

# Regional Financing Strategy

## Octoraro Watershed

---

December 2019



ENVIRONMENTAL  
FINANCE CENTER



LANCASTER COUNTY, PA  
Economic Development Company

CENTER FOR  
REGIONAL  
ANALYSIS

# Table of Contents

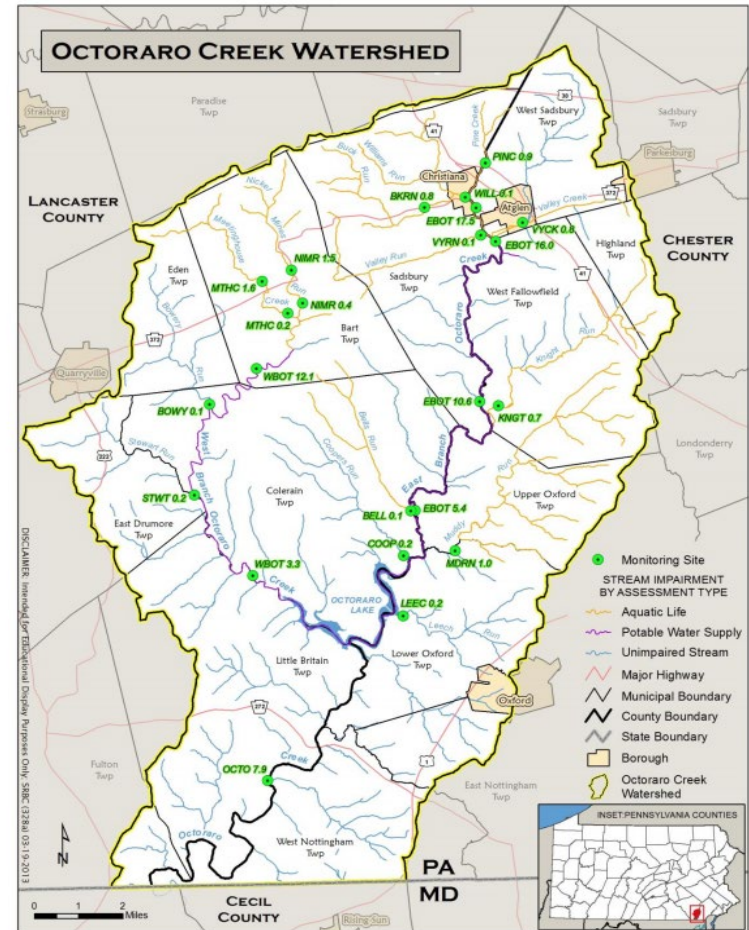
- Octoraro Watershed ..... Slides 3
- Role of the Financing Strategy ..... Slides 4
- Source Water Collaboratives ..... Slides 5 – 6
- Drivers of Restoration and Protection ..... Slides 7
- Stormwater ..... Slides 8 – 17
  - Drivers ..... Slides 8
  - Implementation ..... Slides 15
  - Funding Sources ..... Slides 16
- TMDL ..... Slides 18 – 22
  - Drivers ..... Slides 18
  - Implementation ..... Slides 22
- Drinking Water Protection ..... Slides 23 – 26
  - Drivers ..... Slides 23
  - Implementation ..... Slides 26
- Collaborative Drivers and Funding Needs: Summary ..... Slides 27 – 28

# Octoraro Watershed

Octoraro Creek Watershed drains 208 square miles of land that covers parts of counties in southeastern Pennsylvania (Chester County and Lancaster County) and one county in Maryland, Cecil County. In addition to federal and state environmental regulations, 17 different municipal governments have responsibility over decisions on how lands and development are managed that directly impact the streams in this watershed. This level of fragmentation gives rise to the need for a regional financing strategy that can provide a basis for coordination and collaboration.

According to the Chesapeake Conservancy's high-resolution land cover dataset, the watershed has roughly 6% impervious cover and 305 miles of streams. Despite the high level of pervious surface, according to PA Department of Environment (PA DEP), all streams in the watershed are impaired. Additionally, the watershed falls with the Chesapeake Bay TMDL.

Stream impairments arise from multiple sources, with the leading causes agriculture and urban stormwater runoff. In addition to two county governments, there are 15 townships and one borough on the PA side of the watershed. On the MD side, there is one county government and one municipal government.



Source:  
[www.dep.state.pa.us/dep/deputate/watermgt/wqp/wqstandards/tmdl/Octoraro\\_Creek\\_TMDL\\_draft\\_04-02-2013.pdf](http://www.dep.state.pa.us/dep/deputate/watermgt/wqp/wqstandards/tmdl/Octoraro_Creek_TMDL_draft_04-02-2013.pdf)

# Role of the Financing Strategy

The total pollutant reduction needed to restore the healthy of the Octoro watershed is moving target, responding to multiple factors including land use, weather patterns, upstream activities, and more. This documents serves as a potential road map to financing the protection and restoration of the Octoro Watershed. It offers an initial framework to understanding the drivers of investment, preliminary funding requirements, and sources of resources (funding as well as capacity) to implement BMPs.

While the Octoro spans both PA and MD, the plan focuses on the PA portion of the watershed for two reasons:

- The PA portion is upstream of the MD portion
- The PA portion represents the largest portion of the watershed
- There are regulatory complexities that arise from significant differences between the two states.

This strategy is intended to provide an evolving and adaptive blueprint to advancing a coordinated approach to the funding and implementation of watershed restoration in the Octoro. It provides:

- An overview of potential collaborative models for bringing together stormwater, impaired water and source water management efforts;
- A discussion of the drivers behind the three efforts;
- Preliminary estimates of the scope and scale of restoration requirements and protection efforts; and
- Identification of the potential implementers and funders.



# Source Water Collaboratives: Octoraro Potential

Source water collaboratives have emerged around the US as an organizing structure that connects and establishes relationships among water and watershed managers to pool resources for more effective implementation and management. Some of the oldest collaboratives were established in the 1990s. Their structures are varied, ranging from formal to informal, and built around new and established relationships. Their funding sources are just as varied. Some establish a fund, others coordinate and leverage partner funding.

Common features of collaboratives are:

- Shared geographic focus, recognizing the problem is more than any one entity's ability to address;
- Multi-organizational, and often crossing several jurisdictional boundaries;
- Belief that collaboration offers more cost-effective options than each organization acting independently; and
- Alignment of diverse interests and benefits (such as, recreation, land use planning, economic development, and water protection).

Their ultimate aim is to align diverse interests and benefits (such as, recreation, land use planning, economic development, and water protection).

The conditions in the Octoraro Watershed suggest that many of the defining features of a collaborative fit.

# Source Water Collaboratives: Octoraro Potential

When exploring the funding and structure of other existing stormwater collaborations, two themes emerge: (1) the holistic nature of a source water protection approach offers multiple benefits making a surprisingly diverse array of funding programs appropriate opportunities, the challenge is weaving them together appropriately; and (2) there is no singular way to structure and support a source water collaborative, each must be built through a consensus-driven process that reflects the unique context and drivers of the community and stakeholders involved.

That said, as the Octoraro partners think about how best to structure their collaborative, based on an examination of existing collaboratives, considerations should be given to the following elements:

- **Leadership:** in existing collaboratives, some are led by a single organization, some are lead by co-chairs who may rotate through from member organizations, and some are lead by a permanent steering committee of key member organizations.
- **Working groups:** establishing working groups enables for a more focused examination of specific issue areas impacting water quality (ex: agriculture, stormwater) or the organizational needs of the collaborative (ex: education, finances) by members with a particular area of expertise.
- **Membership levels:** some collaboratives have different levels of membership with varying responsibility for engagement, plan implementation, and in some cases, financial contributions, each with its own associated voting or signatory privileges.

# Drivers of Restoration and Protection

The Octoraro Watershed has three key drivers of restoration and protection activities for its water resources. They are:

- Stormwater, often referred to as MS4 requirements;
- Impaired Water, triggered by Chesapeake Bay TMDL; and
- Source Water Protection.

Each driver identifies primary entities responsible for delivering best management practices (BMPs) to address water quality and restoration. (potential to add a graphic that highlights the intertwined nature of the drivers and how they often impact the same entity).

# Stormwater: Drivers

For urbanized areas, stormwater runoff is typically conveyed through municipal separate storm sewer systems (MS4s). Through federal and state requirements, municipalities face requirements to address the pollutant loads transported through their storm sewer systems. Most local governments in Pennsylvania are small and only beginning to face MS4 obligations that mandate the installation of BMPs to address already developed areas.

In PA, the Octoraro sits within two counties, Chester County and Lancaster County. The table on the next page identifies the municipalities and their requirements for a MS4 permit. It identifies 11 municipalities in each county.

- In Chester County, given the heavier population and more extensive urbanized areas, DEP identified six of the municipalities with MS4 obligations.
  - They are East Nottingham Township, Londonderry Township, Lower Oxford Township, Oxford Borough, Parkesburg Borough, and Upper Oxford Township.
  - Collectively they have just over 17,800 acres in the Octoraro Watershed.
- In Lancaster County, only one municipality is identified by DEP as having potential MS4 obligations.
  - Only Salisbury Township has potential obligations.
  - This township has roughly 400 acres in the watershed.



# Stormwater: Drivers

Chester County	% of Municipality in Watershed	MS4 Permit Required
Atglen Borough	100%	
East Nottingham Township	21%	✓
Highland Township	22%	
Londonderry Township	<1%	✓
Lower Oxford Township	71%	✓
Oxford Borough	46%	✓
Parkesburg Borough	11%	✓
Upper Oxford Township	56%	✓
W. Fallowfield Township	96%	
W. Nottingham Township	81%	
West Sadsbury Township	80%	

Lancaster County	% of Municipality in Watershed	MS4 Permit Required
Bart Township	100%	
Christiana Borough	100%	
Colerain Township	100%	
East Drumore Township	33%	
Eden Township	59%	
Fulton Township	7%	
Little Britain Township	79%	
Paradise Township	2%	
Sadsbury Township	100%	
Salisbury Township	1%	✓
Strasburg Township	<1%	

# Stormwater: Drivers

## Chester County Municipalities

Eleven municipalities in Chester County have land within the Octoraro Watershed. Of the six municipalities with a potential MS4 obligation:

- Three, Oxford Borough, Lower Oxford Township, and Upper Oxford Township, have significant portions within the watershed.
- The other three municipalities, East Nottingham Township, Londonderry Township, and Parkesburg Borough, have less than 1/5 of their land in the watershed.

## Lancaster County Municipalities

Although eleven municipalities in Lancaster County have land within the Octoraro Watershed, DEP identified only one with potential MS4 obligations: Salisbury Township.

- Salisbury Townships is approximately 26,836 acres.
- Of this, less than 2% falls within the Octoraro Watershed (around 400 acres).

# Stormwater: Drivers

**Stormwater regulation serves as a stronger driver for implementation in Chester County than Lancaster County.**

- The MS4 program covers approximately 3,030 acres of urbanized area in the Octoraro Watershed across the two PA counties. **All but 20 of these acres are in Chester County.**
- **Chester County Municipalities.** Eleven municipalities in Chester County have land within the Octoraro Watershed. Of the six municipalities with a potential MS4 obligation, three have significant portions within the watershed: Oxford Borough, Lower Oxford Township, and Upper Oxford Township. The other three municipalities have less than 1/5 of their land in the watershed (East Nottingham Township, Londonderry Township and Parkesburg Borough).
- **Lancaster County Municipalities.** Although eleven municipalities in Lancaster County has land within the Octoraro Watershed, DEP identified only one with potential MS4 obligations: Salisbury Township. Salisbury Townships is approximately 26,836 acres. Of this, less than 2% falls within the Octoraro Watershed (around 400 acres).

The table on the next slide summarizes the potential area within urbanized areas that most directly impact the estimated pollutant loads regulated by the MS4 program.

# Stormwater: Drivers

	Municipal Acres in the Watershed (% of Municipality)	Estimated Acres in the UA	% of UA Impervious	Impervious Acres in the UA (share of municipal area)
<b>Chester County <sup>a</sup></b>				
East Nottingham Township	2,700	1,080	14%	151
Oxford Borough	583	579	36%	209
Lower Oxford Township	8,420	1,111	16%	178
Upper Oxford Township	6,010	147	22%	32
Parkeburg Borough	92	92	37%	34
<i>Chester County Total</i>	<i>17,806</i>	<i>3,008</i>	<i>20%</i>	<i>604</i>
<b>Lancaster County</b>				
Salisbury Township	401	19	21%	4
<i>Total</i>	<i>18,207</i>	<i>3,027</i>	<i>20%</i>	<i>608</i>

- Chester County has an estimated 3010 acres considered urbanized areas in the Watershed. Of these, roughly 20% or 605 acres are impervious.
- This relatively low ratio of impervious acres to acres in the watershed highlights the highlight focused opportunities for BMP implementation through the MS4 program.

<sup>a</sup> The table omits Londonderry Township because it has less than six acres in the Octoraro watershed.

# Stormwater: Drivers

In addition to the difference in land use patterns (as indicated by relative share of urbanized area and impervious acres), the estimated pollutant loading rates for the two counties are also different. The table below details the pollutant loading rates and pollutant loads estimated for each county.

Impervious acres do not always represent the largest source of pollutant loads.

- Developed pervious acres account for close to two-thirds of the TN load and roughly half of the TSS load.

Pollutant Loading Rate	lbs per acre year		
	TN	TP	TSS
<b>Chester County</b>			
Developed Impervious	21.15	1.46	1504.78
Developed Pervious	14.09	0.36	185.12
<b>Lancaster County</b>			
Developed Impervious	38.53	1.55	1480.43
Developed Pervious	22.24	0.36	190.93
<b>PA – Undeveloped Acres</b>	10	0.33	234.6

Estimated Pollutant Load	lbs per year		
	TN	TP	TSS
<b>Chester County</b>			
Developed Impervious	12,766	880	908,270
Developed Pervious	33,880	865	445,120
<b>Lancaster County</b>			
Developed Impervious	155	5	5,975
Developed Pervious	340	5	2,900

# Stormwater: Drivers

Within the 5-year permit period, MS4 municipalities are required to reduce total pollutant loads by:

- TSS, 10%;
- TP, 5%; and
- TN, 3%.

It is assumed that a 10% reduction in TSS will result in 5% TP reduction and 3% TN reduction.

	lbs/year		
	TN	TP	TSS
<b>Chester County</b>			
Pollutant Load	46,645	1,745	1,353,390
Target Reduction	3%	5%	10%
<i>Pollutant Reduction</i>	<i>1,400</i>	<i>85</i>	<i>135,340</i>
<b>Lancaster County</b>			
Pollutant Load	495	10	8,875
Target Reduction	3%	5%	10%
<i>Pollutant Reduction</i>	<i>15</i>	<i>&lt;1</i>	<i>890</i>

# Stormwater: Implementation

**Estimate the level of funding required to treat approximately 1,210 acres across municipalities in Chester County and Lancaster County is nearly \$425,000.**

This cost estimate reflect stormwater management achieved through:

- Retrofit of existing development (that is impermeable surfaces in urbanized areas covered by an MS4 permit) by local government and private property owners.
- The estimated costs of nitrogen removal is based on a estimate of \$300 per lb of nitrogen removed.

Driver	Acres	TN lbs removed	Cost (\$/yr)
Stormwater	1,210	1,415	\$424,500

# Stormwater: Funding Sources

Funding for stormwater management often draws from multiple sources. While compliance is largely a local government obligation, funding stormwater BMPs draws on local, state and federal dollars, as well as private landowners.

- **Local Government.** Financing and paying for stormwater obligations often fall on municipalities because of the regulatory and permitting process. Because of this regulatory requirements, local governments have explored a range of structures and strategies to raise and/or dedicate funding to stormwater management and infrastructure. The most common approaches range from use of general funds, fees and taxes to establishing authorities that assume the responsibility.
  - *General Funds.* In the absence of a dedicated revenue stream, most MS4 communities rely on general funds for stormwater management activities. This means stormwater programs compete for dollars with other critical community priorities like public safety, public works, and general administration, which can make it difficult to sufficiently fund all MS4 program needs. In addition, these funds are often spread across various departments and line items within municipal budgets, which can be inefficient and can make these dollars difficult to locate and access. Many communities supplement stormwater general fund expenditures with grant funds from various public and private sources. This can be an effective approach for the installation of individual or small collections of BMPs or demonstration projects, but often cannot support the full scale of MS4 requirements and will not maintain these practices over time.



# Stormwater: Funding Sources

- *Fee systems.* While none of the Octoraro's MS4 communities currently do so, some municipalities elect to develop a dedicated revenue stream for stormwater program needs. These typically take the form of a fee system collected from property owners as a way of paying for municipal services that deliver water quality improvements and flood management benefits. Having a dedicated revenue stream that is specifically set aside for maintenance and upgrades is often critical to the effective management of stormwater systems at the local level.
- **Federal & State:** There are a host of federal and state grant programs that communities turn to for the implementation of stormwater projects, although few if any are appropriate for addressing the associated cost of administration and operations and maintenance. While some funds come directly from federal agencies, like US EPA's environmental education or justice programs, the vast majority of federal dollars for stormwater come from US EPA and US HUD are funneled through state programs, such as PA DEP's 319 program PENNVEST's state revolving loan fund, and DCED's Community Development Block Grants, or through foundations like the National Fish and Wildlife Foundation's Chesapeake Bay Stewardship Fund, Urban Waters or Five Star grants programs. Funding specifically for urban trees tends to flow from the Forest Service to state forestry programs and could be applicable to addressing stormwater management needs.
- **Private/landowners:** When limitations in capacity, resources and space bound how much can be accomplished on public lands, municipalities often turn to engaging the private sector. While this does not provide direct funding to the municipality for stormwater programming, it can reduce the municipal "how to pay" burden. This may take the form of incentivizing private property owners to install water quality BMPs on their own parcels, or engaging private companies in pay-for-performance contracts for the installation, operations and maintenance of best management practices.

# TMDL: Drivers

The TMDL becomes embedded within municipal MS4 permits. Where permits not applicable, the County holds responsibility.

For Lancaster, the TMDL applies to nearly the entire county and plays a pivotal role in the Commonwealth meeting its obligation.

This translates to:

- Reductions in areas outside the urbanized areas (ie, municipalities not required to have an MS4 permit), and
- Actively targeting “undeveloped” acres and agricultural land.

In both counties, the TMDL is a strong regulatory driver; however, it requires engagement with private landholders – and particularly farmers. Implementation of BMPs on agricultural lands often adversely impact the bottom line of a farm enterprise, representing increased costs with little to no impact on the farm’s profitability or production.

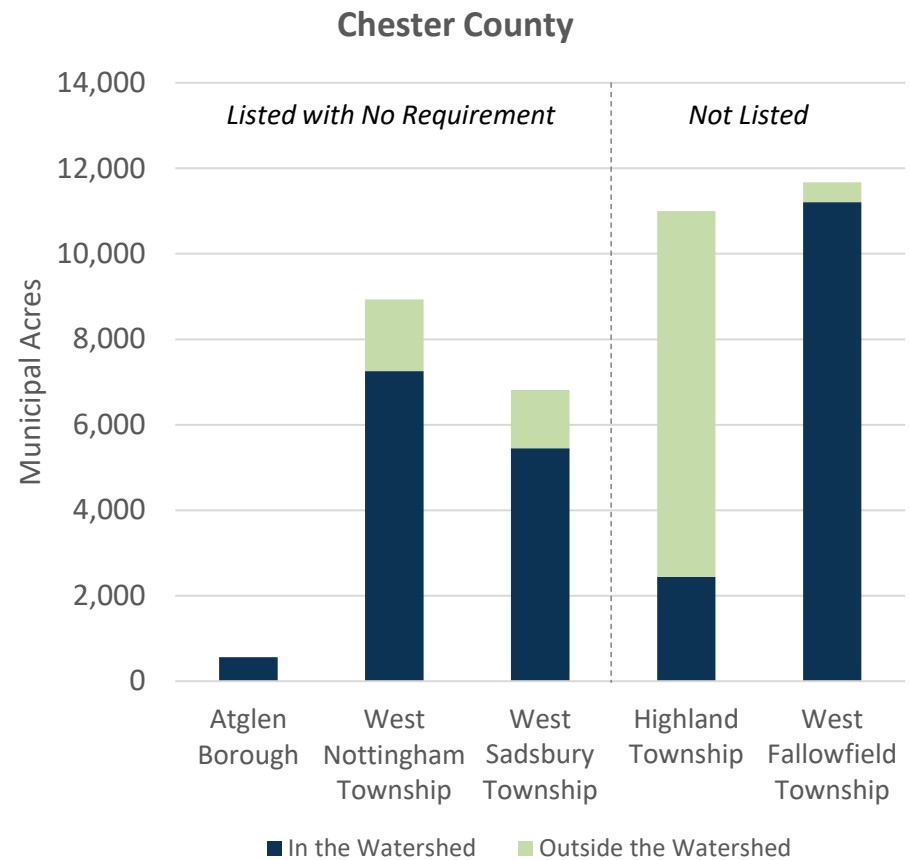
# TMDL: Drivers

In Chester County, approximately 44,730 acres are in the Octoraro Watershed, spanning 11 municipalities.

- **Over half (60%) of these acres fall in municipalities without a potential MS4 per obligation.** They are Atglen Borough, Highland Township, West Nottingham Township, West Fallowfield Township, and West Sadsbury Township.

The chart details these municipalities, dividing them between two broad categories: municipalities listed and not listed in DEP's requirements table.

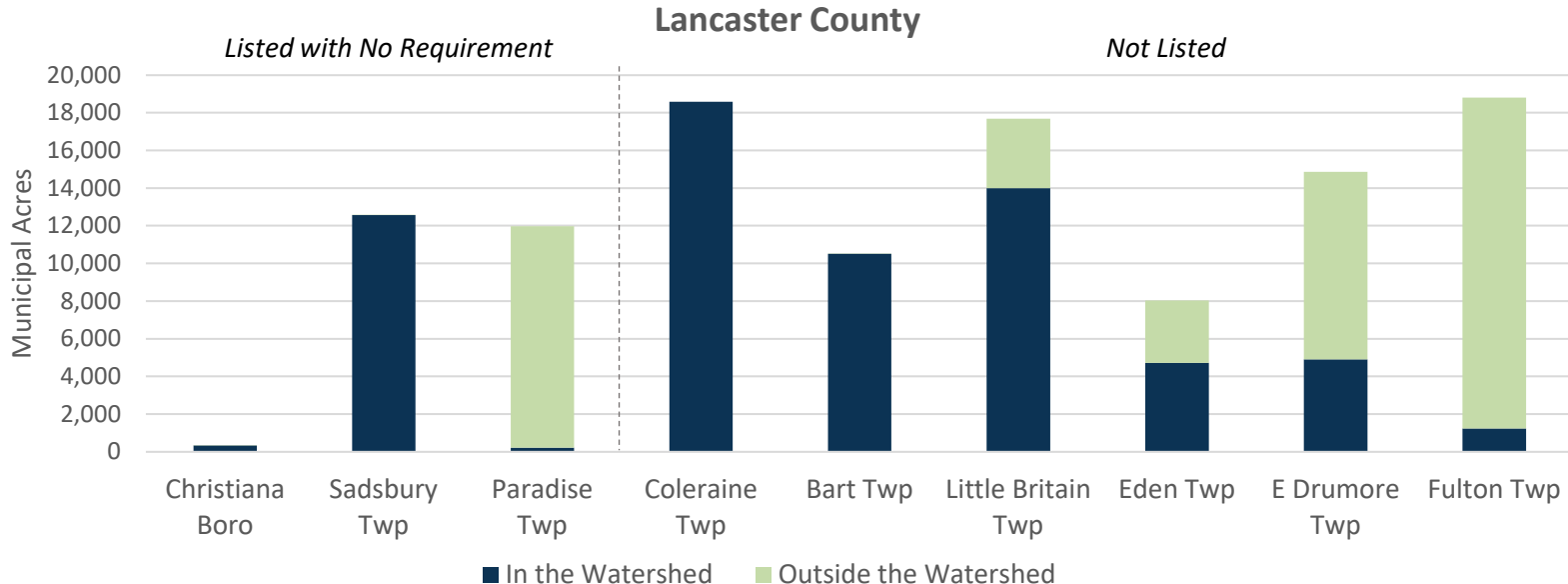
- With the exception of Highland Township, these municipalities have a significant portion of their land in the Octoraro Watershed.



# TMDL: Drivers

In Lancaster County, approximately 67,450 acres are in the Octoraro Watershed, spanning 11 municipalities.

- **Nearly all of these acres (99%) fall in municipalities without a potential MS4 per obligation.**
- The chart details these municipalities, dividing them between two broad categories: municipalities listed and not listed in DEP's requirements table. With the exception of Christiana Borough and Sadsbury Township, these municipalities have a significant portion of their land in the Octoraro Watershed. Note, Strasburg Township is not included because it has only 4 acres in the watershed.



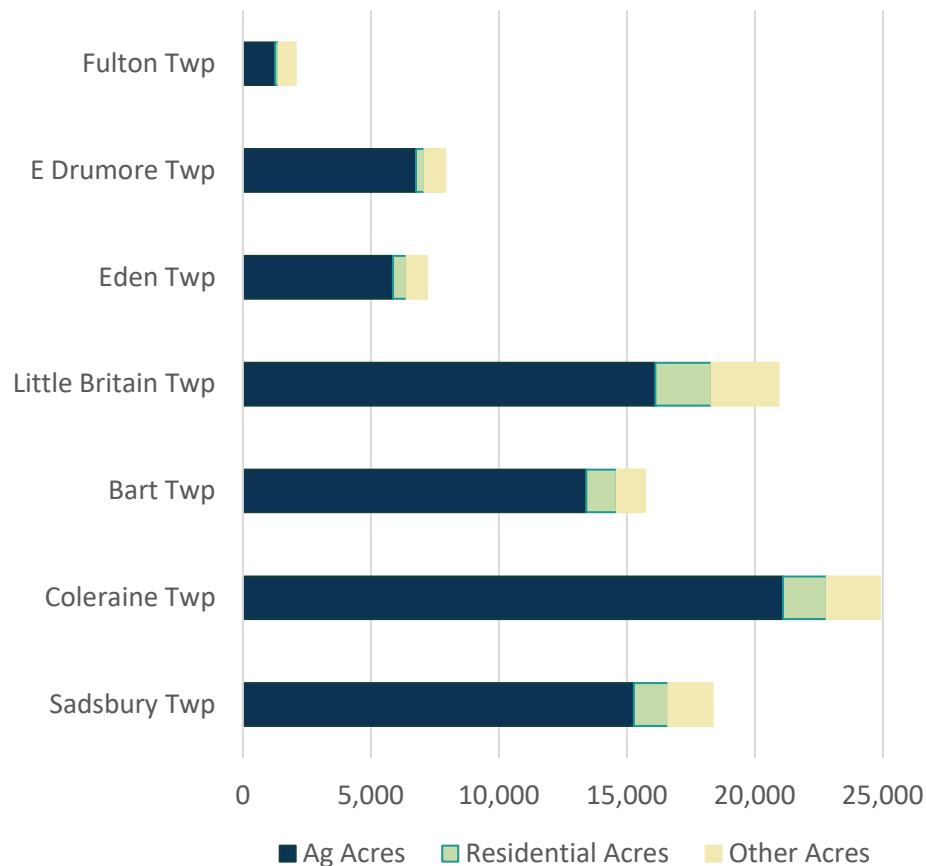
# TMDL: Drivers

In Lancaster County, agricultural lands play a critical role in water quality – both as a source of pollutant loads and potentially cost-effective opportunities for BMP installation.

The chart details land use categories for municipalities in the watershed that do not have a permit obligation.

- Agricultural land use represents anywhere from 60% to 85% of municipal acres in the watershed.
- Residential land use represents an additional 4% to 11%.

Lancaster County: Land Use by Municipality



# TMDL: Implementation

The level of funding required to treat approximately 9,000 urbanized acres unlikely to be addressed by stormwater drivers in an MS4 framework is approximately \$2.7 million.

This estimate is based on an average cost of \$300 per pound of TN removal through retrofitting urbanized areas with stormwater management.

Estimated Funding Requirement – Area subject to TMDL Driver without DEP Permit Requirement		
	Chester County	Lancaster County
Area covered by TMDL but without DEP permit requirement (acres)	13,270	13,110
... area that is in an urbanized areas (UA acres)	2,590	6,410
Pollutant Load – Total Nitrogen (lb/yr) <sup>1</sup>	54,781	247,047
Estimated Pollutant Reduction (3%)	1,643	7,411
Cost per lb abated <sup>2</sup>	\$300	\$300
Total Cost of Abatement (\$/yr)	\$493,000	\$2,223,400

**Notes:**  
<sup>1</sup> Based on county-specific loading rates for develop land, impervious surface. <sup>2</sup> EFC report.

# Drinking Water: Drivers

The Octoraro Reservoir is approximately 620 acres owned by the Chester Water Authority (CWA). The reservoir – or lake – is an important source of drinking water and recreational opportunity.

CWA uses the reservoir and water pumped from the Susquehanna as two important sources of water for its more than 43,500 customers, predominantly located of the Susquehanna River Basin in Chester and Delaware Counties.

As a source water, CWA regularly monitors the water quality in the reservoir. Over the last 20 years, CWA has found increasing nitrate levels, forcing it to pump more water from the Susquehanna River to dilute pollutant concentrations. CWA's attributes the increased nitrate levels to heavy agricultural activity and urban stormwater. The challenges of nitrogen is consistent with Lancaster County's challenge in helping the Commonwealth meet its Chesapeake Bay TMDL obligations. (The County reports that can meet its phosphorous targets but only achieve 80% of its nitrogen goal.)

Locally, the reservoir is known for bass fishing, bird watching and boating, as well as its aesthetic value. These public recreational benefits are more locally concentrated, being enjoyed by residents in the reservoir's vicinity. Notably, the beneficiaries of the reservoir's public and recreational services have limited overlap with CWA's customer base. CWA does not supply potable water to Lancaster County residents and businesses.

# Drinking Water: Drivers

As a source of drinking water, CWA treats and pumps an average of 30 million gallons per day from the reservoir for its customer base. Decreased water quality imposes higher operating costs for CWA. These costs come from increased treatment costs, as well as increased pump costs as it draws water from the Susquehanna River to dilute pollutant concentrations in the reservoir.

CWA finalized a Source Water Protection Plan (SWPP) in July 2015. This plan represents a road map to interested parties and stakeholders in preventing contaminants from entering the reservoir. The assessment that informed the plan emphasized agricultural activity as a key source of pollution. The focus on agriculture creates opportunities for alignment between TMDL and Source Water Protection.

Currently CWA estimates water quality problems have cost roughly \$5.4 million from 2001 to 2018. Annual costs have fluctuated over this seven-year period, ranging from \$0.5 million to \$1.1 million per year.

These costs reflect both the need to switch water sources and treating water. It includes labor, electricity (for pumping), and lost capacity payments.

It is not clear how much pollutant reduction is needed to avoid these costs. However, were these funds diverted to diffuse restoration and BMP practices on surrounding agricultural land, it would fund:

- treatment of 500 to 1000 acres of agricultural land per year; and
- with the average farm parcel around 63 acres, this level of funding would engage between 8 and 16 farm parcels (or around  $\frac{1}{4}$  of the farm parcels in Colerain Township and Little Britain Township).

The next slide details the assumptions for this estimate.

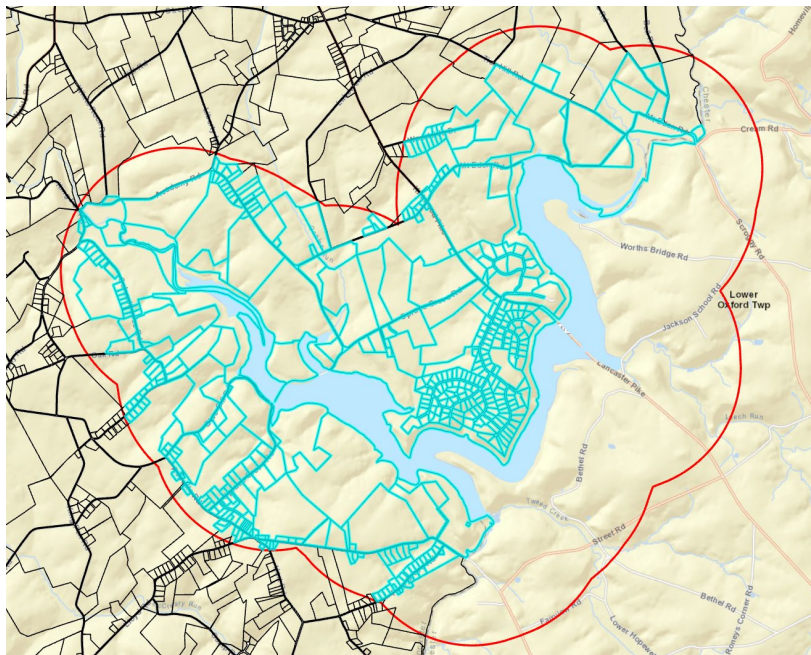


# Drinking Water: Drivers

A ¾-mile buffer surrounding the Octorara Lake is used to approximate and prioritize parcels with the greatest potential to impact source water protection.

On the Lancaster County side, this buffer captures roughly 460 parcels in two municipalities: Colerain Township and Little Britain Township.

The land use analysis shows that within this buffer, 70% of the acres are used for agriculture and an additional 20% is residential. Most of the agricultural acres are in the Colerain Township. The average agricultural parcel is 68 acres, while the average residential parcel is less than 2 acres.



	No. of Parcels	Total Acres	Avg Parcel (Acres)
<b><i>Colerain Township</i></b>			
Agriculture	45	3048	68
Residential	232	365	1.6
Other	8	319	40
<b><i>Little Britain Township</i></b>			
Agriculture	15	721	48
Residential	144	270	1.9
Other			
<b>Total</b>	<b>460</b>	<b>5414</b>	<b>12</b>

# Drinking Water: Implementation

## Treating Agricultural Land in a ¼-mile Buffer around Octoraro Lake

Number of parcels	60	
Total acres	3769	
<b>Pollutant Load</b>	<b>TN</b>	<b>TP</b>
lb/acre/yr <sup>1</sup>	22.24	0.36
Target reduction	45%	29%
Total lbs reduced	37,720	395
<b>Total annual cost (\$mill)</b>	<b>\$3.77</b>	<b>\$0.393</b>
<i>Avg cost per lb reduced <sup>2</sup></i>	<i>\$100</i>	<i>\$1000</i>
<i>Cost per acre</i>	<i>\$1000</i>	<i>\$105</i>

**Notes:**

<sup>1</sup> Based on develop land, pervious loading rates for Lancaster Co. <sup>2</sup> EFC report.

# Collaborative Drivers & Funding Need: Summary

While drivers of restoration and protection in Octoraro Watershed are diverse, they also provide a patchwork that covers significant portions. Importantly, the drivers have distinct overlapping areas that are ripe for a collaborative approach. The table on the next page summarizes the extent of coverage each driver creates and a preliminary estimates of the resources needed to meet restoration objectives.

The table serves as a starting point for understanding the scope and scale of resources needed to coordinate among vested interests in the watershed, including:

- CWA,
- municipalities,
- private landowners,
- Conservation Districts, and
- watershed associations and other nonprofits.

# Collaborative Drivers and Funding Need: Summary

Driver	Acres	Target reduction	Lbs of TN Removed	Total Cost (\$/yr)	Overlap with other drivers?
Stormwater	1,210	3%	1,415	\$425,500	<i>Limited.</i> MS4 program applies to limited number of municipalities due to low population density and dominant rural landscape.
TMDL	9,000	3%	9,060	\$2,716,400	<i>Yes – with Source water</i> With a focus on agricultural land, direct overlap with source water protection. <i>Limited – with Stormwater</i> For developed land, limited overlap with MS4 driver and municipalities having low population density and rural.
Source Water	3,770	45%	37,720	\$3,772,000	<i>Yes – with TMDL</i> With focus on agricultural land, direct intersection with TMDL drivers
Total	13,980	n/a	48,200	\$6,913,900	