

# PRAM

## Perkiomen Recovery Action Mission

UAPP 411/611 Group 8

### Action Plan

Lydia Franks, Bisesh Joshi, Cooper Feeny, Noah Brogden, and Thomas McGalliard



Flooding on the Perkiomen Trail from Hurricane Ida (The Times Herald, 2021).

**Mission statement**

The Perkiomen Creek watershed is currently facing problems consisting of flooding, erosion, runoff pollution, invasive vegetation, as well as land development. PRAM's goal is to reinstate the overall ecosystem of the watershed by improving water quality, mitigating flooding issues, and conserving native species by the year 2040.

**Background**

The Perkiomen Creek is a tributary of the Schuylkill river in southeastern Pennsylvania. The drainage area of the Perkiomen Creek watershed is 362 square miles, among which 10.68% of the area is urban, 3.16% is wetland and 45.56% is covered by forest. The mean annual precipitation in the watershed is 44 inches, with a mean annual discharge of 519 ft<sup>3</sup>/s. This watershed encompasses 55 municipalities in four counties: Berks, Bucks, Lehigh, and Montgomery (USGS Streamstats, n.d.).

The Perkiomen creek and tributaries supply drinking water to a large community in the Perkiomen watershed and also serve as a habitat for diverse populations of fish and wildlife. This watershed is home to historical sites such as Valley Forge National Historical Park and Pennypacker Mills. It also has several parks and recreational areas including Green Lane Park, the Perkiomen Trail, and Evansburg State Park. The Perkiomen Watershed Conservancy, a nonprofit organization established in 1964, is continuously working to conserve and protect the natural resources of the Perkiomen Creek watershed, improve water quality, and educate the public about the importance of the watershed (Perkiomen Watershed Conservancy, n.d.). Formerly the Reading Railroad line, the Perkiomen Trail is a 20-mile-long multi-use trail that runs along Perkiomen Creek and through several local parks (Montgomery County, n.d.). This trail sees high foot and bicycle traffic, and with some sections of the trail situated in a floodplain, it frequently becomes inundated with water when the creek's water level rises.

Between 2020 and 2021, the Perkiomen Creek broke historic high record flooding levels on two occasions. The August 2020 and September 2021 floods were a result of heavy rain from hurricanes Isaias and Ida, with the most recent flood maxing out the USGS stream gauge with a higher than 20-foot crest and 70,000 cubic feet per second discharge (USGS, 2023). Although these aren't the first two occasions of flooding in the Perkiomen Creek watershed, these events caused extensive damage, destroying homes, roads, and habitat. Montgomery County, in which most of the watershed is situated, has seen a steady rise in population over the past 50 years. Since 2010, this population has grown by more than 60,000 residents (U.S. Census Bureau, n.d.). With more residents moving into the area than are leaving, both residential and commercial development has increased. This expansion in Montgomery and neighboring counties can be attributed to urban sprawl from Philadelphia. The Perkiomen watershed is facing issues such as water pollution from point/nonpoint source, flooding/erosion, and invasive vegetation and recovery actions need to be taken to restore the preexisting quality of the watershed.

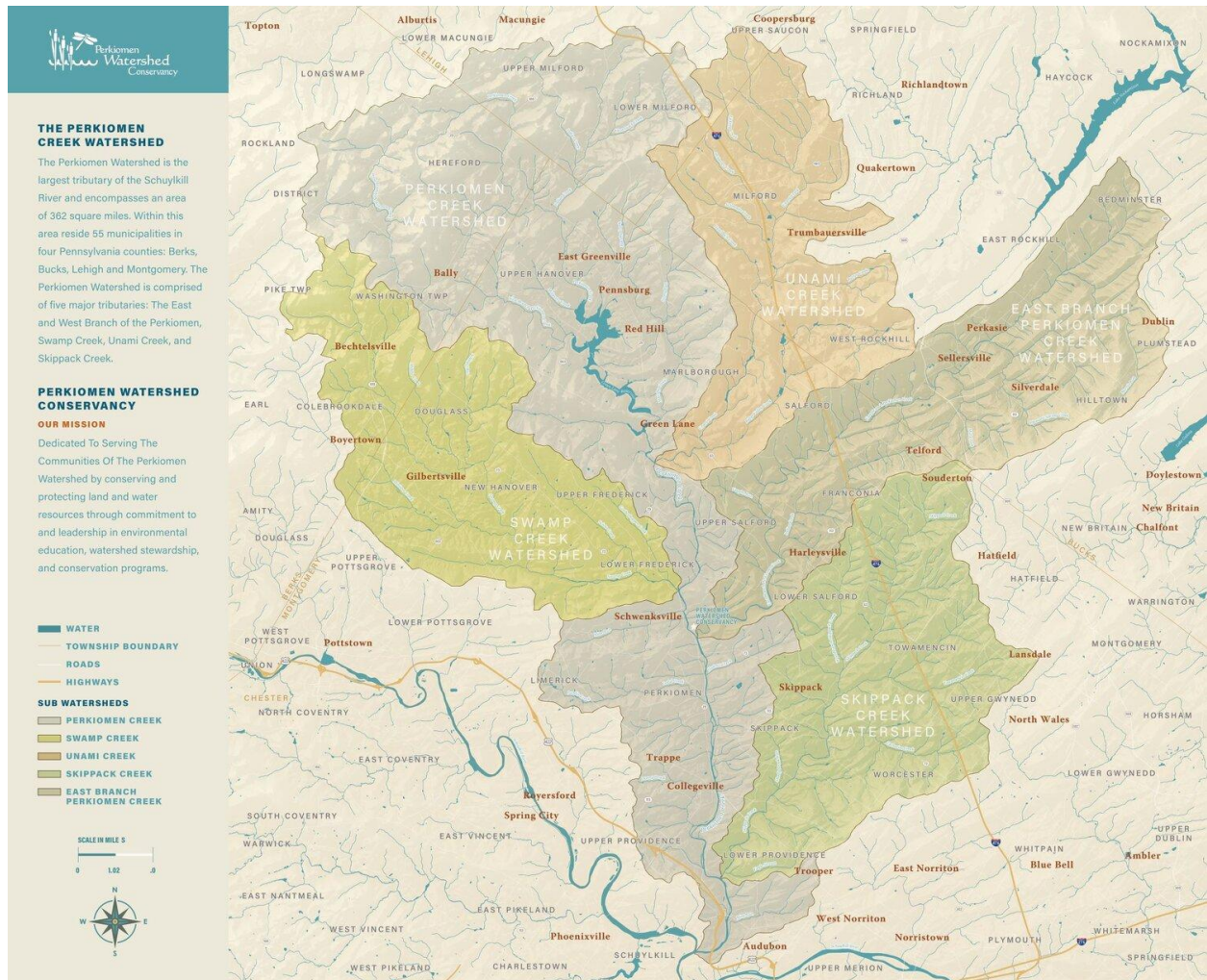


Figure 1. The Perkiomen Creek watershed (Perkiomen Watershed Conservancy, n.d.).

## Governing policies and mandates

The Perkiomen watershed provides drinking water, recreational opportunities, and is home to many aquatic and terrestrial species. In order to manage the issues that we identified in this watershed, several acts, policies, and mandates are required as mentioned below.

- 1. Clean Water Act:** It is a federal law that sets standards for concentrations of pollutant discharges into surface water and regulates the water quality. This provides the outline for regulating point source pollution that comes from point sources such as factories or treatment plants (U.S. EPA, 2022).
- 2. Nonpoint Source Program:** This program focuses on reducing nonpoint source pollution and is implemented by the Environmental protection Agency (EPA) and state

agencies. It provides funding and technical assistance for reducing nonpoint source pollution (U.S. EPA, n.d.).

- 3. Invasive Species Control Act:** This federal law establishes and regulates national programs to prevent the introduction and spread of invasive species, and provides funding for their control and prevention, as well as for research and education (US Fish & Wildlife, n.d.).
- 4. Flood Control Act:** This federal law authorizes the construction of flood control structures and facilitates the funding for their maintenance, sets standards for floodplain management, and requires people to adopt these regulations.
- 5. Soil and Water Conservation Act:** This federal law develops the national program for soil and water conservation, allocates funding for conservation projects, and provides technical support to farmers and landowners (USDA, n.d.).
- 6. Pennsylvania's Clean Streams Law:** This state law regulates water quality and point source pollutant discharges in the streams in Pennsylvania (PA Code & Bulletin, 2023).
- 7. Pennsylvania's Nutrient Management Act:** This state law controls nonpoint source pollution (nutrient pollution) that requires farmers to implement nutrient management plans to reduce nutrient runoff. It gives financial and technical assistance to farmers (USDA, n.d.).
- 8. Pennsylvania's Floodplain Management Act:** This state law sets standards for floodplain management and requires people to follow those regulations (PA General Assembly, n.d.).
- 9. Executive Order 13112:** This federal mandate requires federal agencies to develop plans to prevent the introduction and spread of invasive species (USDA, n.d.).
- 10. Watershed Protection and Flood Prevention Operations Program:** This federal program facilitates local communities with financial and technical resources for projects that aim to protect watersheds and prevent/control flooding (USDA, 2019).
- 11. Pennsylvania's Environmental Rights Amendment:** This amendment to Pennsylvania's constitution recognizes the rights of citizens to pure water, clean air, and preservation of natural resources, and requires state agencies to consider the environmental impacts of their projects/actions (Pennsylvania Land Trust Association, n.d.).

**Problem Matrix:**

Issue	Description	Recommendation
P1: Point and Nonpoint source water pollution	Presence of pesticides and fertilizers from nearby farms as well as chloride brought by road salt. Pollution from point sources, industries, and treatment plans, leaking of sewer pipes. Pollution brought by people as a result of touring/nearby land development.	Discourage off-season and excessive use of fertilizers and pesticides. Implement state and federal policies/standards strictly. Raise awareness programs about best management practices (BMPs). Collaborative action between federal and state authorities, and the local community.
P2: Invasive Vegetation	Reduction/compromising of native vegetation.	Plant more native vegetation, and protect existing native species. Control invasive vegetation growth.
P3: Flooding and erosion	Soil Type. Issues with agricultural practices. Low capacity stormwater waterways. Land development, and increase in impervious areas.	Floodplain and wetland development. Buffer areas and streambank protection. Green Infrastructure. Temporary structures to assist with runoff channeling.

**P1: Point and Nonpoint Source Water Pollution**

In the Greater Perkiomen Creek watershed a large portion of the area is developed for human use, with most of the land used for residential, commercial, or agricultural needs. This increase in impervious ground cover and agricultural land use has led to an increase in pollutants in the area compared to ideal natural levels. The combination of increased pollutants and no method to absorb them has led to a catastrophic rise in measured pollutants like nitrogen and chloride. These impervious surfaces include roads, sidewalks, driveways, and other concrete structures, and the increase in runoff arises from domesticated animals, such as outdoor pets like dogs and cats, but mostly from farm animals such as cattle, sheep, hogs, and chickens, among others. Stormwater runoff carries pollutants from agricultural or urban sources into the watershed, further impacting the water quality.

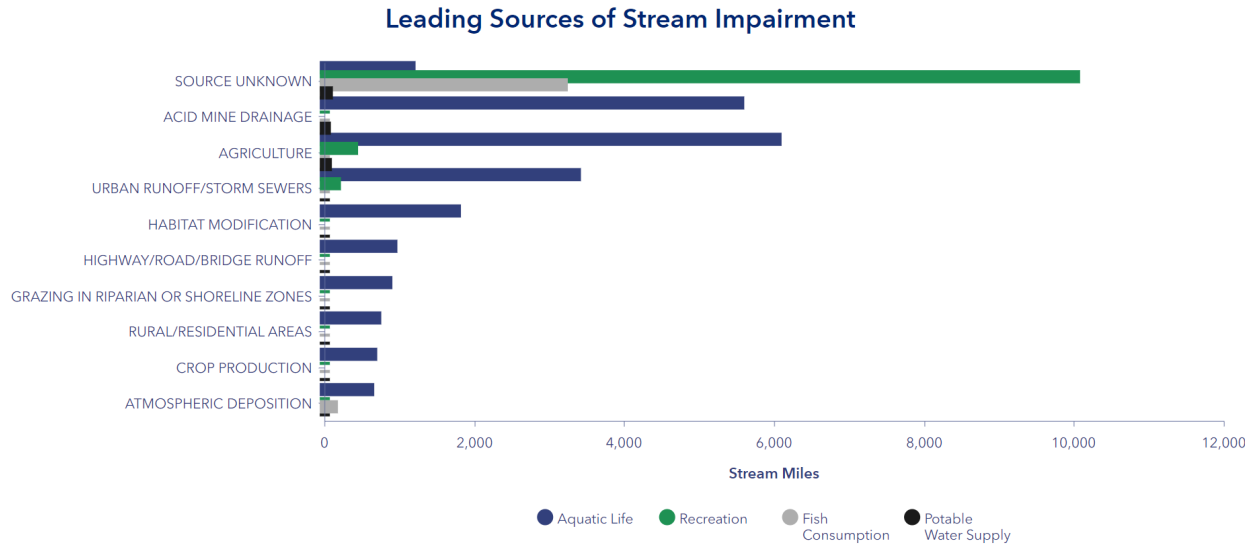


Figure 2. Leading sources of stream impairment across the state of Pennsylvania (PA DEP, 2022).

### **G1: Source and Transport Control of Pollutants**

We recommend identifying industry or treatment plants that are discharging pollutants not following the guidelines provided by the Environmental Protection Agency (EPA) and the Pennsylvania Department of Environmental Protection, and seeking solutions through dialogues, strict warnings, and/or penalties if no options are available. Similarly, we plan to organize local level awareness programs to encourage strict policy implementation for water quality maintenance, that should discourage people from nonseasonal and excessive use of fertilizers and pesticides in the farmlands and lawns. Promoting effective best management practices (BMP's) to reduce nonpoint source pollution and making them effective by identifying the concentrated area and prioritizing them more for regulation. Furthermore, delaying the transport of nutrients in rivers by maximizing green cover with respect to impervious areas, and maintaining buffer areas would help pollutants typically seen such as excess nitrogen, chloride, and other foreign elements will be absorbed by the vegetation or lost to the atmosphere, and filtered out of the ecosystem long before it reaches the creek. We also recommend keeping domesticated animals away from both natural and man made streams, to reduce the total amount of pollutants in the waterway. Under the Clean Water Act, the MS4 Program which is administered by the EPA, requires municipalities to obtain permits to discharge stormwater into local waterways. In order to obtain these permits municipalities must develop Stormwater Management Programs to reduce nutrient loading and other pollution runoff that would enter the waterways. Incentivizing and supporting programs, such as the MS4 program, would help municipalities meet permitting requirements and improve the health of the watershed.

### **P2: Invasive Vegetation**

The problems that arise as a result of invasive vegetation lead to a decrease in biodiversity as

well as populations of local organisms that have, for a long time, been the primary overseers of the watershed through natural processes. As more non-native, invasive species such as lesser celandine, spotted knapweed, Arthraxon grass, multiflora rose, purple loosestrife, crown vetch, Japanese hops, and Canada thistle arise in the area, native species diminish, which isn't healthy for the area as it disturbs the original ecosystem of the watershed (PA Code and Bulletin, 2023).

## **G2: Adopting Control Measures**

Our recommendation to combat the issues brought forth by invasive vegetation mentioned above would be to adopt an invasive species management plan including a combination of mechanical, biological, and chemical control techniques. Similarly, promoting the plantation of more native vegetation in restoration and landscaping would help reestablish the native species. Moreover, developing the best management practices for agricultural land, buffer zones, and floodplains by incorporating conservation efforts for native plants and controlling measures for invasive species. Organizing educational and outreach programs to raise awareness in the local community about the impacts of invasive species on the local ecosystem would encourage community people to develop better management efforts to control these invasive species. The Perkiomen Watershed Conservancy sets a successful example for education and outreach regarding invasive species, and continuing to support these efforts will be important to the health of the watershed.

## **P3: Flooding and Erosion**

Multiple flood events have been experienced in recent years in the Perkiomen watershed. Several reasons include urbanization, deforestation, extreme storm events, and climate change. Much of the area is used for human activities, which has led to an increase in impervious surfaces such as roads in the area, as well as urbanization around the area leaving fewer places for excess water to naturally flow to. This leaves most excess water to runoff thus creating lots of flooding and erosion as the waterways alone simply aren't big enough to handle such excesses. The erosion in the Perkiomen watershed is exacerbated by construction activities, agriculture, and stormwater runoff. Erosion can lead to several problems such as loss of valuable topsoil, sedimentation in waterways, and water pollution. If not mitigated properly, the flooding and erosion that occur regularly in this watershed could have detrimental effects on local as well as surrounding ecosystems. As a result of recent flooding, buildings and homes have been washed away or damaged beyond repair, garbage and other items were washed into the creek and deposited downstream in the watershed, and the related erosion left roads and trails crumbled. Along with the immediate visible damage, this flooding caused nutrient and pollution loading which will continue to impair the watershed over time.

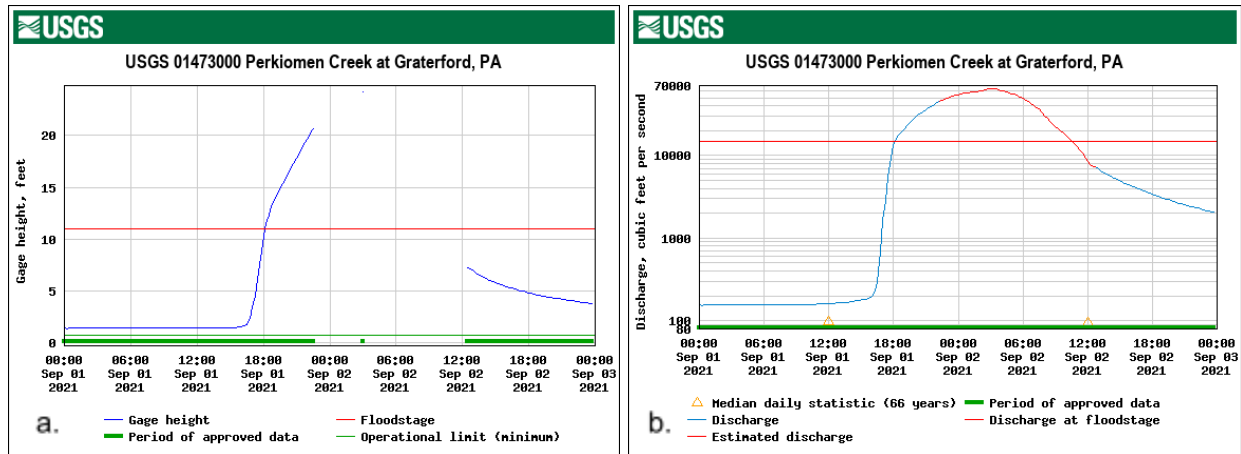


Figure 3. USGS Stream gauge during 2021 historic flooding of the Perkiomen Creek. Gauge height at Graterford station surpassing flood stage and exceeding the gauge (a) and discharge at Graterford station surpassing flood stage and cresting at 70,000 cubic feet per second (b) (USGS, 2023).

### G3: Green Infrastructure and Engineering Control Measures

We recommend adopting various approaches to mitigate flooding and erosion issues. Adopting green infrastructure practices such as green roofs, rain gardens, and permeable pavements help reduce flash flooding, at the same time, allowing groundwater recharge. Developing and implementing strict land use policies for managing stormwater and preventing land development in flood-prone areas, and developing best management plans for developing buffer areas with stream bank protection techniques will significantly help in controlling flooding as well as erosion issues. Bioengineering and/or floodwalls would also reduce erosion due to flooding, while (extra) floodplains and wetlands can be developed for excess flood runoff to solve the problem of downstream flooding. We also believe that adding temporary structures to assist with the channeling of runoff to the watershed would be beneficial in delaying/channelizing the flow of excess water. Most erosion is caused by stormwater runoff, thus, if flooding is mitigated erosion problems will be reduced significantly. Moreover, for erosion control, measures such as cover crops, reduced tillage, vegetative cover, mulching, and sediment fences can be implemented at the local level.

#### Economic Aspect

Developing and implementing these solutions should be ventured through economically efficient ways. Upfront costs, maintenance costs, opportunity costs, and regulatory costs for individual control measures should be estimated and compared against other options, as well as the value of potential loss if not mitigated in time. For instance, the loss of economic value due to the collapse of the fishing industry and treatment costs for drinking water may be compelling reasons to implement water pollution mitigation measures. Similarly, tangible and intangible benefits that these measures would yield in long run prevention of property loss and death due to flood mitigation measures, and reinstatement of a healthy ecosystem that would house native floras and faunas due to invasive species control measures. These should be assessed before selecting the optimal control measures for the aforementioned issues.



**Summary of Goals**

The water quality of the Perkiomen Creek watershed can be significantly enhanced by assessing the problems and their causes and developing tangible and optimal solutions. Proper coordination between stakeholders is essential for developing and implementing these solutions. Thus, federal government authorities should continue to work in partnership with state and local authorities, as well as local residents to raise awareness about problems and their consequences if they are not solved in time. Flooding and erosion can be mitigated by developing buffer areas, restoration floodplains, and stream bank protection with bioengineering or gabion walls. Similarly, maximizing semi-pervious/pervious areas and developing detention ponds and ditches can also be effective ways to mitigate flooding while allowing for groundwater recharge. The problem of water pollution can be mitigated through development and implementation of stricter policies for regulating point source discharges and promoting effective, result-oriented-reward based best management practices to control pollution from nonpoint sources such as agricultural lands. Planting more native plants, developing stricter conservation policies for existing native species, and limiting the growth of invasive species can be immediate efforts to be carried out, while enhancing the overall quality of the watershed will also help reinstate the prior native ecosystem. Since 2004, a segment of the Perkiomen Creek between Schwenksville and Oaks has been restored to support recreation and aquatic life (PA DEP, 2022). We plan to achieve supporting waters for aquatic life and/or recreation as defined by EPA and DEP standards for all tributaries in the watershed by 2040.

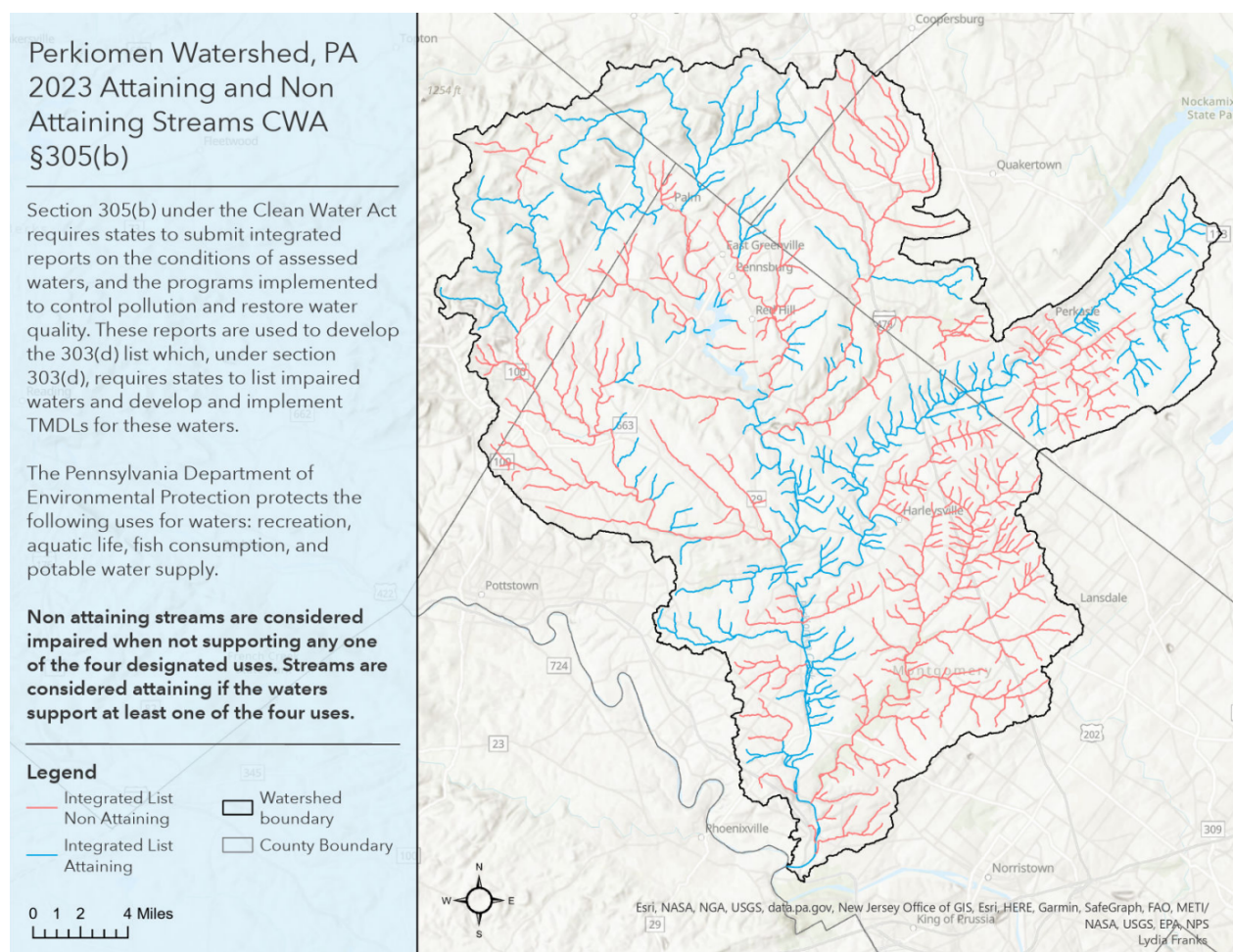


Figure 4. Status of streams in the Perkiomen Creek watershed as listed by the Pennsylvania Department of Environmental Protection. Attaining streams support at least one of four uses, while non attaining streams do not support any of the four uses outlined by the state DEP.

## Recommendations

To mitigate the issues identified above in the Perkiomen watershed, PRAM recommends effective collaborative action from its federal (EPA), state, and local stakeholders to develop necessary plans to solve these issues in accordance with previously mentioned regulations and mandates. Some possible recommended solutions for each of the identified problems in this report are provided below.

For invasive species control:

- Develop proper landscaping plans and floodplain development plans promoting native species.
- Identify and control invasive species by mechanical, chemical, and biological measures.

For flooding and erosion control

- Develop state-level plans and policies championing green infrastructure

- Adopt engineering /bioengineering measures for developing buffer areas and streambank protection
- Develop wetlands and restoration flood plains
- Promote vegetation cover/crop cover, tillages, and sediment fences for sediment loss from agricultural lands.

For nonpoint/point source pollution control

- Develop a focused plan in collaboration with EPA, State, and local authorities to strictly maintain point source discharge within numerical standards.
- Incentivise local farmers/landowners for nonpoint source pollution reduction based on the effectiveness of their best management plans
- Organize educational and outreach programs to raise awareness for water quality degradation, their consequences, and stakeholder's responsibility to mitigate it.

### **Conclusion**

The Perkiomen Creek watershed is facing many challenges, not limited to stormwater and agricultural runoff, flooding, invasive vegetation, and erosion. Devastated by the flooding in 2020 and 2021, the impact is still felt as the community continues to rebuild and restore. The community has since called for better stormwater management, which among other measures we have recommended here. The Perkiomen Watershed Conservancy is a model organization which supports communities within the watershed through outreach and education. It offers programs such as the MS4 Program to help municipalities meet permit requirements under the Clean Water Act, it leads ongoing projects such as the Native Plant Project, Plant-A-Thon, and European Water Chestnut Removal to combat invasive vegetation, it offers educational opportunities for all ages, as well as opportunities to help cleanup trash from the watershed (Perkiomen Watershed Conservancy, n.d.). Continuing to implement programs such as those offered by PWC will help reach the goals outlined above.

Mitigating point and nonpoint source pollution, invasive vegetation, and flooding and erosion will restore the watershed to clearer and cleaner waters, which will in turn accommodate and encourage more native biodiversity. Segments of streams within the watershed are continually being improved enough to support recreation or aquatic life, with the recommendations outlined in this report we plan to have all tributaries within the watershed delisted as impaired, and instead classified as supporting at least aquatic life or recreation by 2040.

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