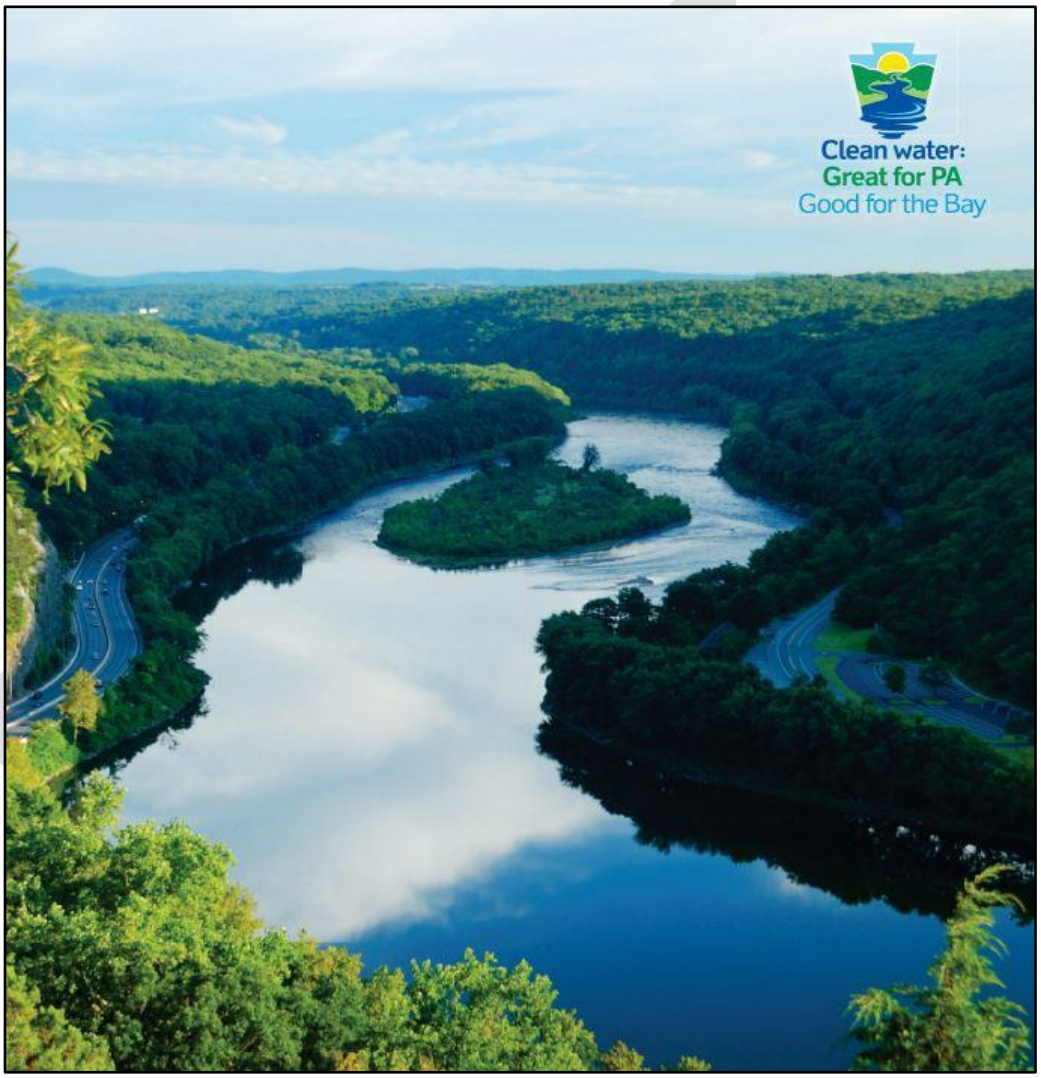
Pennsylvania's Community Clean Water

Technical Toolbox

Cumberland County



Healthy Waters, Healthy Communities

July 2019

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CUMBERLAND COUNTY TECHNICAL TOOLBOX

Pennsylvania Phase 3 Watershed Implementation Plan (WIP)
The Local Planning Process to Meet Countywide Goals

Introduction

Welcome to your Clean Water Technical Toolbox.

This document has been prepared to help you improve local water quality. This collaborative effort is being made throughout Pennsylvania's portion of the Chesapeake Bay Watershed. Each Pennsylvania county within the watershed will have a Technical Toolbox with similar components tailored to that county's specific conditions.

What is the Technical Toolbox?

This toolbox has been developed as a starting point for each county to use to improve local water quality. It contains useful and specific data and information relevant to your county to assist you with reaching local water quality goals.

No county is required to use every tool in this toolbox! You are encouraged to add other tools as fits your local situation. This toolbox serves as a *guide* to assist with collaborative efforts, *not* as a regulatory tool.

The Pennsylvania WIP Workgroups have developed a series of recommendations that can apply across the watershed. These are recommendations, and you will find that as a county you might want to adjust the recommendations based on your county's needs. The recommendations are to be used as a starting point for your county.

The Local Story: Opportunities to Improve Local Water Quality and Meet Countywide Goals

Information is available that can help inform local planning strategies. This information can help answer questions like:

- What is the water quality like in my area?
- What are important sources of nutrients and sediments in my area?
- What opportunities exist to address these sources?
- Where geographically should we focus our efforts?
- Where do I begin in identifying potential reduction strategies?

This Technical Toolbox provides information to help answer those questions and to tell the local story of water quality in your county. In this Technical Toolbox, you'll find information on local water quality, local sources and drivers of nutrients and sediments, best management practice information, and additional available resources.

The information in this Technical Toolbox and the guidance provided for its use are meant to act as a starting point to help answer some common questions that arise during planning. Local groups can utilize whichever pieces of information they find most useful, supplement with their own local knowledge, and use the additional resources listed to find more information. The state technical support team assigned to each county will help in answering your questions and provide assistance by filling out a detailed BMP entry template specific to your county.

We hope this Technical Toolbox gives you a foundation to build off in telling Cumberland County's local story and in identifying opportunities for meeting local goals.

Cumberland County's Clean Water Goal

Year	Nitrogen (lbs/year)	Phosphorus (lbs/year)
	Delivered to Local Cumberland County Waterways	**Delivered to Local Cumberland County Waterways**
1985	6,582,942	388,974
2017	6,256,881	265,488
2025 (Final TMDL Planning Target)	4,094,563	237,038
Remaining Load to be Achieved Through Local Planning Goals	2,162,318	28,450

The monitored nitrogen and phosphorus loads for Cumberland County (above) are broken into nitrogen and phosphorous goals. The top line represents the conditions of Cumberland County in 1985. The second line (2017) represents the current conditions in Cumberland County. The third line (2025) represents the goal that Cumberland County needs to achieve by 2025. The last line represents the total reduction goal, in pounds, that Cumberland County needs to achieve by 2025.

Cumberland County needs to reduce its current nutrient pollution by 2.162 million pounds of nitrogen and 28,000 pounds of phosphorous. Since 1985, Cumberland County has made great progress in reducing the amount of phosphorous to local waterways, but still needs more reductions in order to meet the 2025 goal.

There is a lot of work that needs to be done with regard to nitrogen reduction. However, through the planning process, the county's goal is to completely reduce the reductions needed by 2025, for both nitrogen and phosphorous. This may take a combination of state and county efforts.

The chart above can be found on CAST at http://cast.chesapeakebay.net. Log in and click on reports' tab; Report type: loads report, Geographic Scale: county-area in CBWS only, Geographic Area: select your county, Scenarios: 2017 Progress V9

A Summary of Cumberland County's Water Quality Story

Current Conditions of Cumberland County's Streams

- Monitoring shows that streams in Cumberland County have elevated amount of nitrogen, phosphorous and sediment.
- Water quality in Cumberland County's streams is changing over time:
  - Cumberland County has 760 total streams miles.
  - Of the 760 stream miles approximately 30% are impaired due reasons such as siltation (excess sediment), nutrient pollution and others.
  - Some of Cumberland County's local impairments are being addressed through local Total Maximum Daily Loads (TMDLs).

Sources of Nutrients & Sediment in Cumberland County

- It is estimated that most nutrients in Cumberland County streams are coming primarily from agricultural sources (63%), developed/urban (17%) and wastewater (10%) also make up a significant portion of the total load.
- Effective management will address the specific sources of nutrients and sediment in Cumberland County:
  - On agricultural lands, the majority of nutrients are applied to the land as both fertilizer (63%) and manure (34%), addressing both sources will be important.
  - On developed/urban lands, more than half of the nutrients entering local streams comes from outside of the MS4 areas (regulated municipal separate stormwater sewer system). Turf grass or grassy areas in Cumberland County are responsible for more than half of the nutrient load, and will be important to manage in both MS4 areas and outside of MS4 areas.
  - Areas outside of MS4 may require outreach, financial programs etc. to address the problems.
  - Wastewater has been slightly reduced, but there is still opportunity for additional reductions.
  - Septic contributes a small portion of nutrients to local streams, but can be important locally.
  - Most of the phosphorus and sediment in local streams comes from overland runoff or streambank erosion during rain events; the most effective management practices reduce application of phosphorus to the land, reduce runoff, and reduce soil erosion.
  - In both agricultural and developed/urban areas, erosion of stream banks are important sources of sediment and nutrients to local streams.

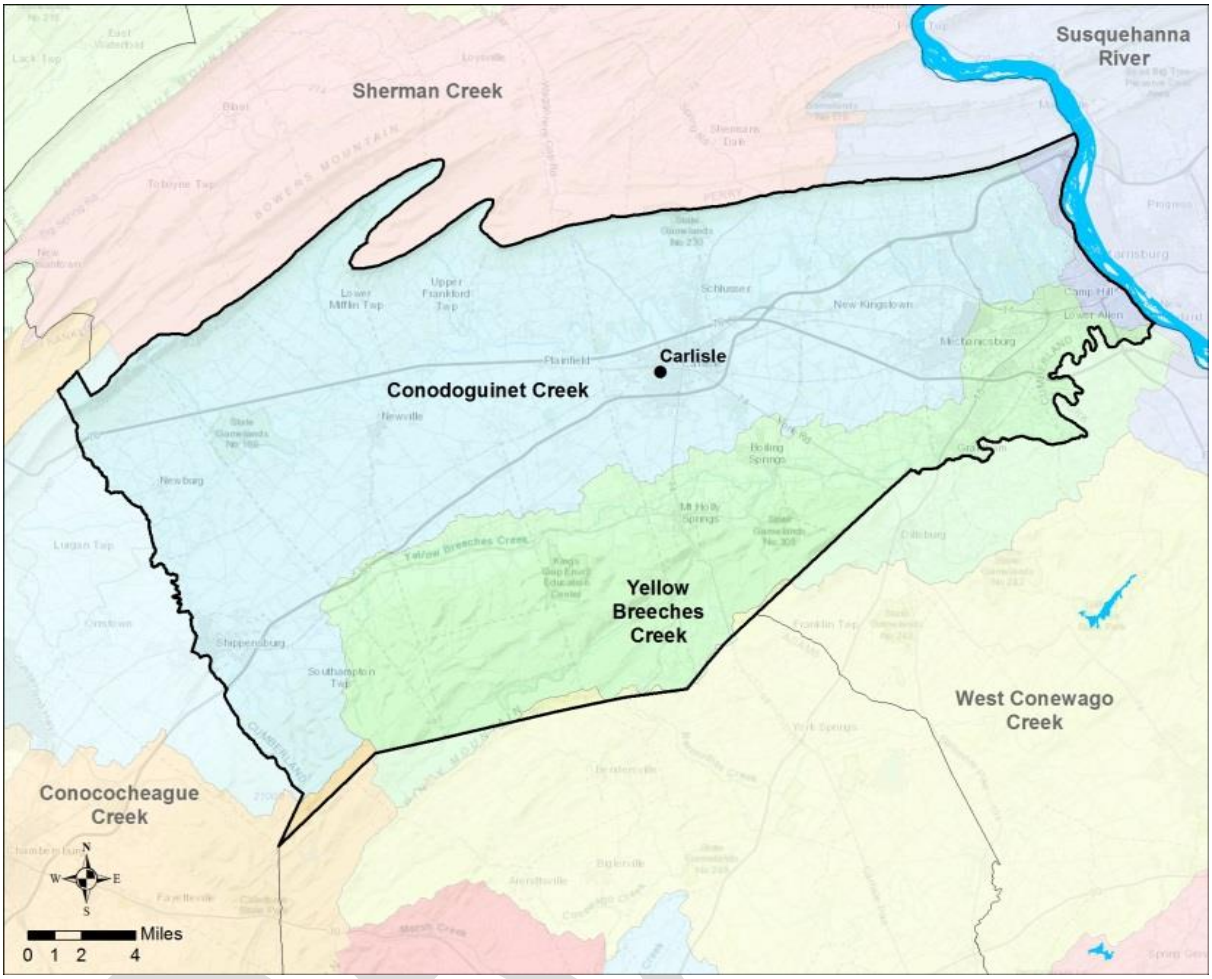
Challenges to Implementation in Cumberland County

- The significantly large area vulnerable to groundwater contamination (karst geology), will present a unique challenge for Cumberland County. However, focusing efforts on the nutrient application rate above the karst geology will be especially important to effectively managing the problem.
- In Cumberland County there is a high rate of nitrogen that is entering the stream through ground water in the form of nitrate, opposed to overland runoff. This means if practices only focus on overland runoff, they could be missing of a lot of the nitrogen that is entering local streams.
- Cumberland County has areas with elevated levels of ground water nitrogen levels above EPA's safe drinking standard.

Opportunities for Implementation in Cumberland County

- The Conodoguinet Creek watershed is an effective place to focus efforts. The highest loading areas within Cumberland County are located in the Conodoguinet Creek Watershed. The Conodoguinet Creek Watershed also contains a majority of the county's impaired stream miles.
- Some effective practices to address nutrients and sediment are currently being implemented in Cumberland County, such as conservation tillage and barnyard runoff control.
- There are many more opportunities within the county to increase implementation of effective practices such as basic and advanced nutrient management, cover crops, grass and forest buffers in agricultural areas, stormwater controls, and urban nutrient management in developed areas.

Cumberland County's Local Watersheds



The following pages provide in-depth information on local water quality in Cumberland County's monitored watersheds.

Water Quality Monitoring

The overall objective of the WIP is improving Chesapeake Bay health; however, Pennsylvania is much more focused on improving local water quality in our local communities, which in turn will improve the waters of the Chesapeake Bay.

With this focus, it is important to utilize the most appropriate water quality monitoring data for each county or region. Below are some resources that can provide information on the local rivers and streams in your area. While these resources are often robust, they are not the only data available and local partners are encouraged to incorporate other local water quality monitoring efforts in this planning phase as well.

Throughout the county WIP planning stage, these data resources may provide important information stakeholders may need.

Chesapeake Bay Non-tidal Monitoring Network (NTN)

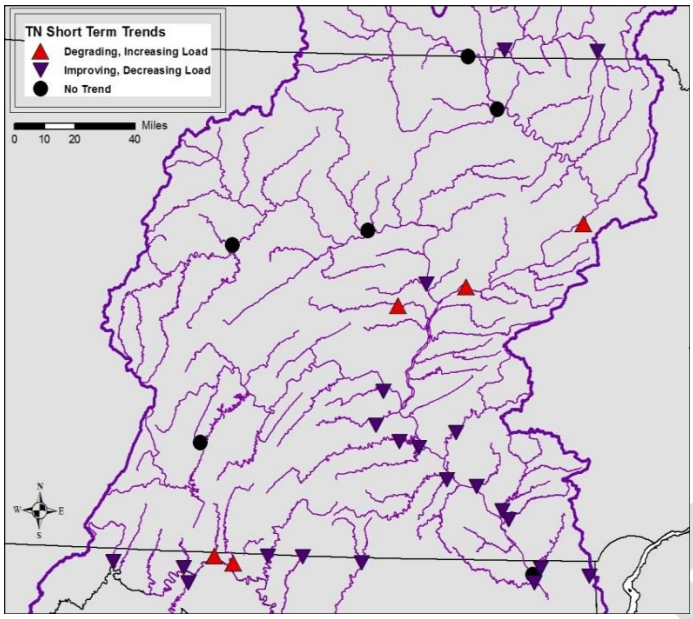
The United States Geological Survey (USGS), Susquehanna River Basin Commission (SRBC), Pennsylvania Department of Environmental Protection (DEP) and other state partners across the Chesapeake Bay watershed, monitor water quality at 115 stations. Changes in nitrogen, phosphorus, and suspended-sediment loads in rivers across the Chesapeake Bay watershed have been calculated using these monitoring data. Nutrient and sediment loads are calculated with at least five years of monitoring data, and trends are reported after at least ten years of data collection.

This data set is very robust. Though all counties may not have a long term monitoring station within the county boundary, the nearest downstream station gives a regional picture of the current status and historical trends for nutrients and sediment.

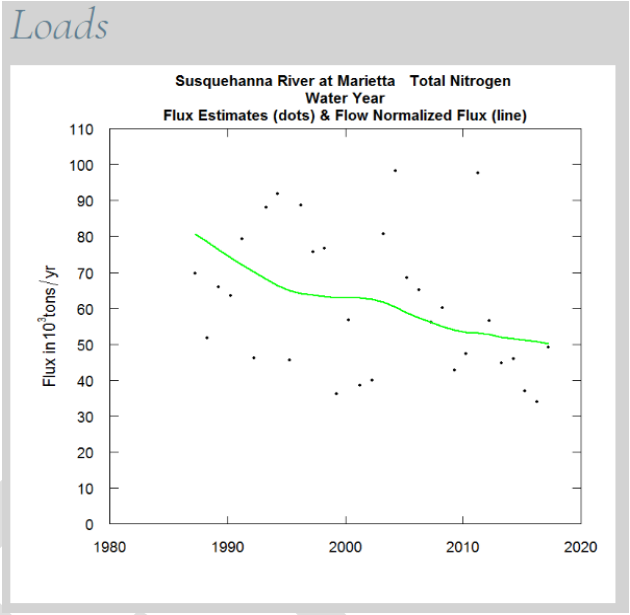
This data set is used to help calibrate the Chesapeake Bay Watershed Model which is the source of much of the information in the remainder of the toolbox.

Additional information for each monitoring station is available at:

- USGS Chesapeake Bay Non-tidal Website: https://cbrim.er.usgs.gov/summary.html
    - Interactive Map- https://cbrim.er.usgs.gov/maps/
- SRBC Sediment and Nutrient Assessment Program: https://www.srbc.net/portals/water-quality-projects/sediment-nutrient-assessment/



Nitrogen trends map from USGS



Historical Nitrogen Load from Susquehanna River at Marietta, Pa.

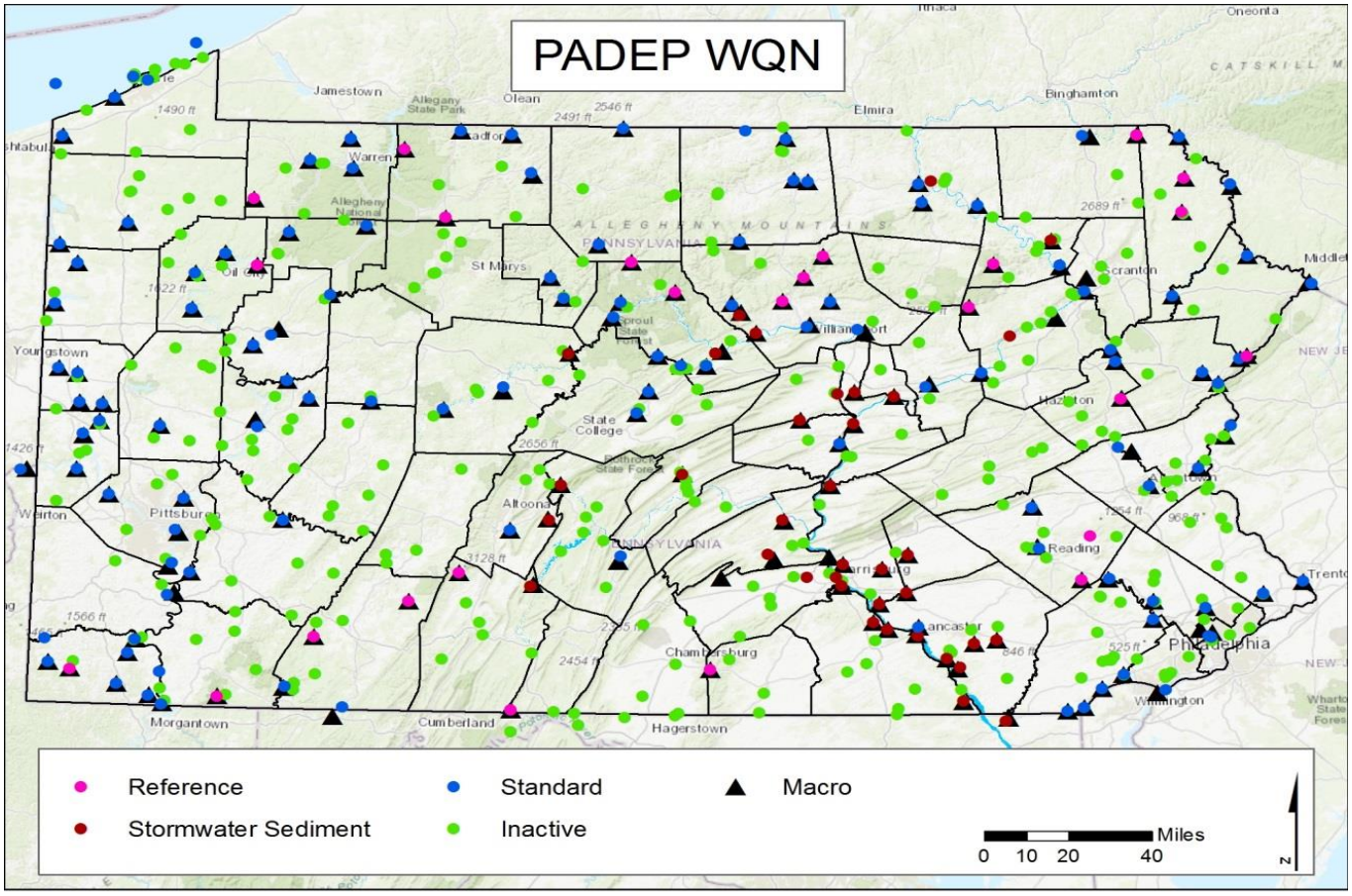
Pennsylvania Water Quality Network (WQN)

The Pennsylvania Water Quality Network (WQN) is a statewide, fixed station water quality sampling system operated by the PA Department of Environmental Protection's (DEP) Bureau of Clean Water. It is designed to assess both the quality of Pennsylvania's surface waters and the effectiveness of the water quality management program by accomplishing four basic objectives:

- Monitor water quality trends in major surface streams throughout the Commonwealth of Pennsylvania
- Monitor water quality trends in selected reference waters
- Monitor the trends of nutrient and sediment loads in the major tributaries entering the Chesapeake Bay
- Monitor water quality trends in selected Pennsylvania lakes

Some of these stations are also included in the NTN network, however there are many additional monitoring stations that are sampled at a different frequency than the NTN stations.

Additional information and access to the data can be found here:
http://www.depgis.state.pa.us/WQN/

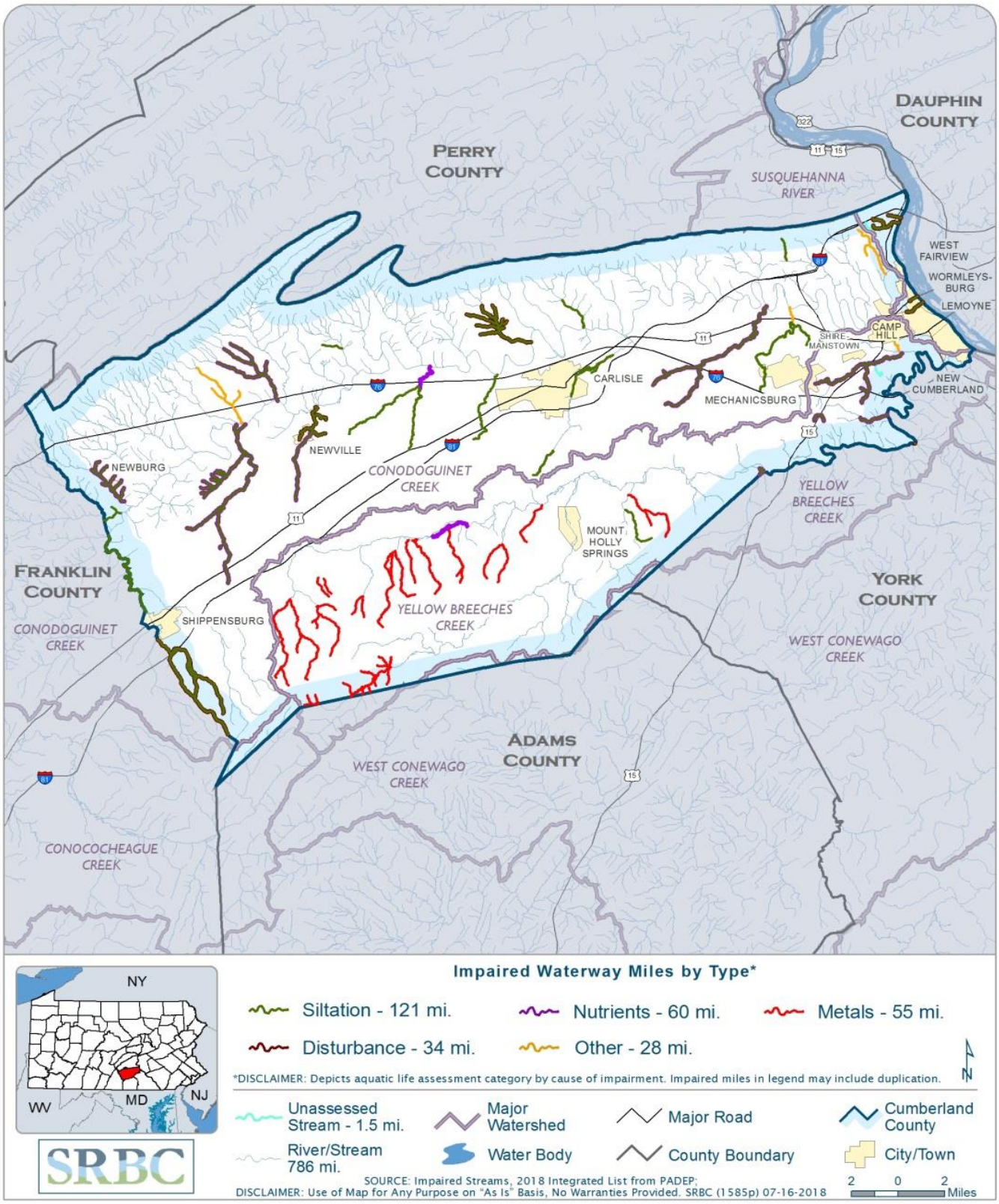


Additional Water Quality Data Sources-

There are additional data resources that may help to target efforts to local streams. Macroinvertebrate data and Continuous In-stream Monitoring (CIM) data are extensively collected across Pennsylvania to both assess and monitor stream health. Below are some additional resources to find this data:

- PADEP Macroinvertebrate Story Map and Data Viewer
  - http://www.depgis.state.pa.us/macroinvertebrate/index.html
  - Contains macroinvertebrate information, and scores as well as viewer for accessing water quality data.
- National Water Quality Portal (USGS, U.S. EPA, National Water Quality Monitoring Council)
  - https://www.waterqualitydata.us/
  - Contains national water quality data; can be searched by county/region and downloaded.
- Susquehanna River Basin Commission Water Quality Portal
  - https://mdw.srbc.net/waterqualityportal
  - Contains water chemistry, macroinvertebrate, fish and habitat data across the Susquehanna River Basin.
- Susquehanna River Basin Commission CIM data
  - https://mdw.srbc.net/remotewaterquality/data_viewer.aspx
  - Contains CIM data including temperature, pH, conductance, dissolved oxygen and turbidity, along with quarterly additional parameters.

Impaired Waterways in Cumberland County, PA, 2018



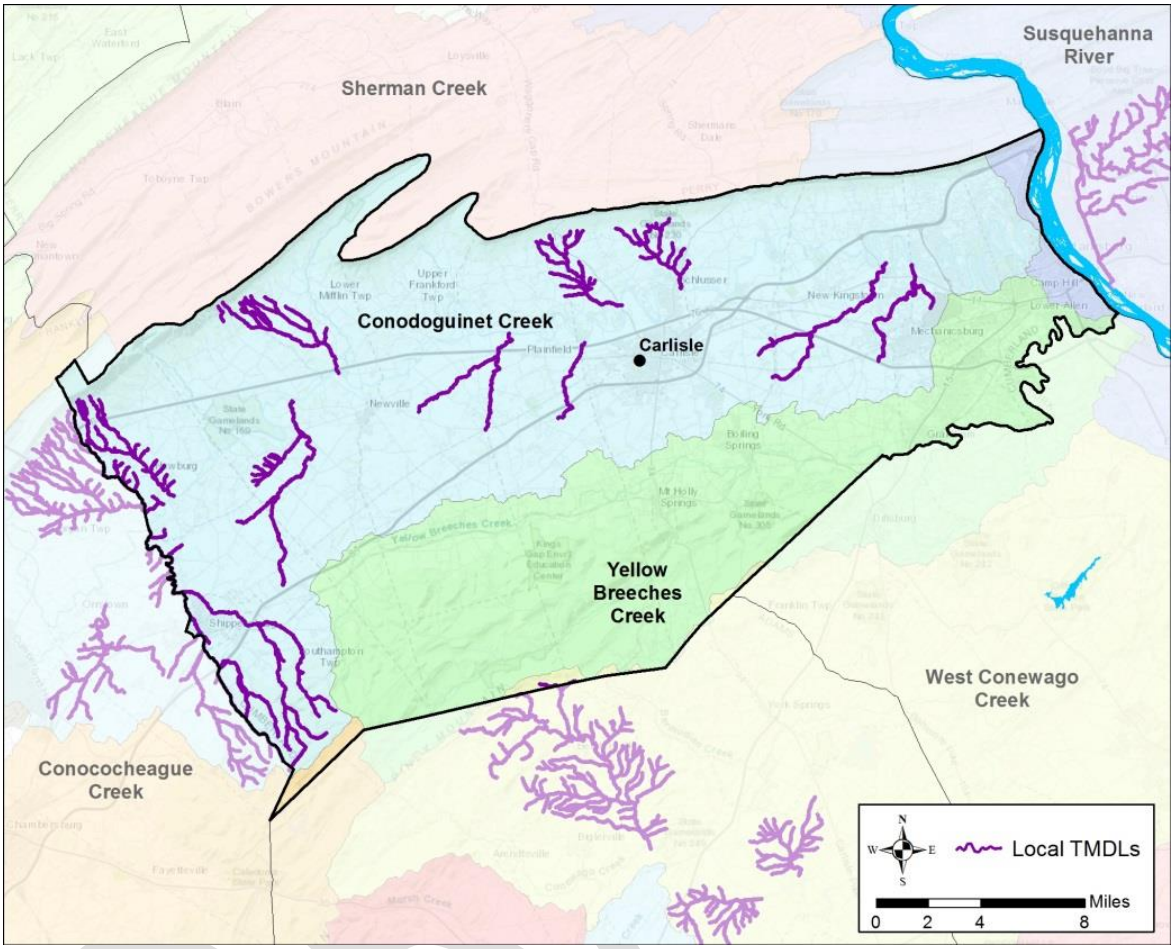
Of Cumberland County's 786 stream miles, approximately 30% have degraded aquatic communities due to causes such as siltation (excessive sediment), nutrient pollution and others.

Knowing the sources of these impairments helps to prioritize or coordinate efforts.

- For example, many agricultural practices that address nutrients can also address siltation impairments from sediment.
- Many urban/developed practices that address nutrients and sediment also address the same causes of pathogen impairments.
- Focusing efforts geographically in areas with impaired streams can help address local issues.

Local impaired waters listed on the 303(d) list can be found at PADEP: http://www.depgis.state.pa.us/integratedreport/index.html.

Local restoration efforts will help Cumberland County's watersheds.



While many waters are listed as impaired, only some of these impairments are being addressed through regulatory Total Maximum Daily Loads (TMDLs).

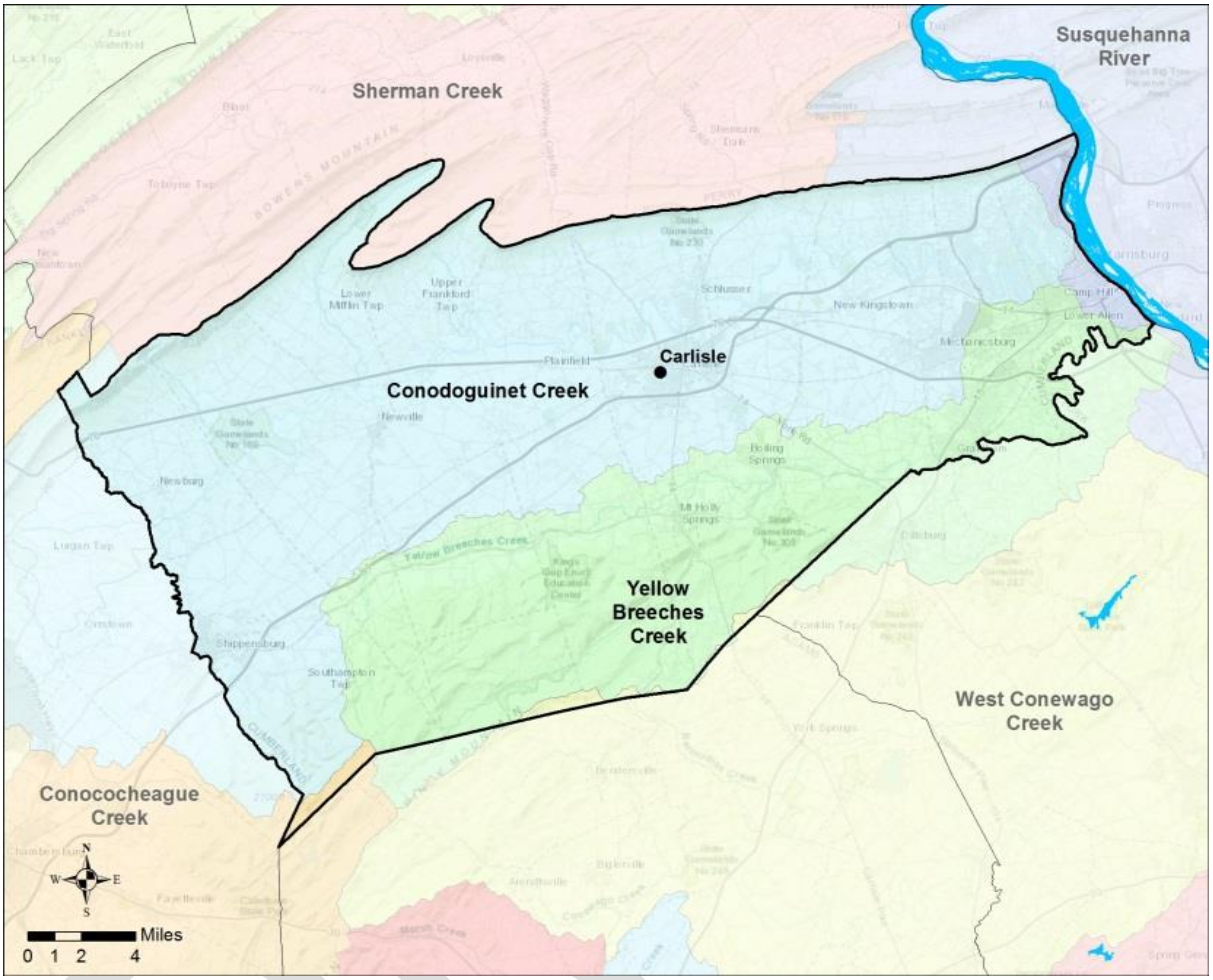
Local groups may want to coordinate restoration efforts to focus on the watersheds that already have these local TMDLs. Major watershed with TMDLs in Cumberland County:

- Conodoguinet Creek
- Opossum Creek

Local impaired waters listed on the 303(d) list that have TMDLs can be found at PADEP: http://www.depgis.state.pa.us/integratedreport/index.html.

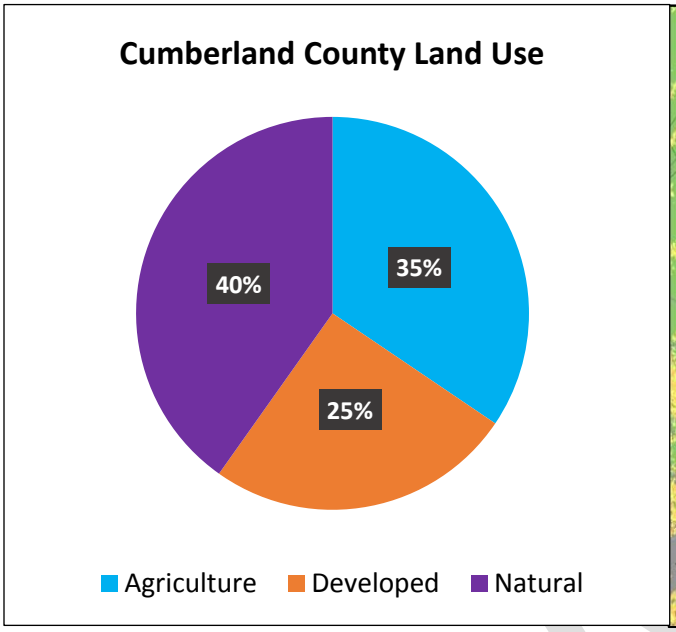
TMDL reports can be found at PADEP: http://www.ahs.dep.pa.gov/TMDL/

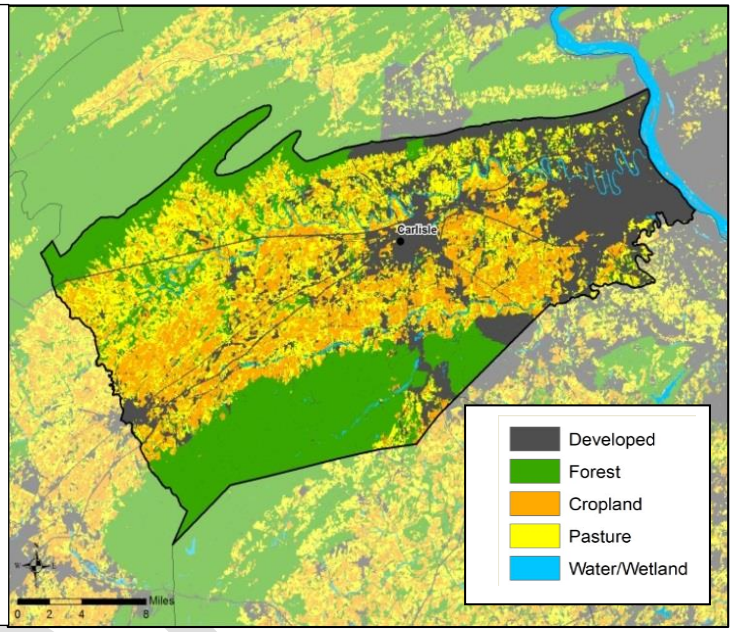
Cumberland County's Local Watersheds



Sources of Nutrient and Sediment in Cumberland County

Water Quality is Strongly Tied to Land Use





Cumberland County Land Use Map

Cumberland County has challenges in restoring water quality.

- Agricultural and developed land generates more nutrients and sediment than forested land. Cumberland County has unique local water quality challenges in part due to its high acreage of these land uses.
- The pie chart above shows the breakdown of land uses in Cumberland County. 60 percent of the county is agricultural or developed land, which is higher than most other counties in Pennsylvania.
- The map above shows the geography of land uses, specifically illustrating the relatively small amount of forested land in the county.

High resolution land-use for the Chesapeake Bay watershed is available from USGS and the Chesapeake Bay Program at: https://chesapeake.usgs.gov/phase6/.

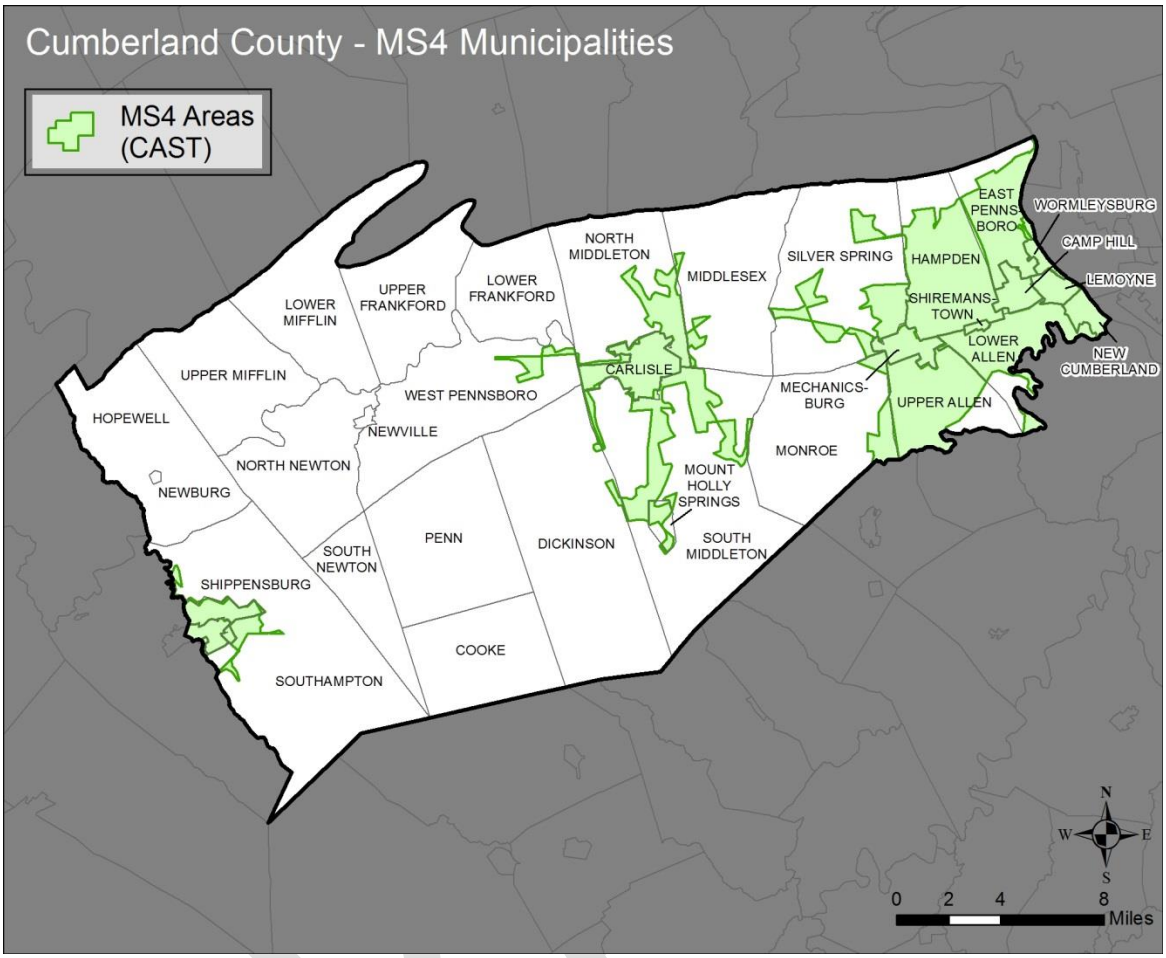
The map above is from Falcone, 2015. The breakdown of land use by county can be found on CAST at http://cast.chesapeakebay.net. Log in and click on reports' tab; Report type: loads report , Geographic Scale: county-area in CBWS only, Geographic Area: select your county, Scenarios: 2017 Progress V9

Land Use Breakdown in Cumberland County

Sector	Load Source	Acres Available
Agriculture	Feeding Space	241
Agriculture	Hay	34,105
Agriculture	Pasture	12,479
Agriculture	Row Crops	72,906
Agriculture	Other Ag	1,868
Developed	Construction	497
Developed	Pervious Developed	52,400
Developed	Impervious Developed	24,265
Natural	Forest	117,906

The numbers listed above represent the land use breakdown in CAST for Cumberland County. The available acres will influence the quantity of BMPs that can be put into CAST. These numbers are intended to help identify the potential in Cumberland County.

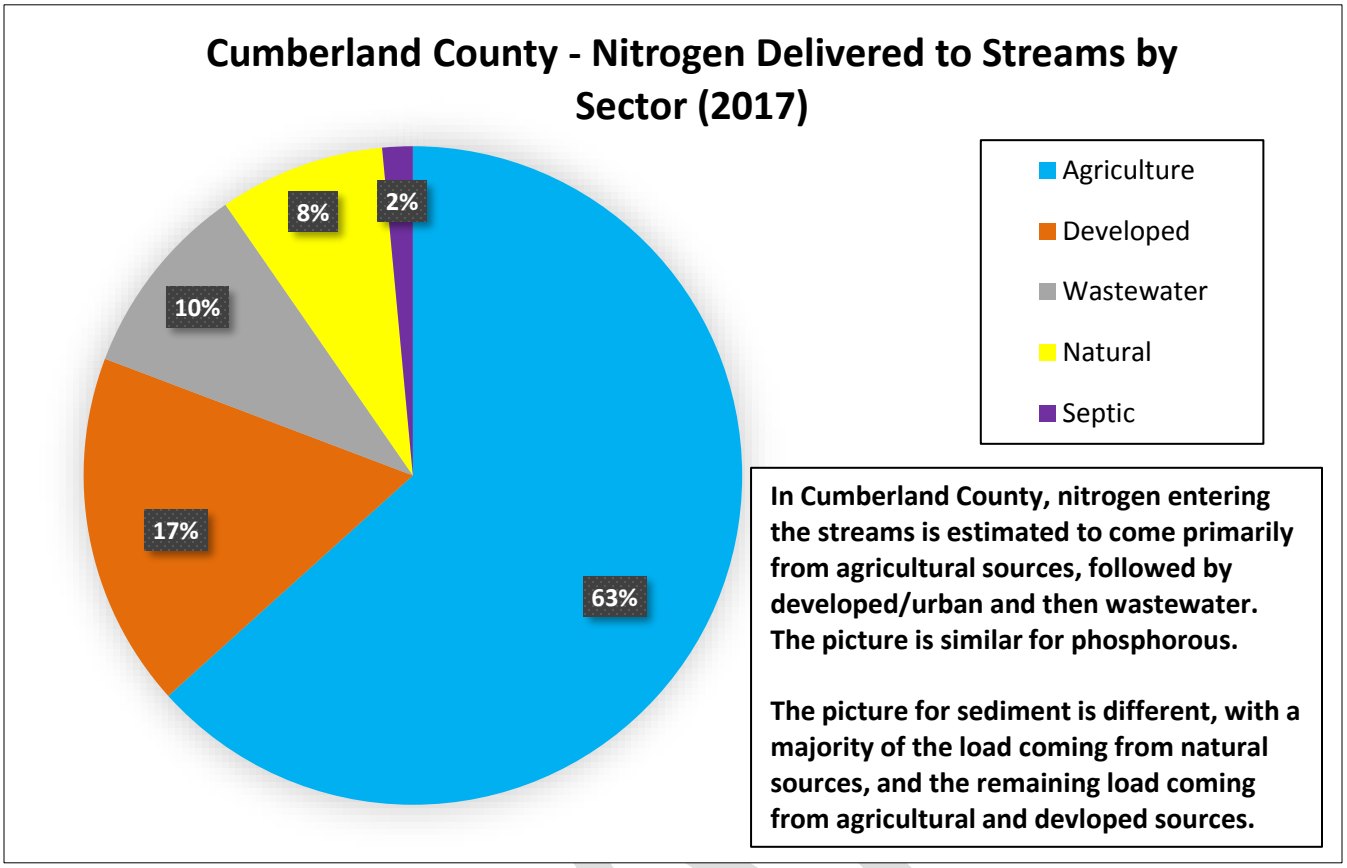
Additional breakdowns for each of the categories can be found at http://cast.chesapeakebay.net/. Log in and click on the reports' tab; Report Type: loads report, Geographic Scale: county-area in CBWS only, Geographic Area: select your county, Scenarios: 2017 Progress V9



Municipal separate storm sewer systems (MS4s) are identified above in Cumberland County.

Municipalities and other entities that meet certain standards must obtain NPDES permit coverage for discharges of stormwater from their municipal separate storm sewer systems (MS4s). MS4s must apply for NPDES permit coverage or a waiver if they are located in an urbanized area as determined by 2010 Census data.

More information can be found here- http://www.dep.pa.gov/Business/Water/CleanWater/StormwaterMgmt/Stormwater/Pages/default.aspx



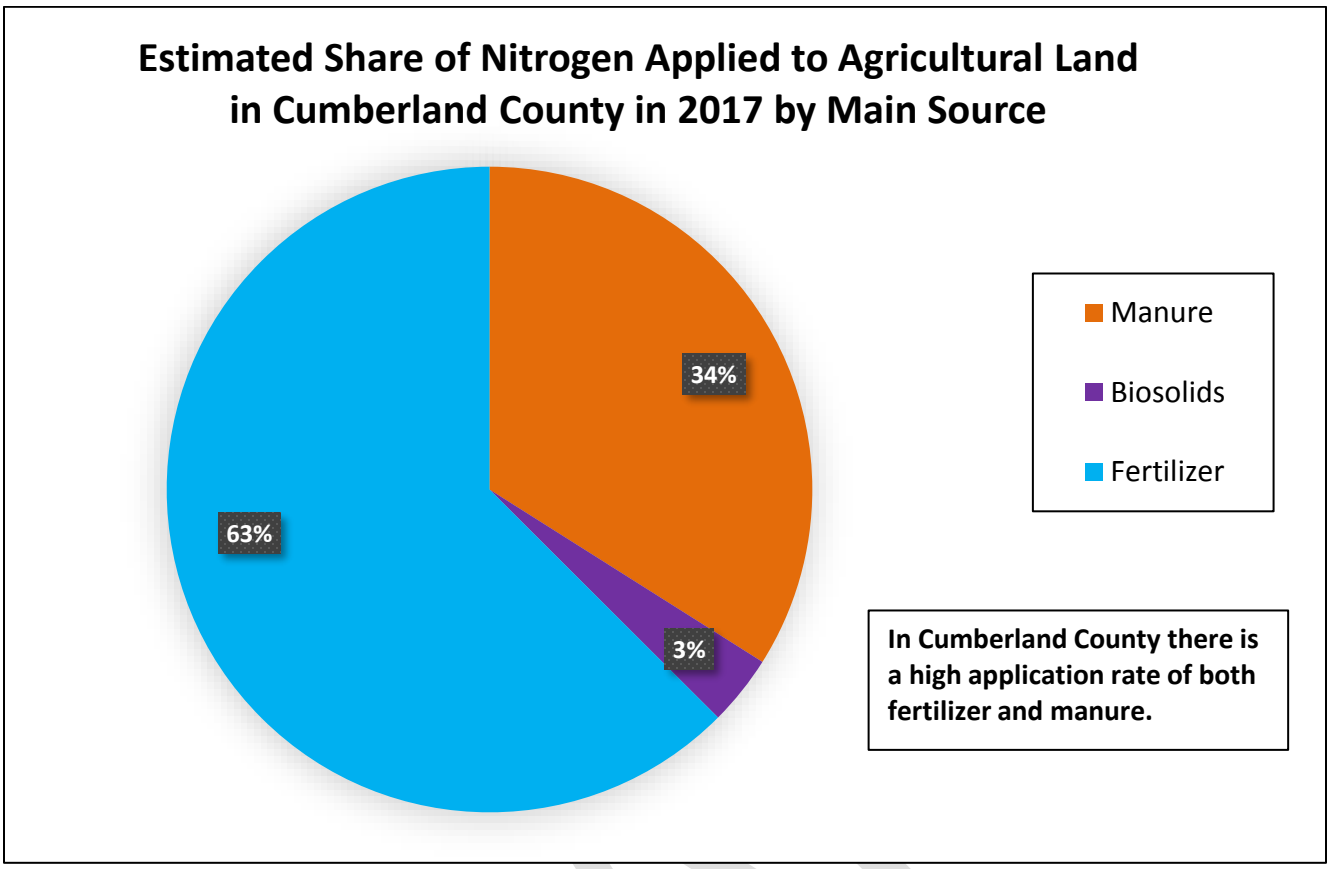
The pie chart above shows the percentage of nitrogen delivered to local streams based on land use or activity. Most nitrogen entering local streams in Cumberland County comes from agricultural sources including cropland, pasture and barnyards.

The developed/urban sector also contributes a fair amount of the load from stormwater.

Because agriculture and developed/urban sources make up the majority of the load in Cumberland County, these sectors will need to consider how they can supply the majority of the reductions to reach local goals. Wastewater and septic sources can also be reduced.

These estimates were generated using the Chesapeake Bay Program's Phase 6 Watershed Model. The model is generated using water quality monitoring data.

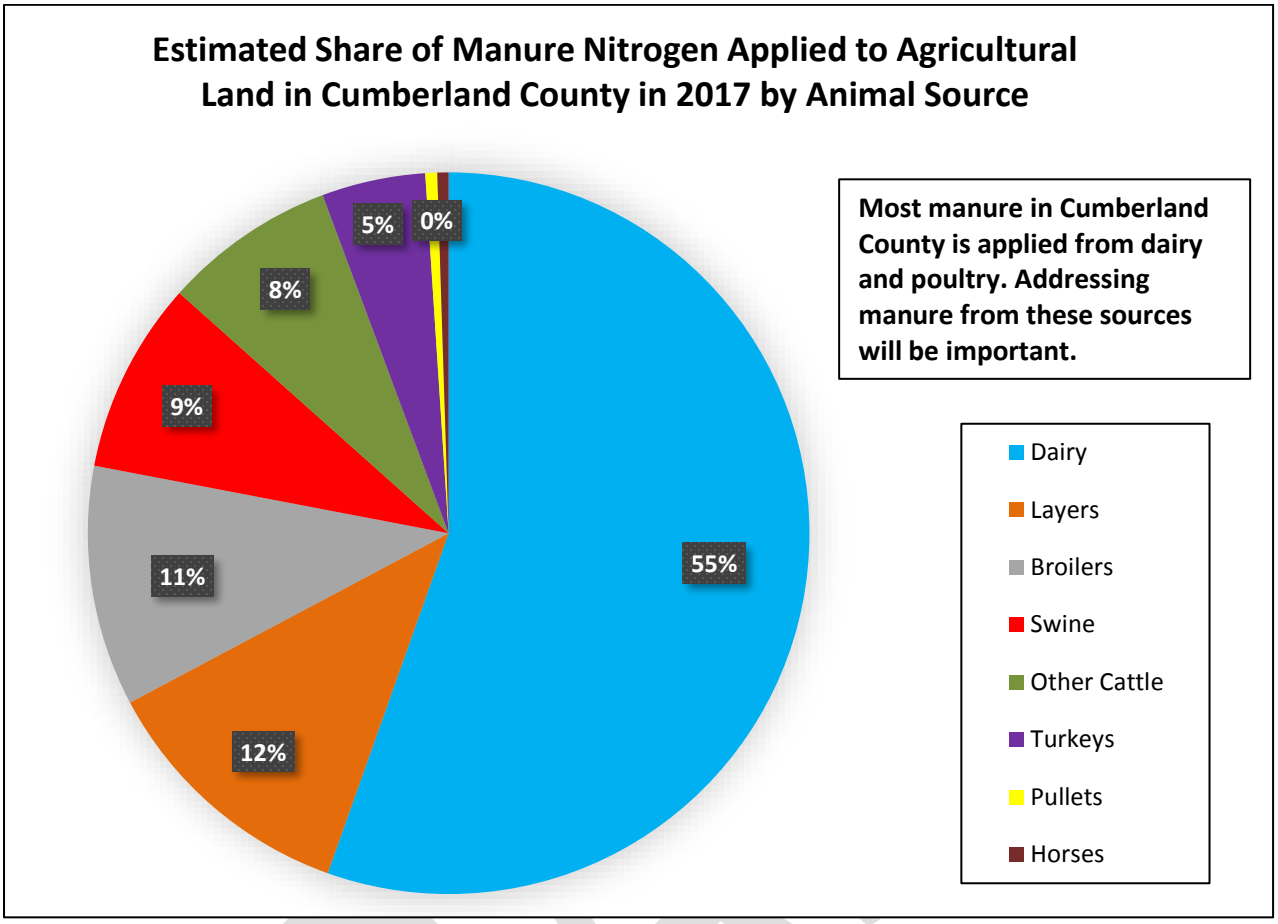
Estimated loads by sector can be found on CAST at: http://cast.chesapeakebay.net/. Log in and click on the reports' tab; Report type: loads report, Geographic Scale: county-area in CBWS only, Geographic Area: select your county, Scenarios: 2017 Progress V9



Understanding how nutrients are being applied to the land can lead to the sources that may need to be managed.

- Most nutrients are applied to agricultural land in Cumberland County as both fertilizer and manure
- Nutrients that are applied to agricultural land and not taken up by crops can negatively impact water quality.
- When identifying strategies to manage nutrient application, focusing on both fertilizer and manure will be important to address the issue. These can require different control and management practices such as advanced or precision nutrient application, manure storage, manure transport, etc.

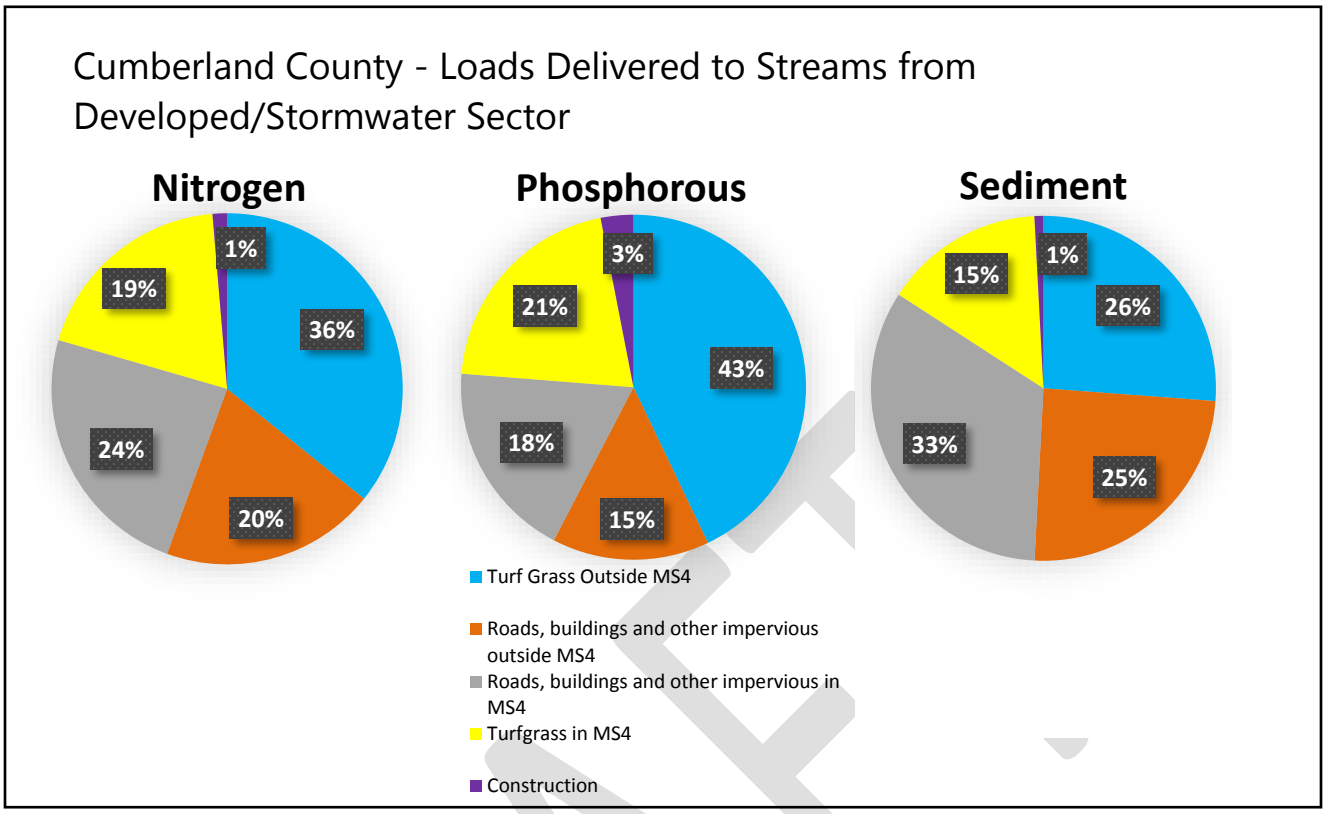
Estimated application of nutrients by source can be found on CAST at: http://cast.chesapeakebay.net/. Log in and click on the reports' tab. Report type: Nutrients Applied, Geographic Scale: county-area in CBWS only, Geographic Area: select your county, Scenarios: 2017 Progress V9



Understanding where manure is coming from within the county will help identify opportunities to manage it.

Most manure in Cumberland County is from dairy and poultry operations. Focusing efforts on implementing practices at these operations can address a large portion of Cumberland County's manure management needs.

Estimated share of manure nutrient animal sources can be found on CAST at http://cast.chesapeakebay.net/. Log in and click on the reports' tab. Report type: Nutrients Applied, Geographic Scale: county-area in CBWS only, Geographic Area: select your county, Scenarios: 2017 Progress V9



The developed/ stormwater sector is also an important source of nutrients and sediment in Cumberland County.

The charts above show the estimated breakdown of sources of nutrients and sediment to local streams exclusively from developed/urban lands.

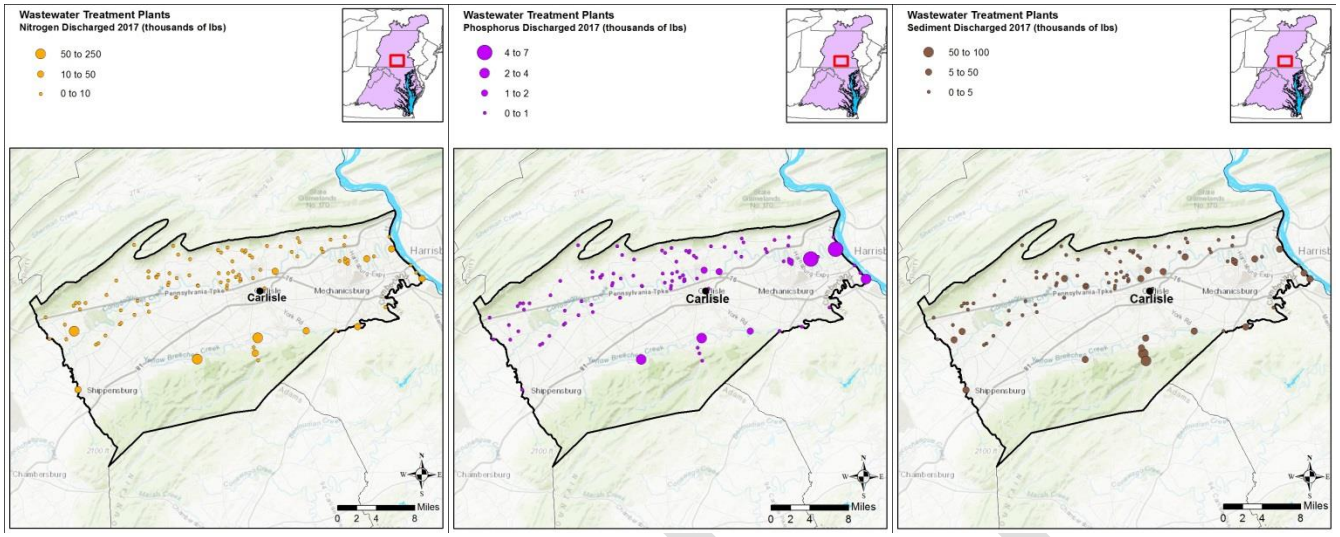
- MS4 (municipal separate storm sewer systems) areas are regulated by DEP, while land outside of MS4 areas is not regulated for stormwater.
- More than half of the developed/urban load comes from outside MS4 areas.
- Managing unregulated stormwater areas may take different outreach, voluntary programs and funding programs to implement practices.
- Turf grass represents grassy and barren lands that have been altered through compaction, removal of organic material, and/or fertilization. These include all lawns and grassy areas in residential, commercial, recreational, cemeteries, shopping centers, etc.

Understanding where stormwater nutrient and sediment comes from is an important first step in addressing it.

- In Cumberland County, a majority of the nutrient load attributes from turf grass, while a majority of the sediment load comes from impervious areas.

Estimated loads by sources can be found on CAST at http://cast.chesapeakebay.net/. Log in and click on the reports' tab. Report type: loads report, Geographic Scale: county-area in CBWS only, Geographic Area: select your county, Scenarios: 2017 Progress V9

Wastewater Treatment Plant Locations and Loads



The maps above show the locations of wastewater treatment plants within Cumberland County and their annual discharges of nitrogen, phosphorus and sediment in 2017.

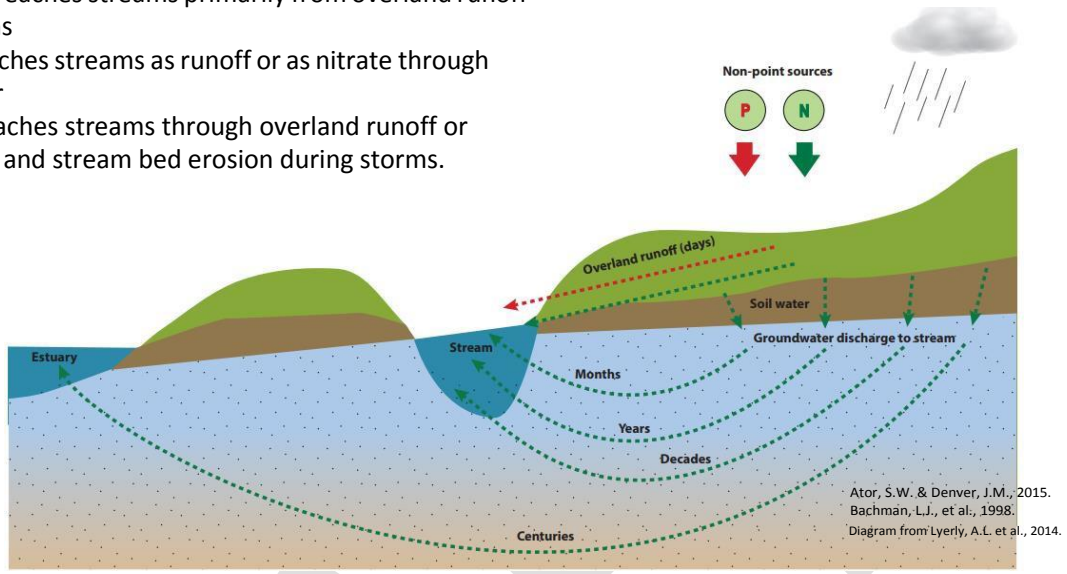
Although wastewater makes up a smaller portion of nutrient loads to streams than agricultural or developed land and has already been significantly reduced in Cumberland County, there is still room for reductions, particularly of nutrients. Wastewater is an important sources to control as discharges directly enters the streams.

Understanding where the higher loading plants are located can help identify opportunities for treatment plant upgrades in the future.

Reported wastewater treatment plant discharges and treatment plant locations are available from the Chesapeake Bay Point Source Database: https://www.chesapeakebay.net/what/downloads/bay_program_nutrient_point_source_database

The transport of nutrients matters for planning implementation

- Phosphorus reaches streams primarily from overland runoff during storms
- Nitrogen reaches streams as runoff or as nitrate through groundwater
- Sediment reaches streams through overland runoff or stream bank and stream bed erosion during storms.



The way in which nutrients and sediment reach our streams impacts which practices will be effective at controlling them.

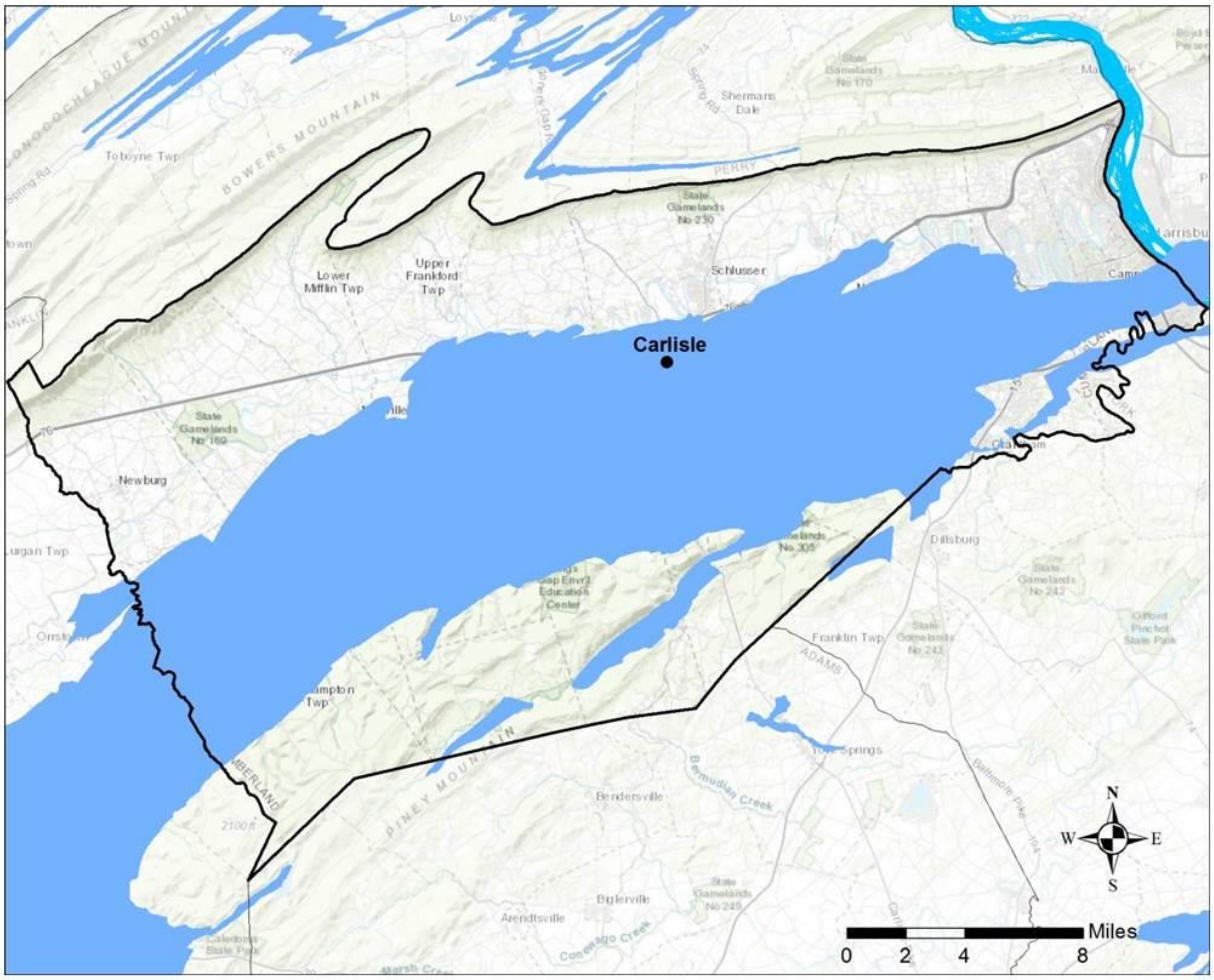
Phosphorus and sediment travel over the top of the land during high runoff events such as storms and rainfall, and also enter streams from stream bank or stream bed erosion.

Nitrogen can travel over land as well, but in many watersheds, including those in Cumberland County, it travels primarily as nitrate underground in groundwater.

- For example, in the Conodoguinet Watershed 61.2% and in the Yellow Breeches 81.4% of the nitrogen entering the streams in the form of nitrate from groundwater.
- If management practices only focus on overland runoff, they could be missing a lot of the nitrogen that is entering streams through groundwater.
- Once nitrogen is in groundwater, it is very difficult to remove. Effective practices include those that stop nitrogen from entering groundwater in the first place, like applying less nitrogen and planting cover crops.
- Riparian buffers can remove nitrate from groundwater if placed in effective locations.

Percent of Nitrogen entering the streams as ground water nitrate can be found at https://pubs.usgs.gov/wri/wri98-4059/pdf/wri98-4059.pdf

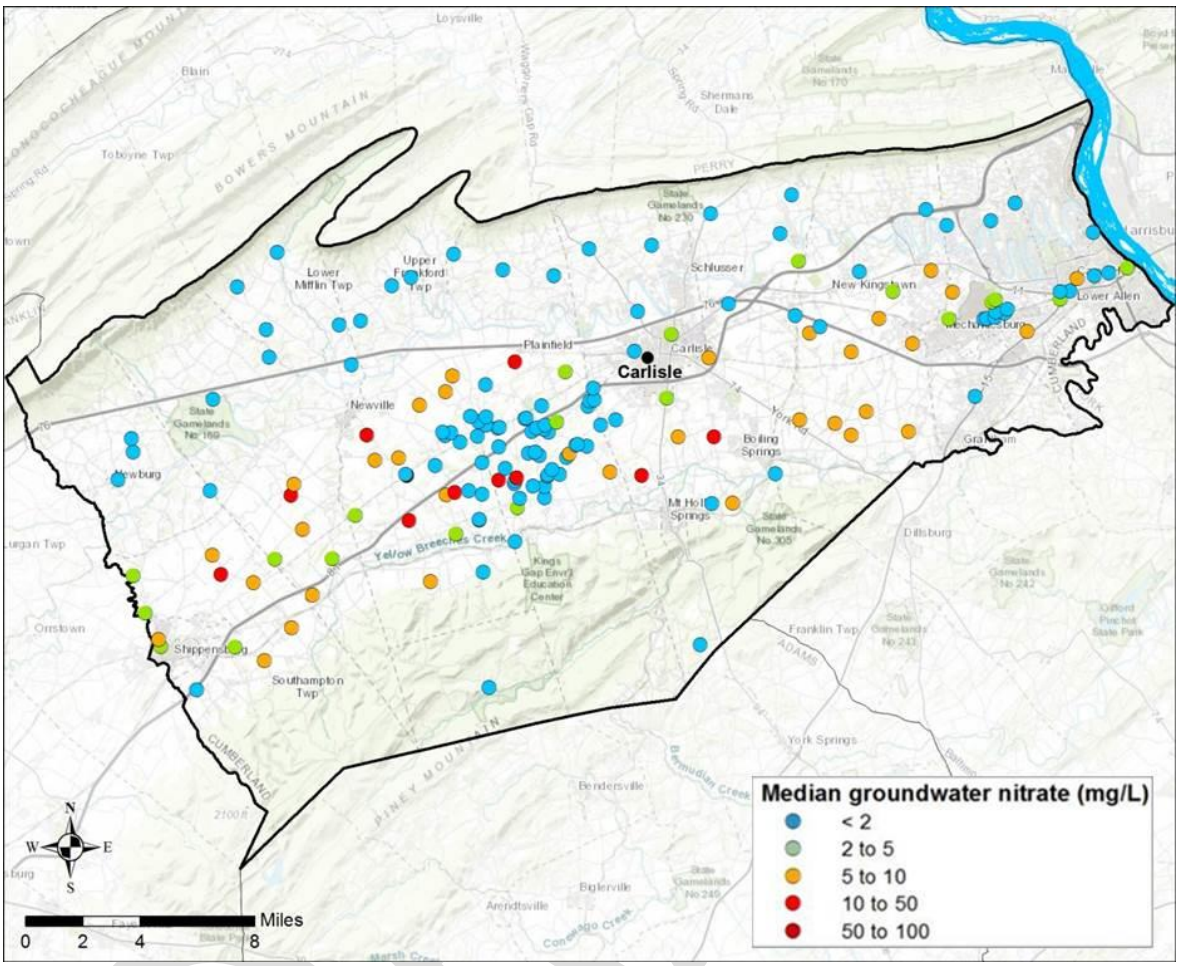
Cumberland County contains a large area vulnerable to groundwater contamination (Karst highlighted in blue)



Certain areas of the watershed are more vulnerable to nitrate contamination of groundwater because the geology under the soil makes it easier for nitrogen to enter groundwater and provides less opportunity for its removal to occur naturally.

- The map above shows these vulnerable areas, which have Karst or carbonate geology.
- Cumberland County has a unique challenge due to the significantly large area vulnerable to groundwater contamination.
- Agricultural land on top of these areas makes the groundwater especially vulnerable due to the high inputs of nitrogen onto the landscape.
- These areas can be very effective for focusing efforts that keep nitrogen from getting into groundwater and are especially important areas to manage application of nitrogen.

Nitrate groundwater concentrations in Cumberland County

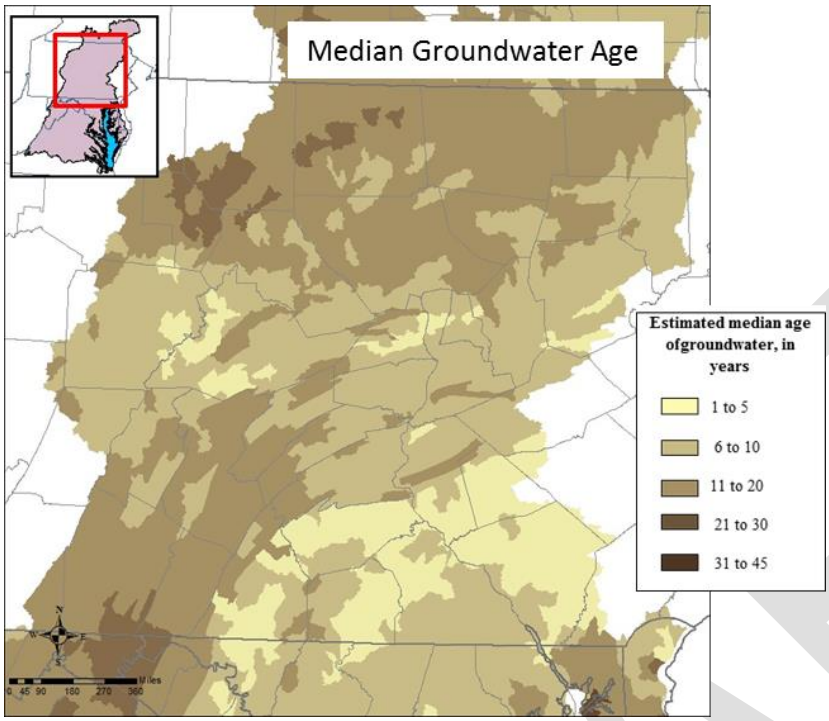


Groundwater in Cumberland County has some elevated nitrate levels.

- This can be due to the vulnerable geology, and also to the over-application of nutrients over time.
- Because groundwater contributes a significant portion of nitrogen to streams in these watersheds, groundwater nitrate levels are good indicators of what will eventually enter streams.
- In a few cases throughout Cumberland County, groundwater nitrate levels exceed the EPA's safe drinking water threshold of 10 mg/L.

Groundwater quality data over multiple years can be found from USGS: https://water.usgs.gov/owq/data.html.

Groundwater takes varying amounts of time to reach streams depending on location



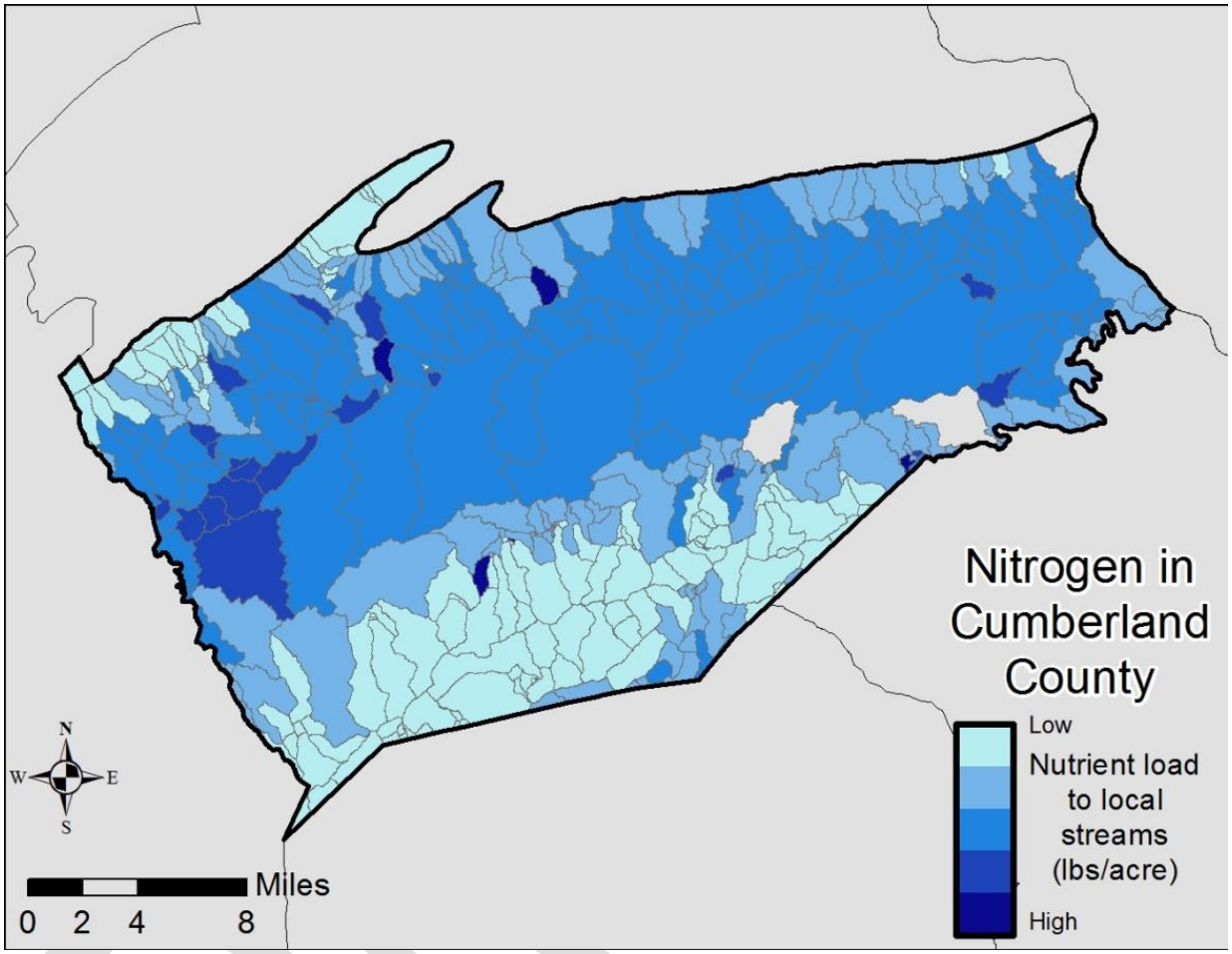
- Nitrate in groundwater represents a range of ages from recent to decades old
- Benefits from management actions will manifest immediately as well as into the future
- Chesapeake Bay Program estimates the median groundwater age across Cumberland County is between 1 and 10 years, with much of the groundwater being less than 5 years old.
- This means we expect very little "lag time" between when a practice is implemented and when that practice's impact can be seen in local streams. That presents a unique opportunity for Cumberland County.

Groundwater takes anywhere from days to years to reach nearby streams.

In Cumberland County, the groundwater is some of the youngest in the Chesapeake Bay watershed, meaning that it doesn't take long to reach streams.

This means we would expect to see benefits from management actions related to groundwater relatively sooner compared to other areas of the watershed.

USGS SPARROW Model Nitrogen



Focusing efforts on the highest loading areas within Cumberland County can result in the greatest water quality benefits

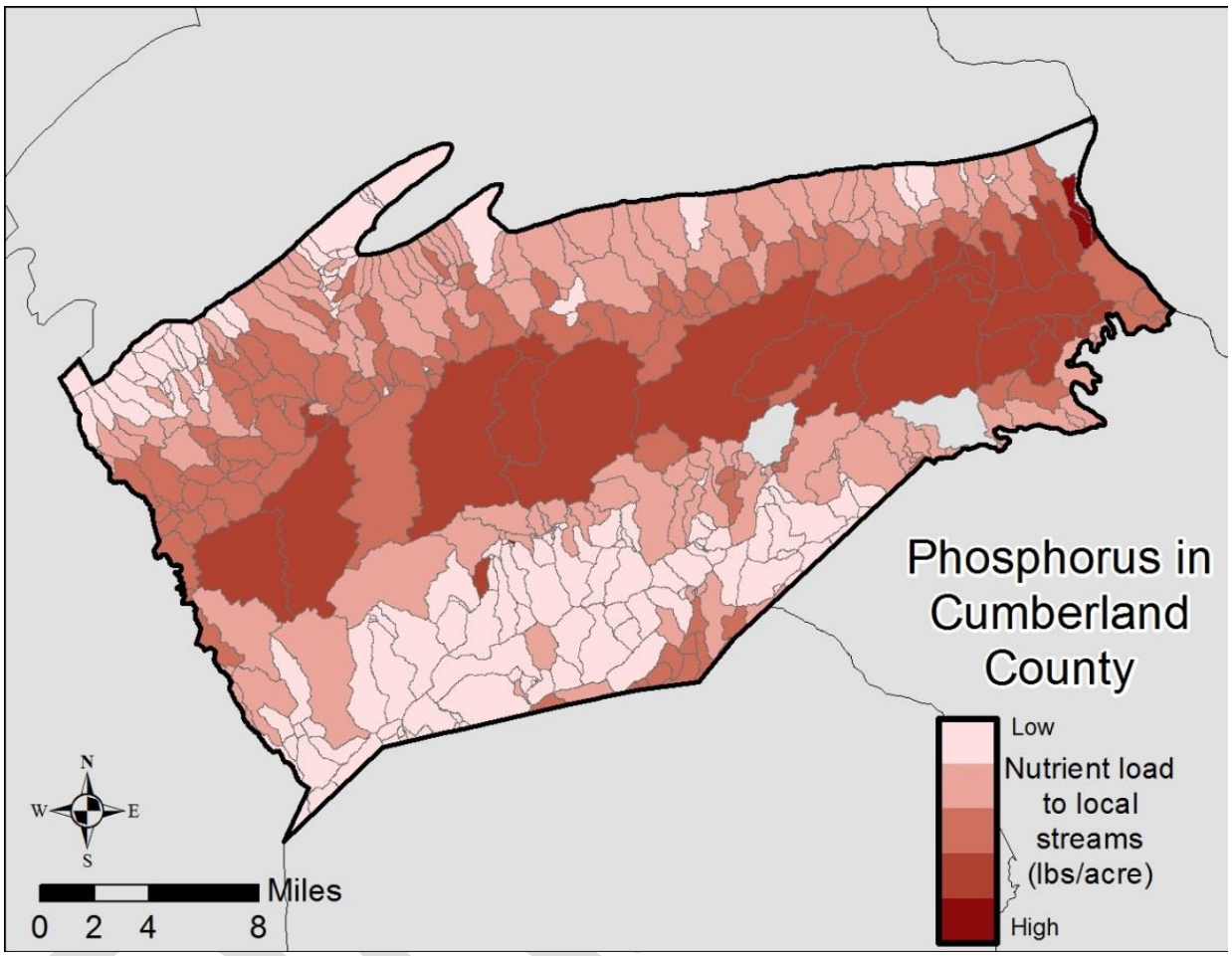
We can estimate where the highest amounts of nitrogen are entering local streams.

The maps above show these higher loading areas within Cumberland County.

Focusing efforts on the highest loading areas can result in the greatest water quality benefits by addressing a larger portion of the nutrients entering streams. In Cumberland County the highest loading areas for both nitrogen and phosphorous tend to overlap in many areas. Focusing restoration efforts in those areas can be effective for both nitrogen and phosphorous.

The maps above are generated from the USGS SPARROW model for the Chesapeake Bay watershed. More info can be found- https://water.usgs.gov/nawqa/sparrow/#

USGS SPARROW Model- Phosphorus



Focusing efforts on the highest loading areas within Cumberland County can result in the greatest water quality benefits

We can estimate where the highest amounts of phosphorus are entering local streams.

The maps above show these higher loading areas within Cumberland County.

Focusing efforts on the highest loading areas can result in the greatest water quality benefits by addressing a larger portion of the nutrients entering streams. In Cumberland County the highest loading areas for both nitrogen and phosphorous tend to overlap in many areas. Focusing restoration efforts in those areas can be effective for both nitrogen and phosphorous.

The maps above are generated from the USGS SPARROW model for the Chesapeake Bay watershed. More info can be found- https://water.usgs.gov/nawqa/sparrow/#

Most Cost-effective Agricultural Practices for Nitrogen Reduction in Cumberland County

Sector	BMP	Nitrogen $/lb reduced/year
Agriculture	Dairy Precision Feeding and/or Forage Management	-3.38
Agriculture	Alternative Crops	0.72
Agriculture	Grass Buffer	1.38
Agriculture	Grass Buffer-Streamside with Exclusion Fence	1.38
Agriculture	Soil Conservation and Water Quality Plans	1.61
Agriculture	Barnyard Runoff Control	1.94
Agriculture	Wetland Restoration – Floodplain	2.52
Agriculture	Forest Buffer	2.96
Agriculture	Agricultural Stormwater Management	3.10
Agriculture	Water Control Structure	3.10
Agriculture	Grass Buffer – Narrow	3.16
Agriculture	Forest Buffer – Streamside Exclusion Fence	3.36
Agriculture	Loafing Lot Management	5.26
Agriculture	Cropland Irrigation Management	5.84
Agriculture	Tree Planting	6.21

The list above reflects the top 15 most cost-effective agricultural practices for reducing nitrogen in Cumberland County.

This list can serve as a starting point to assess feasibility of practice implementation.

For example, even though Alternative Crops are cost-effective, this practice involves replacing crops with others such as switchgrass, which may not be a feasible practice to implement.

Most Cost Effective BMPs can be found here:
http://cast.chesapeakebay.net/Documentation/DevelopPlans

- Under "Cost Effectiveness of BMPs", Click on the "BMP Pounds Reduced and Costs by County" link.

Detailed information about the BMPs can be downloaded on the CAST website at http://cast.chesapeakebay.net/Home/SourceData by clicking "Download Source Data".

The Official Quick Reference Guide for BMPs can be found here:
https://www.chesapeakebay.net/documents/BMP-Guide_Full.pdf

Most Cost-effective Developed Practices for Nitrogen Reduction in Cumberland County

Sector	BMP	Nitrogen $/lb reduced/year
Developed	Forest Planting	13.42
Developed	Forest Buffer	16.85
Developed	Bioswale	127.09
Developed	Infiltration Practices w/o Sand, Veg. – A/B soils	140.41
Developed	Wet Ponds and Wetlands	169.75
Developed	Dry Extended Detention Ponds	176.01
Developed	Vegetated Open Channels – A/B soils, no underdrain	187.04
Developed	Tree Planting – Canopy	200.12
Developed	Storm Drain Cleaning	341.08
Developed	Bioretention/raingardens – C/D soils, underdrain	435.29

The list above reflects the top 10 developed, most cost-effective practices at reducing nitrogen in Cumberland County.

This list can serve as a starting point to assess feasibility of practice implementation.

For example, even though forest planting is cost effective, it may not be feasible to turn parks and open spaces into forests.

Most Cost Effective BMPs can be found here:
http://cast.chesapeakebay.net/Documentation/DevelopPlans

- Under "Cost Effectiveness of BMPs", Click on the "BMP Pounds Reduced and Costs by County" link.

Detailed information about the BMPs can be downloaded on the CAST website at http://cast.chesapeakebay.net/Home/SourceData by clicking "Download Source Data".

The Official Quick Reference Guide for BMPs can be found here:
https://www.chesapeakebay.net/documents/BMP-Guide_Full.pdf

Remaining Opportunities in Cumberland County for Agricultural Practices

Practice	Current Reported Implementation	Acres Currently Reported	Acres Remaining
Basic Nutrient Management	23%	28,000	92,000
Conservation Tillage	6%	4,700	26,000
High Residue Tillage	59%	43,700	--
Traditional Cover Crop	2%	1,300	70,000
Commodity Cover Crop	9%	1,200	--
Prescribed Grazing	7%	900	12,000
Barnyard Runoff Control	60%	143	100
Soil & Water Conservation Plans	12%	14,600	107,000
Forest Buffers	N/A	760	32,000

This chart shows the current **reported** implementation in Cumberland County of some effective agricultural practices, and the remaining acres of land in the county available to implement those practices.

The current reported implementation percent reflects how much of the land that is available for a particular practice already has that practice reported to be implemented on it.

For example, prescribed grazing's current percent implementation reflects that 7 percent of pasture land in Cumberland County is currently reported to have prescribed grazing implemented. 12,000 acres of pasture remain in the county without prescribed grazing, which may represent an opportunity for further implementation of that practice.

Remaining opportunity is determined as the difference between reported implemented acres and all available acres on which the practice can be implemented. Land on which BMPs can be implemented are available in CAST. Reported implementation is available on CAST at http://cast.chesapeakebay.net. Log in and click on the reports' tab. Report type: BMP Summary, Geographic Scale: county-area in CBWS only, Geographic Area: select your county, Scenarios: 2017 Progress V9.

Remaining Opportunities in Cumberland County for Stormwater Practices on Developed/Urban Land

Practice	Acres Currently Reported
Erosion & Sediment Control	100%
Runoff Reduction	1,585
Stormwater Treatment	179
Wetlands and Wet Ponds	177
Bio retention	8
Urban Tree Planting	12

This chart shows the current **reported** implementation of stormwater practices in Cumberland County.

Erosion and sediment control addresses construction areas and time periods. However, sediment from developed land and from erosion of streams on developed land persist as issues long after construction is over. Therefore, stormwater management is incredibly important for managing these issues once construction ends.

Opportunities exist in Cumberland County to implement stormwater management practices in developed and urban areas.

Remaining opportunity is determined as the difference between reported implemented acres and all available acres on which the practice can be implemented. Land on which BMPs can be implemented are available in CAST. Reported implementation is available on CAST at http://cast.chesapeakebay.net. Log in and click on the reports' tab. Report type: BMP Summary, Geographic Scale: county-area in CBWS only, Geographic Area: select your county, Scenarios: 2017 Progress V9.

Appendix I

The State Recommendations: How to Create A Customized Partnership

The Pennsylvania Phase 3 WIP workgroup recommendations are available and can help inform local planning strategies. This information can help answer questions like:

- How can I develop a starting point?
- What BMPs can I identify in my county as potential opportunities?
- How do I begin to quantify a goal?
- What are important areas to focus my efforts?
- What resources exist to address these sources?

Appendix I provides information to help answer those questions and to give each county a starting point for developing their county plan. In this Appendix, you will find information on the multiple state WIP workgroup recommendations, a county scenario using the state recommendations, information about closing the gap, and resources to help identify the next steps.

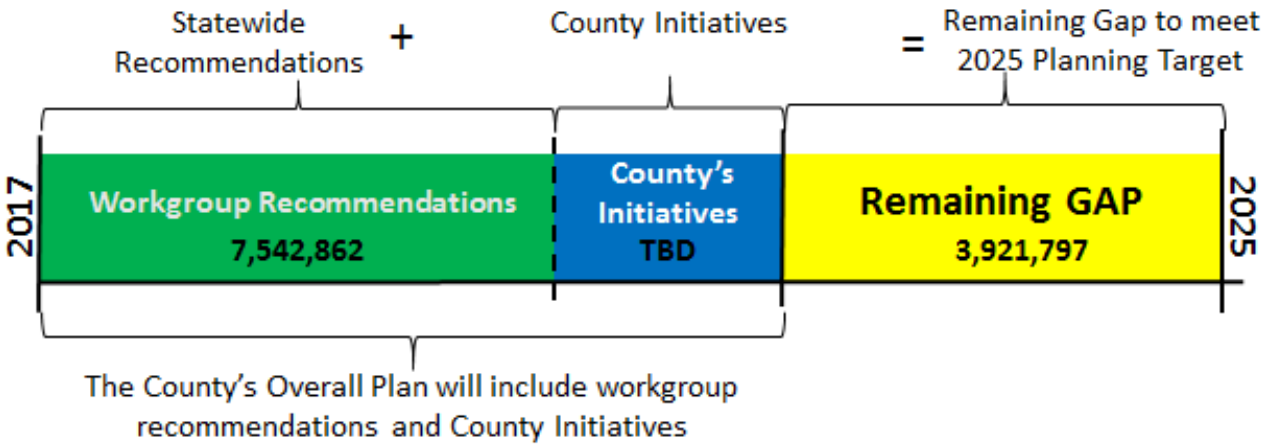
The information in this Appendix and the guidance provided for its use are meant to act as a starting point to help answer some common questions that arise during planning. Local groups can utilize the state recommendations and tailor the recommendations to better fit their county structure, build upon what is currently listed, and remove recommendations that do not fit within their county's structure.

We hope this Appendix gives you a foundation to build off in telling Cumberland County's local story and in identifying opportunities for meeting local goals.

Placeholders:

- **Agriculture Workgroup Recommendations placeholder**
- **Stormwater Workgroup Recommendations placeholder**
- **Forestry Workgroup Recommendations placeholder**
- **Wastewater Workgroup Recommendations placeholder**

- **WIP Agriculture Workgroup Recommendations CAST Model Run placeholder**
- **WIP Stormwater Workgroup Recommendations CAST Model Run placeholder**
- **WIP Forestry Workgroup Recommendations CAST Model Run placeholder**
- **WIP Wastewater Workgroup Recommendations CAST Model Run placeholder**



Hypothetical Journey to a County Goal (Nitrogen)

The hypothetical journey is a depiction to the countywide goals and overall Pennsylvania water quality targets. Moreover, the figure above represents a county's journey to clean water.

The nitrogen and phosphorus planning targets for the Pennsylvania counties are broken down into local planning goals for each county. Added together, these goals will help Pennsylvania reach its assigned planning targets.

- The green section depicts the estimated reductions that can be achieved by accepting the state workgroup recommendations. This does not mean that you have to accept the state workgroup recommendations, but serves as a starting point for your county. You may find that your county needs to make a few changes to the state workgroup recommendations to better fit your county's structure. It is important to remember the state recommendations were developed as Pennsylvania's watershed wide state recommendations. The counties plan may be to lower the state's recommendations and that is okay. Just understand the yellow bar will get larger, which means you will be expected to stretch somewhere else.
- The blue section represents the county's initiatives that goes beyond the state workgroup recommendations. These could include practices that the state workgroups did not identify in their recommendations. This could also mean exceeding the state workgroups recommendations for a particular practice.
- Reductions from these initiatives and the state workgroup recommendations will be added together to form the County's Comprehensive Plan that will be submitted to DEP. The goal of the County's Comprehensive Plans are to reduce the yellow "Gap."
- The yellow section is defined as the "Gap." This gap is a resultant of the blue and green section added together, which forms the County's Comprehensive Plan. As more county initiatives are added the yellow bar will shrink until the County has met its nitrogen and phosphorous goal. Every county is expected to meet the yellow gap, but that does not mean it will be achieved for every county.

Next Steps in Completing Cumberland County's Planning Process

The state workgroup recommendations are to be used as a starting point for development of Cumberland County's planning process. How can Cumberland County use the states recommendations, and what changes can be made to better fit what is needed in your county.

The following is a list of questions that may help to begin the planning process:

- What technical and financial resources are needed in order to meet the state recommendations?
- What are the programmatic changes needed in order for Cumberland County to meet its goal?
- Are the state recommendations realistic for Cumberland County? If no, how can we adjust the numbers to make the goal realistic?
- Are we able to exceed state recommendations. If so, how?
- Are there additional practices that we would like to focus on that the state did not identify?
- How does our goals as a county align with the state workgroup recommendations? Are there co-benefits that can be achieved with the workgroup recommendations?

The next step in your planning process is to begin thinking through how you can accomplish your goals. This will require you to work in coordination with your county support team to begin filling out your county's planning templates. The templates will capture what it is you are trying to achieve and how you will be able to achieve those goals.

Once your county has identified how they can achieve these goals, you will want to take the time to quantify your final goals. The state technical support member will assist in helping to finalize your county's goals. As you finalize your county's goals, you also will finalize your county templates that help to identify how the goals will be met. All pieces of the planning process will be submitted to DEP.

Resources and Contact Information

The following list will provide you with expanded resources and contacts to assist you with planning efforts. Your support team contact names and information are also provided as your points of contact throughout your county action planning and implementation process.

Cumberland County Support Team Members	WIP Planning Role	Organization	E-mail	Phone
Kristen Wolf	DEP Chesapeake Bay Office – Overall WIP lead for Cumberland County	PA DEP	kwolf@pa.gov	717-772-1675
Jamie Shallenberger	WIP Technical Support	Susquehanna River Basin Commission (SRBC)	jshallenberger@srbc.net	717-238-0423 ext. 1115
Jordan Baker	WIP Technical Support	Susquehanna River Basin Commission (SRBC)	jbaker@srbc.net	717-238-0423 ext. 1143