will *you* do with the plan now that it has been written?” The roadshow was successful and was the main driver in the initial formation of the Association. Given Albright College’s involvement in the initial study and an existing pooled procurement program, it was a natural candidate for hosting the new Association.

Collective Actions

The Association has three main focuses: economic development, source water protection, and disaster planning and response. It operates under the leadership of a 10-member executive board, whose members are elected by the rest of the association. Board members have terms ranging from one to two years, and rotate off in alternating years so that there is never a complete replacement of the board in any given year. Though the Association is a volunteer organization, it has been supported by various funding sources.

Initially, the Association was supported by six organizations that provided seed funding: the Greater Reading Economic Partnership, the Western Berks Water Authority, the City of Reading, the Reading Area Water Authority, the Joint Municipal Authority of Hamburg, and the Pennsylvania American Water Corporation. More importantly, Berks County committed to a three-year seed budget of \$15,000 per year, to be matched by dues paid by members of the Association. The three-year seed budget expires in April 2017, at which point the Association will be supported only by dues and sponsorships. The Association has ended each of the past three years with a surplus budget. Membership dues were, and still are, assigned in a tiered system based on the number of people served by water providers, or the type of organization (municipality, consultant, individuals). Member municipalities that do not operate a water or sewer system pay \$100 annually and are permitted two voting members. All funding goes toward administration by Albright College’s Center for Excellence, training, conferences, and educational materials.

Training

One of the Association’s main initiatives is providing local training to municipal professionals. Within the Association, the Education Committee works to find training opportunities that provide required contact hours for accredited water providers. The committee seeks opportunities that are located nearby in order to assist water providers and other professionals with remaining up to date with cutting-edge practices and studies, without requiring excess travel time. The Association also hosts its own training workshops, which are rigorously reviewed by the Pennsylvania Department of Environmental Protection (PADEP) to ensure contact hour/continuing education credit eligibility. Previous topics have included pipeline maintenance, leak detection, process instrument verification, and hypochlorite verification. The Association also hosts an annual conference, attended by over 100 interested individuals and professionals. Past conference topics have included source water protection, disaster planning and management, and partnerships.

Berks County Water and Sewer Association

Year formed: 2013

Municipalities participating:

Kenhorst Borough, Wyomissing Borough, Sinking Spring Borough, City of Reading, Cumru Township, Topton Borough, Kutztown Borough

Current members: 75

Annual operating budget: \$30,000 (\$15,000 from Berks County and \$15,000 membership dues and contributions)

Pooled Purchasing Power

One of the major benefits of the Association, as a multi-municipality organization, is its collective purchasing power. Under the Association, the Berks County Cooperative Purchasing Council (BCCPC) was formed allowing certain entities to join together in order to purchase necessary goods and services, and to share information regarding these purchases. An example of a past joint purchase is chlorine for water treatment, shared by multiple water providers. Pooled procurement allows participating members to reduce expenditures thanks to bulk prices or collective bargaining. The council meets quarterly, separate from the Association, and each participating entity is represented by one individual.

Multi-Municipal Planning

Though not a member, PADEP is currently partnering with the Association and working with members to produce a joint source water protection plan. Many of the current members have individual source water protection plans, but the joint document seeks to identify common goals and complementary actions that will eliminate duplicate efforts and fill existing gaps in source water protection within the Schuylkill River Watershed.

As Carolyn O'Hare of SSM, an Association consultant member, puts it, "Everyone feels like they don't have enough time to get [everything] done, so if you can prioritize effectively and look for other people who have similar goals to each other, [we can] take a piece of the burden, then a lot more gets done a lot more quickly... everybody has a specific piece. You can get policy from the agencies, but they can't provide money, so you need a nonprofit to be able to apply to get money, so it all hangs together."

Along with pinpointing next steps in the short, medium, and long term, the Source Water Protection Plan will also identify potential agencies and actors who have the authority and resources to implement actions and redistribute responsibilities where possible to match capacity. The plan is slated to be released in 2017.

Given that source water protection is generally considered an "upstream" activity and stormwater management is considered a "downstream" activity, one plan that addresses both holds much promise for water quality improvements. One plan will involve a variety of different agencies and outline specific plans and projects that require cooperation, hopefully breaking down some barriers and building valuable relationships. In addition, the plan may incentivize municipalities to participate in more coordinated actions. Coordinated efforts could save both time and money: precious resources for local governments and public agencies.

Challenges and Benefits

The Association meets once a month. Given that the Association's membership is voluntary, it can be challenging to accomplish time-intensive actions since members do not receive additional compensation, and participating can conflict with already busy schedules. Another challenge that the Association

Motivating Factors

Countywide planning: In 1998, BCPC undertook a Sewer and Water Regionalization Study to inventory water and sewerage systems spread throughout multiple municipalities. BCPC updated the study in 2007.

Recognized leader: Albright College's Center for Excellence in Local Government is seen as an unbiased entity working for the good of the group. It already hosts the BCCPC.

Shared goals: Members have explicit goals around keeping the county economically competitive, protecting water sources, and providing professional training.

faces, common to many other membership-based organizations, is maintaining sufficient membership to sustain the financial needs of the organization.

Despite these challenges, members find that the Association offers a highly cooperative and supportive environment. Members circulate news and events that they are hosting. Members often participate in community events that impact water quality, such as community cleanups. The Association also provides an environment where professional relationships can be forged and strengthened. The opportunity to network and partner with other professionals in the field provides more intangible benefits to members and serves to solidify the cohesion of the water quality community in Berks County as a whole.

Conclusion

According to members of the Association, the key to starting similar initiatives starts with countless small actions. Members began by considering the possibilities of building on existing relationships to partner in new ways. The impetus for new action stemmed from countywide planning that required the collaboration between multiple municipal and private-sector actors. A key player that enabled action between multiple jurisdictions and municipalities was the administration at Albright College, which could act as an unbiased third party—and just as important are the dues that finance their work. Actions may be difficult to accomplish as an individual, but they can be accomplished when split between multiple partners with a common goal.

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Published to web: July 25, 2017

MUNICIPAL CASE STUDY

City of Camden, New Jersey

While Camden is revitalizing, a coalition of public and private organizations are implementing green infrastructure projects that benefit the city’s residents and improve overall quality of life.



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Background

Camden, New Jersey, is a post-industrial waterfront city across the Delaware River from the City of Philadelphia. Camden is essentially a peninsula, surrounded by water on three sides. While the city had a booming industrial economy 70 years ago, job loss and a declining population over the years contributed to severe economic distress. The city has seen high vacancy rates, poverty, and increased crime, and city government itself has struggled financially for many years. However, Camden is in the midst of a major transformation. In 2013, the State of New Jersey passed the Economic Opportunity Act to encourage businesses to move into cities, and Camden has benefitted significantly. Several recent developments attest to this, among them: the decision by Subaru to relocate its North American headquarters in the city and a one-billion-dollar investment in the city by Liberty Property Trust, a real estate investment trust.

Quick Stats
City of Camden

Annual average rainfall: 47 inches

Major adjoining water body:
 Delaware River

Population: 76,119 (2015)

Sewer System:
 Combined Sewer Overflow

Land area: 10.3 square miles

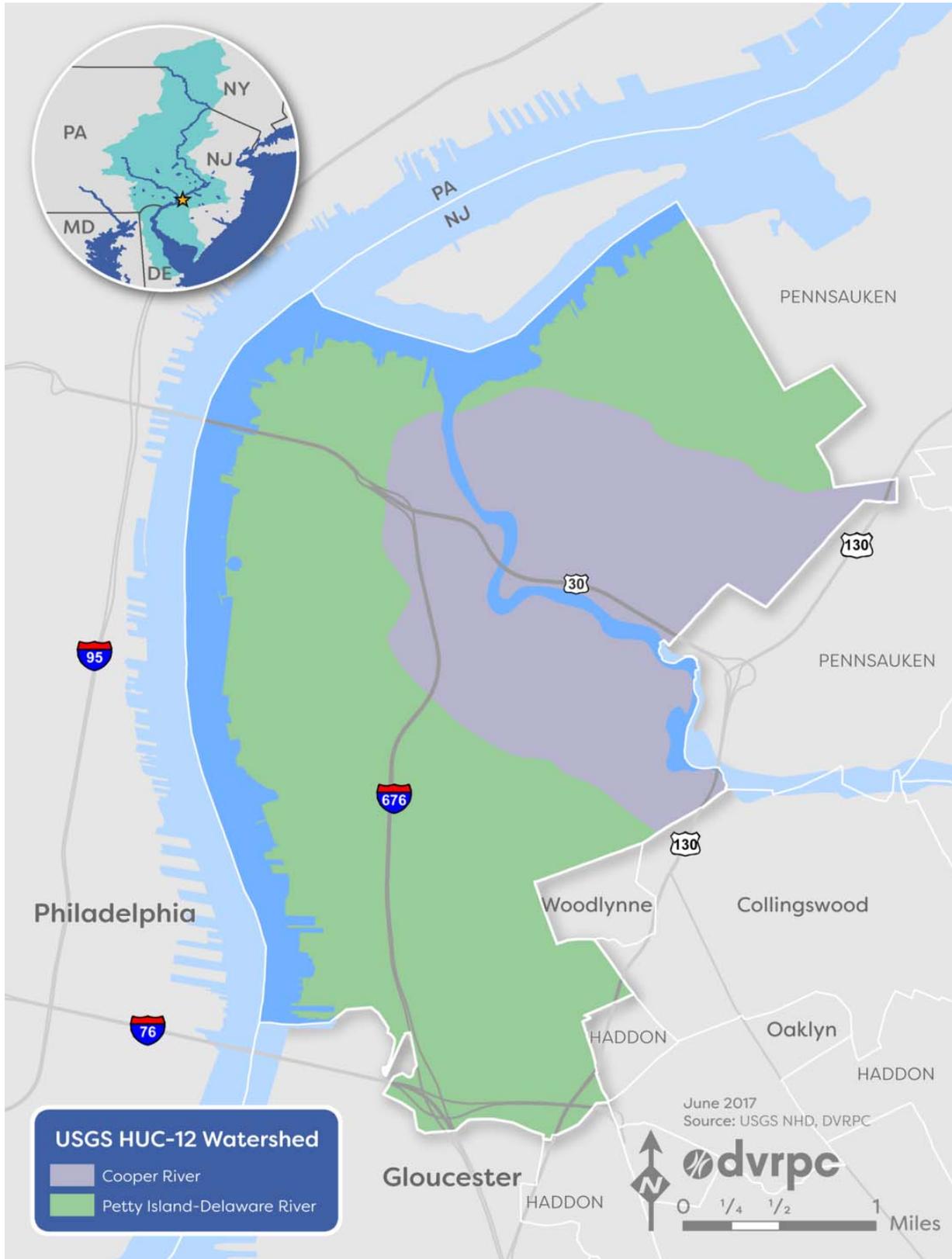
Water area: 1.42 square miles (13.73%)

Water Resources

The city is 10.3 square miles with a 2015 population of 76,119 (approximately 7,479 persons per square mile). Approximately 14 percent of the city’s land area is water; water bodies include the Delaware River, the New Jersey Channel (also referred to as the Delaware River Backchannel, a navigable channel of the Delaware River), the Cooper River, and the Newton Creek (both its Main Branch and Tributary).

The Delaware River Basin is a significant natural resource and economic engine, providing drinking water to more than 15 million people, including New York City and Philadelphia. Much of the City of Camden’s identity and future are tied to the Delaware River waterfront. Along the waterfront are thriving residential neighborhoods, redevelopment opportunities, tourist attractions, natural areas and a trail network, and large port and industrial facilities.

Map: Camden City Watersheds



The Cooper River measures 16 linear miles and drains approximately 40 square miles. Of note are several lakes and impoundments upstream of Camden.

The Newton Creek is approximately six linear miles and is comprised of three tributaries; its watershed area is approximately 13.6 square miles.

Water Quality Problems

The city faces several challenges, but the single biggest threat at present are the city's Combined Sewer Overflows (CSOs) and the flooding affiliated with them. The current system is aged, severely taxed, and overflows routinely. A one-inch storm can inundate the system, causing back-ups onto the city's streets, parks, and homes, and/or discharges into the Delaware River. It is considered by many to be a public health crisis.

A second problem, according to New Jersey American Water, one of the city's water suppliers, is that the city loses upwards of 40 percent of its potable water through transmission leakages.

The city also has lead in its drinking water, the source of which is the internal plumbing in homes, not in the water system itself. A first flush by residents—running the water for 30–45 seconds—can clear the lines, but it is a worrying issue nonetheless.

Some of Camden's environmental challenges are the result of past industrial pollution. The city has nearly 200 known contaminated sites (including several Superfund sites). Of the city's 21 neighborhoods, the Waterfront South community alone has 27 known contaminated sites and two Superfund sites. Much of the land that could be used for infill is contaminated. Despite this, the city sees great potential for redevelopment and has undertaken many projects that have contributed to a "greening" of the community.

Water Quality Solutions

Water quality is very important to the City of Camden, and the city acknowledges that without proper investments, access to clean water resources will be an impediment to the city's revitalization. Action taken by the city and its partners was spurred on by serious flooding events and concern for public health, recognizing the connections between water health and public health.

One of the most important strategies being used to improve and protect water quality was the formation of partnerships with other public and private entities engaged in water resource issues. The city has been leveraging tremendous assistance from community partners to develop strategies to improve and protect water quality. For example, the Camden SMART Initiative and the Camden Collaborative Initiative (CCI) work to improve the city's gray infrastructure and create opportunities for green infrastructure. These partnerships are thinking creatively to reduce the burden on the city's combined sewer system. The U.S. Environmental Protection Agency (U.S. EPA) and New Jersey Department of Environmental Protection (NJDEP) have also become true partners, frequenting the city for meetings and



Source: CCMUA
Baldwin's Run Daylighting is an example of a project undertaken by Camden SMART.

Coalitions Dedicated to Improving Camden through its Environmental Resources

Camden Collaborative Initiative (CCI): CCI is a solutions-oriented partnership between governmental, non-profit, private, and community-based agencies formed to implement innovative strategies to improve the environment and the quality of life of Camden's residents. The City of Camden, with the support of CFP, CCMUA, NJDEP, and the U.S. EPA, launched CCI in 2013. There are now over 40 member organizations.

Camden SMART Initiative: Camden SMART (Stormwater Management and Resource Training) is a working group within CCI that was originally founded in 2011 by a coalition of six entities: the City of Camden, CFP, CCMUA, Rutgers Cooperative Extension Water Resources Program, New Jersey Tree Foundation, and the NJDEP. The initiative is a community-driven movement to protect human health, improve conditions for economic development, improve water quality, and enhance the quality of life for Camden City, its residents, and the Delaware River watershed through the broad use of green and gray infrastructure techniques for stormwater management. It now is a part of the more extensive CCI, administered and staffed by Cooper's Ferry.

participating in creative problem solving, not just regulatory enforcement.

CCI is a partnership of over 40 organizations that work together on a wide range of environmental issues. The group has five main partners: the City of Camden, the U.S. EPA, the NJDEP, the Camden County Municipal Utilities Authority (CCMUA), and Cooper's Ferry Partnership (CFP). Together, this group brainstorms solutions related to brownfield remediation, air quality, illegal dumping, recycling, environmental education, stormwater management, public health, and environmental justice. The group has identified the interconnectivity of many

environmental issues and believes that a peer-to-peer partnership approach is the best way to collectively solve environmental problems in the city. Examples of projects include joint programs to tackle illegal dumping, address combined sewer flooding, improve riverfront access, and fast track permits. Additionally, the Initiative has held seminars for environmental professionals and developed programs to create environmental jobs in

the local community. In 2015, the partners worked with the city to adopt the first sustainability ordinance in New Jersey that requires land development applicants to submit an Environmental Impact Assessment to the Planning Board.



Source: CCMUA
 Von Neida Park is a facility that benefited from daylighting Baldwin’s Run, which is immediately adjacent to the active recreation site.

As of 2016, Camden SMART has completed 50 new green infrastructure projects, four park projects with green infrastructure elements, and a stream daylighting project that addressed wastewater flooding in a large city park. The city and its partners have worked together to identify the public benefits of their activities and seek out projects that achieve multiple benefits (e.g., a park that offers recreation, infiltrates stormwater, and daylights a stream). Work to improve the sewer system has involved pipe replacements that have averaged between two and three million dollars a year, and CCMUA is about to implement a \$60-million improvement plan to reduce flooding, improve the waterfront, further reduce combined sewers, improve pipes, and upgrade the wastewater treatment plant. Additionally, Camden SMART hosts an annual public convening focused on stormwater management and environmental efforts in Camden and beyond.

The Camden SMART Initiative, a working group within CCI, developed a multi-pronged approach to address the city’s stormwater management challenges, including: (1) implementing a water conservation ordinance to reduce usage; (2) undertaking green infrastructure projects; (3) cleaning and restoring combined sewer pipes; (4) replacing components of the combined sewer system and its overflows and separating the system near the Delaware River to reduce sewage discharges; (5) upgrading CCMUA’s wastewater treatment plant; and (6) educating and engaging the public through events, partnerships, and presentations.

Key Partners

Camden County Municipal Utilities Authority (CCMUA): CCMUA operates the County Regional Wastewater Treatment System, which manages 58 million gallons (220 million liters) of sewage per day. CCMUA has been a key partner in helping the city manage its sewage and CSOs.

Cooper’s Ferry Partnership (CFP): CFP is a non-profit community and economic development organization that serves as a catalyst for the growth and preservation of the vibrant City of Camden. CFP works to establish public and private partnerships to effect sustainable economic development and promote and grow Camden as a place in which to live, work, visit, and invest.

U.S. EPA Region 2: Responsible for Clean Water Act enforcement in New Jersey, including issues related to CSOs, Total Maximum Daily Loads, and Municipal Separate Storm Sewer System.

New Jersey Department of Environmental Protection (NJDEP): The state agency collects water quality data to determine the status of water quality impairments and assists Camden in meeting its regulatory requirements.

For its efforts, the city recently attained the silver certification from Sustainable Jersey and won a special award from Sustainable Jersey for the multiple partnerships involved in its sustainability endeavors.

Progress to Date and Challenges Ahead

The City of Camden has had much success: CSO impacts have been reduced, stormwater has been better managed, sewer system upgrades have been installed (and will continue), community outreach has improved, and the city has seen corresponding improvements in its parks, waterways, and overall water quality. In addition, the partnerships that have formed, such as CCI, have been instrumental in bringing about change that minimally affects the city’s limited budget.



Source: CCMUA
 A demonstration/exhibit on Roosevelt Plaza, in front of Camden’s City Hall.

Additional partnership efforts by the city include: working with the U.S. EPA to develop a “green infrastructure handbook” that is provided to local businesses, utilizing the services of the Trust for Public Land to help identify appropriate sites for green infrastructure, engaging the Nature Conservancy to undertake a study of vacant parcels for their potential to manage stormwater, working with the Pennsylvania Horticultural Society to develop a rain barrel program, and utilizing the guidance offered by the Philadelphia Water Department to develop water resource management programs and initiatives. Capitalizing on the desire to achieve multiple project benefits, the city, along with CCMUA and Center for Family Services, a non-profit, created a job-training program to train

young people in landscape management, park maintenance, and green infrastructure maintenance. This program not only provides job training for work related to the city’s park, water resources, and land management projects, but also assists with job placement, a critical component of any job-training program.

Historically, cities such as Camden have both depended upon and degraded their waterways: channeling them, dumping into them, and often overlooking their importance. For Camden, connecting people to water in all its forms and for all its uses is now seen as critical to the city’s long-term viability. Opportunities exist, and the city and its partners have done a good job implementing projects as time and dollars have been made available.

Camden’s greatest limitation to continued progress is lack of financial resources. Although social capital is high, money needed to finance projects is often elusive. The city does not have a dedicated stream of funding; currently, stormwater impact fees or service fees are not considered viable given the overall economic conditions of the city. Clearly the city has accomplished a great deal in the last five years through partnerships and collaboration, but it is constrained from doing all it would like by budgetary limitations. For the city to accomplish more, it will need to continue to build capacity within its departments, as well as within the organizations that support CCI. The will and interest are there, but the city’s current staff members are spread

thin. Additionally, there is not an Office of Sustainability or Environmental Protection and/or dedicated staff for such offices and efforts.

Nevertheless, the city and its partners believe that recent improvements and investments will contribute to immigration and create a brighter future for the community. There are many challenges ahead, but also many opportunities. As Andy Kricun, Executive Director of CCMUA, stated, “the Collaborative treats the city as a partner, not a patient.” Although there is never enough money to do all that is needed, the partnerships that have developed with the city’s guidance have made progress possible.

Key Factors in Success

The city has an engaged mayor and staff that are willing to enter into innovative partnerships with a diverse group of citizens and local, regional, state, and federal agencies to address the needs of the city in unique and productive ways. Although money is in short supply, social capital is high and the city has put faith in its many partners to achieve what might not have been done otherwise.

Cooper’s Ferry has been able to rally support of community organizations and residents. NJDEP provides guidance and facilitation with the U.S. EPA. Rutgers Cooperative Extension has provided research. All of this has leveraged foundation grants and other types of funding for numerous projects.

Important issues to address in the future will be the costs of ensuring water quality and the continued value of partnerships and collaborations. As Andy Kricun stated, “The city’s champions are the various partnerships that have been formed over many years. These partnerships have made it possible to achieve many projects in Camden that would otherwise not have occurred. Given the city’s distressed economy, it is these partnerships that have made it possible for the city’s water resources to improve.”

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Motivating Factors

Failing Infrastructure: Flooding events and impacts to the city’s CSOs created health hazards that forced action by the city and its partners.

Regulatory: The U.S. EPA and NJDEP discharge regulations requiring water quality improvements.

Local Partners: Partnerships developed with the city by diverse groups, such as CCMUA, CFP, as well as others mentioned herein, have contributed greatly to progress in Camden.

Unifying Issues: Flood issues and the inability of the city’s CSOs to manage increased loads.

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Published to web: June 23, 2017

📍 **MUNICIPAL CASE STUDY**

Cooks Creek Watershed Association, Pennsylvania

The Cooks Creek Watershed Association (CCWA) achieves its goals by working with its municipalities, providing education and public outreach, and serving on environmental advisory councils (EACs), planning commissions, and open space commissions.



By: Julie Schneider, Watershed Planner
 Center for Watershed Protection

Background

CCWA was created in 1974 and has very active volunteer board members. These individuals may be among the most important contributors to the success of water quality protection efforts in Durham and Springfield townships in Bucks County. Many have been active for over 30 years and are passionate about watershed protection. CCWA board member Hans Reimann’s passion for open space began as a child exploring the woods and streams in his backyard. In the early 2000s, he joined Springfield Township’s Open Space Committee. “I knew I needed to get involved after hearing a local official discuss removing trees along a stream so they don’t fall into the stream.”

Water Resources

Located in northeastern Bucks County, Pennsylvania, the 30-square-mile Cooks Creek Watershed drains to the Delaware River. The majority of the watershed is in Springfield Township (70.29 percent) and Durham Township (19.39 percent). Smaller portions of the watershed drain Lower Saucon, Upper Saucon, and Williams townships in Northampton County and Haycock and Richland townships in Bucks County. The watershed is underlain with limestone bedrock and contains a high-quality drinking water aquifer that serves many of the residents. It is classified as an Exceptional Value Cold Water Fishery under the Pennsylvania Chapter 93 Water Quality Standards, as it supports a wild brown trout and native brook trout fishery. In addition, the watershed contains numerous rare and endangered species, was rated Priority 1 in the 1999 Bucks County Natural Areas Inventory, and is designated an area of special concern by the Highlands Coalition.

Quick Stats

Cooks Creek Watershed

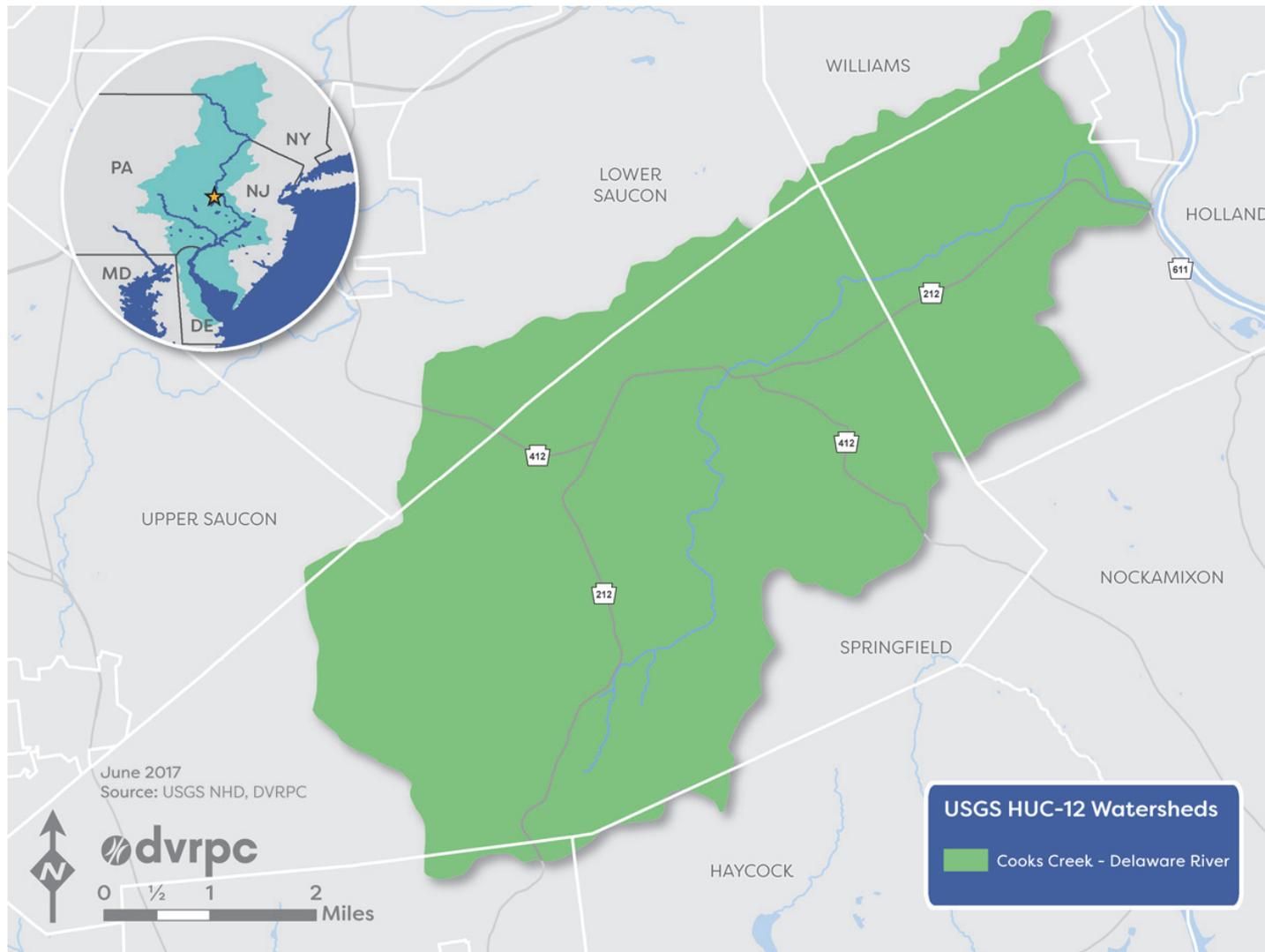
Major adjoining waterbody:
 Delaware River

Land area: 29.6 square miles

Other special characteristics:
 Exceptional Value watershed, natural brook trout fishery

Watershed association: Formed in 1974

Map: Cooks Creek Watershed



Watershed protection efforts began in the early 2000s with the development of the Cooks Creek Watershed Conservation Plan (CCWCP) by the Durham Township EAC. The CCWCP was created in response to concerns about a water quality “crisis” in the form of increased development pressure in adjacent townships, protecting the limestone aquifer drinking water supply, and the proposed development of a petroleum farm. A member of the Durham Township Planning Commission and CCWA explains: “When there’s a crisis, people rally around to protect what we have here. If everything’s going okay, we’re kind of complacent.”

While there is no formal agreement between Durham and Springfield townships, the board members of CCWA work across jurisdictions to integrate protection of the watershed into municipal planning documents. A core group of watershed association members participates on multiple boards and commissions, including the EACs, planning commissions, and open space commissions. They have been instrumental in integrating watershed protection into municipal land use and development ordinances. This cross-participation allows the environmental group to influence policy and provide education, and fosters communications across

municipalities. The importance of this work is noted by a member of the Durham Township Planning Commission and CCWA, Lois Oleksa: “Water is a basic thing that all of us humans need—can’t live without it.”

CCWA has become the “go-to” resource for municipal officials on watershed-related topics and has also been the driving force behind starting up the EACs and securing grant funding for watershed activities. “One of the watershed association’s goals is to be on different boards (planning commission and EAC) in the township so that we can influence policy and educate others. It has led to the betterment of things for citizens/residents,” notes Lois Oleksa.

Integrating Watershed Planning into Municipal Planning

The CCWCP was funded through a Rivers Conservation Grant and a Growing Greener Grant from the Pennsylvania Department of Environmental Protection. The main goal of the document was to provide the basis for developing comprehensive plans and zoning ordinances that take into account the current quality of the watershed, the quantity of available drinking water, and its sensitivity to degradation. As such, one of the plan recommendations was to update the Comprehensive Plan and zoning ordinance for both Durham and Springfield townships. This plan has been instrumental in integrating watershed protection into township land use and development guidelines.

“I knew I needed to get involved after hearing a local official discuss removing trees along a stream so they don’t fall into the stream.”

- Hans Reimann, CCWA board member and member of Springfield Township’s Open Space Committee

Through the dedicated work of CCWA board members, both townships have since integrated the CCWCP into their comprehensive plan and zoning ordinance to help protect water resources. The Durham Township 2006 Comprehensive Plan incorporates the CCWCP by reference and states, “The Plan is invaluable as a tool for identifying the important features and significance of the watershed. It also establishes a framework for developing a program for the protection and proper management of the watershed.” In addition, the overall goal of the plan is “to maintain the high quality of life in the Township by protecting the natural resources—including the Cooks Creek Watershed, prime agricultural land, the floodplain of the Delaware River and its tributary streams, the limestone geology and the wooded slopes.”

Some examples of where the CCWCP plan recommendations have been incorporated into the township zoning ordinances and other land use regulations include:

Key Factors for Success

Many CCWA Board Members are on municipal bodies, such as planning commissions, EACs, and open space commissions, and are seen by municipal officials as trustworthy resources.

The CCWCP was funded by two state grants: Rivers Conservation Grant and a Growing Greener Grant. Key recommendations have been integrated into municipal land use and stormwater ordinances.

CCWA provides educational resources and opportunities, and outreach to property owners.

- Section 301 of the Durham Township zoning ordinance (2015) defines five districts and three overlay districts that divide up the township, one of which is the Resource Protection District or RP. The purpose of the RP is defined in Section 304 as: “To protect areas of natural features such as mature forest, steep slopes, scenic

areas, wetlands, streams, floodplains and ponds including those identified in the latest version of the Bucks County Natural Resources Plan.”

- Springfield Township’s zoning code has a Watershed District defined in section 304.B as: “To protect key portions of the Cooks Creek watershed that greatly affect the water quality of the water supply of many Township residents and businesses... to carry out the Cooks Creek Watershed Conservation Plan.”
- Section 508 of Durham Township zoning ordinance contains Environmental Protection Standards that provide strong protection of natural resources. The ordinance defines a percentage of natural resource protection for each zoning district.
- The Springfield Township 2009 stormwater management ordinance requires a stormwater plan for all projects that propose the addition of more than 1,000 square feet of impervious cover to residential properties. This is a very proactive approach to minimize the impacts of land disturbance and stormwater runoff on water resources, as most municipal stormwater management ordinances only require stormwater plans when an area of more than 5,000 square feet is disturbed.

Another important contributing factor to the successful protection of the Cooks Creek Watershed is education. The close working relationship between the watershed association and the municipalities has been instrumental in educating landowners on the importance of stewardship to support stream health. The townships look to this group to provide education to residents that helps gain support for municipal programs and regulations to protect water quality. “Everyone needs to be educated including homeowners on stream buffers’ importance for water quality and habitat for wildlife,” states a member of the Durham Township Planning Commission and the Cooks Creek Watershed Association.

Efforts to preserve important lands in Durham and Springfield townships have been very successful, with preserved land in Durham Township doubling over the past 10 years. Many of the old farm homesteads adjacent to Cooks Creek in Durham Township have conservation easements held by the township, the Heritage Conservancy, or the Wildlands Conservancy.

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Published to web: September 25, 2017

MUNICIPAL CASE STUDY

East Bradford Township, Pennsylvania

Motivated by watershed impairment caused by suburban development over the past 30 years, a township with a full slate of water quality improvement programs looks outside its boundaries and examines new funding strategies to continue protecting its waterways.



By: Paul Racette
 Pennsylvania Environmental Council

Background

East Bradford Township is a suburban community located in northwestern Chester County with abundant rural character. It contains many high-quality environmental resources, such as the Brandywine Creek and its tributary streams, floodplains, and woodlands. The township has prioritized open space preservation, conserving 34 percent of its land base through fee simple acquisition and conservation easements (*East Bradford Township Strategic Comprehensive Plan Update 2004–2014*). Steep slopes and floodplains place limits on the amount of new developable land in the township. The township is developing a greenway trail system that connects its parks and open spaces.

East Bradford is currently 40 percent developed, with about 95 percent residential land, as well as 5 percent commercial/industrial land focused on the southeast corner of the township. The township is located downstream of more densely developed municipalities, such as West Chester Borough and Downingtown Borough.

The total population of the township is 9,942 (2015 Five-Year American Community Survey [ACS]). The median household income is over \$109,000.

Water Quality Problems

Like many other municipalities, East Bradford Township is facing stormwater management and watershed impairment issues caused by urban and suburban development trends. Land converted from forests and meadows to impervious surfaces, such as roads, parking lots, and buildings, increases the amount of stormwater runoff. This in turn has led to increases in flooding, stream bank erosion, and water pollution.

Quick Stats
East Bradford Township

Major water body:
 Brandywine Creek

Population: 9,942 (2015 Five-Year ACS)

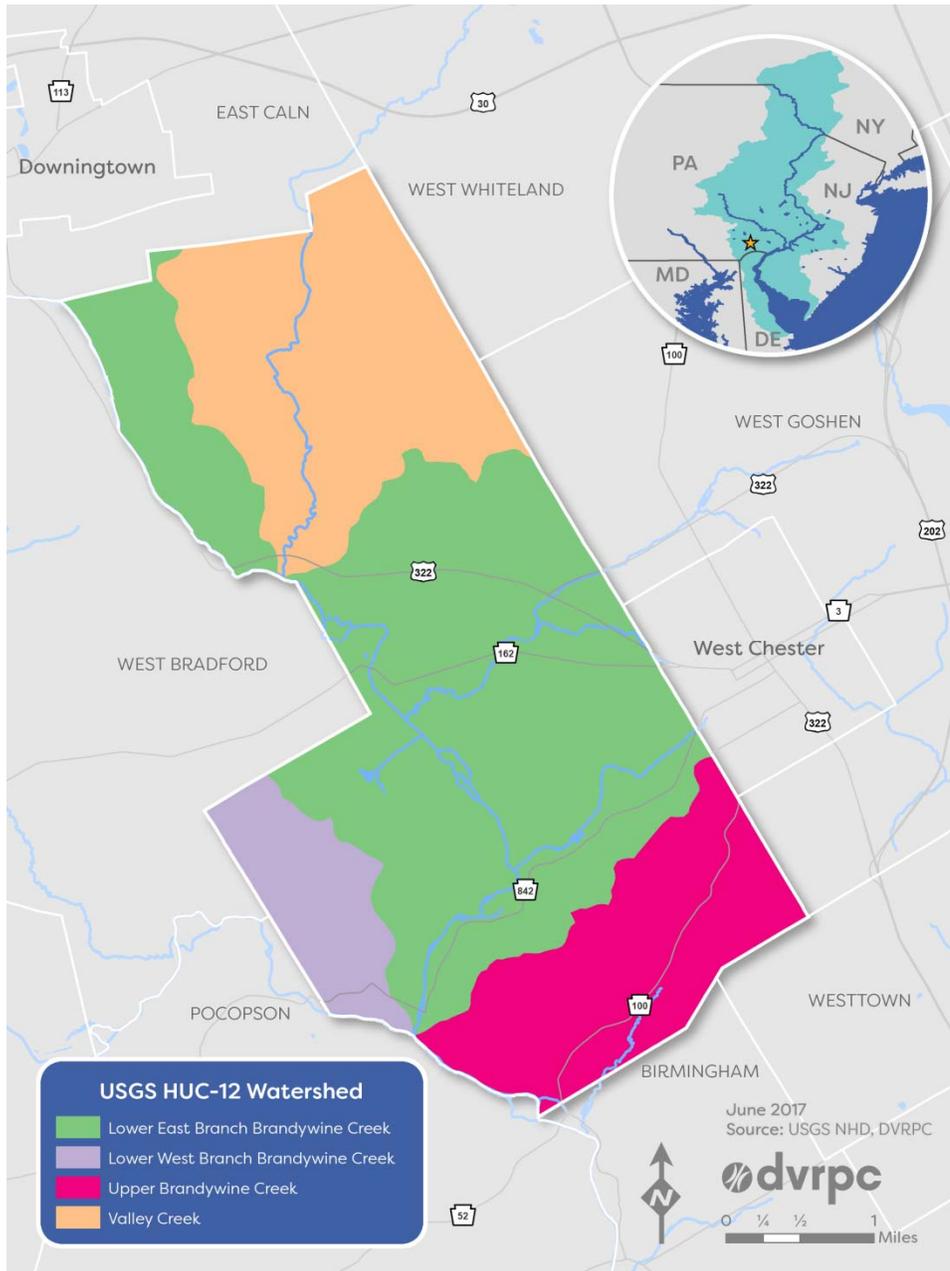
Land area: 15.0 square miles

Water area: 0.1 square miles (0.66%)

Total stream miles: 50.1

Impaired stream miles: 27.9 (55.7%)

Map: East Bradford Township Watershed



Much of the township’s land development occurred between 1980 and 2008. The development from the earlier decades of this period of growth, having not been subject to stormwater management regulations, is likely a significant contributor to current runoff-related problems. In addition, the township has identified more developed upstream communities as a major source of runoff that is affecting water quality and stream health. Rapid runoff from these developed areas increases the volume and velocity of water in Brandywine Creek and its tributaries, causing stream bank erosion and sediment pollution in downstream areas.

Flooding is also an issue. The east and west branches of the Brandywine Creek converge in the township. Rapid runoff from upstream areas has resulted in flooding in the township, blocking access to roads and damaging bridges.

In response to these negative impacts on community safety and environmental health, regulatory agencies such as the U.S.

Environmental Protection Agency (U.S. EPA) and the Pennsylvania Department of Environmental Protection (PA DEP) are requiring municipalities to update their land development regulations and work to restore damaged streams.

East Bradford Township has updated its stormwater management regulations to reduce the amount of runoff that development and redevelopment are allowed to generate. The township incorporated the Chester County-Wide Act 167 Stormwater Management Ordinance in December of 2013. The Act 167 Ordinance expands

stormwater management requirements to smaller projects, and requires a suite of controls to reduce runoff, increase infiltration, and protect stream channels.

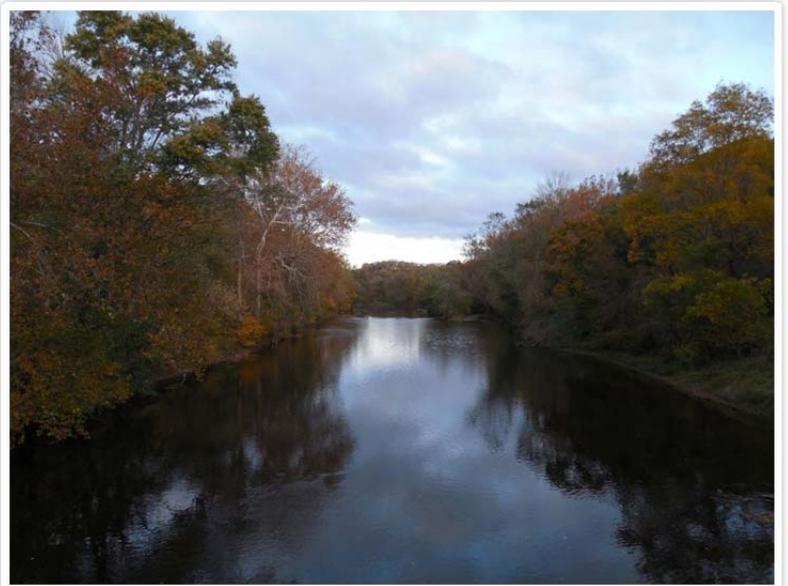
Regulatory agencies are also requiring municipalities to implement restoration projects that undo negative impacts created by past development. These projects are referred to as Total Maximum Daily Load (TMDL) plans and projects. The TMDL establishes the amount of pollution (for example, sedimentation in streams) that is currently occurring and how much it must be reduced to restore stream health. The TMDL plan adopted by municipalities must list the projects that will be implemented to facilitate the reduction in pollutants.

East Bradford Township is currently developing a sediment TMDL plan for Brandywine Creek and its tributaries. According to the township, its sediment reduction requirements are higher than those of other municipalities upstream. Township officials are unsure why this might be; specifically, they do not know how the TMDL modeling allocates pollutant reduction requirements. PA DEP is requesting that the township implement stream bank restoration projects to meet the TMDL requirements. However, township officials are concerned whether runoff upstream will be reduced sufficiently to make significant stream restoration investments by the township effective.

Water Quality Solutions

East Bradford Township has adopted and continues to implement several key strategies to address stormwater management and watershed restoration issues. The township is pursuing these strategies as part of its planning, development, and parks and recreation activities, as well as through its response to regulatory requirements such as the sediment TMDL.

Key strategies include land conservation, natural resource protection, existing and new stormwater control measures, and stream restoration. These key strategies are in turn linked to the township's consideration of stormwater financing, multi-municipal collaboration, and changing public attitudes.



Source: Jimmy Emerson via Flickr, October 19, 2014. www.flickr.com/photos/auvet/
Brandywine Creek in Autumn.

Land Conservation: East Bradford Township continues to pursue conservation of open space, agricultural, and natural lands. This preservation strategy protects surface and groundwater resources, as well as conserving farmland and creating recreational opportunities (most notably, a park and greenway trail network along Brandywine Creek). Township residents pay an open space fee that finances fee simple and conservation easement acquisitions.

As mentioned previously, the high priority that the township places on open space preservation has led to the protection of approximately 34 percent of its land area. The township's preservation effort continues and in the long term will contribute positively to the protection and restoration of water quality.

Natural Resource Protection: Natural resources, such as streams and wetlands, can be protected from the impacts of development by rules that restrict activities in areas surrounding them. Riparian buffer ordinances are one example of this strategy. The Brandywine Conservancy is promoting municipal riparian buffer ordinances in the Brandywine Creek watershed, with the goal of protecting streamside land that infiltrates and cleans stormwater runoff and provides other values such as wildlife habitat.

East Bradford has adopted a riparian buffer ordinance that restricts development in the area within 100 feet of streams, or up to 150 feet if the stream is designated as “impaired” or as having “special protection waters.” The riparian buffer ordinance requires native vegetation within the first 50 feet of the stream. Within the remaining buffer area, the ordinance requires vegetation that will reduce stormwater runoff velocities and pollutant loads.

Existing and New Stormwater Control Measures:

While some of the development in East Bradford Township predates more rigorous stormwater management requirements, the township views itself as an early adopter of strict development regulations. Officials report that most of their developments have been required to install stormwater runoff controls, such as extended detention stormwater basins, wet ponds, and underground storage. They note that only a few opportunities remain to reduce stormwater runoff volumes in the township, and that these projects are being pursued as part of the township’s TMDL implementation.

The township is now exploring how to foster and support stormwater runoff controls in more developed upstream municipalities. The township is also coordinating with PA DEP on a TMDL strategy that includes stream bank restoration projects and several additional strategies.

Stream Bank and Flood Plain Restoration: As mentioned previously, East Bradford Township is working with PA DEP to complete a sediment TMDL plan. With few additional opportunities to reduce stormwater volume and velocity on its developed land, the township is focusing its TMDL planning on stream bank

Key Partners

East Bradford Township representatives, including its three supervisors, the township manager, township engineer, and the Environmental Advisory Board chair, are engaged in stormwater management issues.

The township receives support from the *Brandywine Conservancy and the Brandywine Red Clay Association*. These two non-governmental organizations help with ordinance development, stream restoration, and tree planting projects.

The *West Chester Fish, Game & Wildlife Association* has led a multi-decade effort to steward and protect West Valley Creek, a tributary stream that flows through the township into Brandywine Creek. The Association, initially formed in 1937, advocates for fish, game, and wildlife through habitat improvement projects, education, and outreach, and the operation of a trout hatchery which provides fish for West Valley Creek.

The township has received support from the *Chester County Water Resources Authority*. The Authority supports municipalities with model ordinances and TMDL plan development, and collects water quality data that it makes available to its townships. East Bradford Township also receives water quality monitoring support from the *Stroud Water Research Center*, which runs citizen science monitoring programming with a focus on Plum Run.

East Bradford officials are working with *PA DEP* on the development of TMDL plan for reducing sediment pollution, as well as on their overall Municipal Separate Storm Sewer System (MS4) permit.

Upstream municipalities, such as West Chester Borough, West Goshen Township, and Downingtown Borough, are key players in addressing sources of stormwater runoff. East Bradford Township is interested in collaborating with these and other upstream municipalities in the Brandywine Creek Watershed on watershed-wide efforts.

restoration. Stream restoration projects can improve water quality by filtering pollutants from overland flow and reducing stream bank erosion and associated sediment loading. The township's projects include stream bank re-contouring, followed by re-vegetation with native grasses, wildflowers, trees, and shrubs.

The township is working to restore its stream banks in partnership with several entities, including the Brandywine Red Clay Association. This organization supports restoration of the Plum Run, which originates in West Chester Borough and flows through the township before entering Brandywine Creek, through an initiative referred to as "Red Streams Blue." The initiative is so named because it aims to restore streams from an impaired (red) status to an un-impaired (blue) status. The Brandywine Red Clay Association is also conducting a National Fish and Wildlife Foundation funded TMDL pilot project to develop stream restoration strategies for urban, suburban, and agricultural use areas.

Where opportunities exist, additional stormwater volume storage can be restored when fill is removed from floodplains. Legacy sediments associated with historical mill pond dams are reported to be present in the township.

Other TMDL Implementation Projects: In addition to stream bank and flood plain restoration, the township has proposed other categories of projects, including stormwater basin retrofits; redevelopment strategies, where the township had developers over-control runoff from development projects in order to obtain stormwater management credits; and tree planting in riparian buffers.

The township reported it has completed nine projects that are included in its TMDL plan, which gets it to 20 percent compliance with its required sediment reduction loads. It is considering re-adjusting the proposed TMDL plan to "parse out" areas that do not discharge into its storm sewer system, understanding that this action could boost it to 50–60 percent of its required sediment reductions. If it "parses out" land from which runoff does not discharge into its MS4 storm sewer system, the township will not have to calculate pollutant loading or consider sediment reductions from these "parsed out" areas.

One point of controversy raised by the township is that the amount of sediment reductions required for its TMDL plan is higher than reductions required for similar upstream municipalities; PA DEP requested that extensive stream restoration projects (nine miles of projects) be included in the township's TMDL plan. The township recognizes it has stream bank restoration opportunities on its preserved lands, and it is willing to collaborate with partners, including the Brandywine Red Clay Association and upstream municipalities, on the projects. As noted previously, township officials are concerned about the scale and cost of stream bank restoration being placed under their TMDL responsibility.

The township is also concerned about the time and resources needed to get the required permits for stream bank restoration projects, noting that the process should be streamlined to make it easier to get restoration permits. Overall, the township reports that it does not have the funding to comply with PA DEP's stream restoration target (the nine miles will cost approximately five million dollars), and requests that the agency be more open-minded in identifying a workable solution.

Stormwater Financing: Several themes were raised by the township related to financing stormwater and stream restoration projects.

The first is the overall challenge of funding the projects. The township is concerned with the potential costs associated with its TMDL requirements for stream restoration. It views the cost of restoration as a steep financial challenge, noting that restoration and retrofitting costs are not incorporated into the township's budget. It has received grants to do projects, especially through partnerships with the local watershed non-profits, and views additional grant funding as essential. It has achieved some water quality improvements through new construction and redevelopment.

The township is open to establishing its own sources of funding, such as through stormwater fees. Officials recognize the political challenges associated with new fees; residents may view the fees as a tax, or fail to recognize PA DEP as the body spurring the township to raise fees, which helps give the township political cover.

The township is also interested in incorporating stormwater credits as part of its TMDL planning. For example, it would like to be able to collaborate and share costs with other entities in East Bradford on projects in their own township (for example, a stream restoration project) or with upstream municipalities within that municipality's jurisdiction (for example, a runoff reduction project). In this situation, the most cost-effective projects can be prioritized at a regional scale, and each party receives partial credit. The township would also like to know more about how PA DEP determines credits for different project types.

Another finance issue is private landowners' inability or unwillingness to pay for streambank planting projects, and even more critically, their long-term maintenance. Township landowners currently access state Treevitalize funds for streamside plantings. Another incentive program is the Conservation Reserve Enhancement Program (CREP) run by the U.S. Department of Agriculture, which funds stream planting projects on private land. CREP allows property owners to rent their land for a period of time and be reimbursed for the cost of restoration and associated maintenance. Triple-bottom-line incentives such as improved property values can be highlighted to encourage landowner participation.

Another proposal is to create a municipal funding program for riparian buffer improvements that covers both installation and maintenance. Townships typically do not have budgets for maintenance activities such as removing invasive vines, protecting buffers from deer, and uprighting trees after flooding. It is often difficult to maintain volunteer programs for such maintenance. The township suggested a streamlined, municipal-only buffer restoration grant program.

Multi-Municipal Collaboration: The township is located midway down the Brandywine Creek Watershed, where the East and West branches converge. The township has implemented an array of conservation and stormwater management programs within its jurisdiction and is considering how to address upstream sources of runoff that have a detrimental impact on township resources. The township is willing to work with upstream partners, and is exploring collaboration options. A key issue is how the township can receive credit for upstream investments.

Changing Public Attitudes: Another theme raised by township representatives is the need to provide education and outreach programs to shift public attitudes toward land management (for example, changing preferences for turf lawn to appreciation for native landscapes). Since paved surfaces and compacted turf grass landscaping are major causes of increased stormwater runoff, there needs to be a shift to a broader public acceptance of meadows, rain gardens, and forested stream banks. It was noted that this change in

public attitudes and aesthetics may be generational, and may come about as people see successful restoration projects.

It was also reported that while people generally “support water quality,” they do not fully understand how to protect water quality. The general public tends to be reactive, meaning they will not address water quality issues until directly affected (for example, their tap water is polluted, there is neighborhood flooding, or they receive a stormwater bill in the mail). As such, it is hard to win over broad audiences unless a specific action is required. In the case of a new stormwater fee, residents need to understand that the fee they are paying is addressing larger issues (the township’s entire ecosystem and risks to long-term watershed health) in addition to the issues that directly impact them (which may include local flooding and stream bank erosion).

The township expressed a desire for an outside party to help provide programming on community-wide best practices to educate homeowners about water quality issues and solutions.

Progress to Date

One of the case study interviewees suggested several key practices for a successful municipal conservation and water quality protection program, including land protection, agricultural programs that protect streams, and strong stormwater development ordinances. This interviewee noted that such practices should be implemented early in development trajectories before the “tipping point” to water quality impairments occurs. Before the tipping point occurs, a healthy watershed can deliver ecosystem services such as clean water and healthy streams. But without a commitment to sustainable development, ecosystem services are degraded and the cost to restore them increases as unsustainable land development practices continue.

East Bradford Township has been implementing proactive land conservation, natural resource protection, and stormwater management programs. Motivations for these actions may be attributed to a number of factors, ranging from goals to protect open space and create parks for residents, township concerns about flooding, and township requirements to comply with water quality regulations. A tipping point has been reached in the township, with some (but not all) of the stream corridors impaired. A pathway to successful restoration is open through the implementation of sound redevelopment and development practices, and restoration efforts implemented through watershed-wide TMDL plans.

The timeline for achieving water quality restoration goals is driven by the township’s MS4 permit cycle (typically five years), during which PA DEP requires a certain percentage reduction in pollution loading from storm sewers into local impaired waterways. Several permit rounds will likely be required before water quality restoration goals can be met in the township and across the watershed.

Barriers to Overcome and Potential Solutions

The township has made great strides in the effort to protect and restore water quality, but barriers remain in the path toward water quality and watershed health. Key barriers and potential solutions include:

Better Understanding of How Sediment Load Reduction Requirements Are Determined: The township is concerned with the scale of stream restoration being proposed by PA DEP for the township’s TMDL plan. It has raised issues of fairness in the manner in which TMDL sediment load requirements have been apportioned to it and other municipalities. It wants to determine a way forward that results in positive, incremental progress in improving water quality in a manner that addresses multi-municipal stormwater flow. The township and PA

DEP need to discuss and resolve the fairness issue raised by the township, and establish TMDL project goals and timelines that result in steady improvements in water quality at costs that the township can sustain.

Better Understanding of How Restoration Projects Are Credited: The township has asked for clarification on how stormwater and stream restoration projects are assigned pollutant reduction credits. Pollutant removal efficiencies are available for general project categories (e.g., they are cited in the PA DEP *Best Management Practices Manual*, and in the general literature). PA DEP is moving toward a Performance Standard approach to calculating pollutant reduction efficiencies that relies in part on site-specific conditions (for example, drainage area and storage volume). Guidance on this approach was provided by PA DEP at recent Pollutant Reduction Plan (PRP) training in Fall 2016.

Streamlining Collaboration: The township is interested in collaborating with upstream municipalities on stormwater runoff reduction projects and is exploring financing options for projects both inside and upstream of the township. The recent PA DEP workshop on how to prepare PRP/TMDL plans provides direction on where such project collaboration may occur. The guidance allows municipalities to share credits for projects that are located within a common drainage area, and a municipal agreement must be established to enable credit sharing.

External and Internal Funding: The township is exploring both internal and external funding sources. Its collaborations with the Brandywine Conservancy and the Brandywine Red Clay Association have led to the successful procurement of grant funds. The availability of open space land is a factor (i.e., projects with site control and a willing landowner are more eligible for grant funds). The use of riparian buffer planting funding programs such as CREP would also benefit restoration efforts on private land.

The township is open to self-financing in the form of stormwater fee programs. Its upstream neighbor West Chester Borough recently passed such a fee program.

Raising Awareness and Changing Perceptions: The township recognizes the need for increased public awareness of how residents can contribute to clean water programs. This includes increased awareness of watershed-wide water quality issues and a broader acceptance of green stormwater management practices. The township is interested in water quality education and outreach programs that are targeted to homeowner and property manager audiences. Continuing efforts in this area are needed to boost the number of landowners who are open to managing water on their own properties, and residents who are willing to accept a stormwater fee. Constituents who understand and work to improve water quality will more likely support elected officials who propose municipal finance options.

Motivating Factors

Flooding: Riverine flooding from storms has damaged local infrastructure and caused erosion.

Local Champions: Township staff, residents, and elected officials support the concept and the practice of improving water quality, and are devoting time and energy to determining solutions.

Regulatory: U.S. EPA and PA DEP discharge regulations requiring water quality improvements.

Local Partners: Partnerships developed with the township by diverse groups, such as the Brandywine Conservancy, the Brandywine Red Clay Association, the Stroud Water Resources Center, the Chester County Water Resources Authority as well as others mentioned herein, have contributed greatly to progress in East Bradford.

Replicating Good Land Use and Stormwater Management Practices: East Bradford Township has exhibited leadership in adopting sound land conservation, natural resource protection, and stormwater management ordinances. The replication of these practices in other municipalities will enable the achievement of broader Brandywine Creek Watershed restoration goals.

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Published to web: August 11, 2017

📍 **MUNICIPAL CASE STUDY**

Hamilton Township, New Jersey

Hamilton Township turned negative publicity on the township’s approach to managing stormwater to positive action by engaging the Rutgers Cooperative Extension Water Resources Program (RCE). Township staff embraced a new, proactive perspective, RCE has since completed numerous implementation plans, and the community is now interested and engaged in water quality issues.



By: Ryan Walker,
Natural Lands Trust

Background

Hamilton Township, located in Mercer County, New Jersey, adjoins Trenton to the east and might be described as a typical suburb, given the development patterns that characterize much of the township. However, in addition to the suburban landscape, western portions serve as an extension of Trenton’s more urban neighborhoods while areas to the south of NJ Route 130 contrast with a distinctly rural and agricultural character. Its central location between Philadelphia and New York make Hamilton an economic center, with nearly 50,000 jobs in the township as of 2015. It is also a transportation hub, with numerous highways crossing the township, including Interstates 195 and 295, and the New Jersey Turnpike.

The community is highly populous and is one of the five largest townships in New Jersey, with a population approaching 90,000. While modest population growth continues, it has leveled off sharply since the post-World War II boom. Housing stock reflects an older suburban community largely developed during that time. Hamilton’s median household income is about \$70,000.

In terms of natural features, a portion of Hamilton is located along the Delaware River where extensive wetlands remain. Numerous streams feed these wetland systems, including Crosswicks Creek flanking the township’s southern boundary. Assunpink Creek forms a portion of the town’s northern and western boundary. Township parks and open space are typically located near stream corridors. Greenway corridors have been established in particular along Crosswicks Creek, Doctors Creek, and Miry Run. Some farmland is preserved in the southern portion of Hamilton.

Quick Stats
Hamilton Township

Major adjoining water body:
Delaware River

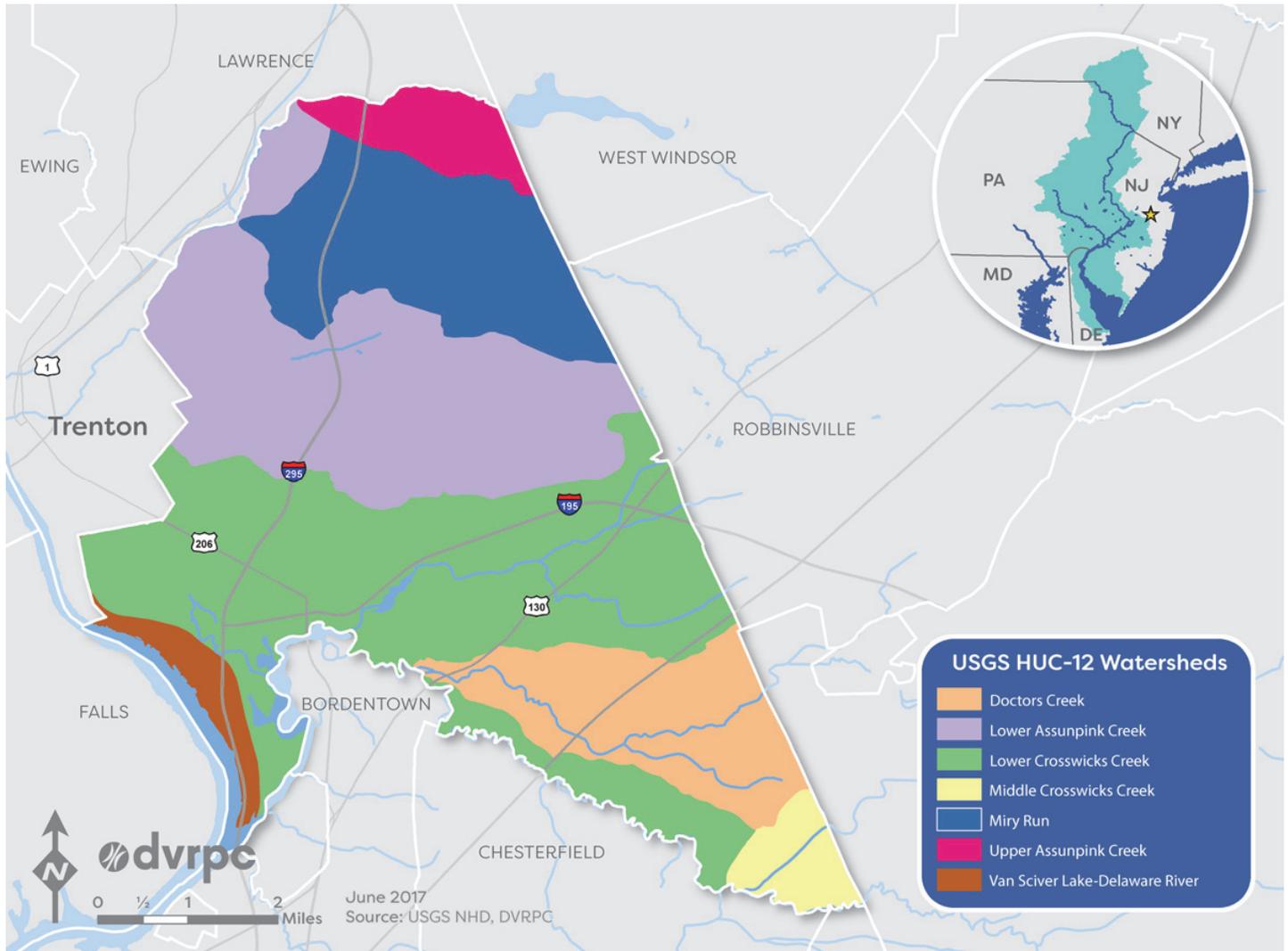
Major streams: Assunpink Creek, Pond Run, Miry Run, Crosswicks Creek, Doctors Creek

Population: 89,055 (2015 Five-Year American Community Survey)

Land area: 25,733 acres

Water area: 870 acres (3.4%)

Map: Hamilton Township Watershed



Stormwater Challenges

The level of development and infrastructure within Hamilton Township hinders the township’s ability to handle and mitigate stormwater in the community. This is particularly apparent after large storm events, which cause extensive flooding in portions of the township. Assunpink Creek, a particular problem area, collects substantial volumes of stormwater before reaching Hamilton. The creek has its headwaters in Monmouth County, extends along much of Hamilton Township’s western border, and then travels through central Trenton before it empties into the Delaware River at Hamilton Township. Flooding in Trenton backs up into Hamilton, and residential, commercial, and industrial sectors are affected. Pond Run, an Assunpink Creek tributary located wholly within Hamilton Township, has significant flooding issues as well. Both Assunpink Creek and Pond Run are heavily channelized, in some cases with concrete spillways, which disrupt existing stream ecology and can result in more powerful and dangerous floods from higher velocities of stormwater.

A detention facility in Hamilton Township’s Veterans Park was installed many decades ago as a flood control measure for Pond Run, but there are now questions regarding its stability. The U.S. Army Corps of Engineers

(ASACOE), with assistance from the New Jersey Department of Environmental Protection (NJDEP), is assessing the Assunpink corridor and performing a feasibility study to determine the best flood reduction strategies. Completion of the study is anticipated in summer 2017.

While flash flooding on Assunpink Creek and Pond Run represent the greatest stormwater challenge in Hamilton Township, other waterways experience flooding, and all eight of Hamilton Township's streams are classified as impaired. Major threats contributing to flooding and poor water quality include stormwater runoff, ineffective and aging stormwater infrastructure, and the development and disturbance of land.

In general, water quality seems to be of lesser importance to residents compared to other concerns, such as fixing roads, or other environmental priorities, such as open space protection. This sentiment is slowly changing, however. Flooding catalyzed interest in water quality, particularly in the short term, and some long-term interest is burgeoning because of the ongoing community engagement described further in this case study.

A Critique of Hamilton's Stormwater Program

Stormwater Management Rules in the state of New Jersey require that major new development projects reduce flood damage and soil erosion, account for effective design and operation of stormwater management basins, minimize increases to total runoff, and protect groundwater recharge and water quality. The Stormwater Management Rules provide guidance and serve as the basis for the New Jersey Municipal Stormwater Regulation Program (NJ MSRP). In May of 2010, the Delaware Riverkeeper Network (DRN) published a report critiquing the NJ MSRP, specifically focusing on Hamilton Township's treatment of stormwater as part of new development projects and indicating that the township was not complying with Stormwater Management Rules.

The DRN report found that from 2005 to 2008, township staff and engineering consultants failed to identify inaccurate information in development proposals. Hamilton Township received an average grade of 42 percent (on a 0–100 percent scale) with lower-average grades for certain factors, such as integration of non-structural stormwater elements. Additionally, the report mentioned that environmental organizations pushed back on the land use board with little response, thereby leading to litigation in some cases. DRN used this assessment to argue that municipalities should not be given additional responsibilities under Stormwater Management Rules and to recommend state-wide changes to the stormwater review process.

While the report stated that there are likely many municipalities not complying and that the issue extends state-wide, Hamilton Township was the only municipality highlighted. DRN emphasized Hamilton Township because of its large size, scale of development, and potential impacts to the historically flood-prone Assunpink Creek. However, Hamilton Township staff viewed the report as one-sided, with additional reservations because Hamilton was the only community analyzed. The report also caused friction between the township and NJDEP, which implements Phase II Stormwater Regulations. Nevertheless, township staff realized that stormwater management shortfalls existed and began looking at solutions.

Water Quality Solutions

Partnership with Rutgers Cooperative Extension

Ultimately, the DRN report and localized flooding problems motivated the township to look at improving its stormwater management practices and approvals. Rich Watson, Director of the Hamilton Township

Department of Water Pollution Control, saw a presentation on stormwater management held by the RCE Water Resources Program. The Water Resources Program is focused on tackling water issues across the state, including stormwater management. The township proceeded to engage RCE, specifically Dr. Chris Obropta, Associate Extension Specialist in Water Resources, and Jeremiah Bergstrom, Senior Research Project Manager.

Hydrologic Evaluation

The first task by RCE was a Hydrologic Evaluation, completed in September 2011, which serves as the basis for future stormwater management efforts. It contains an inventory of stormwater infrastructure, plans, and policies that will guide the township's stormwater management program. The report cost \$20,000, for which the township paid using funding set aside for stormwater management plan updates. The Hydrologic Evaluation found that impervious surface from new development is the primary reason for the township's stormwater difficulties. RCE recommended reducing new impervious cover, implementing green stormwater infrastructure within existing development, educating landowners, and retrofitting detention basins.

Watershed and Stormwater Management Implementation Plan

RCE followed the Hydrologic Evaluation by conducting a Watershed and Stormwater Management Implementation Plan, adopted in February 2012. This plan was funded by the township for \$40,000. The implementation strategies focus on community engagement and compliance with stormwater regulations.

Originally, the RCE partnership aimed at simply assessing and addressing flooding concerns, but these initial evaluations recommended a comprehensive suite of goals to tackle stormwater, which included engaging the community in water resource protection, managing water quality, minimizing localized flooding, implementing Phase II stormwater controls, and improving stormwater facility maintenance.

RCE presented these opportunities to Hamilton Township staff and elected officials in the winter of 2012. The township viewed them favorably and began work on two phases of its program—stormwater mitigation planning and a Green Communities Program—between 2012 and 2016. These two phases are discussed below.

Stormwater Management Planning

RCE completed various analyses, building upon the Hydrologic Evaluation, to bolster stormwater management planning in the township. The township's stormwater infrastructure and its attributes (for example, flow rate), are now mapped in a geographic information system (GIS). The township also assessed its impervious cover. It found that nearly 23 percent of its land area consists of impervious cover, with the Pond Run watershed having the greatest coverage at over 30 percent. RCE recommended a 10 percent reduction township-wide through the elimination of unnecessary impervious surfaces, the conversion of some necessary surfaces to

Key Partners

Rutgers Cooperative Extension Water Resources Program (RCE): RCE helps New Jersey residents improve their lives and communities through an educational process that uses science-based knowledge. The Water Resources Program is one of many specialty programs under RCE. Dr. Obropta created this program in 2002 and has developed it into an award-winning state-wide program dedicated to solving New Jersey's water resources issues in three categories: Agricultural Water Management, Stormwater Management & Green Infrastructure, and Watershed Planning & Restoration.

New Jersey Department of Environmental Protection (NJDEP): The state agency collects water quality data to determine the status of water quality impairments and assists Hamilton in meeting its regulatory requirements.

porous treatments, and the implementation of filtration mechanisms, such as rain gardens and swales. Along Pond Run, a 180-acre impervious surface reduction is required to meet the 10 percent reduction goal, which is about 3 percent of the nine-square-mile watershed.

The township also developed a hydrologic model that can estimate stormwater runoff rates, and reduction thereof, at a sub-watershed level. The tool, which cost \$50,000 to initiate, is used by township staff to inform its land use board. While the model does not have the ability to easily detect the effect that most individual stormwater mitigation projects have on the township's stormwater quality, it can estimate the impact of multiple projects within a larger area, such as in a developed corridor.

The township completed a Stormwater Mitigation Plan (SMP) in June 2014 that looks at potential public and private properties in each sub-watershed of the township that may provide opportunities for reducing impervious surfaces through green stormwater installations or naturalization. The SMP also includes site-specific estimates for impervious coverage, construction costs, and reduction in stormwater runoff volume. Mitigation projects must prevent additional volumes of pollutants from entering the township's waterways and help add water back into the township's groundwater system and underlying aquifer.

The SMP cost \$40,000 to complete. It is an optional element of a Municipal Stormwater Management Plan, but it is required if a municipality wishes to grant variances for design and performance standards when a developer cannot meet them because of property constraints. The SMP has not yet been adopted by Hamilton Township but is under review by the township engineer.

Green Communities Program

The second element of the RCE partnership is the Green Communities Program, which focuses on engagement of residents and municipal officials in stormwater planning, assessment, and management.

Detention Basin Assessments

As one component of this program, the township conducted a detention basin assessment program between 2011 and 2014. Over 300 basins were assessed for a cost of \$30,000. The resulting data was entered into GIS mapping software for use by township staff and officials. The data identifies the sites most in need of retrofits. One-third of the basins in Hamilton are in good condition, while nearly half require maintenance. Many of these latter basins need more significant repair.



Source: Watson & Bergstrom, 2016
Basin assessment.

Implementation following the assessments focused on reduced mowing within and around basins. Increased plant growth around the basins absorbs more stormwater runoff than mown grass and can also trap sediments and pollutants carried by the stormwater. As a result of this change in maintenance strategy, however, township staff received many complaints from residents about the basins being unsightly. Meetings with homeowners, as well as community sessions held by RCE, mitigated the negative feedback somewhat. Informational media, such as brochures, supplemented the outreach.

Stormwater Outfall Assessments

The township followed this project with a stormwater outfall assessment project in 2015. This project involved locating and assessing outfalls at over 200 locations, with a focus on those draining directly to streams, for a cost of \$15,500. The data produced by the assessment was entered into a GIS map.

Riparian Assessments

RCE led riparian investigations with assistance from community volunteers to identify the highest-value stream corridors in regard to existing conditions and future conservation value. Visual assessments were conducted. As with the basin and outfall assessments, the data are now integrated into the township GIS mapping system. The assessments were followed by a township stream monitoring program. In 2015, the township held sessions for elected officials and the general public to promote the stream monitoring. The township is now working to recruit additional participants.

Rain Barrel Workshops

In addition to data collection and assessment, education and training is an integral part of the Green Communities Program. The township budget includes \$5,000 per year for education programs, such as for rain barrels and rain gardens. The township and RCE have held five rain barrel workshops since 2014, which have educated residents on the utility of rain barrels. Residents purchase barrels for \$25 and construct them at the workshop; over the span of this program, Hamilton residents have constructed over 200 barrels.

Rain Gardens

Between 2015 and 2016, the township provided rain garden information to 45 residents, and RCE developed conceptual designs for 12 properties from that group of attendees.



Source: Watson & Bergstrom, 2016
Rain garden training session.



Source: Rutgers Cooperative Extension
Steinert High School rain garden before and after.

The township has also installed rain garden demonstration projects at all three of its high schools. Installations at Steinert High School and Nottingham High School were completed in 2013, while a rain garden at Hamilton West High School was finished in 2014. In all cases, the rain gardens were installed in partnership with RCE, Hamilton Township, and students within the science curriculum or related clubs.

Training

RCE offered training programs for Hamilton Township land use board members in 2014, and similar sessions will be held when there are newly elected officials. The two-day sessions focus on what to look for in development plans regarding stormwater management. According to RCE, municipal officials learn what questions they may ask of developers and what they can require in development proposals. Following the workshops, officials are better equipped to require development projects to be compliant with stormwater regulations. It is RCE's belief that training is critical to giving officials tools to make informed decisions.

On the heels of the 2014 sessions in Hamilton, RCE has now developed an e-learning portal for municipal officials across New Jersey to address stormwater requirements and provide answers to commonly asked questions.

Partnership Moving Forward

Building on their current momentum, Hamilton Township and RCE renewed their partnership with a commitment to continue engagement with the general public and schools, as well as to focus on developing a comprehensive implementation strategy to manage flooding and enhance stormwater infrastructure. The 2016 renewal totals \$62,000 in fees. A Characterization Study (\$24,000) of stormwater infrastructure and flooding will use the previous studies to develop detailed priorities, with associated costs, for implementation by the township. A Stormwater and Flood Management Improvement Plan (\$28,000) will identify and prioritize stormwater management alternatives, such as green stormwater infrastructure. These products are currently in progress. A "Stormwater Management in Your Backyard" program (\$10,000) will continue many elements of the Green Communities Program, such as rain barrel and rain garden workshops, with a focus on engaging the township environmental commission and other boards.

Moving forward, the township is looking to expand its implementation strategies and build on funding sources. The goal of renewed planning work with RCE is to outline a five-year plan for Hamilton Township to update its stormwater infrastructure and management practices. One strategy may involve stormwater mitigation for development projects, as outlined in the township's 2014 Stormwater Mitigation Plan. In addition, the township would like to build on the Hydrologic Model with more predictive modeling so that an individual development proposal can be modeled to determine its potential stormwater impact. Hamilton Township now dedicates between

Motivating Factors

Flooding and Runoff: As a mature suburb, much of Hamilton developed before environmental regulations were in place, and localized flooding problems were common.

Bad Publicity: The DRN produced a critical report on Hamilton's handling of stormwater from a structural and political perspective. The township viewed the report as one-sided but realized that stormwater management shortfalls existed and began looking for solutions.

Regulatory: The U.S. Environmental Protection Agency and NJDEP discharge regulations requiring water quality improvements.

Partners: Rutgers Cooperative Extension Water Resources Program and NJDEP.

Unifying Issues: Flooding, lack of stormwater management plans, ordinances and funding.

\$50,000 and \$80,000 per year from the general fund for the stormwater management partnership.

The partnership has also been highly beneficial for the RCE Water Resources Program. According to Jeremiah Bergstrom, it was rare in prior years for RCE to work one-on-one with a municipality because it was rare to find a local champion in municipalities with a direct connection to community leadership who also understood stormwater issues. Hamilton Township has local champions in Rich Watson and the Department of Water Pollution Control. Following the Hamilton Township experience, RCE Water Resources Program is now working with other communities through local champions, such as the Association of New Jersey Environmental Commissions, local watershed groups, and local collaboratives formed in urban areas known as Municipal Action Teams. RCE is now working with Camden, Jersey City, Newark, Paterson, Perth Amboy, Philipsburg, Pilesgrove, Trenton, Upper Deerfield, and Woodstown on stormwater management issues. The RCE Water Resources Program looks to continue building interest across the state.

Factors in Success

Hamilton Township's experience with stormwater evolved greatly since 2011 and continues to do so. In a relatively short time following the DRN report criticizing Hamilton Township, the township made significant progress, particularly on those critiques regarding the knowledge base of land use boards and other officials. Township staff have noted a change in how land use boards approach development projects in the context of stormwater during the past five years, taking into account information gained from the RCE partnership.

The leadership of Rich Watson brought about the new perspective. As a former member of the Planning Board, he understands the position of elected officials. As flooding issues kept getting worse, and with the release of the DRN report, there was a realization that something needed to change. Watson understood that what the township really needs is expertise. They cannot do it on their own, so he involved RCE. It has turned out to be a mutually beneficial partnership.

Engagement of the broader community bred success in Hamilton. Township staff found the niche that interests citizens in issues of stormwater management and water quality protection, whether it is students constructing rain gardens or residents interested in rain barrels. Municipal training sessions have given municipal officials information they need to make informed and effective decisions regarding the development process. While there is still much to do, Hamilton Township is in a stronger position than it was regarding stormwater. Therefore, Hamilton Township turned adversity into a productive partnership for addressing water quality.

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Published to web: July 12, 2017


MUNICIPAL CASE STUDY

Kidder Township, Pennsylvania

A resort town in the Poconos best known for Jack Frost Big Boulder ski resorts, Hickory Run State Park, and Lake Harmony, Kidder Township's economy depends on eco-tourism, and residents and businesses alike know that good water quality is good business. Recognizing that what happens on the land impacts the water, Kidder Township adopted new land use regulations designed to protect and improve water quality.

By: Laura An, *Engagement Planning Intern, DVRPC*

Background

Kidder Township is a resort town in Carbon County, Pennsylvania, nestled among the Poconos by the intersection of PA Route 80 and Interstate 476. The township encompasses 70 square miles of wooded land and encircles Hickory Run State Park, known for its 16,000 acres of trails, trout streams, and other recreational opportunities. In addition to the park, some of the town's most notable attractions include the Jack Frost Big Boulder ski resort and Lake Harmony. The township has maintained a fairly constant population over recent years, hovering around 1,818 as of 2015. However, Kidder Township receives over 10,000 vacationers throughout the year, who visit for the variety of activities available year-round.

Quick Stats

Kidder Township, Carbon County

Major water bodies:

Lehigh River, Lake Harmony, Big Boulder Lake

Population: 1,818 (2015)

Land area: 69.1 square miles

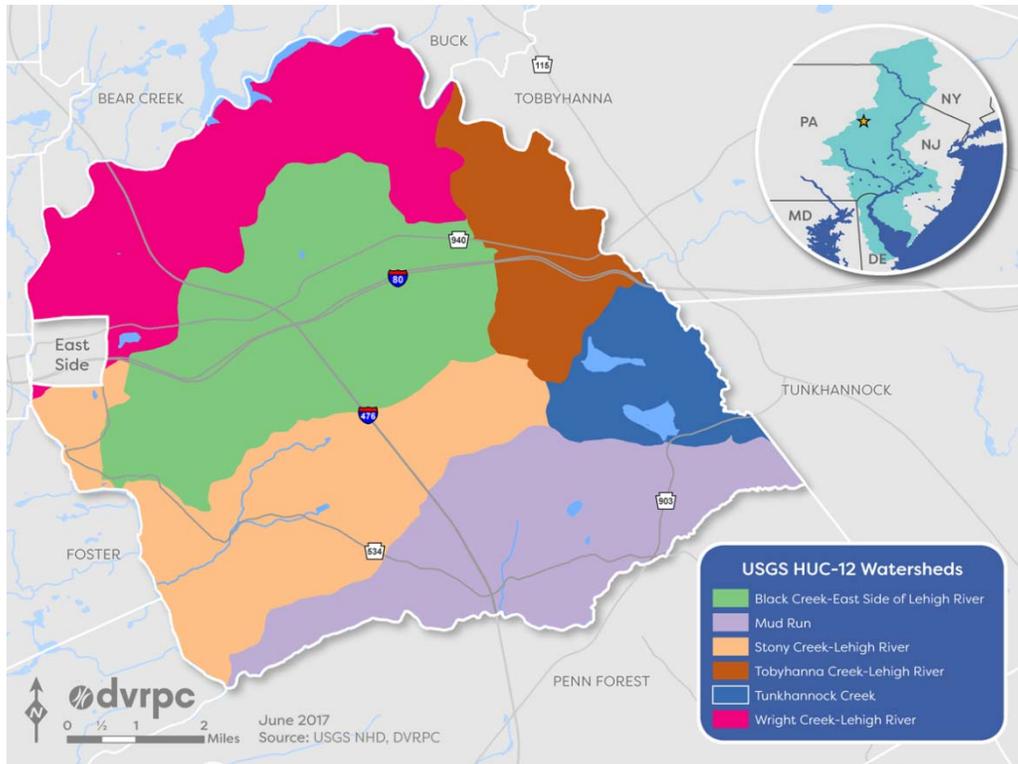
Water area: 0.7 square miles (1%)

Among the most prominent water bodies in the area are the Lehigh River, which bounds the township to the west; Lake Harmony; and Big Boulder Lake. In addition, all of Kidder Township's streams are high value or exceptional quality. Because the township's economy depends heavily on eco-tourism, protection of water quality is a high priority for many who live and work there.

Challenges

One of the biggest challenges in protecting water quality cited by Bob Dobash, township building inspector, is the amount of impervious surfaces. Managing stormwater runoff becomes a challenge when precipitation is unable to percolate into the ground, and runoff carries pollutants like car oil into nearby waterways. Much of the township was developed in the 1950s, prior to the codification of many of the land development and stormwater management standards that exist today to control the construction of impervious surfaces. Adding to the problem of older, more impervious development, much of the impervious development in the township is on private property, and many of these property owners are unable to make the necessary investments to install better stormwater management features. The township is unable to provide financial assistance to these homeowners due to prevailing laws that prevent them from spending public money on private property.

In addition to impervious surfaces, one recent object of contention has been the development of the PennEast Pipeline. The 120-mile pipeline has been proposed to run from Dallas Township, Pennsylvania, to Mercer County, New Jersey, and will carry natural gas through many communities, including Kidder Township. In addition to the pipeline, the pipeline’s compressor station was proposed and approved to be located in Kidder Township. The compressor station will sit along the route of the pipeline, remove excess solids or liquids from natural



gas, and create the necessary pressure to maintain a steady flow of gas. Some residents in Kidder Township were (and many are still) concerned with potential negative effects of the pipeline, such as noise pollution, potential harm to water quality, and decreased property values along the pipeline. However, after hearing the measures presented by the PennEast Pipeline Company to mitigate those problems, the Kidder Township zoning board approved the project and permitted the company to proceed. While the township’s zoning board determined that the pipeline was not the most pressing concern with regard to water quality, the pipeline may still contribute to a reduction in water quality, potentially affect eco-tourism, and thus have economic repercussions.

Given the importance of high-quality environmental assets in an eco-tourism hub like Kidder Township, maintaining water quality is a priority to the municipality. The township has formed an Environmental Advisory Council (EAC) to serve as an advisor on issues affecting natural resources, including air, land, water, and open space, within Kidder’s borders. To date, the EAC has been active in implementing projects such as developing a natural resource inventory, drafting ordinances to reduce the effect of the PennEast pipeline on the township’s environment, running citizen science programs, producing a guide to protecting the township’s waters, and partnering with elementary schools in a rain garden program. One of its most significant recent projects was assisting with updating the township’s zoning and subdivision ordinances.

Water Quality Solutions

Kidder Township updated its ordinances with assistance from the Natural Lands, a land trust located in Chester County. In 2015, Natural Lands received a grant from the William Penn Foundation to lead a project in the Upper Lehigh area focusing on how zoning ordinances could be used to improve water quality. When Natural Lands approached Kidder Township to see if it would be interested in participating in the project, the municipality had already been searching for funding that would allow it to take measures to improve and

protect its water quality. The township was prompted by the zoning board's approval of the pipeline and compressor station, and by the impending completion of a new interchange from the Pennsylvania Turnpike to PA Route 903, which is four miles south of Kidder. The interchange was expected to increase access to the township, potentially prompting the development of some of the larger parcels in proximity. In order to preserve the ecologically significant portions of those parcels, the municipality wanted to update their ordinances in advance of future development.

Over the course of two years, Kidder Township has worked to update its zoning and subdivision ordinances, supported by a 75 percent subsidy on the cost of drafting the zoning ordinance from the William Penn Foundation. The most significant changes to the updated ordinance are the addition of a natural resources overlay and language outlining conservation subdivision design requirements.

In Kidder's subdivision ordinance, conservation subdivision design includes provisions for conserving up to 60 percent of buildable land in addition to significant ecological features like streams and wetlands, and prioritizes contiguous conserved land rather than isolated patches.

According to the updated ordinance, conservation subdivision design can be divided into four steps.

1. Delineation of Conservation Open Space: Highlighting all primary conservation areas, including steep slopes, floodplains, wetlands, and other buildable land with high resource significance.
2. Location of House/Development Sites: Highlighting potential development sites, maintaining a 100-foot distance from primary conservation areas and a 50-foot distance from secondary conservation areas. The design should also consider potential benefits to housing location, including attractive views for residences.
3. Designing Infrastructure: Identifying streets, trails, and stormwater/wastewater management facilities that can optimize the landscape's natural ability to manage water.
4. Drawing in the Lot/Development Lines: Drawing lot boundaries to delineate individual parcels.

Motivating Factors

Stormwater management: All the streams in Kidder are exceptional value or high quality, but poorly managed stormwater and impervious surfaces threaten their status.

New Infrastructure: The proposed PennEast Pipeline and compressor station, and pending completion of a highway interchange, have mobilized township officials, staff, and residents to take action to preserve their local natural resources.

Foundation Subsidy: A 75 percent subsidy from the William Penn Foundation for the township's zoning ordinance update allowed the work to happen comprehensively and at a fast pace.

Developers were included in the process of updating ordinances, along with the EAC and municipal officials. The ordinances were recommended for approval by the township planning commission in late 2016, and are awaiting review and comment periods at the county level before being adopted by the Board of Supervisors.

Ann Hutchinson of Natural Lands notes that Kidder Township was successful in writing a progressive ordinance with conservation subdivision design because the community has a strong environmental ethic due to its commitment to eco-tourism as its primary form of economic activity. As a result, the township was ready to improve its construction standards when it was approached by Natural Lands because the township correlated good water quality with good business. "The subsidy allowed the work to happen more

comprehensively, and sooner rather than later,” she observed. Strong local leadership, particularly within the EAC, was also a key component in the municipality’s initiative to search for funding, which made the partnership with Natural Lands a natural connection.

Conclusion

A common driver behind Kidder Township’s initiatives to improve water quality is the importance of eco-tourism to the municipality’s local economy. This case study presents a scenario where the economic value of the environment is quantified through the economic productivity of the businesses that depend on it. Tied together, residents and business owners know that good water quality is good business.

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Published to web: June 27, 2017

📍 **MUNICIPAL CASE STUDY**

Lower Salford Township, Pennsylvania

Lower Salford’s water quality problems, including stormwater, nutrient pollution, and sediment pollution, mainly come from two waves of population growth that occurred in the mid and late 20th century. The township entered into successful litigation with the Pennsylvania Department of Environmental Protection (PADEP) over their Total Maximum Daily Loads (TMDLs). The township has also dedicated funding to the problem, revised their planning and zoning, and worked with technical assistance providers, like the Perkiomen Watershed Conservancy and Penn State Extension. It also leads by example with Best Management Practices (BMPs) on its golf course and stormwater basins.



By: Ayse Unver
 Pennsylvania Horticultural Society

Background

Lower Salford Township is located in Montgomery County, Pennsylvania, within the greater metropolitan area of Philadelphia. The township is 14.5 square miles with a 2015 estimated population of 15,277 people. The township is a mainly residential bedroom community; local residents and employees highlight its good school district, low crime rates, and good access to local parks and open space. The township’s median household income is \$92,574 (2015 Five-Year American Community Survey).

The community contains a linked network of green spaces, with trails that connect people to parks and other natural resources.

There is a scenic rural component to the township, which contains 7,000 acres of preserved open areas, including some farms. Lower Salford’s land use, broadly, is 44.55 percent developed, 35.11 percent agricultural, and 13.13 percent forested.

Watersheds and Waterways in Lower Salford

Lower Salford contains five subwatersheds that include the Perkiomen Creek and its tributaries. The drainage area for the Skippack Creek and West Branch Skippack Creek comprises about 60 percent of the township, followed by Perkiomen Creek and West Branch Perkiomen Creek with about 30 percent. The Indian Creek makes up about 10 percent of Lower Salford.

Quick Stats
Lower Salford Township

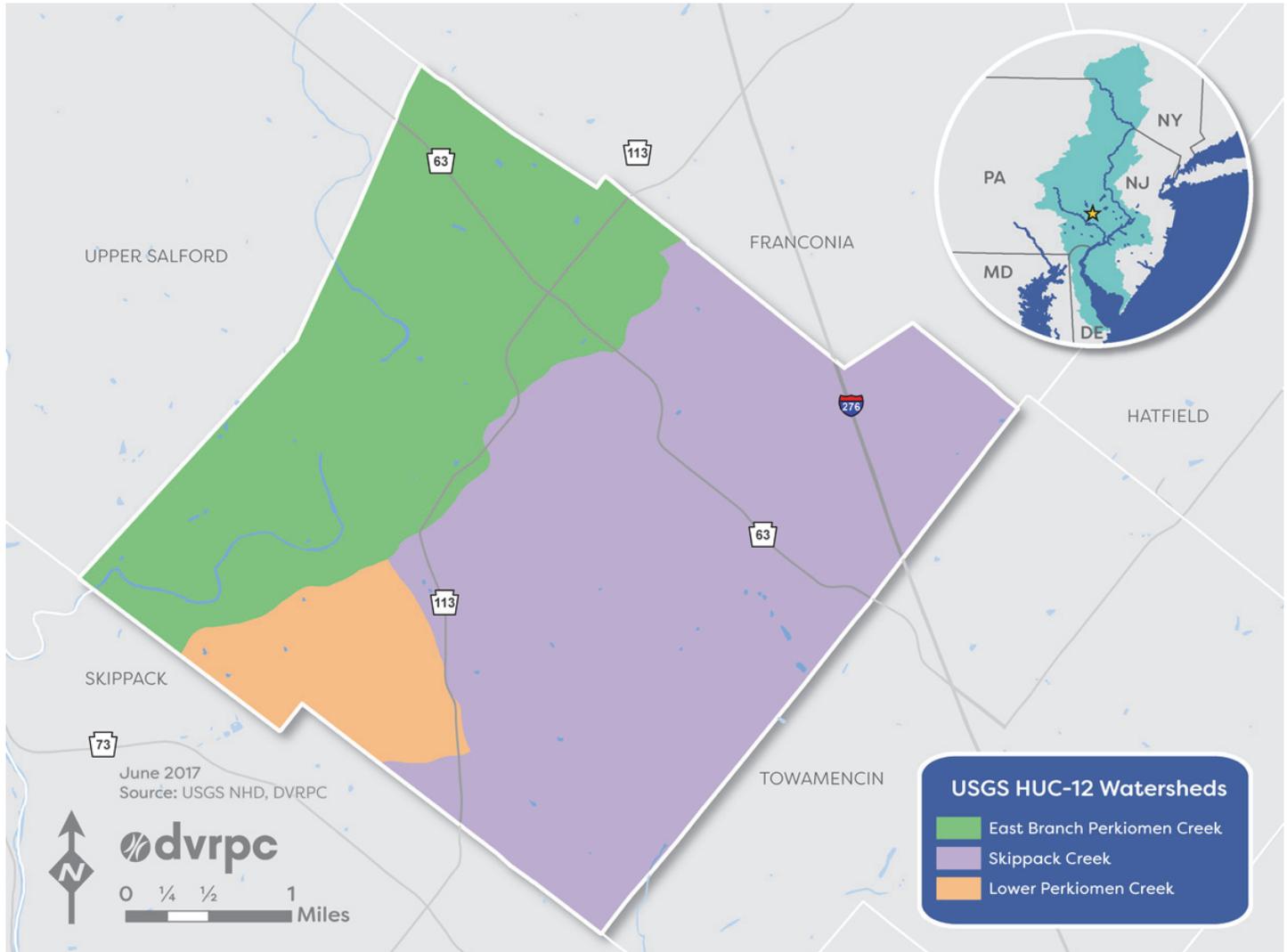
Population: 15,227 (2015)

Land area: 14.5 square miles

Water area: 0.1 square miles (0.69%)

Median household income: \$92,574

Map Lower Salford Township’s Watersheds



Water Quality Problems
Population Growth

Lower Salford’s water quality problems mainly come from two waves of population growth that occurred in the mid and late 20th century. The first wave occurred between 1950 and 1970. The population jumped by 48 percent between 1950 and 1960 and by 47.8 percent between 1960 and 1970. This growth was largely attributable to the openings of two major highways, the Northeast Extension/Route 476 (1955) and Route 422 (1965), which facilitated travel between Lower Salford and regional economic centers.

In the 1990s, the township experienced its second surge in growth. Steven L. Nelson, chief of countywide planning at the Montgomery County Planning Commission during that time, attributed this growth to “access and...available land.” Chris Canavan (Lower Salford Board of Supervisors) similarly noted that it was simply the natural next stage of development pressure on the suburban rings of Philadelphia. The inner ring was built out, and then development was moving to outer rings, where there was more available land.

The township's existing infrastructure and facilities were stretched thin as a result of this growth, and it struggled to quickly provide new infrastructure for its new residents.

Key Terms

TMDL: A regulatory term in the U.S. Clean Water Act that describes the maximum amount of a pollutant that a body of water can receive while still meeting water quality standards.

Municipal Separate Storm Sewer System (MS4): A system of infrastructure that moves stormwater, *not* sewer water, that typically includes roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains, and that is owned by a public entity.

Minimum Control Measures (MCMs): Six program elements required through the state MS4 permit, and focused on municipal practices as well as resident behavior, that are expected to result in reductions of pollutants discharged into receiving water bodies.

Urbanized Area (UA): A geographic area defined by the last decennial Census. A “densely settled core of census tracts and/or census blocks that have a population of at least 50,000 along with adjacent territory containing non-residential urban land uses as well as territory with low population density included to link outlying densely settled territory with the densely settled core.”

Lower Salford's Impaired Waterways

New construction from these two waves of growth increased the amount of impervious surface in the township. Trees and vegetation were removed to make way for new homes, retail, and the roads and parking lots that served them, increasing the volume of water flowing across surfaces and into storm sewer systems and streams rather than percolating into the ground. Greater volumes of this stormwater, moving at faster rates, increased the amount of pesticides, fertilizers, fuel, livestock waste, trash, sediment, and other pollutants carried into local streams by stormwater. Stormwater flowing out of storm sewers and into streams moved at greater velocities, eroding stream banks, churning up sediment, and causing localized flooding. Together, these conditions degraded the township's water quality. PADEP determined that the township's waterways contained sediment and phosphorus concentrations too high to support their typical use by humans or wildlife.

State and Federal Requirements

Lower Salford is working to comply with two sets of water quality regulations. The root of these regulations is the federal Clean Water Act of 1970, the implementation of which is the responsibility of each state.

- MS4 Program

In 2002, PADEP initiated an MS4 (see definitions above) permitting process for smaller municipalities within an urbanized area (see definitions above). Because Lower Salford is considered an urbanized area and has an MS4, it must comply with federal and state regulations to control certain pollutants that the community commonly (and usually inadvertently) disposes into sewer drains and thus into waterways.

In order to meet the permit's requirements, Lower Salford must create and implement a stormwater management program that reduces the discharge of pollutants into the storm sewer system. Part of Lower Salford's and other MS4 communities' responsibilities include meeting six MCMs (see definitions above). These measures are intended to increase community awareness of and involvement in water quality issues,

eliminate illicit discharges into waterways, control stormwater runoff during and after construction projects, and prevent pollutants from getting into waterways.

The permit also requires that municipalities pass a stormwater management ordinance to regulate development and any other activities that affect stormwater runoff. Lower Salford passed this ordinance in March 2005.

- TMDLs

Because Lower Salford's MS4 discharges water into impaired streams, the township is also required to create and implement a plan to achieve specific pollutant reductions in those waterways.

Lower Salford must reduce to acceptable limits the quantity of sediment and nutrients entering the Skippack and Indian creeks from within its borders. PADEP calculated these "acceptable limits" and issued them as TMDLs (see definitions above) for these water bodies. The Skippack Creek has a TMDL for sediment, and the Indian Creek has TMDLs for both sediment and nutrients.

- Nutrients

Lower Salford is required to reduce phosphorus concentrations in Indian Creek through its nutrient TMDL. An excess of phosphorus in water bodies can yield rapid growth of algae in the short term and algal blooms in the long term, which severely reduce if not eliminate dissolved oxygen in the water, leading to illness or death in fish populations. Algal blooms can also produce toxins and yield bacterial growth that can make people sick from contact with polluted water, consumption of tainted fish or shellfish, or drinking contaminated water.

- Farm and lawn stormwater runoff

Runoff in Lower Salford contains phosphorus from farmers, residents, and the township overfertilizing their crops and lawns, respectively. In areas where no riparian buffer exists between a stream and lawns or farmland, fertilizer can easily run off into the stream.

- Wastewater treatment plants

Wastewater treatment plants are one of several contributors to an excess of phosphorus in Lower Salford's waterways. The township operates two sewage treatment plants that are managed by the Lower Salford Sewer Authority. The Harleysville plant discharges to the tributary of the East Branch of the Indian Creek and the Mainland plant discharges to the Skippack Creek. Lower Salford's wastewater treatment plants process wastewater through secondary treatment, which does not remove enough nutrients to mitigate the impact of phosphorus on the township's water quality. Retrofitting or developing tertiary treatments would require significant funds from the township.

- Sediments
 - Issues with legacy infrastructure

During the development boom in the 1970s, stormwater management regulations were more limited in scope. As a result, the flood control basins in Lower Salford from this time are not designed to remove nutrients. Furthermore, they are insufficient for holding the volume of stormwater runoff produced in present-day storms from present-day levels of impervious surface. As a result, the excess stormwater contributes to sedimentation by moving soil from streambanks into waterways.

- Construction Sediment Control

Sediment-laden runoff can also be caused by the improper installation or enforcement of sediment control measures during construction. Michelle Fountain of CKS Engineers noted that all development projects in Lower Salford must get an Erosion and Sediment Control Plan approved by the municipality. If the development is less than 5,000 square feet, then the MCCD has to approve the plan. If the development is between 5,000 square feet and one acre, the plan has to be approved by the township, the MCCD, and PADEP. This system has been in place for a long time and is working well, Fountain said, but enforcement of current practices is challenging. In particular, construction crews install silt fence and stone construction entrances but do not maintain them, and the entrances stop functioning, resulting in sediment runoff. Fountain believes the township needs stronger enforcement of erosion and sediment controls.

In 2005, Lower Salford Township entered into litigation with PADEP over the TMDL limits they issued for the township. The township argued that the TMDL level set for the phosphorus in the Skippack Creek was unsound: “(1) premised upon an indefensible scientific position which is fundamentally flawed and technically insufficient; (2) based on flawed modeling; (3) not substantiated by fact or law; and (4) contrary to law.” In 2007, the U.S. Environmental Protection Agency (EPA) withdrew the nutrient TMDL requirement for the Skippack Creek, acknowledging that the regression formula used to come up with the TMDL limits was flawed. The model the EPA developed assumed that unwanted plant growth in streams occurred at the same rate as unwanted algal growth when exposed to the same levels of phosphorus. However, studies showed that this assumption “could give results [two] to [sixty] times greater than the standard method.” The nutrient TMDL for the Skippack Creek is still yet to be revised, and the township is still disputing Indian Creek’s nutrient and sediment TMDLs.

Water Quality Solutions

Despite litigation with PADEP, Lower Salford staff and the township engineer maintain that water quality is a high priority for the municipality. The township’s water quality champions assert that they are pushing many projects forward because they believe in the environmental and health benefits of these regulations. As Krista Scheirer of the MCCD noted, “Lower Salford is not a township that says, ‘I don’t know where to start—what do I do?’ They have a good handle on their obligations; they care, and know why it’s important.”

With the sediment TMDL for the Skippack Creek in place, the township is taking steps to remediate the creek’s sediment levels. Lower Salford has proposed 14 projects to reduce the amount of sediment reaching the creek

Key Partners

Mary West, assistant township manager, Lower Salford: Primary champion for water quality efforts.

Chris Canavan, Lower Salford Board of Supervisors and former head of Sewer Authority: Point person for reaching TMDL limits.

Michelle Fountain, CKS Engineers (Lower Salford’s township engineer): Involved with helping the township meet PADEP’s water quality regulations.

Jessie Kemper, conservation coordinator, Perkiomen Watershed Conservancy: Point person for helping Lower Salford with riparian buffer projects and other projects to help the township meet its water quality standards.

Krista Scheirer, Montgomery County Conservation District (MCCD): Former conservation coordinator, Perkiomen Watershed Conservancy.

by 222,000 pounds, with a further goal of reducing sediment by 15,000 pounds per year each year from 2013 to 2017. The township is responsible for eliminating approximately 289,000 more pounds of sediment, but this volume will be addressed in a future TMDL permit cycle.

Dedicated Funding

All of the case study interviewees indicated that finding money for capital improvements is the greatest obstacle to improving water quality. Canavan said that if funds were available, they would implement the projects needed to meet the TMDL limits “in an instant.” For the 2016 fiscal year, the township dedicated up to \$100,000 for stormwater projects. Canavan added that the township has the reserves to increase that number if necessary. This funding may be needed if any of the three TMDLs currently under dispute are ruled as required for Lower Salford. However, it is

unclear what level of improvements for the Skippack and Indian creeks are needed at this time, and thus how much staff time and funds will be needed to address the township’s impairments.

Planning and Zoning

The township has followed a regional comprehensive planning effort to ensure that future growth will be better managed. In 2005, the Indian Valley Regional Planning Commission, which is part of the Montgomery County Planning Commission and of which Lower Salford is a member, passed a regional plan for 2025. The plan establishes designated growth and non-growth areas, focusing growth around existing infrastructure (mainly sewer and water) that will help reduce development in rural areas and the conversion of the region’s remaining open space into impermeable surfaces (see right). Approximately one-third of Lower Salford is in the designated and future growth areas, but the southern half of the township is planned as a rural resource area that supports agriculture, other extractive industries, and tourism. Public infrastructure will not be provided in this area except in villages.

Partnership with Technical Assistance Providers

The township uses resources from a number of entities for technical support: the Perkiomen Watershed Conservancy, a local watershed non-profit, for resources on meeting MCMs; Penn State Extension for educating local farmers; the Pennsylvania Environmental Council for webinars; the MCCD for water quality education and projects; and PADEP for sample ordinances and trainings.

- Perkiomen Watershed Conservancy’s MS4 Membership Program

Lower Salford is a member of Perkiomen Watershed Conservancy’s MS4 membership program, which helps municipalities achieve the MS4 permit’s MCMs for a fee. The Perkiomen Watershed Conservancy offers four membership options to MS4 municipalities, which include varying levels of resources and support. Lower

Salford is a member at the “Benefactor” level. Chris Canavan noted that Lower Salford does not participate in a higher membership level because it takes care of much of the work to meet those MCMs itself or partners with the Conservancy throughout the years on tree plantings.

- 1) The “Promoter” level (\$250 per year to a municipality) includes access to educational resources for redistribution to residents. The distribution of these resources helps municipalities fulfill their MS4 “Public Education and Outreach of Stormwater Impact” requirement. Six municipalities participate at this level.
- 2) The “Patron” level (\$500 per year) includes the benefits of the Promoter level, provision of an online stormwater survey, and a one-hour workshop for residents facilitated by the conservancy about water quality issues. These additional benefits help municipalities fulfill their MS4 “Public Involvement/Participation” requirement. Eight municipalities participate at this level.
- 3) The “Benefactor” level (\$1,000 per year) includes the benefits of the Promoter and Patron levels, as well as a two-hour presentation training session for municipal staff on pollution prevention and good housekeeping for municipal operations, such as how to prevent pollution when salting roads, proper ways to clean vehicles, and sediment control during construction projects. This session helps to meet the MS4 requirement “Pollution Prevention/Good Housekeeping for Municipal Operations.” Eight municipalities participate at this level.
- 4) The “Advocate” level costs \$2,500 per year and includes the benefits from the preceding levels and up to 30 hours of support from the Conservancy with planning events and recruiting volunteers for projects in the municipality, such as tree plantings. No townships have joined at this level.

- Riparian Restoration Efforts

Lower Salford maintains an almost 20-year-old riparian corridor program, built through a partnership with the Perkiomen Watershed Conservancy. The Conservancy works with the township to plant trees and understory shrubs as part of riparian buffer restoration projects. By intercepting and slowing the movement of runoff from the land into streams, riparian buffers protect streams from excess nutrients and sediment. In addition, established riparian plantings with dense root networks keep stream banks from eroding from fast-moving streams or floods.

Lower Salford has been able to plant trees with the Conservancy roughly every other year since 1998 through the TreeVitalize Watersheds grant program. This program, implemented by the Pennsylvania Horticultural Society and its partners, and funded by PADEP and corporate sponsors, plants trees and understory shrubs to create riparian buffers and protect sensitive natural environments. Thousands of trees are planted each year throughout the region through the program.

- Farmer Education

Penn State Extension assists with educating local farmers on water quality issues. Farmland comprises a very small percentage of Lower Salford’s land use, but Canavan said it still contributes to sediment and nutrient issues. Any soil exposed before planting crops and after harvesting them is vulnerable to being washed away during storms. In addition, crops can be overfertilized with phosphorus, which can run off and enter waterways

during storms. Canavan and West believed that the township's farmers are responsible and that the Penn State Extension does a good job of educating farmers on BMPs, such as leaving a buffer between creeks and crops so that when they are plowing, soil and fertilizer do not run off into the creek.

Serving as an Example

Township Golf Course

The township-owned golf course, Lederach Golf Club, is working to keep fertilizer out of the water by educating public works staff on different techniques for maintaining the golf course and instituting no-mow areas that include land next to stream channels, which leaves needed vegetation in areas prone to erosion. The township has not quantified the effects of these strategies, but Canavan thinks they are helping address its sediment requirements.

Detention Ponds

The township is also removing sediment from its detention ponds. Removing the silt that has accumulated in the ponds over decades allows more water to be detained in them, enabling silt to settle to the bottom before the water that carried it in is discharged. Michelle Fountain is also exploring retrofitting detention basins with wood baffles that would allow silt to separate out of the water more easily.

Public Education and Outreach

The township publishes a newsletter about stormwater management twice a year. In partnership with the MCCD, Lower Salford also sponsored a rain barrel workshop to help collect stormwater on private properties. This water can be used for irrigating gardens and lawns, and diverts water out of storm sewer systems during rain events. The reduction in volume can prevent flooding and strong, erosive flows.

The township also works with a local pharmacy to collect and dispose of expired medicines, preventing them from entering and further polluting local waterways along with other household waste. Pharmaceuticals can harm aquatic animals; there is evidence that some such chemicals “disrupt the endocrine balance in various ecological species...and can adversely affect fish and other aquatic species,” potentially interfering with or mimicking natural hormones and disrupting reproduction, development, and behavior. Many pharmaceuticals cannot be filtered through traditional water treatment methods. At this point, there is no evidence of pharmaceutical products in water harming people, as the concentrations are generally too small, but long-term low-level exposure could be a concern.

Progress to Date and Challenges Ahead

Although the township has dedicated funding, an engaged staff, strong partnerships, projects in place to address its MS4 and Skippack Creek TMDL requirements, and a temporary reprieve from addressing multiple TMDLs during its litigation process, the township has still encountered challenges in implementing its water quality program.

Funding

Although Lower Salford dedicates funds to water quality projects, more sources are needed to fully comply with the state's permits. Canavan is seeking further support for grant-writing and implementation projects, but securing adequate funding for these activities is a challenge. The township's sewer fees cannot be raised to support stormwater projects—only sewer projects. Taxes offer an alternative funding source but Canavan reported that residents would support only a modest tax increase to support water quality projects.

Kemper mentioned that funding is available to municipalities through PADEP Environmental Education grants; Schuylkill River Heritage Area grants; and funds from the Pennsylvania Association for Conservation District, which gives matching funds for engineering. Lower Salford could make use of PennVest, which provides municipalities with low-interest loans to fund infrastructure updates, to achieve lower levels of phosphorus through adding a tertiary treatment step or enhanced biological nutrient removal in its wastewater treatment plants. The MCCD and other environmental non-profits provide additional technical assistance and grant-writing support, which could offset township funding for staff time to do the same work.

According to Canavan, however, knowing about additional resources is not the primary challenge. In order to raise enough money for water quality projects, the township has to cobble together grants and other resources, a process that takes its own resources, as well as time and coordination. In addition, Canavan noted that the available grant programs are up to a decade old and do not address current state requirements for stormwater. He believes that grant programs that specifically address stormwater issues would help communities across the state more easily meet water quality requirements.

Education of the Township and of Private Landowners

Canavan said the township could benefit from clear instruction on the best way to achieve sediment and phosphorus reductions in creeks. The township has a technical understanding of what is being proposed by PADEP but is unsure of the best and most efficient way to get to the desired result.

Lower Salford also seeks more education for its residents. As sediment and nutrient problems persist, municipalities are scrutinizing all sources of non-point source pollution, and farms—particularly since they are not regulated under the Clean Water Act—are a potential polluter in the township. Chris Canavan suggested further education of farmers by the Penn State Extension about techniques for keeping sediment and phosphorus from running off of their land. Canavan also noted that homeowner education and a shift in perception of how lawns should actually look could remediate additional nutrient and sediment problems.

Larger Watershed Protection Efforts: A Possible Solution

Faced with funding challenges, information gaps, and the difficulties of working on a watershed-wide issue while restricted by political boundaries, Lower Salford and other municipalities are exploring regional approaches to water quality issues.

Fountain has recently noticed an increase in municipal supervisors or managers meeting with other municipalities as a group to discuss how to meet MS4 requirements. This activity has precedent in the multi-municipal work conducted around TMDL requirements in the Wissahickon Watershed. The EPA and PADEP are allowing municipal permittees in this watershed to develop a collective approach to meeting the stipulations of their TMDL plans. This project developed because individual municipalities were struggling to meet their phosphorus and sediment TMDLs, and the work they had accomplished was not substantially improving water quality in the watershed. The EPA and PADEP decided to allow municipalities to work together and contribute funding to a solution that they developed collectively.

Motivating Factor

Development pressure: Stretched existing infrastructure and facilities

Lower Salford belongs to a group of municipalities that seek a similarly regional approach for the Skippack Creek Watershed. In this effort, municipalities would pool resources and fund larger water quality improvement

projects that would have a larger impact on the watershed. This group is in the early formative stage, but this collaborative model could eventually help alleviate the challenges that Lower Salford faces in meeting its MS4 requirements alone.

Key Factors in Success

The key factors to Lower Salford's success are:

- a dedicated municipal staff and professional consultants;
- a willingness to engage in litigation with PADEP;
- a dedicated funding source for stormwater projects and the ability to cobble together funding from other sources; and
- assistance from the Perkiomen Watershed Conservancy and Penn State Extension.

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Published to web: July 12, 2017

📍 **MUNICIPAL CASE STUDY**

Lower Saucon, Pennsylvania

Legacy residential and industrial development in Lower Saucon has caused the township's streams to suffer from pollution and from wildlife-harming levels of dissolved oxygen. In response, a variety of groups, including Environmental Advisory Councils (EAC) members, watershed association volunteers, elected officials, and township staff, are using strict land use regulation and enforcement, careful monitoring of development proposals, and land conservation strategies to improve their township's water quality.

By: Melissa Andrews, *Environmental Planner, DVRPC*

Background

Lower Saucon Township is a 24.3-square-mile township of 10,788 residents (2015 Five-Year American Community Survey [ACS]), yielding a density of about 443 residents per square mile. Median household income is \$76,362 (2015 Five-Year ACS). The township's land cover includes 0.82 percent water.

The township is known for its farmland, woodlands, and rolling hills, as Township Manager Leslie Huhn notes, and its land use reflects that mixture: it is 17.53 percent agricultural, 26.98 percent developed, and 44.02 percent forested. Lower Saucon's U-shape, created by the presence of Bethlehem City and Hellertown Borough, divides the township into two predominant areas of land use. In the southwestern part of the "U," the township is more urbanized, with homes clustered more densely together. This area typically receives more new residents and development. In the northeastern part of the "U," the township is more rural, with parks and preserved lands.

Quick Stats
Lower Saucon

Population: 10,788 (2015)

Population density: 443 residents per square mile

Land area: 24.3 square miles

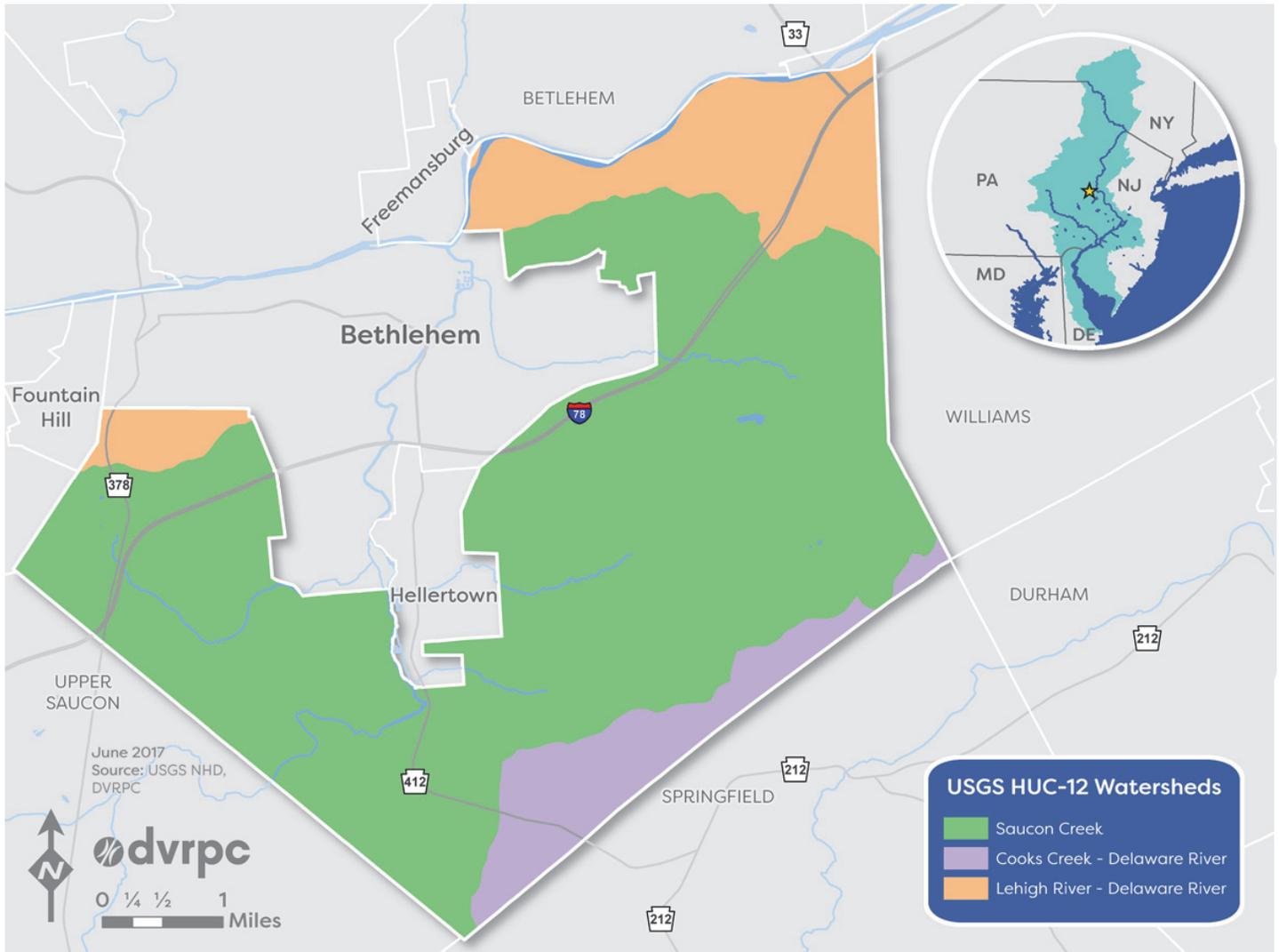
Water area: 0.2 square miles (0.82%)

Median household income: \$76,362 (2015)

Lower Saucon's Watersheds and Waterways

Six named waterways run through Lower Saucon, including Black River, Bull Run, Lehigh River, Polk Valley Run, Saucon Creek (Main Branch and East Branch), and Silver Creek. Lower Saucon contains three major (HUC-12) subwatersheds. The majority of the township is located within the Saucon Creek subwatershed, but the Lehigh River-Delaware River subwatershed is present in the north of the township, while the Cooks Creek-Delaware River watershed is present in the south.

Map: Lower Saucon Township's Watersheds



Water Use and Importance in Lower Saucon

The urbanized section of the township uses a mixture of municipal water and wells, while the more rural east uses well water exclusively. About 25 percent of households use private wells, while 75 percent of households use public wells. Public water is produced by the City of Bethlehem and delivered through the Lower Saucon Authority's distribution system.

Keri Maxfield, director of the Watershed Coalition of the Lehigh Valley (among other roles), noted that water quality ranks high as an issue to residents but low in influencing their daily habits. Nevertheless, she commented that residents have opposed projects that they perceive threaten local and regional water quality, including actively opposing the Penn East pipeline and the expansion of an older landfill in the township.

Water Quality Problems

Stormwater Runoff

Lower Saucon Township is a Municipal Separate Storm Sewer System (MS4) community that is required to comply with the Pennsylvania Department of Environmental Protection's (PADEP's) MS4 permit. An MS4 is a system of infrastructure that moves stormwater, not sewer water, and that typically includes roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains, and that is owned by a public entity. Under the federal Clean Water Act of 1970, municipalities are required to control certain pollutants that the community disposes into stormwater drains and thus into waterways—specifically, waterways that are impaired functionally or ecologically by a contaminant.

Leslie Huhn cites stormwater runoff “from all uses”—residential, commercial, industrial, and agricultural—as a major threat to the township's water quality. PADEP published an “MS4 Requirements Table”¹ listing Pennsylvania municipalities' impairments in each of their waterways, and Lower Saucon's impairments reflect the ways in which its different land uses have caused pollution in its waterways.

Lower Saucon created stringent stormwater regulations in the early to mid-2000s, but the majority of its development was constructed prior to that time so much of the development presently in the township has no construction standards for stormwater. Councilman Glenn Kern feels that this older development and its lack of stormwater controls is the single limitation preventing the township from better protecting water quality. Pesticides and herbicides from agricultural and residential properties are able to flow to the creek and are in part responsible for the township's organic enrichment/low dissolved oxygen impairment. More property development over the past several decades has yielded more impervious surfaces, which can cause stormwater to flow over land at greater volumes and rates, loosening soil and depositing it into waterways. Over time, this process can cause erosion along waterways, and Keri Maxfield listed streambank collapse from flooding as a concern in the township. All of these processes together have contributed to the siltation impairments listed in several of Lower Saucon's waterways.

Because of its proximity to Bethlehem, a major steel-producing city, Lower Saucon is also affected by industrial pollution through runoff, particularly historical dumping of batteries and coal. Lower Saucon itself has its own contaminated lands. Keri Maxfield cited concern about not knowing what dissolved substances are coming out of the range of large and small outfall pipes associated with industrial facilities and homes. Lower Saucon's mercury and polychlorinated biphenyl (PCB) impairments are the result of its neighbor's and its own industrial heritage.

Dam Construction

Several residents and businesses in the eastern rural area of the township have created dams and fish hatcheries within the township's waterways. The state typically monitors for these constructions and requires removal but does not always follow up in a timely manner. Dams alter the flow of a stream, resulting in changes to the stream's physical qualities (temperature, potential of hydrogen [pH], and dissolved nutrients) as well as its ecology.

¹ Pennsylvania Department of Environmental Protection, MS4 Requirements Table (Municipal), May 9, 2107, http://files.dep.state.pa.us/Water/BNPNPSM/StormwaterManagement/MunicipalStormwater/Municipal_MS4_Requirements_Table.pdf, 125.

Onsite Septic Systems

Because many residents in the township have onsite wells and septic systems, they are potentially vulnerable to the transfer of contaminants like E. coli through the groundwater, between their wastewater and drinking water. The township's underlying geology may increase this risk; Tom Maxfield, vice chairman of the township's planning commission and a former councilman, noted that "the limestone in the area fills up like a sponge." Much of Lower Saucon Township is underlain with limestone, which can carry groundwater—clean or contaminated—quickly through a property or between properties. Tom Maxfield noted that any impaired or saturated septic systems in limestone areas must be promptly replaced with new systems, which may include sand mounds and alternate septic sites.

Motivating Factors

- Rapid population growth and corresponding development
- Legacy or non-existent stormwater infrastructure
- Negative effects from agriculture and industrial land uses
- MS4 regulations

Township-Wide Interest in Natural Resources

Lower Saucon experienced a wave of development in the late 1990s. Between 1980 and 1990, it grew from 7,372 residents to 8,448 residents (14.6 percent), and between 1990 and 2000, it grew again to 9,884 residents (a 17.0 percent increase).² Because of the township's population growth, school taxes were high, and residents were concerned about the choice between tax increases and increased pressure on the school system. During this time, Lower Saucon shifted its practices toward the protection of natural resources, including water quality. Municipal leaders and residents aligned with their environmental peers because they were concerned about the strain that an influx of new residents and new development were placing on the township's natural and fiscal resources.

These actions together formed the basis for the township's ongoing water quality work. Glenn Kern is optimistic that the township is "using every tool in their toolbox to improve and protect water quality" and will continue to "network and keep abreast of new techniques and technologies to enhance our current efforts" and "continue to educate our residents and business owners about the importance of water quality and need for water quality protection."

Water Quality Solutions

Citizen Action: EAC and Watershed Associations

Leslie Huhn describes the township's EAC as being "very active" in water quality issues. The EAC started in 1999 with a core group of 10 people who were motivated to react to the presence of 30 proposed developments in the township at one time. Based on the number of proposed units, they determined how residents' taxes would increase, sent their calculations to the township, and offered advice on how to proceed to address the situation. The group also developed a map of planned development in the township. Keri Maxfield noted that it was the first time that residents had copies of that kind of map, and that it was clear that "everyone was affected by the development." Keri Maxfield points to the distribution of this map as one of the events that spurred Lower Saucon residents to act on water quality.

² Lehigh Valley Planning Commission, *Municipal Population Forecasts: Lehigh and Northampton Counties*, January 2013, from the U.S. Census, <http://www.lvpc.org/pdf/population/municipalPopulationForecasts.pdf> (accessed June 1, 2017), 7.

Key Partners

Watershed Coalition of the Lehigh Valley: An umbrella coalition representing community-based watershed associations in the Lehigh Valley. The mission is to preserve and enhance the watersheds of the Lehigh Valley, which the coalition does through outreach and education, resource and information sharing, and advocacy on key issues critical to water resource health in the Lehigh Valley.

Lower Saucon EAC: Has over 300 members. Contributions include reviewing riparian buffer regulations and promoting water quality to other residents through rain barrel workshops and other events.

Saucon Creek Watershed Association (SCWA): Is a volunteer organization dedicated to protecting and preserving the Saucon Creek and its watershed through science and advocacy, including riparian buffer plantings, stream visual assessments, illegal dump clean ups, and educational workshops.

Cooks Creek Watershed Association: Has worked to protect, preserve, and improve the quality of water, land and life in the Cooks Creek Watershed since 1974.

Lower Saucon elected officials: Care deeply about water quality issues and view water quality as a high priority.

Boucher and James (planning consultant): hiring a professional planner, Judy Stern Goldstein, with open space knowledge introduced the township to riparian corridor ordinances, cutting-edge stormwater mitigation technologies, reference studies about water quality, and the idea of cluster development.

Pennsylvania Department of Conservation and Natural Resources (DCNR): Acquired open space and developed parkland.

The EAC is now the most popular commission in the township. Since its first project, it has grown in membership to over 300 people. Most of the original founders, including Keri and Tom Maxfield, Sandra Yerger, and Glenn Kern, are still active in Lower Saucon, but the EAC now has a second generation of participants. Keri Maxfield believes they have been successful because of their “open-mindedness and careful listening.” She observed that officials do not always have time to visit particular sites that need work, but the EAC does. Most recently, they have augmented the township’s work by reviewing riparian buffer regulations and promoting water quality to other residents through rain barrel workshops and other events.

Residents—including some elected officials—serve on two active local watershed associations, one for Cooks Creek and one for Saucon Creek. The SCWA, of which Keri Maxfield is president, worked with other members to conduct a visual assessment of the Saucon Creek and used it to develop a management plan, which led to riparian buffer restoration efforts. The watershed association also received a grant to buy tools for a heavy rain barrel construction initiative in different municipalities: it included building 500 rain barrels and running an educational session. They additionally ran a habitat-building session with an educational component on landscaping to achieve clean water and have completed numerous illegal-dump-site cleanups, including a site with over 300 tires.

The watershed association is small and members are aging and have more limited mobility, so it focuses on conducting outreach while relying on volunteers and other organizations, such as student orientation groups, to do the more physical work. Some members have moved on to manage other projects, including forming other EACs, helping pass open space referenda, and preserving open space.

Committed Leadership

A common observation among those interviewed was that Lower Saucon’s officials care deeply about water quality issues. Glenn Kern effused that “we are blessed to have an entire Town Council in agreement” on water quality as a high priority. Leslie Huhn noted that their council is “proactive” in the MS4 program.

In the late 1990s, the township surveyed residents to see what they wanted in the township. Major responses included passive recreation and preserved farmland. The township was due to update its comprehensive plan, and because the rewrite occurred in 2000, the plan incorporated and thus made an official and guiding record of those sentiments.

Tom Maxfield recalls that beginning 10 years ago, elected officials began considering water quality as “incredibly important,” and became aware of flooding and runoff issues from residential development—some of which was determined to contain harmful chemicals. He noted that residents at the time generally accepted any environmental protection that the township proposed, as it was a “hot button issue.”

Informed Consultants

Part of township leaders’ commitment to water quality is reflected in its choice of, as Leslie Huhn describes, a “talented planning consultant.” The township’s planner, Judy Stern Goldstein, is the managing director of Boucher and James and has a background in planning for natural resources. According to Leslie Huhn, she “complements the work of [our] engineer and adds more proactivity.”

Among other projects, Judy Stern Goldstein has developed riparian corridor ordinances, researched cutting-edge stormwater mitigation technologies, selected reference studies about water quality for the township to consult, and introduced the township to the idea of cluster development.

Tom Maxfield describes hiring a professional planner with open space knowledge as “the best thing that [the township] did.” Tom Maxfield recommends that municipalities hire a good planner—a community planner, not just a resources planner—who “understands how it all works together.”

Land Use Regulation and Enforcement

Zoning Overlays

Lower Saucon has also used overlay zones to protect natural resources where appropriate. Sandra Yerger considers this strategy to have been “very effective” in the township. The township has a natural resources protection overlay zone that protects steep slopes, woodlands, and stream corridors. The township has also adopted other overlays from bordering municipalities, making the protections more regional in scope.

Zoning Ordinance

Lower Saucon’s zoning ordinance (Chapter 180 of the municipal code) contains resource protection requirements that place limits on the amount of development in sensitive natural areas, including woodlands, floodplains, and wetlands, and along steep slopes. The zoning ordinance furthermore requires that those areas be protected. Notably, the zoning ordinance contains a riparian protection ordinance that protects riparian corridors.

The zoning ordinance also includes upper bounds for percentage of impervious coverage for development. Tom Maxfield notes that residents are not always happy about these limits because they are sometimes unable to add decks and other features to their properties, but stated that the township has continued to address these negative initial reactions by talking to residents and developers about the area’s historic flooding issues and making the connection to the imperviousness regulations, which are divided into zones based on septic system locations and soil drainage properties. The township can also cite studies that EAC chair and planning commission member Sandra Yerger compiled, stating the ideal limits of impervious coverage.

According to Tom Maxfield, residents and developers push back against the regulations less now than they did previously.

Through the zoning ordinance, the township also encourages clustering development. In this strategy, the developed area is reduced to a smaller portion of the site and the remainder is dedicated as open space. Though not as helpful for reducing impervious surface cover in a municipality as redeveloping, this strategy keeps development away from a site's most important natural resources. The township tries to fit incentives into cluster development, where more units are permitted if developers follow the cluster regulations. Through clustering, Tom Maxfield noted that the township was able to work with developers to protect an "immaculate wetland" located near developable land.

Stormwater Management Ordinance

The township has a detailed stormwater management ordinance (Chapter 137). Among other elements, it requires best management practices for construction projects, including bioretention, capture/reuse, constructed wetlands, wet or dry extended detention ponds, minimum disturbance/minimum maintenance practices, significant reduction of existing impervious cover, stormwater filters (sand, peat, compost, etc.), vegetated buffers/filter strips/swales, vegetated roofs, and water quality inlets. This has been a requirement for all new development over the past 12 years.

The ordinance also contains wellhead protection provisions for public water supplies within 400 feet of the site. Infiltration is prohibited close to the wellhead, within a Zone I radius dimension that is defined by the public water supplier. However, if the developer does not receive a radius value from the public water supplier, they must still develop at least 200 feet from the wellhead.

Floodplain Ordinance

The township has a separate floodplain ordinance (Chapter 90) that restricts disturbance in the Flood Hazard District, which is defined as special flood hazard areas in the township's 2014 Flood Insurance Rate Maps plus any community-identified flood hazard areas. No disturbance can increase flood levels in the community.

Variance and Waiver Review Process

According to Sandra Yerger, many entities in the township partner to ensure that the zoning ordinance is not undermined by monitoring variance and waiver requests and giving opinions on the requests to the township's zoning board. The EAC makes sure that the planning commission is aware of updates to ordinances, especially when the planning commission members change. The township's zoning officer is also a key player in this process. Their zoning officer is trained as an engineer, giving him a greater awareness of the design and environmental implications of approving a waiver and variance. The zoning officer informs the planning commission of pending or granted variance requests and keeps a log of all of the variances or waivers in areas where stormwater issues are located, enabling him to look at the big picture. The engineer and planner also provide oversight by attending planning commission meetings and governing board meetings to review comments on the variance or waiver requested.

The landowner requesting the variance or waiver comes before the governing board in a public meeting before going to the zoning hearing board. The planner, engineer, and lawyer all review and voice their opinions during that meeting. If they are in opposition, the lawyer attends the zoning board meeting to voice objection. All of these responsibilities help keep the township's regulations around stormwater and other natural resources intact.

Partnerships outside Lower Saucon

Lower Saucon partners with its neighboring municipalities on water quality issues, particularly Springfield Township (Bucks County) and Hellertown Borough (Northampton County). The township also relies on the state for funding water quality initiatives, having received grants from the DCNR for acquiring open space and for developing parkland. They work with non-profits, especially the Heritage Conservancy and Wildlands Conservancy, as well as their local watershed groups and the EAC.

To complete their MS4 requirements to conduct monitoring on the Cooks Creek and Saucon Creek, the township also partners informally with local colleges, including Lafayette University and Lehigh University, to conduct this monitoring work. Professors and classes from these schools have provided information and data to supplement the township's knowledge of watershed protection.

Land Conservation

Leslie Huhn noted that the council is engaged in land conservation and in using natural resource vulnerabilities to prioritize parcels for conservation. Glenn Kern is one council member who values open space acquisition as a means of "preventing haphazard development" and thus protecting water quality.

In the late 2000s, the township took the lead in determining the cost benefits of protecting natural resources over developing them. Prior to its first open space tax referendum in 2006, the township determined that when accounting for costs from school taxes, there would be less financial loss from protecting land than from developing as residential. The township's open space referendum program continues to this day; in the November 2016 election, Lower Saucon residents (58 percent) approved a referendum to extend their 10-year-old 0.25 percent earned income tax for open space. The tax is expected to generate about \$1 million per year for five years.^{3,4}

A recent township acquisition was an aging golf course, in order to remediate its hydrology and ecology, and convert it into a park with passive and active amenities. According to Tom Maxfield, who cites this property as his favorite preserved parcel in the township, the golf course previously caused flooding in downstream areas. However, these floods will likely be mitigated now that the parcel will be left "wild," as he noted, in alignment with his conviction that "habitat will take care of itself."

Municipal Concerns and Challenges Ahead

Keri Maxfield believes that a mixture of additional funding, staff capacity, and technical understanding would help Lower Saucon move its water quality projects forward. She cited several projects that have remained "on the backburner." She would like to do more work beyond the township's ongoing basin naturalization project to address heavy flooding in Silver Creek. According to her, large riparian restorations are being held up by lack of funding and the need for landowner permission, and more oversight and outreach from the township is needed on obstructions on the creek, like dams.

Education of Municipal Officials and Staff

Tom Maxfield noted that the township used to run workshops for municipal officials, and while a budget still exists for those classes, it has decreased. According to him, education of municipal officials is critical for

³ Andrew Wagaman, "Upper Milford, Lower Saucon vote yes on open space taxes," *The Morning Call*, November 9, 2016, <http://www.mcall.com/news/local/elections/mc-saucon-milford-tax-questions-20161108-story.html> (accessed June 1, 2017).

⁴ The Trust for Public Land, *LandVote*, <https://tpl.quickbase.com/db/bbqna2qct?a=dbpage&pageID=8> (accessed June 1, 2017).

addressing water quality issues. He would also like the township to be educated on new technologies for addressing waste storage or waste-to-energy products because, according to him, Northampton County's sewage disposal works along the Lehigh River are not efficient; he has been told that when facilities are overstressed, sewage gets dumped into the river.

Keri Maxfield wants to see an "introduction to water quality protection" class for elected officials that is accompanied by a manual on environmental issues, as new officials do not know the history of these issues in Lower Saucon and do not understand what triggered the township's existing regulations.

Education of Private Property Owners

Keri Maxfield also desires more education for private property owners; she believes that a class helping streamside property owners understand the best way to maintain their property would be beneficial, as well as instructions on protecting well water and naturalizing privately owned stormwater basins. According to her, the township needs to change residents' habits, such as around grass clipping practices. She acknowledges that the township continues to face challenges in getting enough property owners to attend these types of events but hypothesized that "hot-button" issues like "know your rights but manage your property" might interest more attendees.

Larger-Scale Responsibilities

There are many water quality issues stemming from Bethlehem's legacy industrial activities that arise on the township's boundaries. As the issue is multi-municipal, regional solutions are needed.

Keri Maxfield has also observed instances where the Pennsylvania Department of Transportation (PennDOT) has chopped down planting projects along its roadways, and from that experience, she feels that federal and state agencies (most relevant to this case, DCNR and PennDOT) need to work together and ensure that their goals and activities around water quality align.

Key Factors in Success

The key factors to Lower Saucon's success are:

- Educated local leaders
- Talented consultants
- Help from technical assistance providers

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Published to web: July 12, 2017

📍 MUNICIPAL CASE STUDY

Montgomery Township, Pennsylvania

Montgomery Township experienced rapid suburbanization over the last decades. To better manage runoff, the township initiated a stormwater basin naturalization program to maintain its 66 stormwater basins. In addition, a fee in lieu of installing new stormwater facilities for small land disturbances collects funds to support future water quality improvements.



**BRANDYWINE
CONSERVANCY**

By: Seung Ah Byun, PhD, PE
Brandywine Conservancy

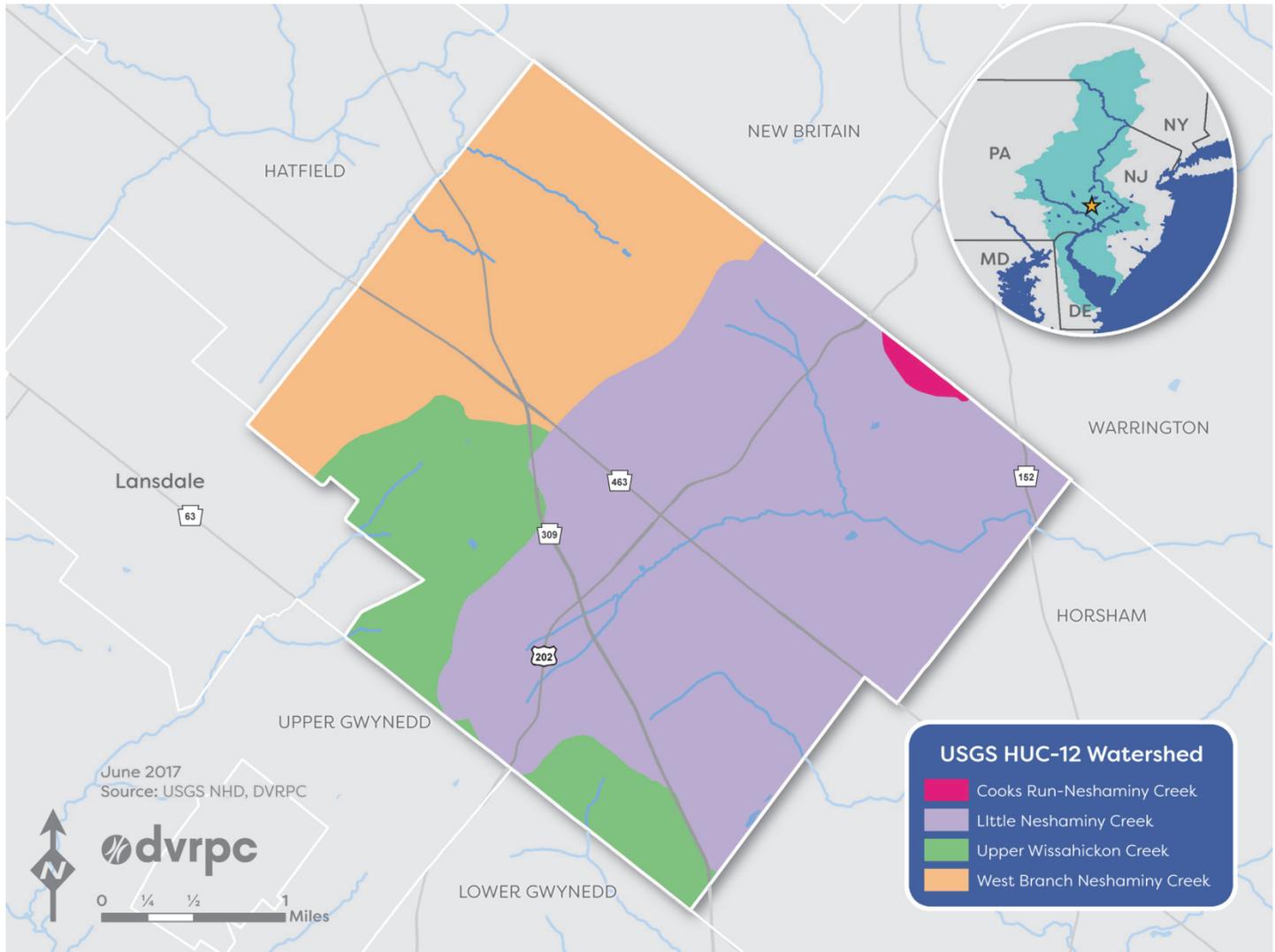
Background

Montgomery Township is located in Montgomery County, Pennsylvania, 25 miles north of Philadelphia. The township's land use characteristics and recent population changes offer several constraints in its water quality protection efforts.

The township has a total land area of approximately 11 square miles, 95 percent of which is developed. Much of this development, though not all, is impermeable, leading to flooding and water quality degradation in the township. According to its 2008 comprehensive plan, the majority of Montgomery Township's land is residential (47 percent), followed by parks/open space (15 percent) and commercial/office (11 percent). Roads, a notable source of impervious surface in communities, make up almost 10 percent of the township's land use. Less than 1 percent of the township is water.

Township officials had the foresight in the 1970s to strategically preserve local open space, riparian corridors, and greenways. Three contiguous open space parcels totaling approximately 270 acres now create an interconnected active and passive recreation area in the township. Township officials see their open space and natural resources as an important community benefit (Supervisor Michael J. Fox 2016).

Map: Montgomery Township Watershed



Population

With a population of 25,640 people (2015 Five-Year American Community Survey), Montgomery Township is large by county and state standards: the ninth largest municipality in Montgomery County and the 59th largest municipality in Pennsylvania. The township has experienced fluctuating rates of population growth over the past four decades. According to the 2008 Montgomery Township Comprehensive Plan Update, the township is expected to add about 200 residents per year between 2008 and 2020, at which time its population will be approximately 27,000.

According to the 2015 five-year American Community Survey, 16.8 percent of the township’s residents reported being foreign born, and 22.3 percent of residents reported speaking a language other than English at home. This diversity in origin and spoken language is relatively new for the township and is a factor with regard to effective public outreach and education strategies for community stormwater management.

Waterways and Watersheds

Montgomery Township lies entirely in the Delaware River Watershed. Eighty-five percent of the municipality drains to the Little Neshaminy Creek and 15 percent flows to the Wissahickon Creek. Despite the township's efforts to protect its natural resources, all 32 miles of streams within Montgomery Township have been designated by the Pennsylvania Department of Environmental Protection (PA DEP) as "impaired." PA DEP's 2014 Integrated Report cites land development and urban runoff as the primary sources of stream impairment in the township.

Water Quality Solutions

Naturalized Stormwater Basin Program

As part of complying with stormwater regulations, the township took ownership of and is maintaining the 66 stormwater basins in its jurisdiction. Starting in 2009, the township initiated a stormwater basin retrofit program that "naturalizes" existing stormwater basins.

In this "naturalization" program, vegetation is left to grow naturally on the inside of the basin and is maintained as directed by the township's landscape architect, Judy Goldstein. Ms. Goldstein is a consultant to the township and has been working on the naturalized basin program since its beginning. According to township's website, naturalizing basins "[transforms] a conventional basin into a natural ecosystem capable of providing habitat, improving the water quality, and providing aesthetic value" ("Montgomery Township, Pennsylvania"). Montgomery Township has developed this naturalized basin program for several reasons. Using the basins, the township can comply with state and federal water quality regulations, improve water quality by reducing the amount of pollutants entering waterways (including through uptake by native plants), and improve rates of groundwater recharge. Furthermore, naturalized basins can decrease the amount of air pollution produced through frequent mowing of conventional basins and improve the safety of township Public Works employees by minimizing their time spent maintaining stormwater basins.

Furthermore, the Montgomery Township's Shade Tree Commission identified that naturalization of conventional stormwater basins reduces their maintenance costs. The Shade Tree Commission also lists additional ecological benefits of naturalized basins. More wildlife will frequent a naturalized basin than a conventionally mowed one due to habitat and food provided by the native plant material. For example, naturalized basins allow for the re-colonization of insects that can help reduce the mosquito and tick population. Canada geese may be deterred by naturalized basins, which is positive because their droppings can further pollute waterways with excess nitrogen.

The township now has 47 naturalized stormwater basins and plans to continue naturalizing the remaining conventional basins over time.

People interviewed for this case study all spoke positively regarding the success of the township's basin naturalization program. Township Supervisor Michael J. Fox, who is also a clean water "champion" for the township, explained that with confidence in the quality and supply of their water source, compliance with the state Municipal Separate Storm Sewer System (MS4) permit became a top priority. Bruce Shoupe, the township's Planning and Zoning (P&Z) Director, echoed Supervisor Fox's comments regarding the township's focus on MS4 permitting requirements. Supervisor Fox also said that the township would like to undertake more water quality improvement projects, but the township's elected officials and staff must spend their time on

compliance with MS4 permitting requirements and have chosen to focus on the basin naturalization program as the primary means for compliance.

Supervisor Fox shared that the basin naturalization program began in the most remote parts of the township to avoid any unintended consequences and allow the Public Works Department to grow more comfortable with inspecting and maintaining the basins under the direction of Judy Goldstein. Ms. Goldstein explained the program's development and implementation in the following steps:

- Visit sites (all of which are on township-owned properties) and collect detailed information about basins.
- Inspect basins (all maintenance is done by the township).
- Allow plant material to grow in to help filter stormwater.
- Train Public Works staff to maintain the naturalized basins.

Both Supervisor Fox and Ms. Goldstein agreed that the basin naturalization program is successful due to the upfront public outreach at various township events, newsletters, signage on the basins explaining the change in maintenance, and the continued educational efforts via the township website and other publications. Ms. Goldstein continues to advise the township on ongoing maintenance concerns and naturalization of the 19 remaining basins.

Arbor Day Tree Giveaway Program

According to Supervisor Fox, the township has been providing free native trees and shrubs to township residents for the past 15 years in celebration of Arbor Day. Generally, between 200 and 400 plants are offered per year on a one-per-household, first-come, first-serve basis.

The township purchases the trees and shrubs and places no restrictions on where residents plant the stock. Ms. Goldstein, township staff, and volunteers provide tree selection, care, and maintenance advice to residents during this free event. Supervisor Fox shared that the Arbor Day program is an effective outreach and education tool that has helped add many trees on the township's residentially developed lands. The township also hosts a Shredding Day and a Community Day, which offer prime opportunities for the dissemination of information to residents and businesses. P&Z Director Shoupe echoed Supervisor Fox's opinions about the effectiveness of township events like Arbor Day on reaching citizens. He said that getting citizens, township staff, and township supervisors on the same page helps insure consistent administration and messaging. Additionally, township events like Earth Day and a summer camp serve to reinforce a community ethic of protecting the environment.

Partnerships

Montgomery Township also takes a leadership role in multi-municipal water quality protection programs. The township participates in the Pennsylvania Stormwater Coalition, which was formed in 2010 and is spearheaded by Montgomery Township Manager Lawrence Gregan and Supervisor Fox. The Coalition consists of 57 municipalities in Montgomery, Bucks, Chester, Delaware and Berks counties. It has worked with local, state, and federal officials to recognize and address the difficulties municipalities face when trying to meet PA DEP's March 2013 stormwater permit requirements. The Coalition continues to be involved with regional stormwater management issues and reflects a commitment by member municipalities to their "cooperative and firm support for a MS4 and TMDL [Total maximum Daily Loads] program that is reasonable, responsible and attainable" ("Montgomery Township, Pennsylvania").

In addition, P&Z Director Shoupe mentioned the township's partnership with the Wissahickon Valley Watershed Association (WVWA) on education initiatives and with the Wissahickon Clean Water Partnership. The WVWA is a non-profit land trust founded in 1957 with a mission to protect the quality and beauty of the Wissahickon Creek and to enhance all life in the Wissahickon Watershed. The partnership was formed to address excessive sediment and phosphorus impairments to the Wissahickon Creek. PA DEP has permitted the municipalities within the Wissahickon Watershed to develop their own alternative TMDL plan to address the water quality issues in the creek. The township has signed an intergovernmental agreement with 16 other municipalities and four wastewater treatment plants. This agreement commits Montgomery Township to work collaboratively on a plan to improve drinking water, mitigate damaging flooding, reduce streambank erosion, protect fish and wildlife, and restore valuable recreation areas throughout the watershed.

Aside from these two partnership efforts, Supervisor Fox believes that the township would be willing to collaborate with other municipalities more fully to address stormwater, but he finds that the state and federal regulations offer little incentive for collaborative municipal efforts. Both Supervisor Fox and P&Z Director Shoupe mentioned that adding to and strengthening Montgomery Township's partnerships could lead to increased coordination and efficacy on water quality efforts on a watershed or regional level.

Challenges and Needs

The three interviewees from Montgomery Township identified four major challenges to protecting water quality in their municipality.

Understanding and Meeting PA DEP's New Municipal Stormwater Regulations

Both P&Z Director Shoupe and Supervisor Fox discussed concerns with the state's new MS4 permit requirements. Supervisor Fox felt that previous regulations were rigid. With new regulations in place, P&Z Director Shoupe expressed the challenge of learning and meeting additional requirements. The new MS4 permit regulations require municipalities to develop TMDL plans and/or pollution reduction plans for impaired waters. Through development of these plans, municipalities need to identify best management practices to meet pollution reductions during a five-year permit period and describe how they will be implemented.

Funding Stormwater Management Program

Funding water quality protection is a major issue with municipalities in Pennsylvania, including Montgomery Township. While the Shade Tree Commission funded the township's naturalized basin program, dedicated funding for other stormwater management initiatives to meet PA DEP's regulations may be an issue in the near future.

Key Partners

Pennsylvania Stormwater Coalition: Spearheaded by Montgomery Township Manager Lawrence Gregan and Supervisor Michael J. Fox, this partnership of 57 municipalities in Montgomery, Bucks, Chester, Delaware and Berks counties works together and with government officials to address the state MS4 and TMDL program requirements.

Wissahickon Clean Water Partnership: A multi-municipal partnership that addresses excessive sediment and phosphorus entering the Wissahickon Creek. PA DEP has permitted the municipalities within the Wissahickon Watershed to develop their own TMDL alternative plan to address the water quality issues in the creek.

Wissahickon Valley Watershed Association: A non-profit land trust founded in 1957 to serve as a steward of the Wissahickon Creek.

One promising means of funding stormwater projects is the township’s fee in lieu initiative. In 2016, one year after adopting a new stormwater management ordinance, the township established a fee in lieu of stormwater facilities for “small projects” as defined in the ordinance: residential projects with less than or equal to 5,000 square feet of impervious surface and less than one acre of earth disturbance (§206-24). In this program, a fee of \$ 0.50 per square foot is applied after the first 1,000 square feet of land disturbance. The fee creates a dedicated funding source for stormwater management in the township.

From January 1, 2016, to February 1, 2017, the township collected \$4,606 on permit applications for residential additions, patios, driveways, and in-ground swimming pools with decking (Gregan, personal communication, February 3, 2017). The township has yet to allocate the funds for any other stormwater projects.

Communicating Water Quality Initiatives to Immigrant Populations

As discussed earlier in this case study, the percentage of residents who were born outside of the U.S. or who speak a language other than English at home is increasing. This demographic shift can present challenges to effectively communicate the township’s water quality problems, goals, and solutions. According to P&Z Director Shoupe, this challenge can be overcome by working with community members who are better able to communicate with the township residents who have a language barrier. P&Z Director Shoupe indicated that community members in churches and other capacities are already working to fill in those gaps but acknowledges that the township may need to devote more resources toward this special outreach and education effort.

Technical Assistance and Training Needs

While Supervisor Fox could not identify any additional training needs or concerns, he underscored the importance of training the township’s Public Works Department staff with naturalized stormwater basin maintenance. Ms. Goldstein shared that she works with the Public Works Department on ongoing training and also attends all township Shade Tree Commission meetings. She noted that Greg Rice of the Shade Tree Commission was a crucial player in the basin naturalization process and the “boots on the ground” implementer of many of the aforementioned initiatives.

Conclusion

Montgomery Township has taken significant steps to protect its natural resources and water quality. This municipality has had particular success with preserving open space and parkland; retrofitting conventional stormwater basins to better mimic natural systems; and offering a township-wide, no-cost tree planting program. The township is able to emphasize water quality and other conservation benefits to its residents and businesses through township-sponsored events such as Arbor Day. The commitment to the basin naturalization program and training by the township’s elected officials, consultants, and staff extends to the township’s investment in greener stormwater management facilities and their maintenance.

Motivating Factors

Fast Growth: Rapid growth in residential development created many stormwater basins that may not have been kept functional without municipal ownership, maintenance, and naturalization.

Regulatory: PA DEP regulations for MS4s led local officials to form the Pennsylvania Stormwater Coalition to recognize and address the difficulties that municipalities face when trying to meet PA DEP’s March 2013 stormwater permit requirements.

Local Partners: Pennsylvania Stormwater Coalition, Wissahickon Clean Water Partnership, and the WVWA have helped the township make progress in its own water quality protection.

Unifying Issues: Compliance with PA DEP regulation and a need to cost effectively manage stormwater in a suburbanized landscape.

Montgomery Township has continued efforts despite challenges it faces in trying to comply with complex stormwater regulations and permitting requirements. As one of the pioneering municipalities in the Delaware River Watershed, township officials have adopted a new fee in lieu of installing stormwater facilities to fund future water quality improvement projects. In addition, the township has taken the initiative to be involved regionally by forming the Pennsylvania Stormwater Coalition and is participating in the Wissahickon Clean Water Partnership. The township will no doubt continue to actively tackle the problems of stormwater management and water quality improvement through progressive programs and policies.

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Published to web: XXXXXXXXXXXXXXXXXXXXXXX

MUNICIPAL CASE STUDY

City of Newark, Delaware

Driven by the need to fully fund repairs and maintenance to its stormwater system, the City of Newark is working to establish a stormwater utility, and is a regional leader in this regard. The city is focusing its proposed utility on repairing its existing gray stormwater infrastructure system. However, it has yet to craft a comprehensive and complementary funding program for green stormwater infrastructure best management practices (BMPs). While repairs to the gray system are necessary and will address localized flooding concerns, they will likely not do much to limit the volume and velocity of stormwater entering local streams that is a major source of surface water quality impairments.

By: Lyn O’Hare
SSM Group

Background

The City of Newark is an urbanized municipality located in New Castle County, Delaware, and is home to the University of Delaware. The city straddles two sub-basins of the Delaware River Basin: the White Clay Creek Basin and the Christina River Basin. These two basins converge downstream of the city, before emptying into the Delaware River. Lower portions of the White Clay Creek and Christina River are under tidal influence, and both waterways serve as habitats to a wide range of aquatic wildlife. Waterways within the Christina Basin are used for recreation and fishing purposes; however, portions of these waterways have been identified as impaired and may contain harmful pollutants. The city has a backlog of maintenance on its stormwater system, recurring flooding problems that have caught the public eye, and concerns with meeting regulatory requirements around stormwater management.

Quick Stats
City of Newark

Annual average rainfall: 46 inches

Major adjoining water body:
White Clay Creek

Population: 31,454 (2010)

Sewer system: MS4

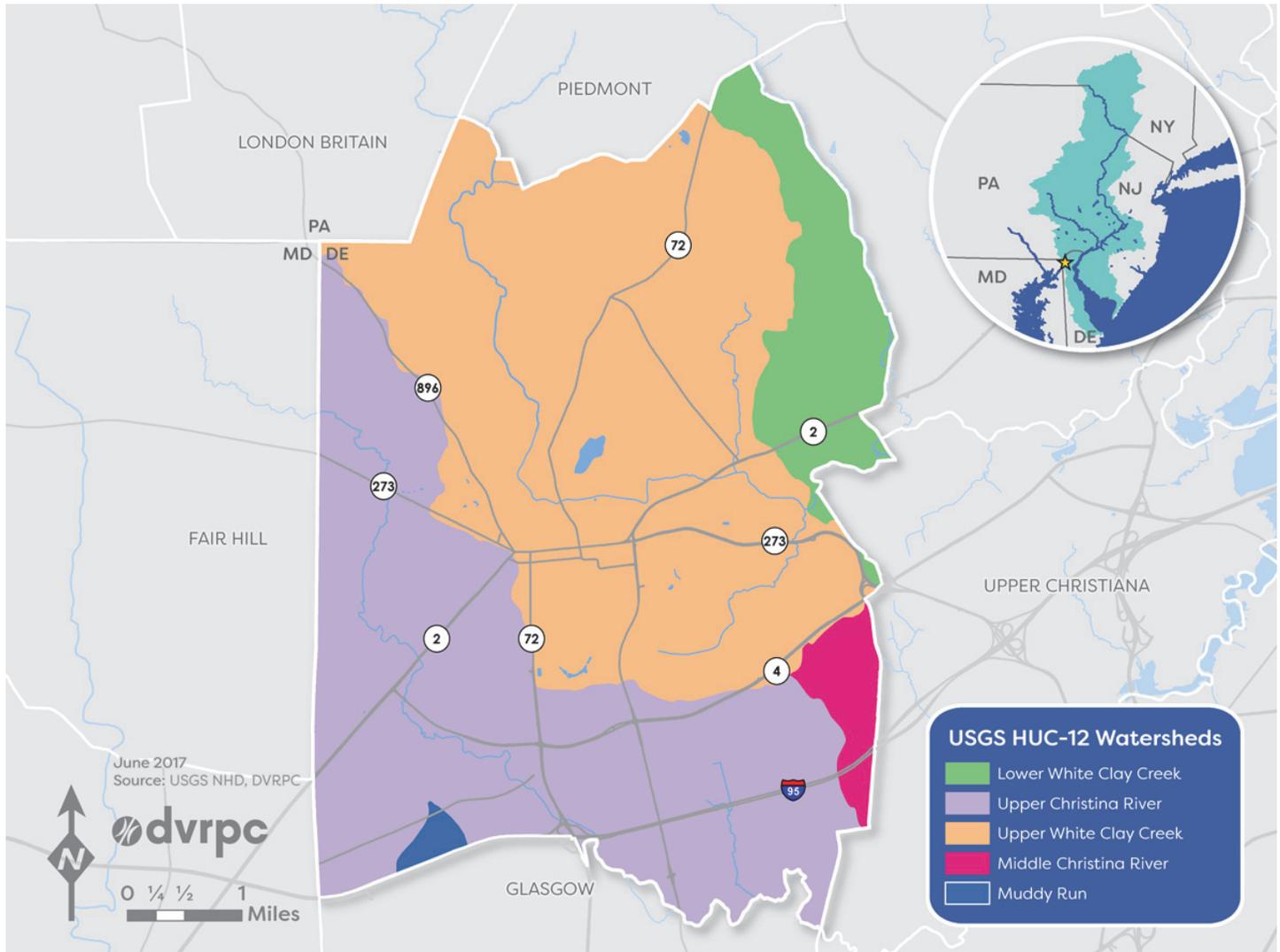
Land area: 9.3 square miles

Surface Waters

The White Clay Creek’s headwaters originate in Pennsylvania and flow southward through Delaware before contributing to the Christina River. In 2000, 190 miles of the White Clay Creek and its tributaries were added to the National Wild and Scenic Rivers System. The ground and surface waters of the basin provide drinking water to a population of more than 120,000, including residents of the City of Newark.

The headwaters of the Christina River Basin originate in Pennsylvania and Maryland and flow through Delaware before draining directly into the Delaware River. The Christina River Basin is the most urbanized basin of the larger Christina Basin, which also includes the White and Red Clay Creek Basins, and the Brandywine Creek Basin.

Map: City of Newark, Delaware Watershed



Water Quality Problems

The White Clay Creek has been identified as having high levels of bacteria and zinc, for which Total Maximum Daily Loads (TMDLs) exist for the creek. Zinc in the White Clay Creek originates from the currently inactive National Vulcanized Fiber site and surrounding stream sediments. This facility is located in Newark.

TMDLs for bacteria, sediment, low dissolved oxygen, and nutrients, including nitrogen and phosphorus, have been set for the Christina River. Pollutant sources are varied but include point sources from industrial and municipal discharges, agriculture runoff, suburban and urban runoff, and runoff from Superfund sites.

Water Quality Solutions

The City of Newark has a Municipal Separate Storm Sewer System (MS4) permit, which means it must meet a number of minimum control measures, including maintenance of the stormwater system, good housekeeping practices at municipal facilities, public education, sampling throughout the system and streams, and illicit discharge detection and elimination. These minimum control measures assist in improving water quality, but

they cannot begin to solve the impairments in the White Clay Creek and Christina River on their own. For this to happen, significant reductions in pollutant and nutrient loadings will need to occur throughout the watershed, outside and upstream of Newark's municipal boundaries. As a result, the city decided to assist in the funding of projects in the upstream reaches of the watershed. These projects included stream bank fencing and manure management on upstream farms. These types of projects help to reduce sediment, nutrients, and bacteria in agriculture-adjacent waterways, and can also have economic benefits for the farmers. However, the authors were not able to ascertain how much funding was contributed by the city to these projects.

Aging Stormwater Infrastructure

The City of Newark has about \$350 million of utility infrastructure underground, much of it in need of maintenance, repair, or replacement. Underperforming and/or ill-maintained stormwater infrastructure has led to localized flooding within the city. Inlets and pipes clogged by sediment, litter, and plant overgrowth; inadequate stormwater pipe capacities and inlet or outlet sizes; and eroded and collapsing drainage ways, have all led to poor drainage and localized flooding problems. As a result, maintaining and repairing stormwater infrastructure has become a priority for the city. However, the city does not have enough capital funding to bring its stormwater system up to a state of good repair, a problem further compounded by the need to maintain its drinking and waste water systems.

Stormwater Utility

Newark views its inability to keep up with and fund repairs of its stormwater infrastructure as a major problem. It has also been the major driver in Newark's desire to create a stormwater utility that would charge fees for the management of stormwater, thereby raising revenue to help fund the maintenance backlog. In 2009, the University of Delaware conducted a feasibility study on creating a stormwater utility to address stormwater problems in the municipality. The study determined that the City of Newark could generate anywhere from \$716,000 to \$1,432,000 annually, based on the rate charged per square foot of property. The utility would be responsible for identifying and managing issues where stormwater is not being conveyed to a discharge point properly and efficiently, and for raising funds to conduct stormwater management efforts. These funds would need to come from fees paid by all users in the municipality, including residents, business owners, and large facilities, such as industrial sites and institutions. It is important that the funds come from fees (as is the case with all utilities), as opposed to taxes, since some of the largest impervious surfaces in the municipality are owned or operated by tax-exempt facilities.

Progress to Date

The city's first attempt to establish a stormwater utility in 2009 was unsuccessful, as was a second attempt in 2013. These two failed attempts can be attributed mostly to a lack of education of the residents about the utility fee and a small, very vocal group in opposition to the utility, which influenced the city council to vote in their favor. Without being properly educated on the purpose and extent of the utility, the general public had a negative view of what they thought would be a "rain tax" and were not given the chance to associate these new fees with a better quality of life. In addition, the failure of the second attempt at implementing a utility could be attributed to the rate structure which was established. This attempt would have implemented a flat rate fee, as opposed to a fee based on the size of a property and its impervious surfaces. Members of the community were also unaware that the fee for residents would be minimal, about \$40 per year. The first attempt at a stormwater fee was mainly aimed at covering the cost of street sweeping and basic MS4 permit requirements, while the second attempt was more directly tied to improvements in and maintenance of the aging stormwater system that has been largely responsible for flooding problems in the municipality.

Key Partners

Delaware Department of Natural Resources and Environmental Control (DNREC): Newark is open to partnering with upstream communities on water quality initiatives outside of Newark's municipal boundaries but will need support and approval from DNREC so that all participants can receive full credit for such activities under state rules.

William Penn Foundation: The foundation is funding the Healthy Watershed Fund for the Brandywine Creek. If successful, this could be a model for the Christina River Basin.

Upstream municipalities: Cooperation with upstream municipalities is needed to implement basin-wide approaches to improving water quality.

Currently, the city is planning its third attempt at implementing a stormwater utility and fee. It has hired a consultant, Black and Veatch, who was responsible for planning the now successfully implemented stormwater utility in nearby Wilmington, Delaware. This firm is modeling Newark's new utility after the one adopted by Wilmington. In addition, the municipality has conducted extensive education efforts aimed at the public in an attempt to change public perception about the purpose of the utility and associated fees. Newark expects the planned utility model to be complete by the end of 2016, so that the city council can vote on it for the upcoming year. The fee would be used for a variety of stormwater related activities, such as the correction or repair of identified problem areas throughout the stormwater

infrastructure system, ongoing maintenance of the system, which could include street sweeping, cleaning storm drains, and upgrading any degraded infrastructure, and other activities as required by the MS4 permit. The city is currently keeping track of all stormwater-related expenses separately, so as to create a realistic budget when the stormwater utility is implemented.

Stormwater System Repairs

In order to begin stormwater infrastructure improvements, the City of Newark has identified major areas of concern throughout its stormwater system, where infrastructure has failed, is inadequate, or is in a state of disrepair. Each area of concern was evaluated, estimating repair costs and feasibility of repair, and several projects have been completed. These projects include grading and surface restoration, repair of failed stormwater basin embankments, reinforcing inadequate and failing infrastructure, addressing major areas of erosion, and stream restoration projects. An example of one of these projects is the Ridgewood Glen Stormwater Pond. In 2013, the embankment for the pond failed, due to failure of the outfall pipe which traverses through the embankment. In the fall of 2013, the existing corrugated metal pipe was removed and replaced with reinforced concrete, and the embankment was repaired. The project cost about \$75,000.

Lessons Learned

The stormwater and water quality story in the City of Newark is still being written. Currently, it is not yet a success or failure. If the city's third attempt at the creation of a stormwater utility is successful, it appears that most of the funds will go to the repair and maintenance of the existing conventional stormwater system. Maintaining the stormwater system to prevent backups and localized flooding should be a priority, but it will not fully ameliorate the water quality impacts associated with high-volume and velocity stormwater runoff entering creeks and streams. In fact, an "improved" gray infrastructure system could even *increase* the volume and velocity of stormwater discharges that lead to water quality impairments by conveying water more efficiently and quickly to creeks and streams. To improve water quality, the city will need to embark on a comprehensive program of green stormwater BMPs, while also repairing and maintaining its system of pipes, inlets and drainage ways. Stream restoration was mentioned by the city as one possible project to be funded by a stormwater fee. Stream restoration projects can help immensely with water quality, but the city would still need

to couple these projects with a comprehensive green stormwater infrastructure BMPs to capture, store, and infiltrate stormwater where it falls. The installation of green stormwater infrastructure BMPs throughout the city is not a priority for the proposed stormwater utility at this time. Perhaps this will change if the stormwater utility is successful and the city is able to overcome its gray infrastructure maintenance backlog.

In addition, regardless of what the city does to manage, store, and treat stormwater within its boundaries, improvements in stormwater management must be made upstream to effectively improve water quality in the wider Christina River Basin. Many of the impairments across the watershed are traceable to upstream development and agricultural uses, and these impairments need to be addressed at their source. Newark should be commended for its efforts help manage nonpoint source water pollution in upstream communities. While further study is needed, it could be possible that investing in upstream stormwater controls, as opposed to green stormwater BMPs within Newark’s municipal limits, could be a more cost-effective way to improve water quality in the Christina River Basin as a whole. However, this needs to be balanced with the knowledge that Newark residents have expressed negative opinions about the city spending funds to improve areas outside city limits, as well as the many regulatory restrictions which prevent the city from being able to assist with water quality issues in other municipalities.

Along these lines, The William Penn Foundation, along with other partners, is working to create a Healthy Watershed Fund for the Brandywine Creek Watershed, which would pool funding from MS4 permittees to make water quality improvements throughout the watershed where they achieve the greatest benefit. This could be a model for the Christina Basin as well. However, the city is unsure whether DNREC will allow individual permittees to receive credit for these efforts toward their MS4 permit requirements. Receiving credit for MS4 requirements is necessary to enable municipalities to justify spending local funding outside of their own community. Regulatory uncertainties such as this example are one reason these regional partnerships, while they may have great advantages, may not work. If the Healthy Watershed Fund for the Brandywine Creek Watershed is successful, it could be replicated on the White Clay Creek.

Plans for the Future

The City of Newark plans to move forward with its newest stormwater utility model. If properly implemented, the city expects the utility to relieve its overworked and underfunded departments of some of the overwhelming stormwater and localized flooding issues they currently face. This will allow the city to turn its attention to other issues impacting water quality. For example, it will be able to turn its attention toward participating in partnerships aimed at improving water quality in the Christina Basin waters and continue to work toward attaining its MS4 permit goals.

Motivating Factors

Failing stormwater infrastructure: Lack of funds to repair and maintain the existing gray stormwater system.

Flooding: Severe storms are leading to localized flooding in developed areas due to the improperly functioning stormwater system.

Water quality impairments and MS4 permit requirements: The city is aware that surface water quality is impaired and that stormwater from the city (along with other locations) contributes to the problem.

Potential for basin-wide partnerships: The city is open to working with upstream communities on basin-wide strategies to maximize the “water quality bang” for their buck.

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Published to web: August 11, 2017

📍 **MUNICIPAL CASE STUDY**

Smithfield Township, Pennsylvania

Smithfield Township is a rural, forested community located between the Pocono Mountains and the Delaware Water Gap. Despite this “woody” heritage, it has experience heightened development pressure in recent decades due to its location on the periphery of the New York/North Jersey metropolitan area, as commuters move farther and farther away from the urban megalopolis. As a result of this development, the township has begun to experience some of the water quality problems associated with suburban levels of stormwater runoff. Township officials and residents both fear that if additional development and land conversion is not held in check, the township will experience an irreversible deterioration in water quality and quality of life.

By: Melissa Andrews, *Environmental Planner, DVRPC*

Background

Smithfield Township is located at the easternmost part of Monroe County in northeastern Pennsylvania. The township is bordered by the Delaware River to the south and east. The town of Delaware Water Gap lies immediately to the south and the city of East Stroudsburg lies immediately to the west.

Smithfield is predominantly a residential community but also contains a mixture of institutions (hospitals and universities), industries (light manufacturing), and resorts (Shawnee Inn Golf Resort and Ski Area). It is also considered a picturesque community, with some rural features and views of the Delaware River, and a location bordering the Delaware Water Gap National Recreation Area on its eastern edge. Smithfield’s land use, broadly, is 69 percent forested, 23 percent developed, and 2 percent agricultural.

Quick Stats
Township of Smithfield

Major adjoining water body:
 Delaware River

Population: 7,353 (2010 Census)

Sewer system: Septic fields

Land area: 23.2 square miles

Water area: .7 square miles

Smithfield’s Perception of Water Quality

According to Brian Barrett, Smithfield Township’s chairperson, the township and its residents agree that water quality is a high priority, but for different reasons. Doug Schryver, Smithfield’s Planning Commission Chairman, supported this assertion by noting that many people who live near the Delaware River care about it and have a strong attachment to it, while others who live farther from the river may not consider surface water a top concern, but they do care about their drinking water and are sensitive to issues around drinking water.

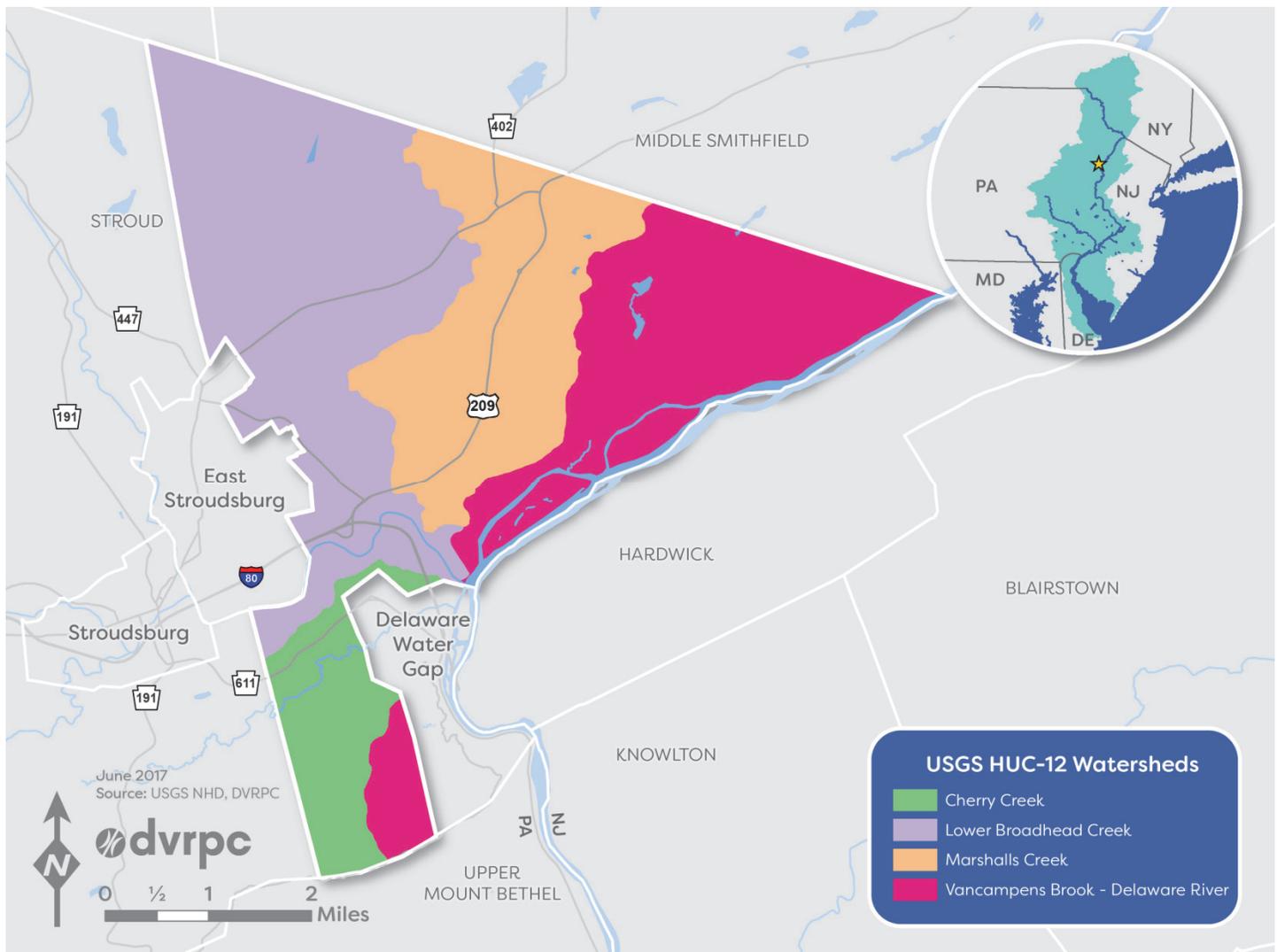
Smithfield’s municipal officials care about water quality protection for another set of reasons. Township officials care about ensuring that future development does not come at the expense of the overall health of the natural

environment, and that the quality of life for residents is preserved. Protecting land for water quality is a means of helping fulfill those goals.

Smithfield’s Watersheds and Waterways

Smithfield Township is located within the Middle Delaware-Mongaup-Brodhead Watershed. Six named waterways are contained within its borders, including Brodhead Creek, Caledonia Creek, Cherry Creek, Delaware River, Marshall Creek, and Sambo Creek. These waterways are located in four sub-watersheds (HUC-12): the Lower Brodhead Creek Watershed in the west of the township, the Marshalls Watershed in the north-center of the township, the Vancampens Brook-Delaware River Watershed in the east, and the Cherry Creek Watershed in the south. The Marshall Creek and Sambo Creek watersheds have the largest presence in the township and make up about two-thirds of the township’s land area. Smithfield contains some headwaters—tributaries of the Delaware River—most notably the Brodhead Creek.

Map: Smithfield Township’s HUC-12 Watersheds



Water Quality Problems

Population Growth

The proximity of Interstate Highway 80 puts the township within 1.5 hours of New York City, and over the past 30 years has made it a destination for residential commuters to New York City, who moved to the township from northern New Jersey municipalities and New York City.

Mary Ellen Higgins, the township's Environmental Advisory Council Chair, notes that in the 1990s, developers created a successful sales pitch for middle-class workers who were finding it hard to pay for life in New York City: "Why rent?" The implication was that in the Poconos, you could own your own home, and Smithfield, though a long commute away from New York, was a prime target as one of the first townships in Pennsylvania off the bridge to New Jersey. The population growth and attendant development of the past two decades have increased stormwater runoff and may have caused private well contamination.

Stormwater Runoff

Prior to the economic downturn in 2007, Monroe County was a fast-growing county, and developers wanted to construct primarily residential development in what happened to be environmentally sensitive land in Smithfield. Increased development on greenfield areas has brought increased impervious surface coverage to Smithfield, including more parking lots, driveways, and roofs. Ellen Lott, a project manager at the Nature Conservancy, a nonprofit environmental organization that has partnered with the township, indicated concern about giant parking lots associated with new large commercial developments in the township.

Over the past several years, the rate of development has decreased in the township, so it has not needed to push back against developers in the same way, but the impervious surface and its negative effects on the township's water quality remain.

Private Well Contamination

Seventy percent of residents in Smithfield use private wells, and 30 percent get their water from one of two water authorities: the Brodhead Creek Regional Authority or the Manwalamink Water Company. Because the majority of households in Smithfield use private wells, a main concern of residents is groundwater contamination. Some wells have been determined to be contaminated with *E. coli*, and according to Ellen Lott, many homeowners are unable to drink their water. The town hall is also facing *E. coli* contamination, which has informed township officials and staff of this issue in a particularly direct way.

There are several possible reasons for the contamination. Ellen Lott believes that because many people who recently moved to the township came from urban areas, they are less likely to be aware that their property contains its own well or septic system, and thus do not get these systems tested regularly. Mary Ellen Higgins cited poorly constructed septic systems, an increase of wells in the township, and a lack of municipal regulations requiring landowners to test their septic systems regularly. Doug Schryver commented that many people abandoned their homes after the financial crisis, and these resulting foreclosed homes are being rented, but absentee landlords are less likely to maintain their wells and septic systems than owner-occupied properties. Many of these homes—and their wells—are now 25 years old, and the wells are now failing.

A positive outcome from this crisis is a public awareness of water quality issues. Mary Ellen Higgins observed that many residents are stretched financially, balancing long-distance commutes and homeownership, making them particularly concerned about property values. Because residents are aware of the connection between

poor water quality from failed septic tanks and property values, they rank water quality “hand in hand” with property values.

Water Quality Solutions

Technical Assistance and Consultant Support

Smithfield hires consultants who have backgrounds in water quality management to work on water quality-related issues. They have consulted for many years with engineering firm Boucher and James, which Doug Schryver describes as “one of the best” and “experts in stormwater.”

The township also sought assistance on an open space referendum from two nonprofit environmental conservation organizations: the Nature Conservancy and the Trust for Public Land. Smithfield Township consults with the Monroe County Planning Commission and Monroe County Conservation District, and makes use of their technical assistance and funding programs for natural resource ordinances and plans. These projects are discussed below.

Land Preservation

Population growth has driven an interest among residents in preserving remaining open space.

One property recently acquired in the township is Mosier’s Knob, a 550-acre property near the Delaware Water Gap. Dawn Gorham looks to this preservation deal as a best practice, particularly in terms of the partnerships that were formed to preserve the property. Ellen Lott noted that a citizen’s preservation group, the Shawnee Preservation Society, assembled to protect it and was successful even though developers were fairly powerful.

Local Open Space Referendum

In the November 2016 election, the township voted on and passed a two-million-dollar bond to fund open space for water quality improvements, among other goals. Seventy-six percent of residents voted in favor. The bond will be floated in 2017, and the township expects to get matches from other organizations.

Ellen Lott from the Nature Conservancy was one of the many partners who worked with the township. The Nature Conservancy has protected land surrounding the Cherry Creek (the Cherry Valley National Wildlife Refuge), and a small portion of that area lies in Smithfield.

The Nature Conservancy got involved with Smithfield Township’s bond referendum indirectly. Brian Barrett knew the Nature Conservancy from its unsuccessful efforts to work with Monroe County to hold open space referendums in 2008 and 2010 after a successful referendum in 1998. The Nature Conservancy and another organization, Trust for Public Land, met with eight members from the township’s Environmental Advisory Council to discuss a referendum in Smithfield, and Trust for Public Land conducted a feasibility assessment that ascertained whether the township could afford to create a bond, what the bond would cost, and the likelihood of residents accepting it. The township wanted to preserve land for growth management and water quality, and had already identified parcels.

The Nature Conservancy conducted a poll to see if residents would support the bond, and as the results were positive, the partners “went into campaign mode,” as Ellen Lott described it. She noted that Trust for Public Land staff, who are “masters of campaigning,” helped craft the ballot language based on the polls. The township approved putting it on a ballot, and—in a rare occurrence, according to Ellen Lott—all three township

supervisors wanted to be involved. Trust for Public Land and the Nature Conservancy made use of mailings, phone banking, and advocates at the polls to explain the referendum and its benefits. Ellen noted that Smithfield did something that townships rarely do: send their own volunteers door to door to talk about it.

The referendum had some additional support. It was aided by State Representative Rosemary Brown (189th District), who made a positive statement about the bond referendum, which neither Smithfield nor its partners requested. Also, when asked by the township, a director of one of the three regional water authorities agreed to send out information about the referendum. Finally, as Ellen Lott noted, “the fact that there was no organized opposition helped.”

Official Map and Partner Ordinance

Smithfield has additional land use policies in place to protect its waterways. Along with three peers in Monroe County, it has an official township map that includes riparian buffers and target acquisition/easement areas, particularly in the headwaters. Monroe County Planning Commission offered the geographic information systems mapping services that enabled the township to create this map and paid for one-half the cost of the associated ordinance. Christine Meinhart-Fritz noted that official maps, which are discussed in Article 4 of Pennsylvania’s Municipal Planning Code, can be a valuable tool for extending a municipality’s budget: a municipality may not have the finances to preserve every parcel that is prioritized on an official map, but the official map gives the municipality extra leverage when working with developers to incorporate water quality protection measures on parcels that have been included on the official map.

Stormwater Ordinance

Smithfield Township is proud of their 2006 stormwater ordinance, which was one of the first to be created in Monroe County. The ordinance requires 150-foot buffers, which is the high end of the 75–150-foot range recommended in Monroe County Planning Commission’s stormwater plan. When the County Planning Commission adopted their stormwater plan, they asked municipalities to adopt a stormwater ordinance that was consistent with their plan, and then met with township supervisors to address their concerns (for example, letting them know that the riparian buffers did not constitute a taking). So far developers and residents in Smithfield seem to have accepted this regulation; Mr. Barrett noted that there was not a lot of pushback when the ordinance was passed.

Subdivision and Land Development Ordinance (SALDO)

According to Dough Schryver, the township’s SALDO is one of the toughest in the state and has helped slow development over the past 10 years. He notes that all residential and commercial builders have to follow it and “few developers want to build under it.”

The SALDO contains strict requirements for steep slopes. No slope over 15 degrees can be disturbed without “directly confronting” the township, as Doug Schryver notes, to find a solution for stormwater to avoid erosion and sedimentation. For land with a slope of between 15 percent and 25 percent, the maximum area of

Motivating Factors

Rapid growth and development: Leading to pressure for protection of natural areas to maintain quality of life.

Residential well-water contamination: Failing septic systems have contaminated private drinking-water wells with *E. coli*.

Valued local natural resources: As a community adjacent to the Delaware Water Gap and the Pocono Mountains, the natural resources of Smithfield are not only critical to its quality of life, but also to its tourist-based economy.

disturbance is 60 percent. For land with a slope of more than 25 percent, the maximum area of disturbance is 10 percent.

Besides regulating disturbance on steep slopes, the SALDO also describes how stormwater should be managed onsite; has provisions for street tree plantings; lists tree protection standards; regulates stormwater pipe size, and drain quantity and quality; and contains a percentage requirement for pervious land onsite.

Commercial Corridor Overlay Plan

The township hired planner Tom Comitta (of Tom Comitta Associates) to create an overlay plan to support development along its commercial corridor, which will help prioritize the use of existing infrastructure and deter development in greenfield areas. Doug Schryver cites science writer and explorer David Quammen, paraphrasing, “if a town is experiencing adverse impact, look to the downtown to rebuild rather than build anew.” The township hired Mr. Comitta because of his distance from day-to-day operations in the town and because he thinks “out of the box,” according to Doug Schryver.

Water Quality Champions

The township also benefits from having water quality champions in different roles. Elected officials and volunteer staff within the township support water quality, as does the Planning Commission, Environmental Advisory Council, and Open Space Committee.

Ellen Lott was impressed with the proactivity of the township’s leaders that led to the passing of their bond referendum. In fact, the township reached out to her regarding the bond after township leaders attended a workshop on funding for land protection that the Nature Conservancy co-sponsored.

Ellen Lott believes that a major criterion for successfully creating an open space or water quality funding program is leadership, but that conservation leaders typically do not run for office. The 1998 Monroe County open space bond campaign was novel in that regard: it motivated conservation-minded people to participate in political roles, and some are still in office. She feels that conservation-minded people need more encouragement to become politically savvy and active.

Municipal Concerns and Challenges Ahead

State Policies and Funding

Looking forward, the interviewees are primarily concerned with actors outside the township boundaries. Brian Barrett noted that the township has struggled with the regulatory limitations of Pennsylvania’s Municipal Planning Code, and is also concerned that the state may “erode” development setback requirements. He has observed efforts by some state-elected officials to weaken existing riparian setback laws and the status of county conservation districts and planning commissions.

He would like the state to be more progressive in its support of water quality protection and offer grants toward that end. One item on his wish list and for which he would like funding support is a township-wide study on the effects of stormwater runoff on clean streams, wetlands, and water quality, which would be expensive to have conducted by a professional.

Mary Ellen Higgins wants to see more state policies regarding septic system maintenance, particularly a state law requiring municipalities to monitor and manage septic systems. Without a law in place, she comments,

property owners have “no reward for being virtuous” if they manage their septic system appropriately, as the impacts of poor maintenance are mostly felt “downstream.” She feels that it would be helpful if the state prodded municipalities to address homeowner complaints in some way, perhaps by tying a related funding source like Growing Greener to a septic system requirement. She also believes that the township needs an ordinance to get residents to test and fix their septic systems.

Capacity

Ms. Higgins wants to use a Growing Greener grant to remove Japanese knotweed that is growing 20 to 30 feet deep in a local park along a 100-foot section of the Brodhead Creek at its confluence with the Delaware River. However, she doesn't have time to write grants, as she is a volunteer who works elsewhere full-time. She wishes that Smithfield had resources to help with the grant writing. Similarly, Doug Schryver wants a separate township officer who is focused on water quality. The township only has one officer, who is focused on code enforcement.

Funding and Time

While development of Smithfield Township has slowed since the recession, economic growth could bring a new surge of interest in the Poconos region and added development pressure to Smithfield. For Smithfield, now is the time to take advantage of the lull in construction to examine its existing land use regulations and determine if they would effectively maintain or improve the township's water quality.

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Published to web: August 11, 2017

📍 **MUNICIPAL CASE STUDY**

Stillwater Township, New Jersey

Stillwater Township is a rural and forested community located in the New Jersey Highlands just south of the Delaware Water Gap National Recreation Area. Tourists began coming to Stillwater in the early 1900s for its natural beauty and the pristine waters of Swartwood Lake. Summer homes began to be constructed around the lake beginning in the 1940s, many of which have since become permanent residences. Due to the quality of the lake and its attractiveness to residents and visitors alike, protecting its water quality has been a priority over the past 50 years. Since 1992, these protection efforts have been led by the Swartwood Lakes and Watershed Association (SLWA) with financial support from New Jersey Department of Environmental Protection (NJDEP).

By: Laura An, DVRPC

Background

Stillwater Township is a rural township in Sussex County, New Jersey, abutted by the Delaware Water Gap National Recreation Area along its northern border. About one-third of township land is already protected through a variety of strategies, including farmland preservation, state park land, Green Acres-funded easements and acquisitions, and other programs.

Among its most prominent environmental features are its two lakes, Swartwood and Paulinskill, and the Swartwood State Park. Stillwater has a history of dairy farming but became a summer resort town for tourists towards the first half of the 1900's, due to its location along a railroad connecting the Pennsylvania coal fields to New York City. Beginning in the 1940s, a proliferation of summer homes were built around the Swartwood and Paulinskill lakes, which eventually became year-round residences. The town saw the majority of its growth between 1950 and 1980, although it has recently seen some decrease in population as a result of the 2008 recession. As of 2015, the population stands at 3,922 people.

In 1959, the Swartwood Yacht Club was formed by a group of residents who enjoyed sailing on Swartwood Lake. In addition to teaching sailing classes and hosting boat races in the summer, the club also assisted the state with performing water tests. They were soon joined by the Paradise Fishing Club in 1974, a group of local fishing enthusiasts who were interested in also preserving the quality of the lake.

Quick Stats
Township of Stillwater

Major water bodies: Swartwood and Paulinskill lakes

Population: 3,995 (2015 5-year American Community Survey [ACS])

Sewer system: Septic fields

Land area: 27.1 square miles

Water area: 1.3 square miles

Median household income: \$79,392 (2015 5-year ACS)

The two groups, along with other residents concerned about the environmental quality of the lake, all of whom were concerned about the quality of lake water and the eutrophication they were witnessing, came together in 1992 to form what would become the SLWA. The SLWA has raised over \$1.6 million in grants that have been used for various projects regarding water quality management. These grants had primarily been 319 grants from NJDEP, given that Swartswood Lake is owned by the state, but that 319 grant program is no longer funded. The loss of this grant source poses a threat to the watershed association's continued work in maintaining or improving the water quality in Swartswood Lake. A SLWA member stated that state grants are critical because the equivalent amount of funding could amount to as many as 10 years' worth of membership dues.

The SLWA's Past Work

Eutrophication in the lake is caused by a variety of contaminants. There are three main sources of excess nutrients that contribute to the eutrophication of Swartswood Lake.

The first source of contamination is septic waste systems, since there is no centralized sewer system in Stillwater. While building septic systems requires a permit in Stillwater, there are no requirements for continued maintenance. Generally, it is advisable that residents have septic pumpouts every one to three years in order to keep their septic systems in good working order. The SLWA advocated for an ordinance that would require septic management every three years, but the ordinance did not pass in the interest of avoiding an increase in township fees. The cost of a pumpout is equal to approximately \$1 per week. In comparison, the cost of cleanup, should a septic system fail, could reach up to \$30,000. SLWA President Margaret Emmetts feels that increased public awareness of the benefits of regular pumpouts could be a solution to reducing septic contamination.

Stormwater runoff is another source of contamination, washing a variety of substances from throughout the watershed into the lake.

The SLWA has made efforts to educate residents through newsletters, brochures, and biannual SLWA meetings on the environmental harm caused by phosphorus lawn fertilizers and by cutting grass too close to the water line. The SLWA received grants in 2000 and 2003 (\$223,640 collectively) to conduct stormwater management studies and to upgrade the stormwater systems around the lake to reduce runoff into the lake.

Finally, agricultural runoff also contributes to water impairment. A particular problem is farmers who let their animals in surface waters that drain into the lake. The biggest concern regarding livestock is having animal feces in the water. Stillwater Township is currently looking into implementing programs similar to the one in Warren County, where in addition to education, residents may own up to seven animals, and if they own more, they are required to have a waste treatment plan.

In addition to the aforementioned work, the SLWA has been very proactive in addressing the contents of the lake itself. It has conducted a limnological study of the lake, installed two hypolimnetic aerators to bind up

Motivating Factors

Presence of lake with high-quality water:

Swartswood Lake's high quality and scenic beauty drew tourists and residents to the area. Maintaining its quality and beauty is important to residents and tourists alike.

Historic efforts to protect Swartswood Lake:

Efforts to preserve the quality of the lake date back almost 50 years. The SLWA grew out of these efforts and continues to draw upon them for inspiration.

Swartswood State Park: The presence of a state park makes protecting the lake a priority for NJDEP.

phosphorus and increase the amount of dissolved oxygen in lake water, managed the growth of weeds like milfoil through the use of weevils, and purchased a weed harvester.

Current Work at the SLWA

One of the biggest challenges that the SLWA faces today is the accumulation of biomass. This task is particularly difficult when nonnative invasive species are the primary source of growth. A few of the species that the SLWA is working to control include Eurasian milfoil, American lotus, and most recently, water chestnut. Progress in these efforts has been difficult to gauge, particularly given that the SLWA does not have the funding to conduct necessary benchmark studies. Another study that it would conduct if funding were available is determining how much biomass is acceptable in Swartswood Lake and to what extent it must be controlled. These studies are difficult to conduct because many existing grants cover implementation projects but not the studies that must precede them.

Overall, the SLWA has proven to be a resident-grown organization that has had a significant impact on water protection efforts and demonstrates what can happen when citizens are invested in the health of the places that they inhabit. However, because of limited funding streams, work like theirs is predicated on the availability of grants, contribution of time and money from local citizens, and the cooperation of NJDEP.

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Published to web: September 25, 2017

MUNICIPAL CASE STUDY

Warrington Township, Pennsylvania

Warrington Township’s drinking water aquifers were contaminated by perfluorinated compounds (PFCs) from the use of fire-fighting foam for practice exercises at the Willow Grove Naval Air Station. These contamination issues have elevated water quality to the highest priority for the township. The township has a cooperative agreement with the Air National Guard to treat water with a granular activated carbon filtration system and is currently supplying township residents with water from the North Wales Water Authority (NWWA).



By: John Gaadt, AICP
 Gaadt Perspectives, LLC.

Background

Warrington Township is a predominantly suburban community with a thriving commercial district, many parks and amenities, and a high standard of living. Little of the township’s past industry remains. The “Gateway to Bucks County since 1734” is 13.8 square miles with a 2015 population of 23,942 (approximately 1,735 persons per square mile). Approximately 95 percent of the township is on public water and sewer, and the township’s Water and Sewer Department serves approximately 25,000 people.

The township falls within the Delaware River Basin, and its relatively modest topography (a high elevation of 468 feet) drains into the Neshaminy and Little Neshaminy creeks. The Neshaminy Creek drains the northern half of the township and contains the Mill Creek subwatershed. The Neshaminy, excluding the Little Neshaminy, has a watershed area of approximately 189 square miles and measures 24.7 linear miles. The Little Neshaminy Creek and its subwatershed, Park Creek, drain the south side of Warrington. The Little Neshaminy drains approximately 43 square miles and measures 16 linear miles. The Bradford Dam subbasin formed by the Bradford flood control dam lies within the Little Neshaminy Watershed. The Bradford Dam (PA 611) was constructed in 1976 and holds 2,156 acre-feet of water. It drains an area of 10.9 square miles. The dam provides flood control for downstream properties.

Quick Stats
Warrington Township

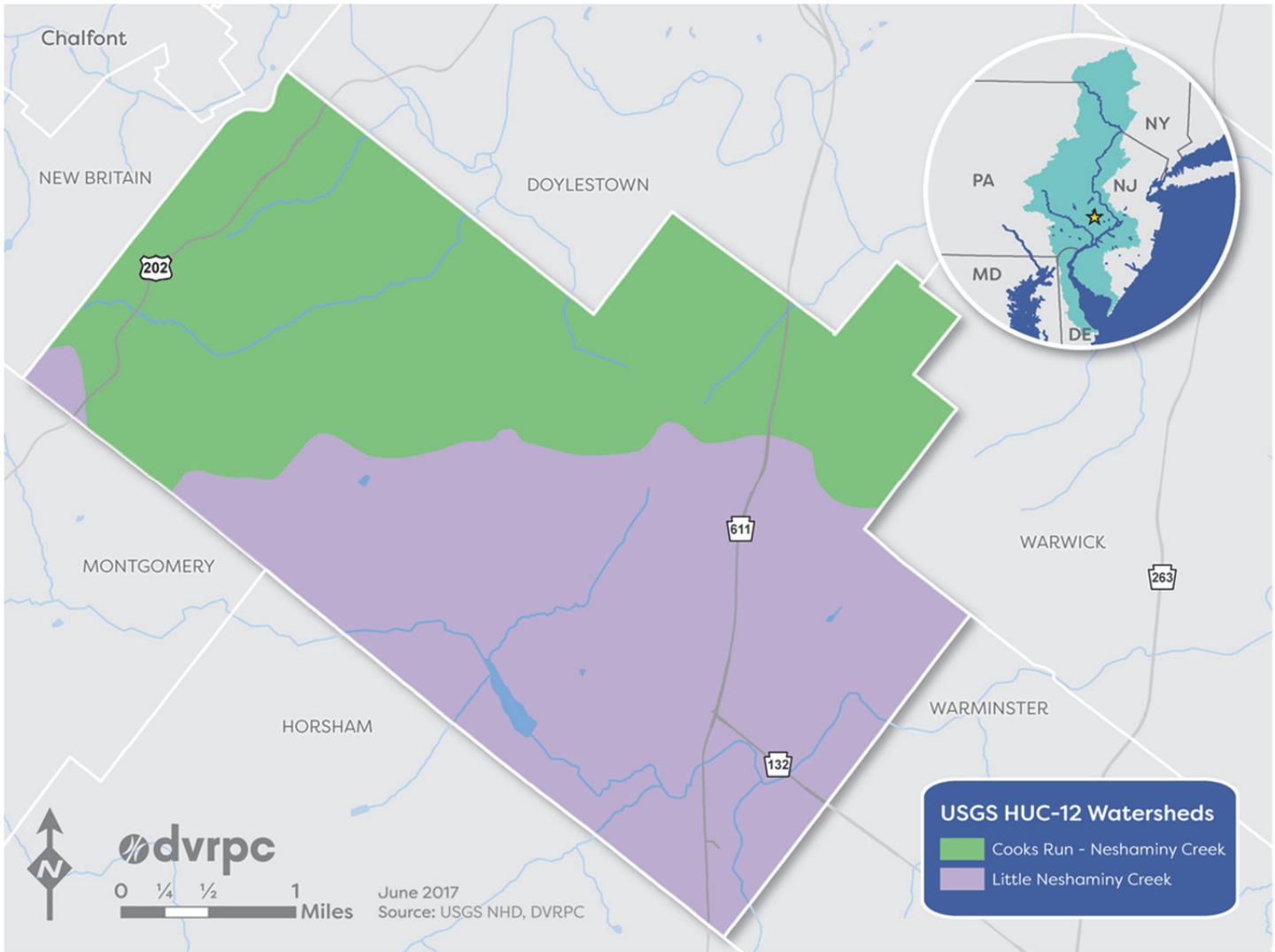
Watersheds:
 Neshaminy Creek and Little Neshaminy

Population: 23,942 (2015)

Land area: 13.8 square miles

Population density: 1,735 people per square miles (13.73%)

Map: Warrington Township's Watersheds



Historically, the Township relied on both surface water and groundwater for its water supply; recent contamination of groundwater has necessitated increased reliance on surface water supplies.

Water Quality Problems

The major challenge facing Warrington in recent years has been contamination of the township’s drinking water aquifers. Industrial contamination caused by past metal plating activities and use of fire-fighting foam for practice exercises at the Willow Grove Naval Air Station resulted in runoff that leached into the township’s aquifers over time. The main culprits are PFCs, of which perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) are the primary chemicals in fire-fighting foam. Discharges of these contaminants went undetected for many years.

Contamination first became widely known in October 2014. Township residents immediately turned to social media and became a strong force in getting the township, the Air National Guard, the Pennsylvania Department of Environmental Protection (PADEP), and the U.S. Environmental Protection Agency (EPA) to

take these issues seriously. Although initially a fair amount of finger-pointing took place, citizen participation contributed to cooperative understanding and needed action.

The townships of Warrington, Warminster, and Horsham have all been affected by contaminants from the Naval Air Station. Contamination was first discovered through a sampling protocol established by the EPA for PFCs. The EPA, through its Unregulated Contaminant Monitoring Rule (UCMR), requires monitoring for systems of 10,000 people or less. By late October 2014 the measured amounts of PFOA and PFOS exceeded the EPA Provisional Health Advisory Level, and three of the township's wells were shut down. In May 2016, a new EPA Health Advisory Level (HAL) was released. Based on research from the Centers for Disease Control and Prevention, the new HAL recommends that drinking water contain no more than 70 parts per trillion of these compounds; of the nine wells previously used for public supply, five (including the previously shuttered wells) exceeded this standard. While these contaminants remain unregulated, the release of the new HAL prompted the township take two additional wells off-line.

Key Partners

PADEP: This state agency collects water quality data to determine water quality impairments and has been helpful in working with the townships to interpret technical information and guide action.

EPA Region 3: Responsible for Clean Water Act enforcement in Pennsylvania, including coordination with other federal agencies involved in testing and enforcement.

Air National Guard (Department of Defense): From 1942 to 2011, the Naval Air Station provided support infrastructure and services to assigned air units to maintain readiness and training goals. The station has been occupied by both the Navy and Air National Guard for many years. In 2005, the base was directed to close, and flight operation ceased in 2011. The Navy's portion of the base is undergoing environmental restoration; the Air National Guard portion of the base is still occupied. The facility is now in caretaker status, pending property transfer to a redevelopment authority. Past activities at the station are known contributors to the aquifer contamination currently being addressed.

Warrington, Warminster, and Horsham townships: The three municipalities directly affected by aquifer contamination.

Active citizens: Loosely formed initially, this group nonetheless coalesced into an effective stakeholder that took to the Internet, attended public meetings, and worked cooperatively with the township to act.

Currently water is being purchased through NWWA. As of August 2016, Warrington has been negotiating with NWWA to fully transition portions of the township over to Forest Park Water Treatment Plant water. Historically, roughly half of the township relied on water from NWWA. A new water supply agreement was executed between the township and NWWA to supply the entire township's public water system with water from Forest Park. The transition to this water supply will begin after additional infrastructure is installed to facilitate the conveyance of Forest Park water throughout the entire public water system.

Since 2014, the township has been confronted with the sometimes arduous task of working cooperatively with PADEP, the EPA, and the Air National Guard (Department of Defense), while simultaneously working to assure the public that everything is being done to secure and maintain a safe water supply.

Water Quality Solutions

Contamination issues in recent years have elevated water to the highest priority for the township. As Christian Jones, Warrington Township's director of water and sewer and assistant to the manager, stated, "It is only after such an event happens that people realize the

importance of protecting their water supply. The Township's aquifer will be needed for future generations, so it is incumbent upon us to clean the aquifer over time." From the standpoint of Rick Zeitler, operations manager

at the Warrington Township Water and Sewer Department, the most important strategy to protect and improve water quality is the Safe Drinking Water Act. Were it not for this landmark legislation, corrective action would not have happened nearly fast enough.

The most important strategy for protecting water quality is the cooperative agreement the township has with the Air National Guard to treat water in a granular activated carbon filtration system. This system is being used primarily to treat well water for backup purposes (and for periods of high demand). In order to use this system and have water available when needed, water must be run from the wells for six hours, one day a week. Currently, this water is being mixed with other potable sources and distributed throughout the system (the EPA and PADEP will not permit the water to be stream discharged).

According to township staff, one of Warrington’s most important actions was the creation of wellhead protection zones around the township’s wells. A wellhead protection plan was developed that evaluated, among other things, zones of influence and surface water interaction. Wellhead protection zones were established based on PADEP guidelines and an assessment of risks for each well; in addition, the township examined emergency procedures for spill management. Final plans for each well were submitted to PADEP for approval.

The real champions of the community are the township’s elected officials and its residents, both of whom have been strong advocates for providing a clean and safe water supply to the community. Members of the Township’s Environmental Advisory Committee have also done much to advocate for the protection of the township’s environmental resources and have been involved in water, sewer, and stormwater issues, including joint efforts to protect the Neshaminy Creek.

The natural resources of Warrington that benefit most from the township’s commitment to water quality protection include the Neshaminy Creek and the Bucks County Bradford Dam and Reservoir. In recent years the township, in partnership with PECO and Bucks County, have invested heavily in creating hiking and biking trails around the reservoir and establishing native plant gardens to manage and control stormwater.

As of this writing, long-term cleanup of the chemical plume has not been achieved (funding for such work has been elusive, and the Air

Motivating Factors

Failing infrastructure: Contamination of drinking water aquifers led the township to coordinate with regulatory agencies and take action to find other sources of water supply.

HAL: A sampling protocol established by the EPA for PFCs identified local contamination of water supply aquifers. Although a UCMR required testing every five years, a HAL issued by the EPA concerned residents and the township, leading to municipal action.

Local partners: Public outcry initially led to township action to find new sources of public water; stakeholder cooperation has contributed to progress.

Unifying issues: Aquifer contamination and the inability of action by regulatory agencies led to municipal involvement and subsequent action.



Source: Warrington Township
This photo shows a system that is distributing fire-fighting foam in a military hangar.

National Guard rejected a recent soil remediation proposal). Uncertainty regarding the health effects of the contaminants, their long-term exposure, and the viability of treating water over time led the township to negotiate with NWWA for potable water. Ultimately the township would like to see the contamination addressed, but in the absence of federal regulations, it may be some time before large-scale use of the township's wells will be possible.

Progress to Date and Challenges Ahead

The township efforts have been successful: community wells are being treated or are off-line, potable water is available to all residents of the township, citizen complaints were heeded, and community outreach has improved. Initial public acrimony over the problem led to a firm resolve by the community to respond in a proactive and decisive manner.

The township currently receives legal guidance and technical assistance to perform needed water supply testing and monitor contaminants. PADEP provides regulatory oversight of the filtration system.

The primary source of outside technical assistance the township receives is from PADEP. The township believes PADEP has been very helpful in providing guidance throughout this process, although at times the township has found their assistance to be highly technical and not easily decipherable by township staff or residents. This has contributed to some uneasiness.



Source: Warrington Township
A series of granular activated carbon filtration tanks used to treat contaminated groundwater in Warrington Township.

The greatest challenge for the township in protecting water quality is funding. The township would like to see more grant opportunities for municipalities in similar situations. To do more, it is likely the township would need to raise water and sewer fees. Unfortunately, while water and sewer facilities provide needed services, the public perception is that water should be "free." Continuing to garner public trust will be imperative to moving forward in the future.

The township does plan to remediate its wells but recognizes it will take time. Granular activated carbon filtration systems are expensive, and soil remediation proposals have not been viewed as viable. Future efforts will

focus on what the township can realistically fund with an eye toward outside grants and assistance as it becomes available.

Key Factors in Success

The key factors to Warrington's success are:

- 1) The township has an engaged staff that has worked hard to earn the respect of the public and honor its commitment to provide safe drinking water to the residents of the township.

- 2) The township has made a strong effort to engage stakeholders (citizens, PADEP, the EPA, Air National Guard, Warminster and Horsham townships) over the last two years and has continually strived to provide outreach to the public in a manner that will benefit all concerned. Although it can be said that several stakeholders were slow to act in 2014, and at times it has been an uneasy alliance, the township took responsibility and acted in a timely manner once it concluded the contamination was a threat to the public.

Important issues to address in the future will be the costs of ensuring water quality and the importance of continued public education and outreach. The township created a “Water Contamination Information Page” at its website to keep residents informed and updated on stakeholder actions. Part of the problem the township faces is the uncertainty regarding the health effects of the contaminants and the long-term viability of current treatment technologies. And the fact that these contaminants are currently unregulated instills much uncertainty in the process. Regardless, the township is committed to cleaning its aquifers over time.

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Published to web: XXXXXXXXXXXXXXXXXXXX

📍 **MUNICIPAL CASE STUDY**

West Chester Borough, Pennsylvania

This case study focuses on West Chester’s new Stream Protection Fee Program and outlines key players and leadership, the fee program’s development and early implementation, barriers and potential solutions, and recommendations for other municipalities interested in fee programs.



By: Paul Racette
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Background

The Borough of West Chester is in eastern Chester County adjacent to the communities of East Bradford and West Goshen townships. While the borough is relatively small at 1.8 square miles, it includes characteristics typical of many larger cities, including residential neighborhoods, institutions (a state university, hospitals, seat of county government), and an urban core. Founded in 1799, it has a downtown historic district with restaurants and businesses that make it a destination town.

Stormwater Management, Water Quality, and Watershed Health Issues

The borough is located along the divide between the Brandywine and Chester Creek watersheds. Being predominantly urban, most of the borough’s land has been built on, leaving little room for new development. Over 50 percent of the land is covered by impervious surfaces.

Water bodies within the borough are encroached upon by older buildings constructed closer to the streams than what is currently allowed. This has created some flooding and erosion issues, such as property owners with eroding stream banks near buildings. This issue is tempered by the location of the borough at the top end of watershed drainage area boundaries.

The borough has a municipal separate storm sewer system (MS4) permit. All tributary streams flowing through the borough are impaired due to nutrient and sediment pollution. Goose Creek originates just upstream of the borough in West Goshen Township before this headwater tributary loops through West Chester on its way to the Chester Creek mainstem. Goose Creek is subject to a Total Maximum Daily Load (TMDL) regulation that requires reductions in nutrient (phosphorous) pollution.

Quick Stats
West Chester Borough

Land area: 1.8 square miles

Stream miles: 2.56 miles

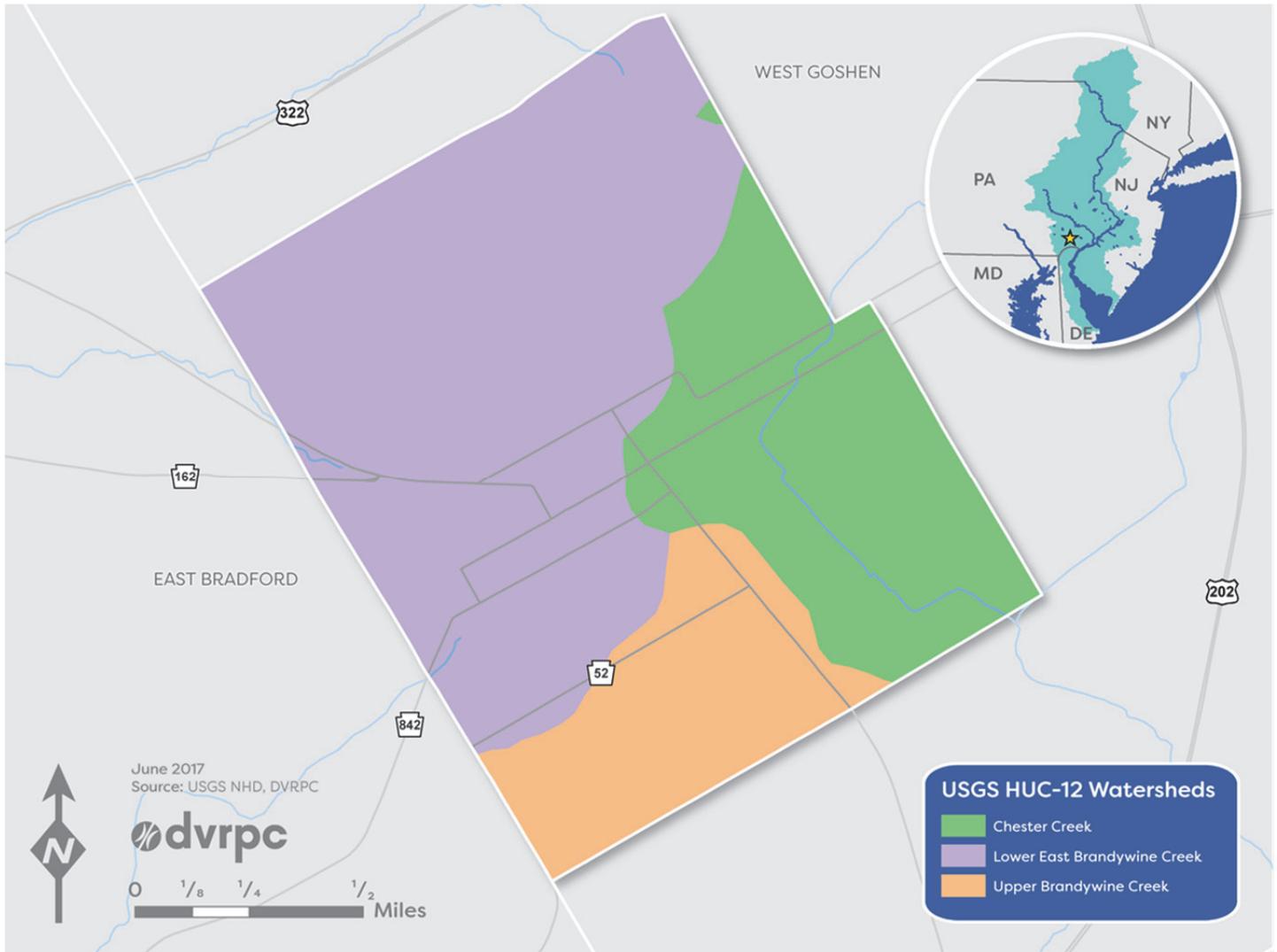
Percentage of stream miles impaired: 100%

Acres of park land: 157 acres

Water and sewer provider: Aqua PA

Population: 18,461 (2015)

Map: West Chester’s Subwatersheds



In addition to the borough’s requirement to develop a TMDL plan for Goose Creek, it must now develop Pollutant Reduction Plans (PRPs) for Blackhorse, Taylor, and Plum Goose Runs, which are impaired by sediment/siltation. These streams, which drain into the Brandywine Creek, have tributaries that originate in the borough.

Other reported water quality threats include trash and illicit discharges. When illicit discharges occur (commonly detected when storm sewer discharges are observed during dry weather), the borough must respond by attempting to track the release back to its source and take appropriate remedial actions.

The borough has been working since 2003 to address water quality issues related to stormwater and land development, MS4 permit compliance, and the Goose Creek TMDL. The TMDL has been the most time consuming and challenging, as the borough is required by the Pennsylvania Department of Environmental Protection to reduce phosphorous pollution by 54 percent in the next five years. The new PRP requirements call for 10 percent reductions in sediment pollution in five years as well. The borough reported that it has used

grants to pay for stormwater projects but recognized the need to figure out how to pay for overall costs greater than grant award income.

Water quality issues have ranked high for borough officials and staff based on MS4 and TMDL regulatory requirements. These triggered the borough to develop and adopt a Stream Protection Fee Program. This program to pay for pollutant reduction requirements and related aging stormwater infrastructure maintenance is in its early implementation phase.

Interviewees noted that the public views water quality as a low- to mid-level priority, with issues of historic preservation, traffic, and university impacts on the community being a higher priority. However, interviewees also indicated that the recent implementation of the Stream Protection Fee has increased public awareness of stormwater and water quality issues as residents seek to better understand the rationale for and implementation of the Stream Protection Fee and associated projects and programs.

This case study for the Borough of West Chester focuses on the Stream Protection Fee Program, addressing the following issues:

- key players and leadership;
- fee program development and early implementation;
- barriers to overcome and potential solutions; and
- recommendations for other municipalities interested in fee programs.

Key Partners

West Chester BLUER Committee: Formed 10 years ago to determine the borough's carbon footprint and promote a carbon reduction strategy.

Sustainability Committee: The BLUER Committee evolved into a borough Sustainability Committee.

Councilman Chuck Christy: He was aware of upcoming borough regulatory obligations and encouraged the borough to price out the cost of regulatory obligations and related stormwater infrastructure maintenance.

Stormwater Assessment Advisory Committee (SWAAC): Formed in 2013 to evaluate and advise on the Stream Protection Fee development process.

Two borough managers (Ernie McNeely and Michael Cotter): Effectively communicated with elected borough officials about the need for and benefits of the fee program.

Borough's Public Works Department: Supports implementation through a mix of education, stormwater control measure and infrastructure projects, and the management of private consultant engineering firms.

Key Partners and Leadership

The West Chester Borough Leaders United for Emissions Reduction (BLUER) Committee was formed 10 years ago to determine the borough's carbon footprint and promote a carbon reduction strategy. The BLUER Committee evolved into a borough Sustainability Committee, with Dianne Herron, a BLUER Committee founder, now the Chair of the Sustainability Committee. The committee advises the council on sustainable practices and stormwater, as well as monitoring the borough's carbon footprint. The Sustainability Committee supports the borough's education and outreach work for the Stream Protection Fee. Another borough resident, Courtney Finneran, has been active on the BLUER, Sustainability, and other borough planning committees, and also advised the borough on the Stream Protection Fee Program through her role as a private consultant.

Starting about four years ago, concerns about water quality issues and the cost of MS4 and TMDL regulatory requirements caught the attention of the borough council, with the stormwater fee

alternative initially considered by then Councilman Chuck Christy. Mr. Christy was aware of upcoming borough regulatory obligations and was also observing how Maryland communities were addressing Chesapeake Bay cleanup obligations by investing in stormwater management and water quality programs. The borough began to price out the cost of regulatory obligations and related stormwater infrastructure maintenance. With a three-million-dollar price tag estimated and the lack of a sufficient budget and/or grant support, the borough recognized the need for an alternative financing method like a fee program to meet these obligations.

A Stormwater Assessment Advisory Committee (SWAAC) was formed in 2013 to evaluate and advise on the Stream Protection Fee development process. The SWAAC included borough residents, nonprofit institutions, businesses, churches, West Chester University, Chester County Hospital, Chester County, and borough council and staff.

Two borough managers have been involved with and supported the development of the Stream Protection Fee. They have been able to effectively communicate with elected borough officials about the need for and benefits of the fee program. The first manager, Ernie McNeely, left his position before the fee was passed. While his replacement, Michael Cotter, also supported the fee program, the transition period between the two managers and changes in council seats delayed the fee program's finalization until 2016.

The borough's Public Works Department, including Director O'B Laing, has played a key role in the Stream Protection Fee. The department was involved in an intensive public education and outreach campaign during the development of the program and is supporting implementation through a mix of education, stormwater control measure and infrastructure projects, and the management of private consultant engineering firms.

Stream Protection Fee Development and Early Implementation

The borough's Stream Protection Fee Program was developed over an approximately four-year period. The SWAAC, formed in 2013, has played an important advisory role. The borough also hired an engineering consultant, CH2M Hill (CH2M), to support the committee with policy and technical research. CH2M developed a 2013 *Stormwater Management Assessment Fee Policy Options and Recommendations* report with the SWAAC. The report provided the SWAAC with policy options and recommendations to the borough's elected officials regarding existing maintenance requirements, new project needs, regulatory obligations, funding needs, and financing options. The report assessed both tax and fee finance options, and considered debt financing versus pay-as-you-go funding options.

The report recommended a stormwater management assessment fee based on the amount of impervious surface on each property. The report evaluated various rate structures for the assessment fee, settling on a six-tier rate structure that applies to all properties in the borough. A fee of \$6.70/month for 1,000 square feet of impervious area was proposed, based on the expected total stormwater management costs the borough is facing over the next 25 years. It also proposed a credit and rebate system for property owners installing stormwater control measures. This fee reduction program applies to both residential and other properties. Eventually, the fee structure evolved into a six-tiered system (shown below).

Public education was and continues to be the most important activity undertaken by the borough to develop and implement the fee program. Public Works staff with consultant support conducted an intensive education and outreach campaign over three and a half years to reach elected officials and residents. This culminated in the passing of the fee ordinance in mid-2016, with implementation now starting in 2017. Residents' feedback during this early implementation phase indicates that more education is required to explain the fee program.

The Stream Protection Fee will provide funding for green stormwater infrastructure (GSI) as well as related infrastructure repair and maintenance. Proposed project work has been incorporated into the borough's TMDL compliance plan for Goose Creek, and can also be incorporated into the upcoming (August 2017) PRP planning requirements. The fee will also be used to address aging stormwater infrastructure maintenance and repair, such as lining or replacing subsurface storm sewer piping.

The borough determined that it should lead the way with GSI on public land, in part to serve as a model for projects that homeowners and other private landowners can see and replicate. The borough developed a project plan that shows where GSI, stream restoration and pipe maintenance projects will be implemented. Demonstration projects include rain gardens, bioswales, green streets, tree planting, and pervious pavement. The borough has completed feasibility studies for GSI projects and will be using revenue from the Stream Protection Fee, a municipal bond, and grants to fund design and construction phases. This work is being completed by borough Public Works staff and by consulting engineering firms when their expertise is needed. The borough has employed CH2M for work on the Stream Protection Fee Program, including educational programming and project development, and with Gilmore & Associates Engineering for MS4 compliance activities.

Challenges to Overcome and Potential Solutions

This section summarizes the Stream Protection Fee Program challenges and potential solutions identified by the borough representatives interviewed for this case study, organized into the following categories:

Stream Protection Fee Rate Structure:

SPF rates are grouped into Tiers based on the amount of impervious area in a parcel.

Tier	Impervious Area/Parcel	Monthly Fee*
1	0-1,000 square feet (ft ²)	\$3.35
2	1,000-1,500 ft ²	\$8.38
3	1,500-2,000 ft ²	\$11.73
4	2,000-2,500 ft ²	\$15.08
5	2,500-3,000 ft ²	\$18.43
6	> 3,000 ft ²	\$20.10 and up

*The base rate has been set at \$6.70 per 1,000 ft² of IA per month. Tiers 1-5 are charged a flat fee as shown above. Tier 6 properties are charged based on actual impervious area. The monthly fee is multiplied by 12 to determine annual costs.

Source: West Chester Borough Stream Protection Fee (SPF) Program, Frequently Asked Questions
The table above shows the rates for West Chester's Stream Protection Fee.



Source: West Chester Borough Public Meeting 2/2/17 Stormwater Fee Presentation
This photo shows sediment-laden runoff in West Chester Borough.

- Education and Outreach
- Training Needs
- Multi-Department Coordination and Related Staffing Needs
- Funding/Sufficient Budget

Challenge 1: Education and Outreach

Conducting effective education and outreach programming is the primary issue identified by borough representatives. A key challenge noted is that you can never do enough outreach; some people are still going to be surprised about receiving a new fee.

Two key audiences were identified: borough elected officials, who needed to approve the ordinance for the fee program; and residents and other property owners, who will be required to pay the fee based on the amount of impervious surface they own. Education and outreach programming can also be broken down into two time periods: during the *development* of the fee program, and during the *implementation* of the fee program.

Education and Outreach during Development of the Fee Program

Education and outreach to elected officials during the development of the fee program needed to focus on clearly articulating why a fee program was needed. To do this, borough staff used their available communication platforms (reports and presentations to council) to highlight stormwater funding needs and options. These communications documented the borough's stormwater management and operation/maintenance fiscal needs, and the shortfall between these requirements and the general fund budget. They also communicated that grants can help bridge the shortfall but require a match (at least 25 percent).

As noted in the "Key Players and Leadership" section of this report, the borough did have early awareness on the part of council members and borough managers about stormwater management needs and the fee funding option. The 2013 *Stormwater Management Assessment Fee Policy Options and Recommendations* report highlighted these issues, and the borough managers and staff communicated these issues to the council whenever they had the opportunity. While delayed due to the change in borough managers and council members, this overall communication effort led to the Stream Protection Fee ordinance being considered and approved by the borough council in June of 2016.

Concurrently, the borough conducted an intensive public education and outreach program during the fee development period, using the expertise of the SWAAC, the Public Works Department, and contractor CH2M. The borough used a variety of educational platforms, including council committees, public meetings, stakeholder meetings, public hearings (for ordinance), open houses, mailings, newsletters, and social media. Some of the messaging points delivered are listed below, and are also highlighted in the *West Chester Borough Stream Protection Fee (SPF) Program, Frequently Asked Questions* (December 2016) document:

- The borough needed dedicated funding to meet cost requirements, and general fund and grants do not provide enough funding.
- The fee applies to all properties, including tax-exempt properties.
- The fee is not a tax. If the borough had developed a tax-funding option it would have cost impacted tax payers 2.5 times more to cover stormwater management costs.
- The fee can only be used for stormwater management projects! It does not go into general fund programs.
- Credits/fee reductions are available for people doing on-site stormwater management (for both residents and larger properties).

Borough officials also considered communication strategies recommended by Eric Eckl of Water Words that Work, presented during an October 2015 Villanova Municipal Workshop. These messaging strategies are further documented under the presentations posted at <https://sites.google.com/a/waterwordsthatwork.com/selling-stormwater-management/>. The borough considered the recommendation that it is best to explain your stormwater fee program in a language people understand. The primary goal of the program is to protect streams, and a “stream protection” message will be understood and resonate with the community more than a “stormwater management” message. For this reason, the borough adopted the name “Stream Protection Fee Program.”

Overall, the borough considered its education and outreach activities during the development of the fee program to have been effective, as opposition to the Stream Protection Fee was negligible. Those persons who expressed concern about the fee were consistently offered the objective rationale for the program.

Education and Outreach during Implementation of the Fee Program

With a January 2017 start, the Stream Protection Fee Program is in its early implementation stage. A key challenge noted by borough representatives is that despite extensive education and outreach during the development of the fee program, many people were surprised about the new fee assessment. During the first months of implementation the borough reported receiving many questions as people received their first Stream Protection bill.

With the recent launch of the Stream Protection Fee Program, the fee is now of high concern to residents. One of the borough representatives interviewed for this case study has been going door to door to talk to residents as part of a political campaign; she reported the following feedback from residents:

- The Stream Protection Fee is the number one or two thing that people are concerned about.
- They are concerned about what the fee will be used for. Is there is a Stream Protection Fee budget? How will the fee revenues be managed/used?
- There are concerns the fee money will go to the general fund.
- They ask about when the borough will achieve the objectives of the fee program. When does the fee program stop?
- They view the fee as a tax, and that it will exist in perpetuity.
- They view the fee as a significant increase in their water bill. The borough is diverse; for some low-income people, the fee is a significant hit on their budget.
- Some residents do not understand the regional stormwater management issues; they see the stream in their backyard as being okay.
- Some of the larger properties are reacting negatively to the higher fees required for their impervious surface footprint (e.g., churches with parking lots and buildings).
- The fee is viewed by some as a burden. The rationale for the fee was not understood by many in the community.

The sentiments above indicate the pre-implementation messaging may not have reached enough residents. It was evident that despite the extensive education effort, many people did not understand or hear about the Stream Protection Fee before getting their first bill with the additional fee, which got their attention. Municipalities can never do enough outreach; some residents are still going to be surprised about the new fee.

Borough representatives recognize that the education and outreach effort must continue during the implementation phase as the fee emerges with more clarity on people’s radar. One of the borough

representatives noted that specific educational programs should have been earmarked upfront to the larger properties facing bigger fees (e.g., address their concerns preemptively).

The borough is willing to receive outside ideas on how to improve its public information programming.

Challenge 2: Training Needs

Seeing the increased need for education and outreach, borough representatives proposed several training programs that would both support and improve the effectiveness of the educational programs delivered:

- Provide training to elected officials and other leaders to help them better understand and advocate for stormwater and water quality needs. Help connect the dots on relationships between stormwater, watershed health, and related regulatory requirements. This could be a training program or watershed summit for elected officials. Keep it at a general concept level, not in-the-weeds training.
- Expose elected officials to the full gamut of stormwater management activities that municipal Public Works staff and other departments are required to accomplish. This will help elected officials better understand the responsibilities and finance needs of each department.
- Provide training to staff/managers/employees that delves more deeply into issues, problems, and solutions. For example, provide internal training to Public Works staff, so they are better able to respond to complaints and questions about the fee program. Have question/complaint response education (e.g., that address the issues that are raised by developers/residents). The primary resource materials are already available; the issue is to train the people to deliver materials.
- Develop and implement employee training programs that address how to effectively communicate to the public/community members; public outreach 101 training. The borough representatives interviewed for this case study believe they had applied proper communication techniques but are willing to learn more about communication programs that get to the essence of:
 - Why is this issue important?
 - Why do we need to do it this way?
 - Why the borough needs to take the lead?
 - How expensive is this?
 - What we are doing right now to follow the regulatory requirements?
- Hold workshops (e.g., by the Sustainability Committee) to help residents reduce their fee by installing rain barrels and rain gardens. Assistance could be provided, such as free rain barrels, direct assistance with building rain gardens, or designing street tree planting programs that provide fee reductions.

Challenge 3: Multi-Department Coordination and Related Staffing Needs

Multiple departments need to be involved early during the development phase of a fee program, based on the general roles they play in municipal government. For example, administrative/management departments typically address financing issues, public works or engineering departments typically address physical stormwater management work and related training, and planning departments might conduct parcel tracking analysis. These and other municipal departments should be involved early in the planning process through communications and meetings, and have their implementation roles clearly delineated.

The setting up of the billing system was pointed out as a key coordination issue. Municipalities may not have utility billing systems. In West Chester, Aqua PA (the borough's water and sewer utility) mails out sewer bills and had concerns about adding the Stream Protection Fee to the bill or providing the billing database. The

borough created its own Stream Protection Fee billing system. Implementation issues such as these need to be addressed early in the planning phase.

Related to this inter-departmental coordination is the need to have adequate municipal staff to manage the fee program and overall stormwater management program. The borough (and municipalities in general) does not typically have dedicated staff for stormwater management. As previously noted, the Public Works Department can manage some of the tasks and relies on contractors for others. They also have a sustainability director, who is becoming more versed in stormwater management work.

It was recommended that hiring employees dedicated solely to stormwater management would be helpful. But with this recommendation came the understanding that the hiring of additional staff comes at a cost and can also be a more involved process than hiring consultants. It was noted that many municipalities have hiring moratoriums, leaving remaining staff with more and more to do, and no way to add staff.

Challenge 4: Funding/sufficient budget

Borough representatives emphasized the importance of upfront accounting to determine what stormwater management costs are and will be. The proposed fee and other sources of revenue should then be high enough to cover costs (with the fee closing the gap after the consideration of other revenue streams).

Adjustments on timing may be necessary to bring the proposed fee into an affordable range. The borough did several iterations of potential fees, starting with a two-tier structure; the consideration of low, medium, and high fee rates; and the final decision to adapt the six-tier rate structure based on impervious surface. The borough also is using a \$2.3 million bond to seed the funding of capital projects as the program gets started.

Recommendations for Other Municipalities Interested in Fee Programs

Based on their experience with the Stream Protection Fee Program, borough representatives were asked what other municipalities should evaluate as they consider stormwater financing/fee options. The following recommendations were provided:

- *Learn from your peers:* Bring in those interested to sit around a table and hear from those who have implemented fee programs. Have those who have implemented fee programs provide a synopsis of milestones and lessons learned. Tell them the story; let them hear how it works; develop case studies.
- *Choose a consultant carefully:* The selection of a consultant who can help the municipality conduct a feasibility assessment, propose financing/fee options, and determine the appropriate fee calculation method is key; a municipality needs to make the right selection. This is a specialized field; it will not necessarily be a municipality's consulting engineer. Ask other municipalities whom they picked and why. Look for proven track records. West Chester heard from five firms when they issued their consultant request for proposal (RFP). Help municipalities with how to put out a good RFP so they can get a comparative set of proposals and choose a consultant.

Motivating Factors

Pressure from citizens groups: BLUER, and later the Sustainability Committee, held elected officials accountable for environmental issues

Regulatory pressure: West Chester needed to create a TMDL plan for Goose Creek and PRPs for Blackhorse, Taylor, and Plum Goose Runs

Lack of sufficient funds/grant opportunities: Forced the borough to evaluate other revenue sources

Issues with flooding

- *Make sure you raise enough:* Make sure the fee is enough to cover stormwater management budget needs, such as capital project costs, as well as administrative, finance, operation/maintenance and enforcement costs, including staff time.
- *Focus on the Pollution Reduction Plan (PRP) process:* This will help with the five-year planning requirement of the MS4 permit program (with the caveat that longer-term planning timelines such as the 25 years considered for the Stream Protection Fee Program should be considered). Train municipalities on ways to develop plans/pollution reduction projects.

Conclusion

While West Chester is still in the early phases of implementing its Stream Protection Fee Program, its lessons learned in the process of passing the fee—especially about the need to educate residents, train municipal staff, coordinate between departments, and raise sufficient funds—are helpful to other municipalities who are considering similar fees to fund and maintain green stormwater infrastructure.

Sources

Borough of West Chester. *Borough of West Chester Stream Protection Fee*. <http://www.west-chester.com/469/Stream-Protection-Fee>

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———. *Stormwater Management*. <http://www.west-chester.com/187/Stormwater-Management>. (This site has links to the following key documents and other reference materials: *Impervious Area Map*, *Stream Protection Fee Overview*, *Stormwater Management Assessment Fee—Policy Options and Recommendations*, *Stream Protection Fee Ordinance*, *Stream Protection Fee Commonly Asked Questions*, *Goose Creek MS4 TMDL Plan*.)

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Herrin, Dianne. Chair of Borough of West Chester Sustainability Committee. Telephone interview, March 24, 2017, 9:00 am to 10:00 am, with Paul Racette, Pennsylvania Environmental Council.

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Stormwater Authorities in Pennsylvania. *A New Option for Pennsylvania Local Governments to Protect Your Water Supplies, Reduce Floods, and Improve Their Communities*. <https://sites.google.com/a/waterwordsthatwork.com/selling-stormwater-management/>

Addendum: Additional Lessons Learned from March 30, 2017, Stormwater Fee Workshop Held by Pennsylvania Environmental Council and PennFuture

Pennsylvania Environmental Council and PennFuture held a Stormwater Fee “Beta” Workshop with nonprofit partners and municipal representatives to test out a stormwater training program that will be offered to municipalities interested in learning more about stormwater financing and fee options. A summary of lessons learned from the workshop that add to or complement Borough of West Chester case study conclusions are as follows:

- When communicating stormwater program needs and appropriate levels of financing, focus on the opportunities and benefits associated with proactive stormwater management rather than on the regulatory burden and potential fines. Examples of positive benefits include protection of life and property from flooding, cleaner water, improved quality of life, and management of future financial risk.
- If referencing regulations, use the argument that action now will reduce future regulatory burdens and higher costs.
- A credit system is a required element of a fee program. Be sure to describe the credit system, including who can access it (e.g., residents, homeowner associations, larger properties) and how. Develop and promote rebate programs (e.g., rebates for rain barrel purchases or rain garden materials).
- Address equity and fairness issues (e.g., smaller properties generate less runoff, so they should pay a lower fee). Extend credits and/or rebates to all landowners impacted by the fee to make it more equitable.
- Involve external partners, like local nonprofits, in education and outreach programming. Also look for opportunities to include green stormwater infrastructure in community infrastructure projects, such as roads, buildings, trails, and parks.
- Adjust pitch to municipalities to focus on the opportunities to use a stormwater fee to avoid pressure on general fund revenue derived from taxes. In current political terms, raising funds via user fees is greatly preferable to increasing taxes.
- When determining total stormwater management costs and budget requirements, the municipality should consider what is spent on stormwater activities and programs across multiple departments.

Published to web: August 11, 2017