Potomac River Optimization for Total Environmental Conservation and Treatment (PROTECT)

Group 4:

Caroline Gilliard, Eli Manning, Katie Brennan, Callianne Mckeon, Brynn Lynch, Sean Breslin



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Mission Statement

The overall mission of PROTECT is to improve the quality of the Middle Potomac River Watershed where it has been impacted by urbanization in the District of Columbia (D.C.) and Virginia. By addressing runoff, legacy pollution, and ecosystem health, we hope to make the United State's Capitol's drinking water source safe for all by the year 2050.

Background

The Potomac River is the Chesapeake Bay's second-largest tributary. The entire watershed is 14,670 square miles, flowing through the Potomac Highlands in West Virginia to Chesapeake Bay in Maryland. The Middle Potomac is approximately 3,450 square miles and is located in the Piedmont region, extending into parts of Pennsylvania, Maryland, Virginia, and all of Washington DC. The Middle Potomac flows almost past Washington DC and meets the Chesapeake Bay near Point Lookout, Maryland. No significant negative ecological impacts caused by human alterations to flow in streams and small rivers throughout The Middle Potomac. Major concerns facing The Little Potomac River include water pollution from urban runoff, agricultural activities, and industrial discharge. (Eco Health Report Card, 2025)

The Potomac River Basin's land uses vary throughout the watershed, as the Upper Potomac is composed primarily of deciduous forest while the Middle Potomac is more diverse with a mix of urbanized, medium-developed land, agricultural land, and deciduous forest. Urban area comprises 49% of the Middle Potomac, agricultural lands make up 24%, and deciduous forests composes 13% of the watershed. Despite a large portion of this watershed being of impervious area, the watershed successfully produces a variety of crops like corn, soybeans, tobacco, and wheat. (DNR, 2013)

The watershed has both historical and ecological importance. The river's name is derived from the Algonquian village, Patowmeck, and the river has served as a transportation route for communities as well as a drinking water source since the opening of the Washington Aqueduct in 1864. The watershed is also home to diverse ecosystems with various aquatic life and aquatic vegetation. For instance, the Potomac River is famous for its Marland fisheries which is located within the Middle Potomac. (Boundary Stones, 2020)

Some of the challenges this watershed has faced and continues to face mainly involve water quality issues from both industrial and urban runoff, as well as agricultural fertilizer pollutants. Climate change is another added stress on the watershed, as the health of ecosystems diminishes and water temperatures rise. Lastly, the increase in development and urbanization within the Middle Potomac has led to an increase in surface water and groundwater withdrawals with implications such as wetland and



habitat degradation, and potential water use conflicts. (Homewater, 2023)

Relevant Policies and Mandates

In early 2024, the Potomac Conservancy advocated to the Maryland and Virginia governments for important laws to protect and restore the health of the Potomac River. Conservation bills often lead to leaders uniting on both sides because clean water is a top priority for everyone. Policy change at the local and state levels is an important part of clean water because the Potomac is only as healthy as the lands that surround it. The Potomac Conservancy's movement urges leaders to pass bipartisan land-use legislation that strengthens the natural defense against pollution and climate impacts. The following recent laws impact the Potomac River.

The Clean Water Justice Act restores important rights that were lost under the Supreme Court's decision in Sackett vs. EPA. The decision dramatically reduced the scope of the federal Clean Water Act jurisdiction. This left countless wetlands and streams to the states to protect. The act restores judicial rights to the public at the state level in Maryland. It also makes it easier for private citizens to sue in Maryland Court to stop illegal pollution or compel a state agency to act. This bill passed into law on May 9, 2024.

The Whole Watershed Act creates a pilot program to improve polluted streams across the state through comprehensive investments and conservation efforts. The bill was built off a Pennsylvania partnership model designed to rapidly delist waterways on the EPA's impaired water list. It also creates a licensing program for waterway restoration practitioners. The act will improve and restore severely degraded ecosystems in Maryland. The passed the same day as the Clean Water Justice Act.

The Great Outdoors Act is a \$200 million request that prioritizes investments in outdoor recreation. This guarantees significant resources are allocated to reinforcing the protection of outdoor recreation offerings, creating new returns on investment that should benefit both the environment and the economy. This, however, is still a bill and has not yet passed in the state of Virginia.

The Wetlands Protection Strategy Work Group Legislation funds an important study of Virginia's wetland protection policies and practices, and finds ways to make them more effective. Virginia's wetlands serve as natural sponges that absorb excess rainwater, reduce pollution, and keep the waterways and wildlife healthy. Greater wetlands protection is called for by experts because they are an effective natural defense against flooding caused by rising waters and high-impact storms. This passed in February 2024.

Problems

Problem	Description	Causes
Runoff	Runoff from the roads has	Area around the potomac is
	increased the amount of salt in	covered mostly by pavement.
	the river about 230% over the	Agricultural runoff into the
	last 30 years. Along with salt the	potomac that carries sediments
	potomac faces an increase in	and nutrients.
	nitrogen and phosphorus runoff.	
Legacy Pollution	Pollution from previous	These chemicals were used in
	industrial activities is still	previous industries. PCBs were
	impacting the Potomac River:	used to make electronics,
	chemicals such as PCBs and	plastics, and paints. PFAS is a
	PFAS. These chemicals last a	chemical used to make products
	long time and are hard to	that resist water, oil, and heat.
	remove naturally.	Both of these chemicals have a
		long lifespan
Ecosystem Health	Habitat loss, specifically the	Degraded water quality from
	decline of submerged aquatic	sediment pollution and increased
	vegetation and forest buffers,	runoff have caused habitats to be
	has caused a deterioration in	disrupted. The growth and
	overall ecosystem health and	resilience of underwater grass is
	resilience.	slow, meaning that aquatic
		wildlife is unable to thrive.

Problem 1: Runoff into the Potomac

Since the area surrounding the Potomac River has large amounts of impervious area, runoff into the river is more frequent, carrying pollutants into this waterway. Due to the river flowing through highly-populated, urban areas, the pavement is necessary for this built environment, but this leads to pollutants like sediments and nutrients (mainly in the form of nitrogen and phosphorus) washing into the river. These pollutants cause algal blooms which harm water quality, deplete oxygen that the aquatic life rely on, and make the river less safe to swim in. Another large pollutant the potomac faces is salt that is used for de-icing the roads in and around the city. This runoff contributes poorly to the rise in chlorine and sodium levels of the river negatively impacting drinking water quality along with aquatic ecosystem life.

Goal 1: Decreasing Runoff into the Potomac

Our first goal is to significantly reduce runoff pollutants entering the Potomac river through stormwater management, green infrastructure, and public education outreach about reduction of nutrient, sediment, and salt pollution. By implementing rain gardens, bio-retention areas, and permeable pavements we can help reduce the amount of runoff and filter pollutants before they enter the river. We can encourage local businesses and residents to reduce fertilizers and pesticide use, and promote less harmful de-icing materials and better management techniques to minimize salt pollution. Pollutant levels can be monitored at points along the river to track the progress of decreasing runoff into the Potomac.

Problem 2: Legacy Pollutants

The surrounding area of the Potomac used to be a hub of industries that manufactured many goods. Pre-1979, many goods such as electronics, paints, and plastics, were made usings PCBs. These chemicals are linked to birth defects and cancer, and over 1.5 billion tons of these chemicals were produced before they were banned in 1979. However, these chemicals can last for decades and are continuing to impact human and marine life in the Potomac.

PFAs is another legacy chemical that is still impacting the Potomac. This chemical is used to make water, heat, and oil resistant products. PFAs are linked to negatively impacting reproductive, immune, and liver systems in both humans and animals, and these chemicals have a lifespan of centuries in the environment. While PFAs are still legal, they are now heavily regulated by the EPA.

Goal 2: Legislation and Sediment Covering

Our goal for removing legacy pollutants would be to implement policies that continue to limit these chemicals along with practicing sediment covering. While PCBs have been banned

since 1979, PFAs are still used in some products. An outright ban or continued regulation would decrease the amount of these chemicals in the water, which would make the river less polluted over time. To quickly clean the river of both of these chemical pollutants, sediment covering could be implemented. In this strategy, clean sediment would be brought in and dumped in highly polluted areas of the river, burying these chemicals under several layers of soil. This process would not get rid of these chemicals, but would trap them under several layers of sediment, leaving them unexposed to the marine life above. This would allow marine life to come back to the river and thrive in an unpolluted environment.

Problem 3: Ecosystem Health

Submerged aquatic vegetation, or underwater grasses, host a variety of aquatic life and produce large amounts of dissolved oxygen. These factors support the fact that underwater grasses are a critical part of the Potomac River ecosystem, in terms of both habitats and the respiration of aquatic life. High amounts of sediments and poor water quality have caused a decline in the population of these grasses (ICPRB, 2022).

Though there has been a decrease in this aquatic vegetation from 2005 to 2017, recent legislation and increased conservation efforts have allowed for growth of the underwater grasses. The percent of vegetation that has met quality indicators increased from 35% in 2018 to 42% in 2021 (Potomac Conservancy, 2023). Although this upward trend is productive, the rate of aquatic vegetation expansion is not large enough for the Potomac River to reach an acreage of grasses able to sustain the aquatic ecosystem populations for the foreseeable future.

Goal 3: Habitat Restoration and Monitoring

By identifying areas of the Potomac that had previously supported underwater grasses, efforts to reseed/plant these shallow and nutrient-rich areas could be successful. Monitoring of these areas to determine the best practices for aquatic vegetation planting through remote sensing or on-site assessments would be ideal. All of the information learned from monitoring the test sites can be implemented into further habitat restoration in other areas of the Potomac. This large-scale restoration would also benefit from the collaboration of multiple groups, such as the community, educational programs, conservation groups, and the local government. Political and educational awareness of this project would provide both funding and support, allowing for the continued growth of these restoration efforts and improved Potomac ecosystem health.

Recommendations

To reduce polluted runoff into the Middle Potomac Watershed, PROTECT DC recommends the following:

- Expand the usage of green infrastructure in urban areas
- Raise community awareness of the impact of fertilizers, pesticides, and road salt on water quality
- Establish monitoring locations along the river to measure the impacts of these pollution reduction efforts

To address legacy pollutants, PROTECT DC recommends the following:

- Implement and support environmental legislation to regulate PFAs, PCBs, and other substances that pose a risk to water quality and wildlife
- Advocate for stricter limits on legacy contaminants in waterways and further research on the long-lasting effects of these chemicals
- Attempt the strategy of sediment covering to trap legacy pollutants in contaminated areas of the river

To restore aquatic ecosystems, PROTECT DC recommends the following:

- Reintroduce submerged aquatic vegetation in shallow areas of the river with suitable growing conditions
- Utilize spatial imaging and site reconnaissance to identify the most successful locations for future restoration
- Promote public involvement and education to generate continued support for the recovery of the Middle Potomac watershed and its ecosystems.

The implementation of the above recommendations will improve the quality of the Middle Potomac River Watershed and make the District of Columbia's drinking water source safe by the year 2050, accomplishing the mission of this watershed restoration project.

Conclusion

Overall, improving the overall health of the Middle Potomac Watershed is vital for the future health of the humans and ecosystems of the United States' Capital. The challenges and solutions outlined in this report represent only the beginning of a broader conservation effort. The proximity of this watershed to Washington DC highlights that it is an integral part of a larger, interconnected system that must be protected, hence the name PROTECT. Achieving lasting impact will require sustained collaboration between local and federal agencies, as well as active participation from community members. Through the PROTECT initiative, we have a clear path forward towards tackling runoff, legacy pollution, and ecosystem damages. A cleaner Potomac is possible!

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