Delaware River Watershed Initiative

Ensuring abundant clean water through the protection of healthy forested watersheds

The Delaware River Watershed Initiative is a broad partnership of nongovernmental organizations that share the goal of ensuring abundant clean water through conservation of targeted watersheds within the 13,000-square-mile drainage of the Delaware River. As part of this initiative, the Open Space Institute (OSI) administers the Delaware River Watershed Land Protection Fund with a $9 million grant from the William Penn Foundation.

This document summarizes OSI's approach to evaluating sites for permanent protection of water resources based on a literature review, expert opinion, and stakeholder input. The approach was developed to evaluate project proposals submitted to the Delaware River Watershed Land Protection Fund. We use three steps to assess projects:

1. **Watershed context screen:** Target healthy watersheds with the ability to produce clean and abundant water for conservation.
2. **Site resource evaluation:** Protect sites that contribute to the production of high-quality surface water and/or recharge of ground water stores.
3. **Site vulnerability evaluation:** Protect sites whose conversion from forest cover is likely to cause sedimentation or ground water pollution.

Further details about the process and data sets used are provided in OSI's Data Documentation Report, available at the OSI website: www.osiny.org.

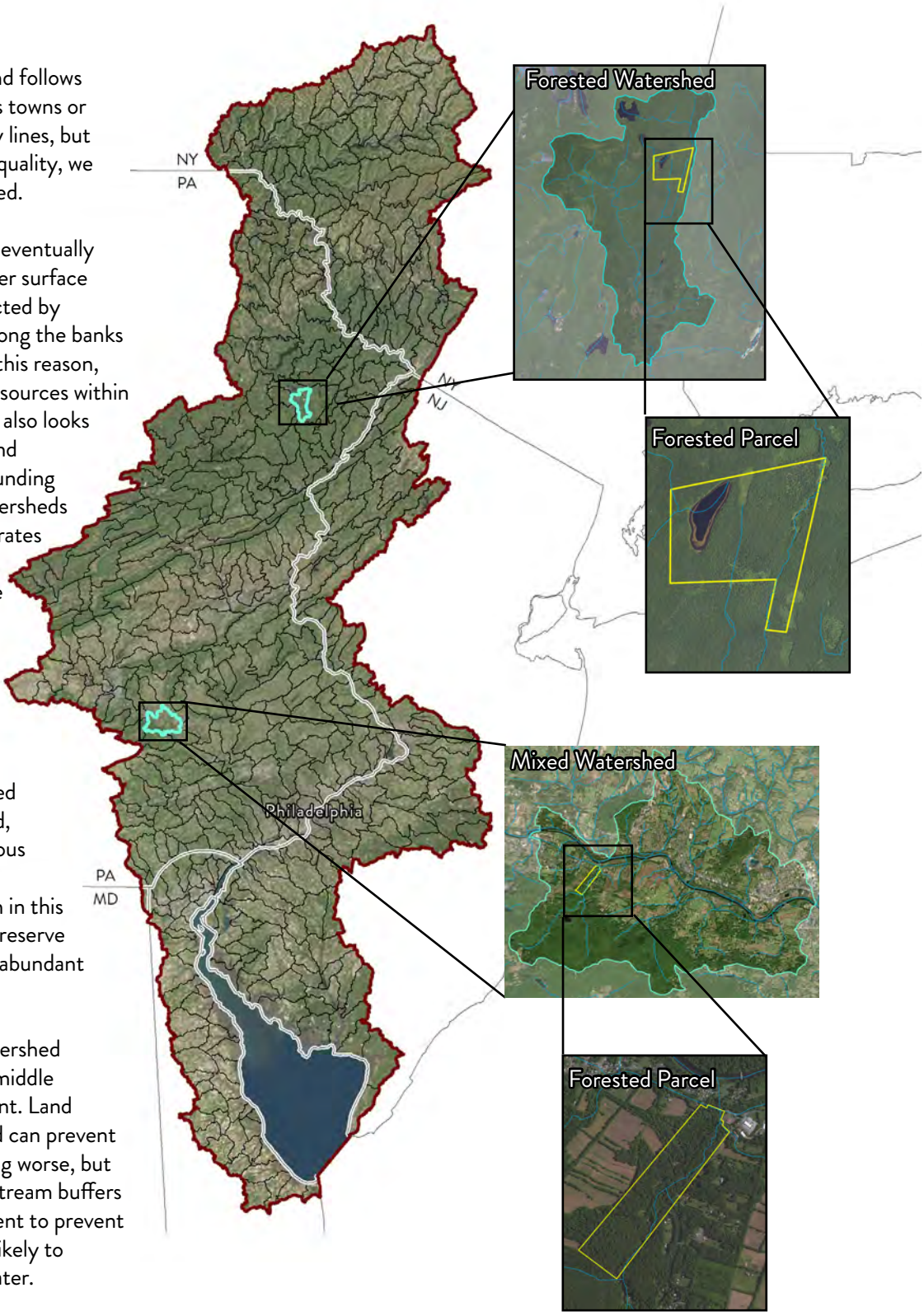
Developing Conservation Priorities:
Thinking Like a Watershed

Protection of a parcel of land follows artificial boundaries, such as towns or counties or private property lines, but when thinking about water quality, we have to think like a watershed.

Water flows. Ground water eventually cycles into streams and other surface water, whose quality is affected by whatever land uses occur along the banks of these watercourses. For this reason, OSI not only reviews the resources within a proposed project area but also looks carefully at the resources and characteristics of the surrounding watershed. OSI targets watersheds that are intact and concentrates its investments in those where land protection alone can realistically protect the water values.

Consider the forested parcel in the headwaters of the watershed shown at upper right. The watershed comprises mostly forestland, with few farms and impervious surfaces, such as highways. Focusing on land protection in this watershed is very likely to preserve its ability to produce clean, abundant water.

On the other hand, the watershed on the lower right is in the middle of farmland and development. Land protection in this watershed can prevent water quality from becoming worse, but without restoration of the stream buffers and careful farm management to prevent runoff, the watershed is unlikely to produce clean, abundant water.



1: Watershed Context

In the first step, we evaluated the 426 HUC 12 watersheds in the Delaware Basin for their ability to produce clean, abundant water. Watershed ratings were calculated based on scores of 1 through 5 for each of the seven attributes listed in the table to the right.

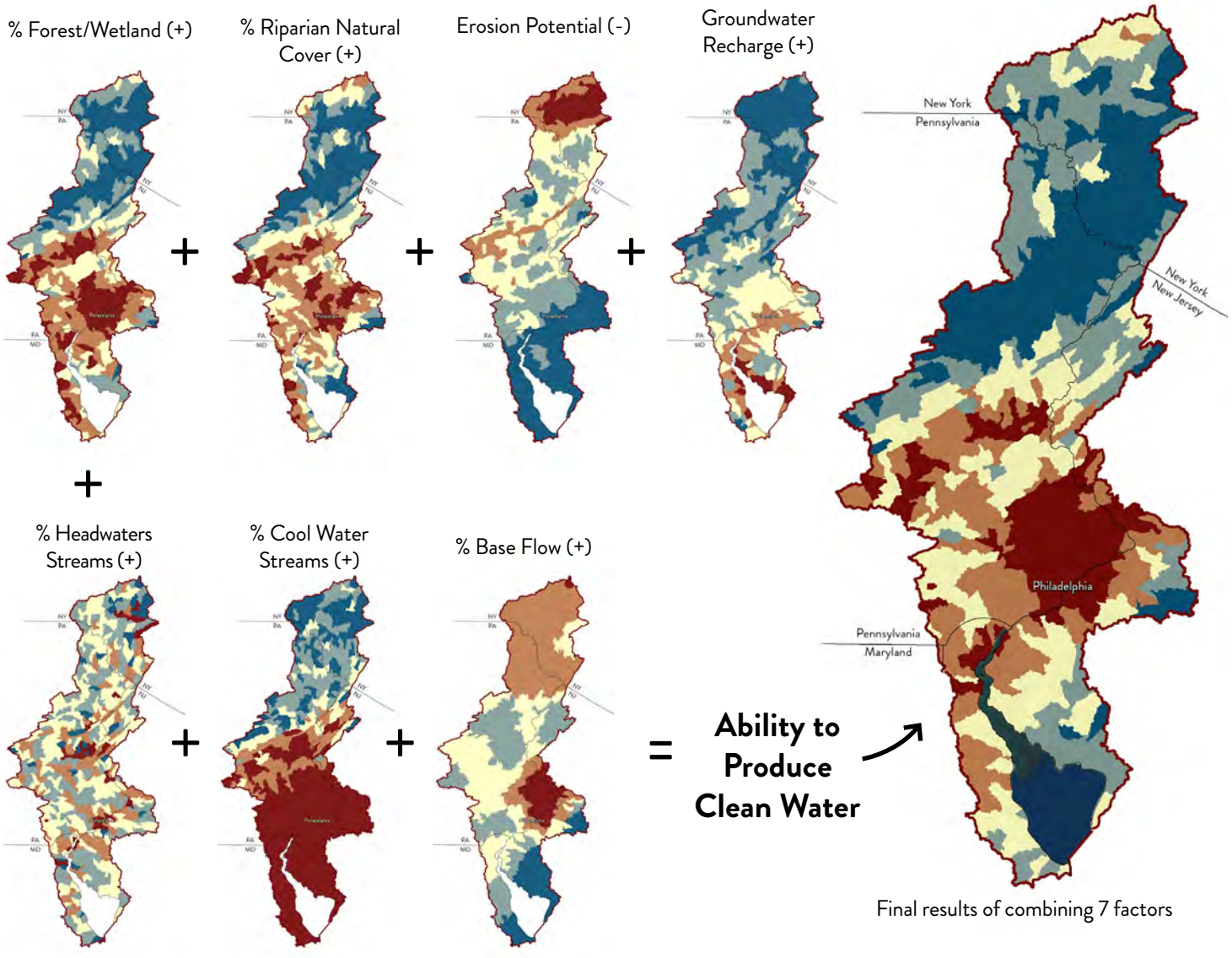
Each factor contributes to surface water and ground water quality. Together, they help us understand how healthy and how intact the watershed is. Watersheds with scores of 5 and 4 are places where land protection can effectively conserve water quality. Watersheds with lower scores may be appropriate locations for a combination of restoration and land protection.

A Three-Step Approach

Evaluating a land protection project for its contribution to water resource conservation involves the following three steps.

7 Factors Necessary for Clean Water

	Very High (5)	High (4)	Medium (3)	Low (2)	Very Low (1)
% Forest/Wetland	> 82	65 – 82	46 – 65	28 – 46	< 28
% Riparian Natural Cover	> 84	70 - 84	54 - 70	37-54	< 37
Erosion Potential	< 106	106 - 149	149 - 197	197 - 268	> 268
GW Recharge (inch/year)	> 17.5	15.7 - 17.5	13.5 - 15.7	10.2 - 13.5	< 10.2
% Headwaters Streams	> 76	62 - 76	49 - 62	29 - 49	< 29
% Cool Water Streams	> 85	62 - 85	38 - 62	13-38	< 13
% Base Flow	> 60	53 - 60	47 - 53	39 - 47	< 39



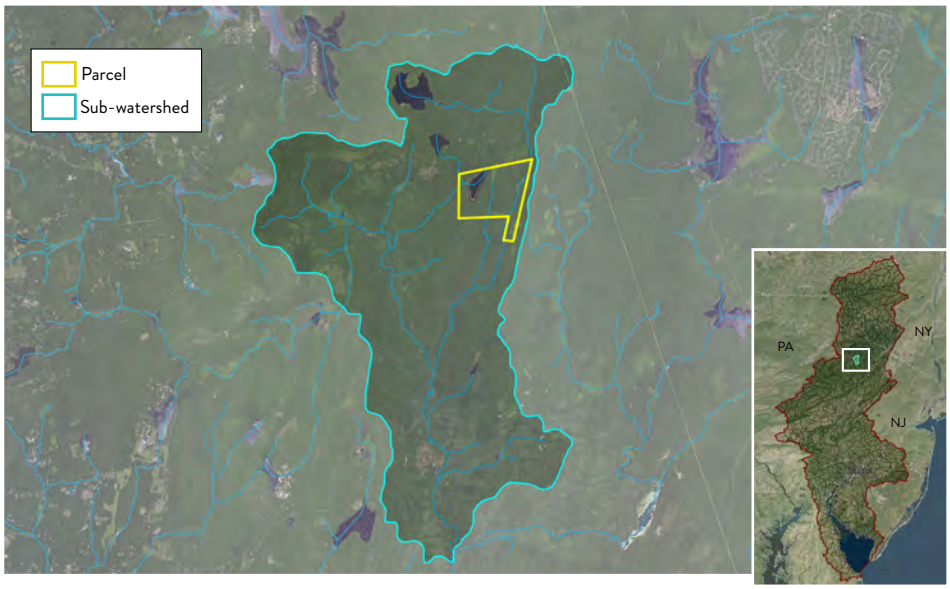
Final results of combining 7 factors

2: Site Resources

The second step is evaluating the resources at the site where land protection is planned. Site resources that influence water quality include: forest cover; location relative to headwaters; protection of the "active river area," or dynamic stream buffer; and recharge capacity. OSI developed data sets to evaluate a potential project area's ability to produce clean surface water and ground water, as described and illustrated below.

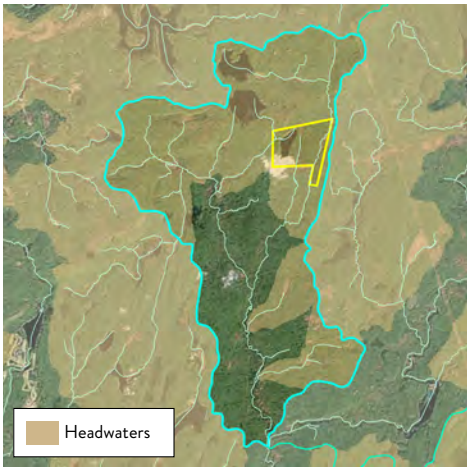
Forest Cover

OSI looks for land protection projects with 90% of the area in natural cover, such as forest, wetland, or open water. Forests and the complex soil structure they create are the best natural water-filtration system. The Center for Watershed Protection has found that freshwater species abundance and diversity begin to decline when 10% of a watershed is covered by impervious surface. Other research has shown reduced trout reproduction where impervious surface covers as little as 3% of a watershed.



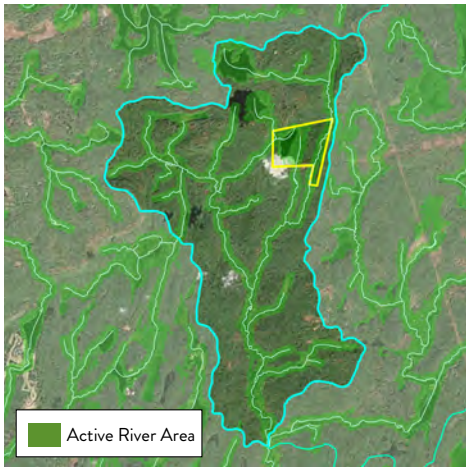
Area of proposed land protection project in watershed. Inset: Project area within Delaware River watershed.

Headwaters



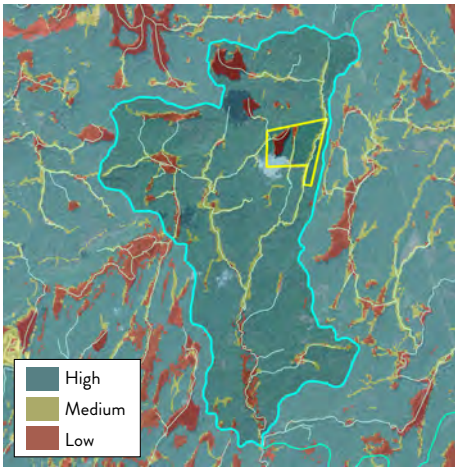
Research shows that the headwaters of streams provide 70% of stream flow to third-order (smaller) streams and 55% of stream flow to fourth- and fifth-order (larger) streams. Headwaters also establish the chemical "signature" of water downstream. We developed a map of headwaters based on the catchment of first-order streams using the 1:100,000 scale National Hydrological Dataset.

Streams and Active River Area



A forested stream buffer of sufficient width slows water flow and therefore allows suspended sediment to settle. OSI used an active river area (ARA) data set created by The Nature Conservancy to identify the dynamic region influenced by water flow, including in-stream wetlands and floodplains. Wetlands greatly reduce the nutrient and sediment loads of streams, thereby making the water cleaner, and also calm water pulses that cause downstream erosion.

Recharge

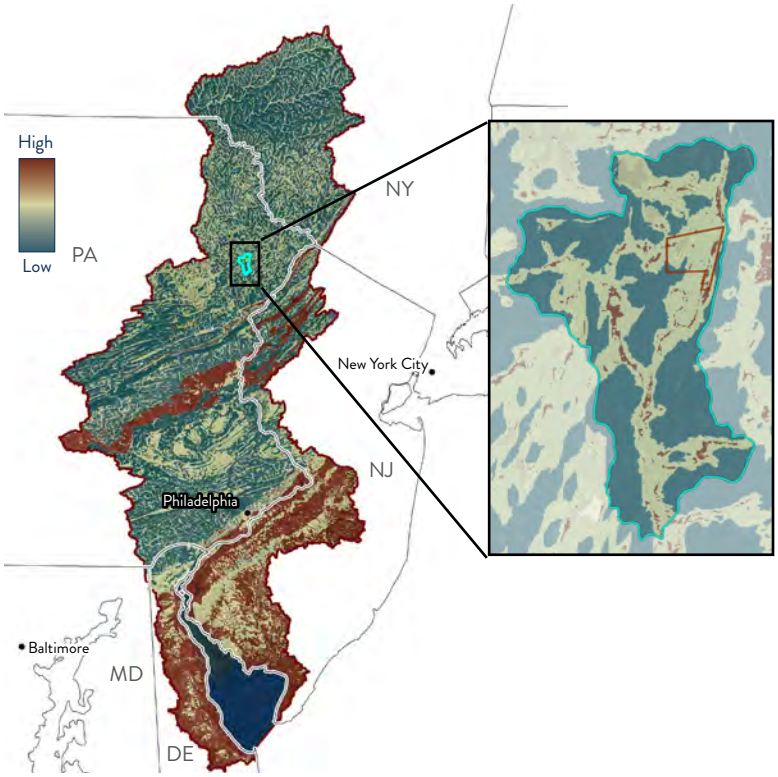


Recharge measures the ability of the site to absorb water for replenishing ground water storage. Ground water storage in turn determines surface water flow in times of drought. Water quantity has a dramatic effect on the concentration of pollutants. A site's ability to absorb water depends on land-use cover, slope, geology, and soil type. We derived site-based recharge capacity scores based on these factors across the basin and divided scores into high, medium and low.

3: Vulnerability Analysis

In the third step, we evaluate the potential impacts to surface and ground water if a site were not protected. Development impairs water quality more on sites with steep slopes and erodible soils or porous soils that allow pollutants to reach ground water.

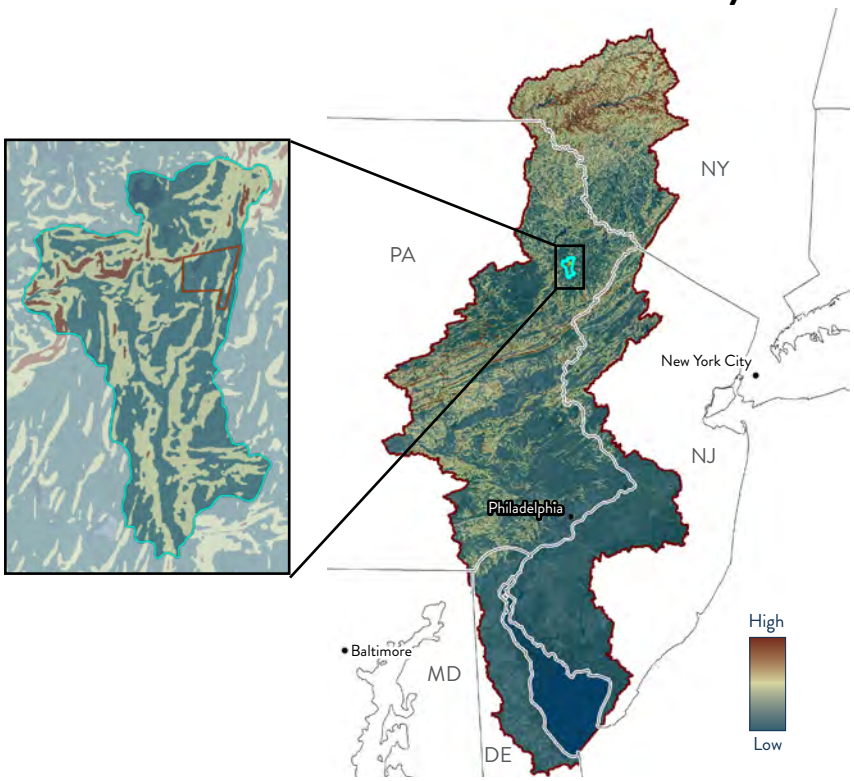
Ground water vulnerability



The vulnerability of ground water can be assessed based on the ability of pollutants to filter into the underlying aquifer. We use the DRASTIC model, developed by the U.S. Environmental Protection Agency. The model evaluates an area of land for the following factors: depth to ground water (D), aquifer recharge (R), aquifer media (A), soil media (S), topography (T), impact of the vadose zone (I) and hydraulic conductivity (C). We seek to protect land at greatest risk of ground water pollution if a site were converted to another land use, such as agriculture or development.

Surface water vulnerability

Areas likely to erode because of steep slopes and soil characteristics produce more sediment than flatter land with less erodible soils. This sediment, in turn, decreases water quality. We developed a data layer combining slope and soils information to assess the relative erodibility of land across the Delaware River Basin. We then use these data to identify whether projects are in places where water quality is more vulnerable to development. Our goal is to protect these areas to avoid future increases in erosion due to changes in land use.



Watershed Cluster Selection

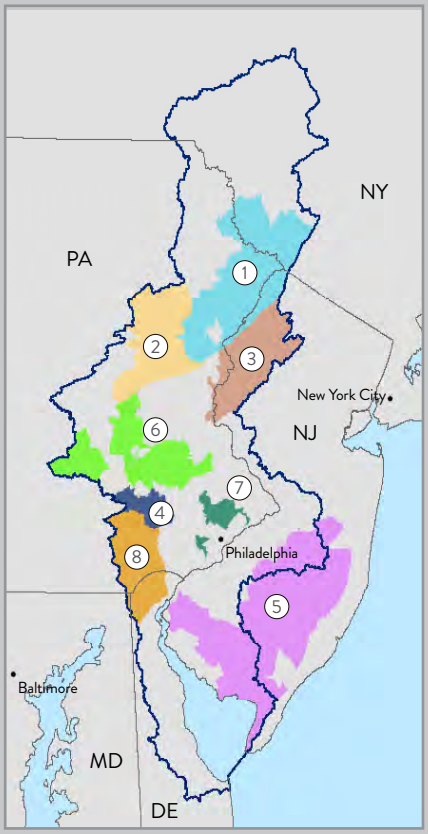
The Delaware River basin comprises more than 400 smaller watersheds that drain into streams that eventually feed into the Delaware River. Based on an analysis by OSI and the Academy of Natural Sciences, the William Penn Foundation selected clusters of these small watersheds to concentrate investment in places where there was sufficient organizational capacity, financial leverage for OSI's Fund and a sister fund focused on restoration, and an urgency to protect land based on likelihood of future development. The eight watershed clusters selected for investment are highlighted in color on the map to the right. Five of the clusters are eligible for funding for land protection:

1. Poconos-Kittatinny
2. Upper Lehigh
3. New Jersey Highlands
4. Schuylkill Highlands
5. Kirkwood-Cohansey Aquifer

Three other watershed clusters are eligible for funding for farmland restoration or storm water management:

6. Middle Schuylkill
7. Upstream Suburban Philadelphia
8. Brandywine-Christina

All proposals submitted to OSI's Fund must be located in one of these clusters and will be evaluated in terms of watershed context, site resources, and site vulnerability.



Resources

If you wish to learn more about OSI's Delaware River Watershed Initiative, or to apply for a grant, visit:
www.osiny.org/DelawareWatershed

Resources for further reading are listed below. To access live links, see the pdf version of this document.

Natural Infrastructure: Investing in Forested Landscapes for Source Water Protection in the United States report
(Conservation Priority Index, pp. 37-39)
World Resources Institute: www.wri.org

Sensitive Water Resource Open Space Criteria
New Jersey Water Supply Authority: www.raritanbasin.org

SmartConservation — Ecological Value Factors
Natural Lands Trust: www.natlands.org

Forest to Faucet project
USDA Forest Service: www.fs.fed.us

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