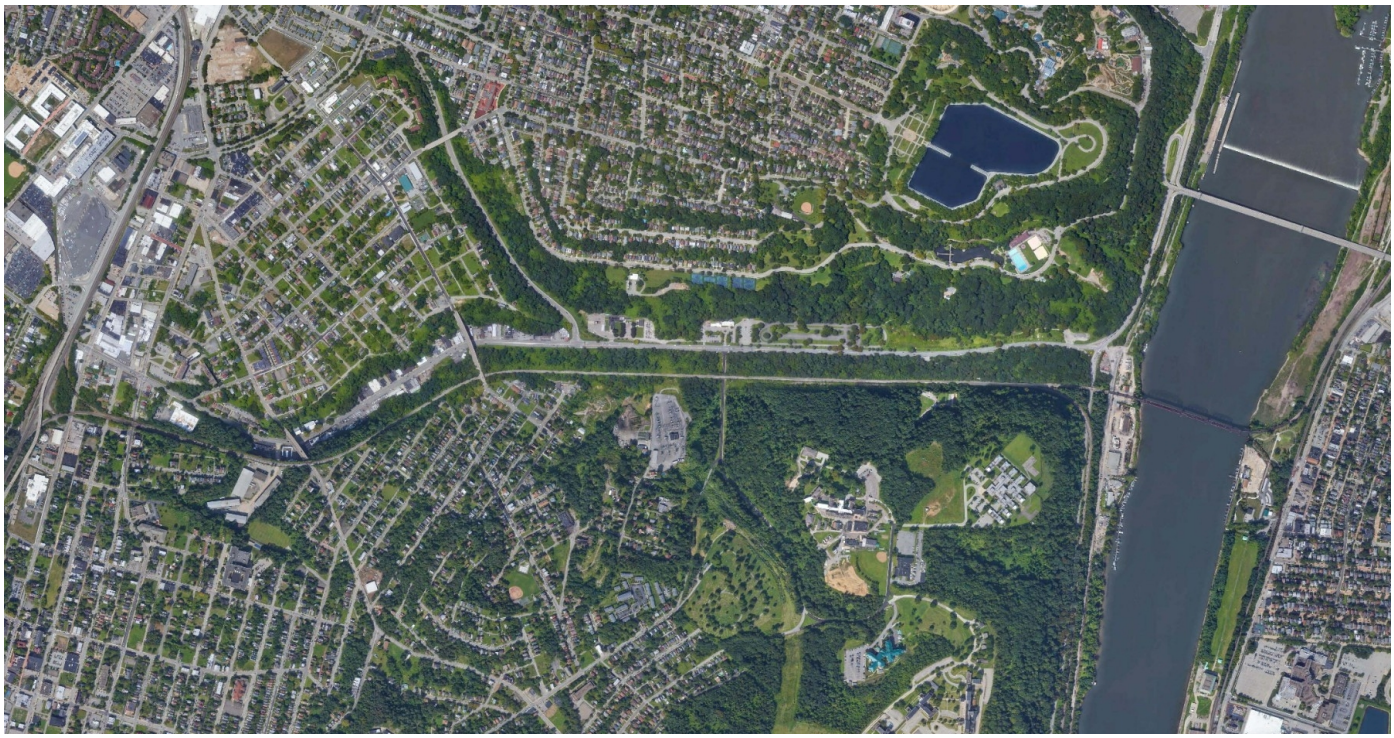


Valuing the Resilience Benefits of Green Infrastructure in Pittsburgh

Urban stormwater management is a growing challenge in many cities across the United States. Continued population growth and urbanization, coupled with inadequate investment in old and undersized storm and wastewater infrastructure, have left many cities exposed to stormwater flooding, sewer overflows, and reduced water quality.

Climate change is expected to add to this challenge by increasing the intensity or volume of rainfall from storms. In addition, there is a growing acknowledgement that these vulnerabilities are also environmental justice and equity challenges, as stormwater flooding and other negative outcomes can disproportionately affect low-income or majority-minority neighborhoods.

In recent years, there has been a substantial push towards investing in green stormwater infrastructure or other innovations that could improve water quality and/or reduce flooding while also providing new green space or other community amenities. However, most cities lack the necessary tools or research capacity to rigorously evaluate or compare these new design approaches across multiple objectives or in different plausible future scenarios, such as wetter or drier futures.

A Focus on Key Pittsburgh Watersheds

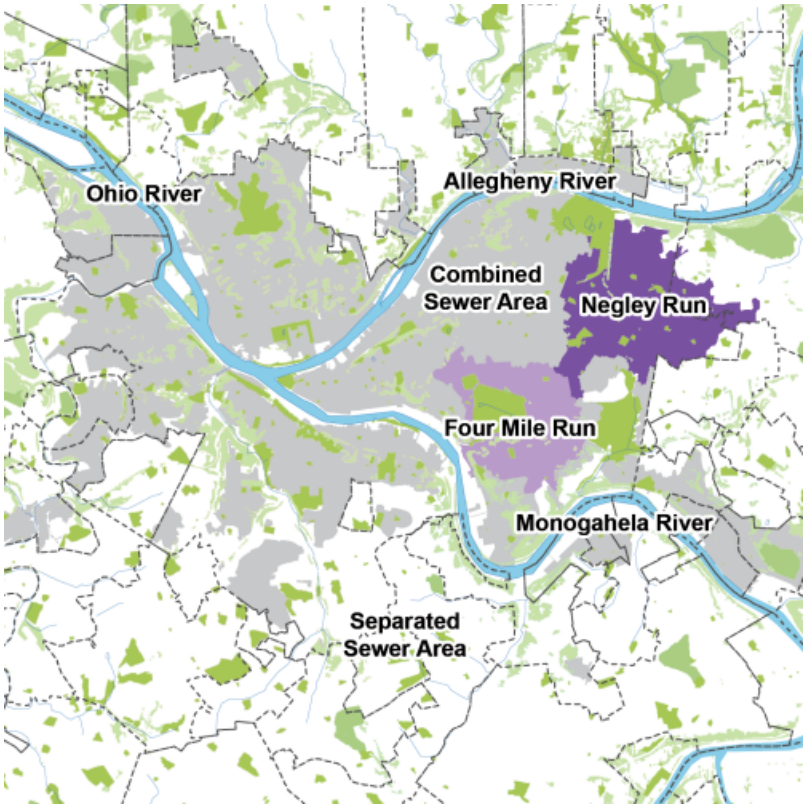
The City of Pittsburgh is a prime example of these challenges. The Pittsburgh region's combined sewer system is inadequately sized to capture and treat most "wet weather" events, which occur frequently throughout the year. As a result, nearly every time it rains, a sewer overflow occurs in at least one of the approximately 450 outfalls in the system, draining a mix of untreated wastewater and stormwater into streams and rivers.

Furthermore, high precipitation events combined with hilly topography and poor drainage can lead to flooding in many low-lying areas. Some neighborhoods regularly face rainfall flooding, which can damage homes, businesses, and municipal infrastructure, as well as block transportation routes. In particular, the Negley Run and Four Mile Run watersheds are exemplars for these challenges and provide ideal test beds for innovative systems design and policy evaluation.

Negley Run drains a diverse area of Pittsburgh's East End, including several neighborhoods (Larimer, Homewood) that have suffered heavily from disinvestment in recent decades. It also represents one of the most urgent flood risk challenges in the city, as heavy rainfall in the area leads to regular flooding of a key road corridor (Washington Boulevard).

Four Mile Run is also challenged by sewer overflows and frequent flooding. But the watershed also has significant opportunities for green infrastructure, with current design efforts focused on utilizing Schenley Park to capture stormwater runoff and provide a direct stream path to the Monongahela River.

Panther Hollow Lake in Schenley Park, Pittsburgh.
Photo by Jack / CC BY ND 2.0



A Pittsburgh area map showing the Negley Run and Four Mile Run watersheds.

RAND's work in these watersheds builds on a prior pilot project supported by the MacArthur Foundation that used a series of linked simulation models of Pittsburgh's combined sewer system to simulate the frequency and volume of regional sewer overflows under a wide range of current and future scenarios and proposed infrastructure strategies.

Research Approach

The RAND Corporation is working to address these planning needs within Negley Run and Four Mile Run watersheds through several key tasks. Results from the analysis will be shared in a forthcoming research report, research brief, and interactive data visualization tool accessible through the RAND website.

1. **Flood risk model development:** we have worked with Arcadis, an engineering firm, to develop a new detailed stormwater simulation model for Negley Run. This new model allows us to consider both sewer overflows and flood risk across a range of historical rainfall and plausible future rainfall conditions.
2. **Stormwater design evaluation:** we are partnering with PWSA, community organizations, design teams, and engineering partners to compile and evaluate a range of proposals intended to divert, capture, or temporarily store water during rainstorms using green infrastructure or a combination of traditional ("grey") and green infrastructure. The goal is to identify strategies that build resiliency against current and future rainfall conditions, search for "no regret" solutions that work regardless of which future comes to pass, and highlight key tradeoffs that emerge between approaches. We will share these analysis results with design teams working in each watershed, providing inputs to inform final design choices.
3. **Valuing co-benefits and costs of green infrastructure:** we are also assessing additional co-benefits and costs of the proposed green infrastructure designs that extend beyond the benefits valued for traditional infrastructure projects. These additional benefits may include enhanced recreational opportunities and aesthetic values, improved health of local populations stemming from improved water and air quality, and local economic impacts such as increases in property values.

Supporting Community Planning in Negley Run

RAND has been an activate participant in Negley Run Watershed Task Force steering committee and community outreach meetings. The new stormwater modeling will allow the Task Force to identify potential contributing sources of runoff in greater detail, and consider how runoff and stormwater flows might change with more severe future rainstorms.

The RAND team is also evaluating the co-benefits of green infrastructure projects, neighborhood-level source reduction strategies, and individual lot best management practices proposed by Task Force members. This process was facilitated by co-convening a stormwater modeling workshop. During the discussion, partner organizations, regional experts, and local interest groups contributed their knowledge of the state-of-the-art as well as aspirational plans for policy levers and design strategies.

Project Timeline

This project began in early 2018 and is expected to be completed by the end of 2019.

Partner Organizations

Pittsburgh Water and Sewer Authority (PWSA)

3 Rivers Wet Weather (3RWW)

Negley Run Watershed Task Force (NRWTF)

Living Waters of Larimer

Pittsburgh Parks Conservancy

US Army Corps of Engineers

Mott McDonald

Arcadis

Tetra Tech

Henry L. Hillman Foundation

The Heinz Endowments