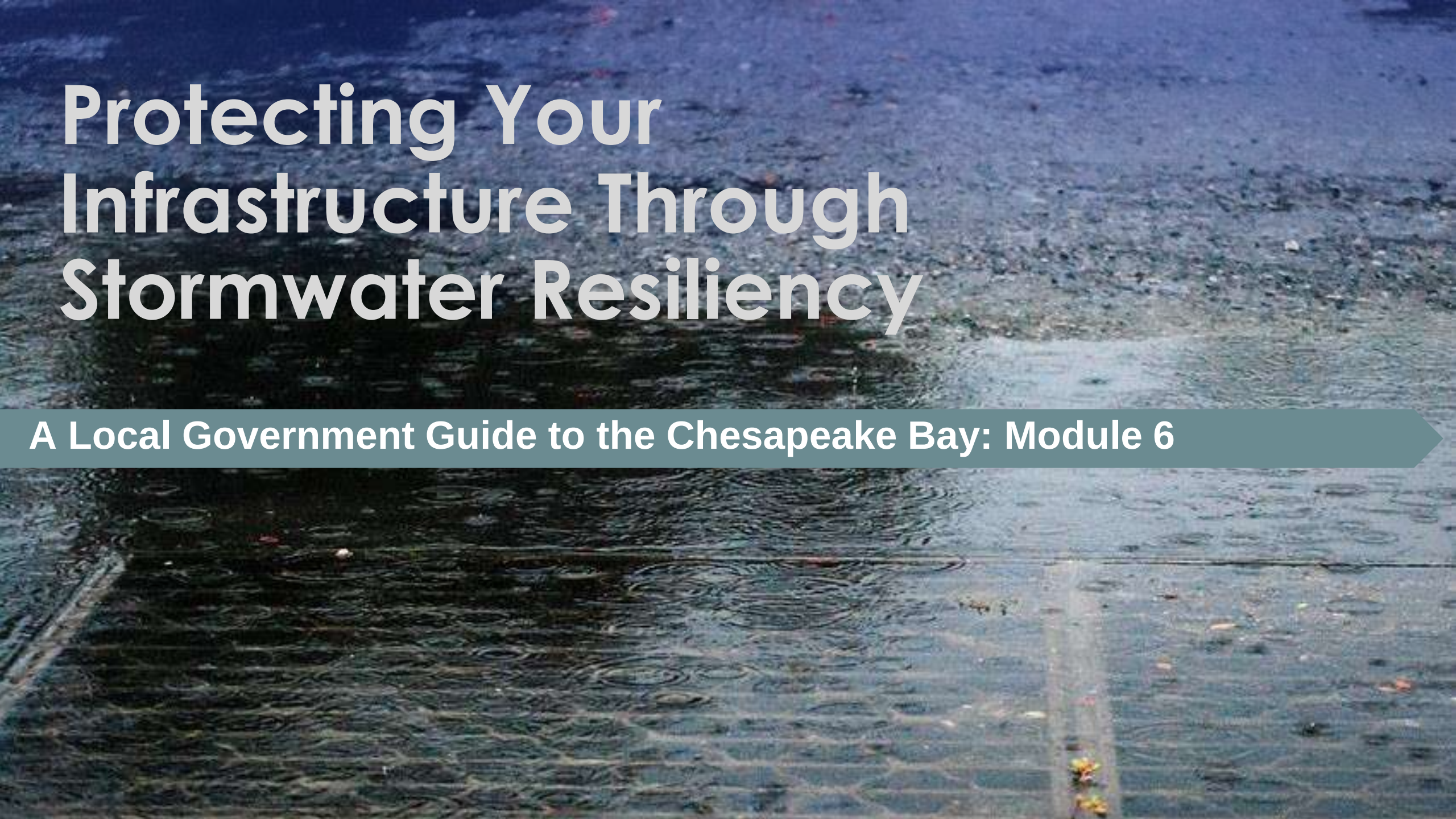

Protecting Your Infrastructure Through Stormwater Resiliency

A Local Government Guide to the Chesapeake Bay: Module 6

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Protecting Your Infrastructure Through Stormwater Resiliency

A Guide For Local Governments

This module is based on one in a series created by the Chesapeake Bay Program to support and inform decision making by local officials:

1. How Your Watershed Works
2. Foundations of Clean Water
3. Healthy Water for the Economy
4. Capitalizing on the Benefits of Trees
5. Preserving Local Character & Landscapes
6. **Protecting Your Infrastructure Through Stormwater Resiliency**
7. Building the Workforce of Today & Tomorrow

To better understand how the information aligns with community priorities, look for these icons:

Economic Development

Public Health & Safety

Infrastructure Maintenance & Finance

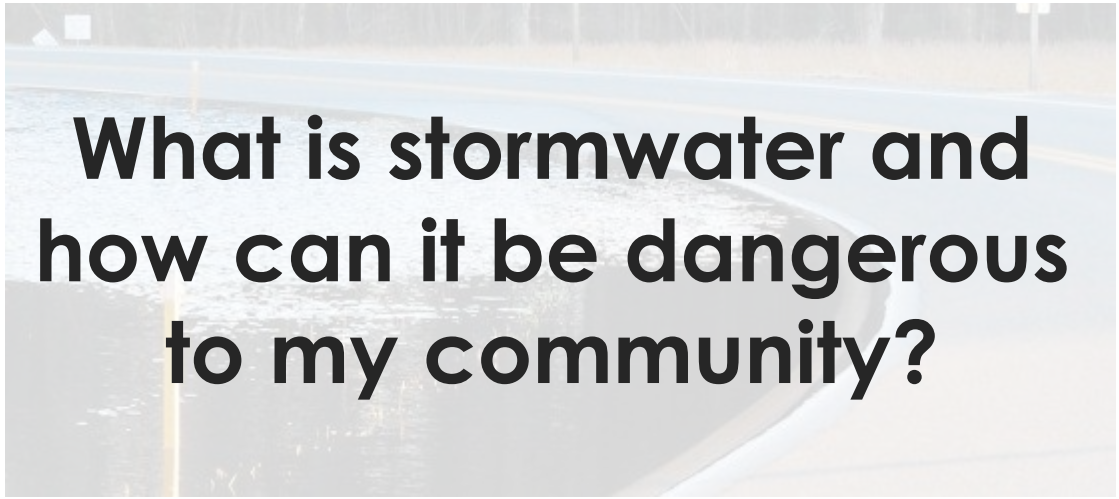
Education

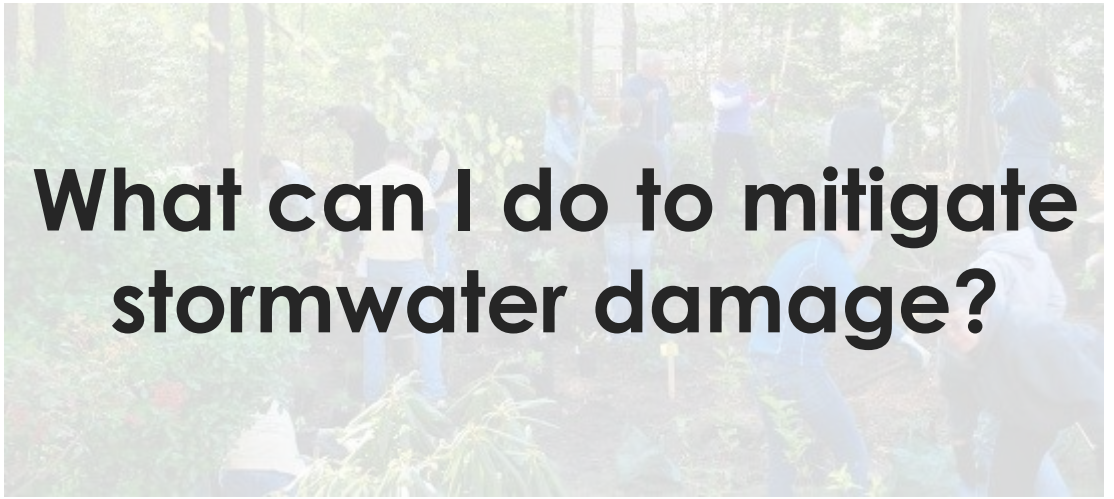
Laying Foundations

Managing stormwater runoff can increase resiliency by:

- Preventing erosion
- Mitigating flooding and flood-related damages
- Improving water quality
- Protecting stream functions

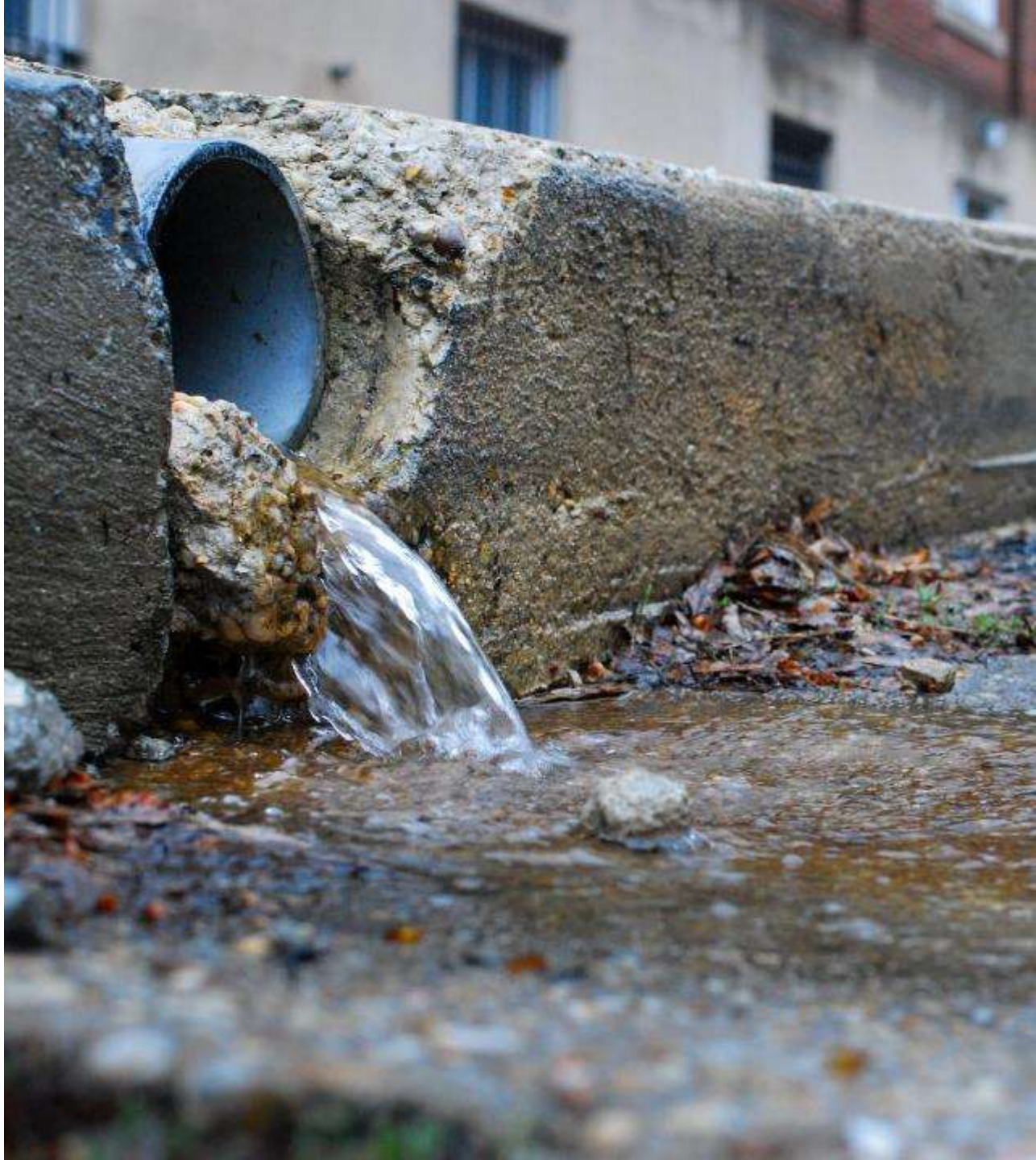
What You'll Learn



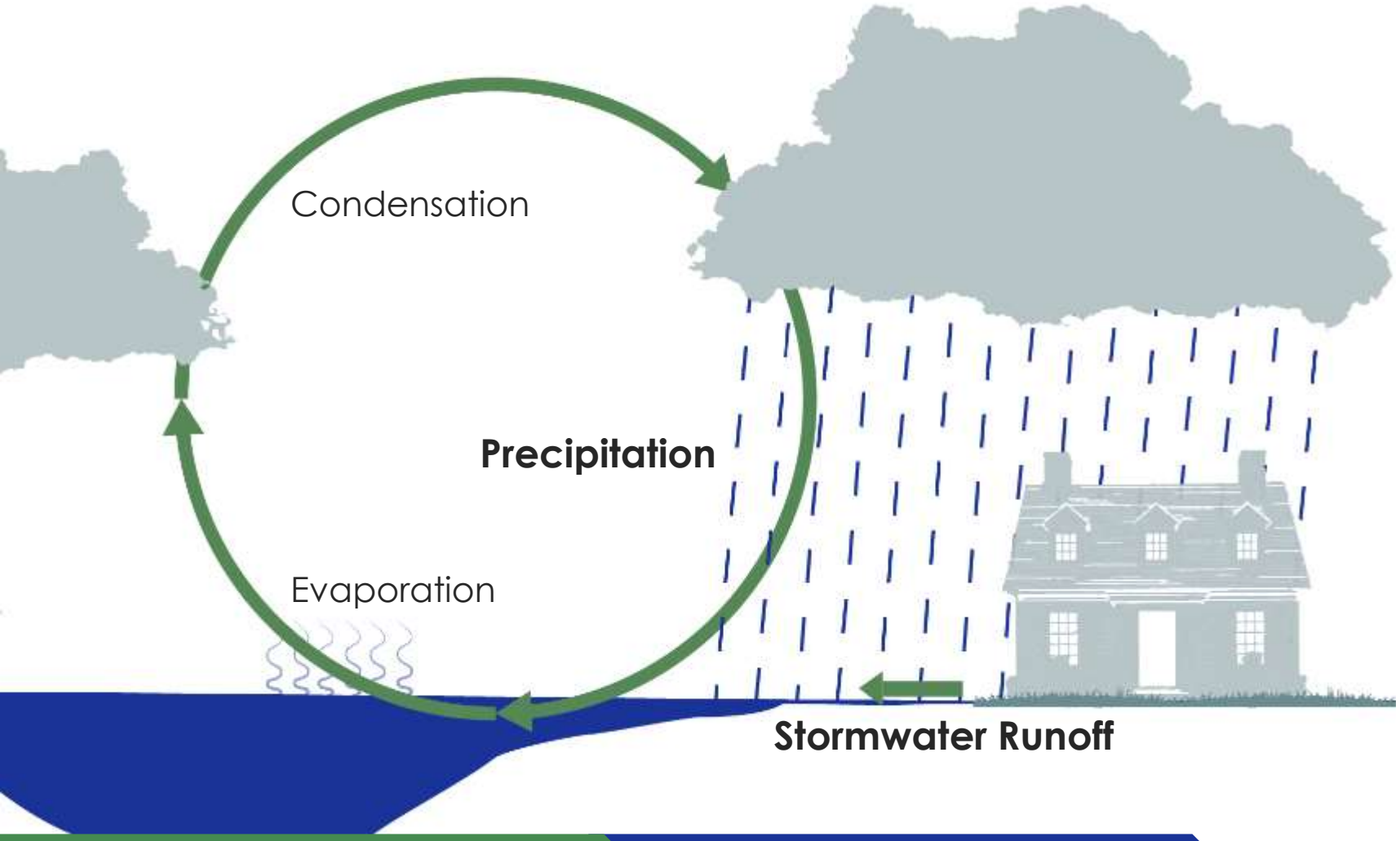


Understanding Stormwater

Rain and snow are natural phenomena. Let’s discuss how they turn into stormwater that impacts your community.



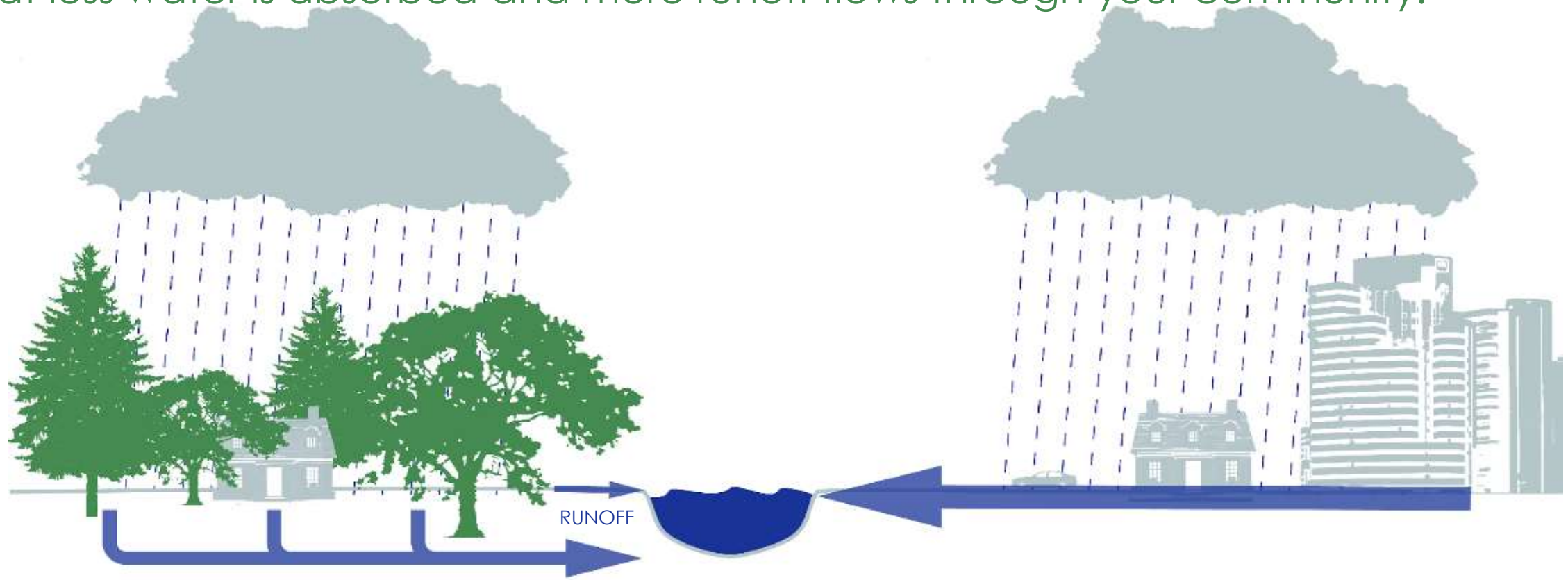
Understanding Stormwater



Stormwater is the water left over after a rainstorm or snowmelt. Some of the water evaporates or soaks into the ground. The rest runs across the land and into the nearest waterway.

Understanding Stormwater

More impervious surfaces that prevent water absorption—like roads and roofs—mean that less water is absorbed and more runoff flows through your community.



Nature provides cost-effective stormwater management.
Forests, wetlands, and other natural landscapes absorb rainwater.

Understanding Stormwater

Stormwater travels downhill as overland flow, in roadside drainage ditches, and in storm sewer systems.

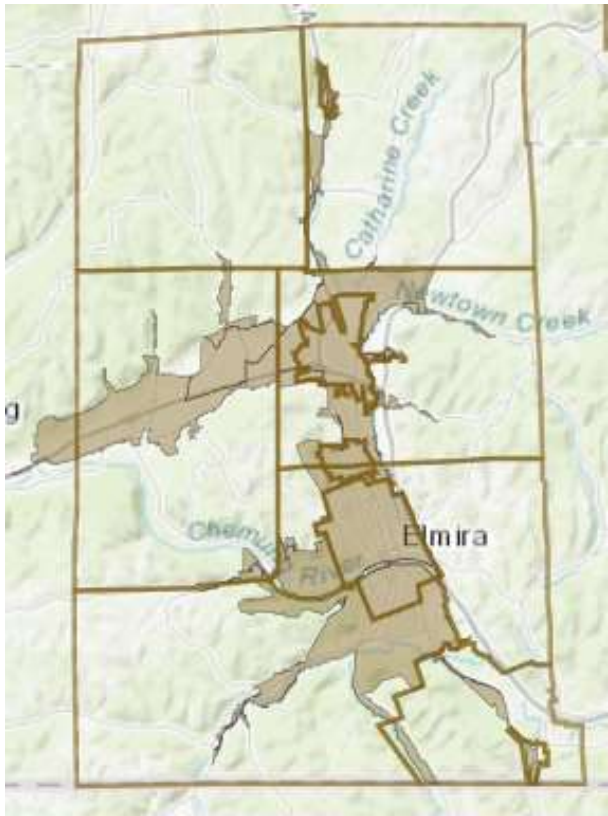
When runoff is concentrated, it picks up speed and has more energy to erode the soil.

MS4 Stormwater Programs

Municipalities and other institutions in designated Urbanized Areas are required to obtain a permit from New York State for discharges from the **M**unicipal **S**eparate **S**torm **S**ewer **S**ystem (or MS4). This includes ditches and other stormwater conveyances that are not combined with sanitary systems and discharge runoff local waterways.

MS4 stormwater programs must include:

1. Public education and outreach
2. Public participation/involvement
3. Illicit discharge detection and elimination
4. Construction site runoff control
5. Post-construction runoff control
6. Pollution prevention/good housekeeping



What's At Stake?

Stormwater runoff can create hazards, damage public infrastructure, and damage private property due to flooding, erosion, and washing of pollutants into local waterways.

Critical Infrastructure

Flooding and erosion caused by poorly-managed runoff can endanger critical infrastructure.

Roads

Roads are particularly vulnerable to erosion and flooding, which can cause significant hazards. Transportation interruptions can hinder all community activities.

Clean Water

Stormwater washes sediment and pollutants from roads, fields, and other surfaces.

Electricity

Water can damage the structures needed to get electricity to residences. In addition, electricity and standing water are a dangerous combination.

Cellular Networks

Communication systems are impacted by power outages. Your community relies on cell phones to communicate, especially in emergency situations without power/internet access.

Critical Infrastructure

During floods, critical infrastructure systems can often fail, leaving residents stranded without service.

Drinking Water

Public and private drinking water supplies can be impaired if contaminated runoff drains into surface water sources or infiltrates to groundwater supplies.

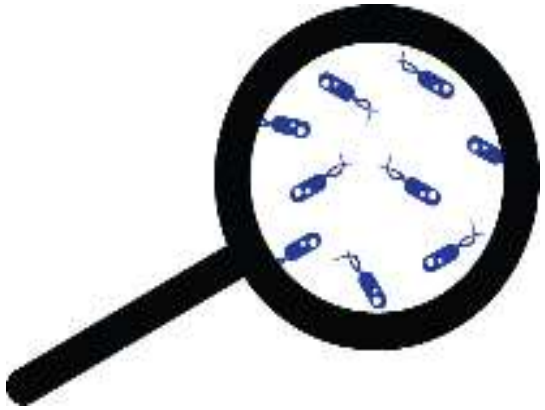
Wastewater Treatment

Sewer treatment systems in low-lying areas may be prone to flooding. In communities with combined storm sewer and sanitary sewer systems, excess stormwater can overwhelm sewer and stormwater systems and wash pollutants into local waterways.

Public Health

Stormwater picks up litter and other pollutants from the land that it passes over. These pollutants include microplastics, bacteria, toxic contaminants, sediment, nutrients that fuel algae, and more. This water gets discharged directly into local waterways without treatment.

TOXIC CONTAMINANTS



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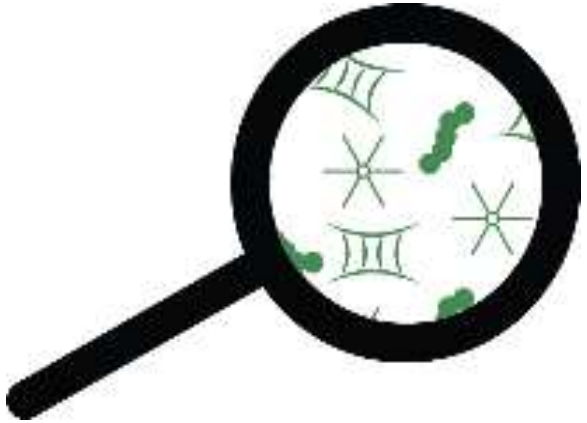


ALGAE

- **Pollution can make recreation in, on, or near water unsafe.**
- **Fish can become unsafe to harvest and eat.**
- **Stormwater runoff can threaten drinking water in your community or downstream.**

Public Health

Detecting public health threats like bacteria in local water is normally the work of public works departments. However, community partners and volunteers can also play a role.

Case study: NY Lake Volunteers

Lake associations across NY participate in the Citizens Statewide Lake Assessment Program (CSLAP), a volunteer lake monitoring program run by the State and the NYS Federation of Lake Associations. Trained volunteers collect water quality data and samples that are sent to a lab for analysis.

Citizens also monitor for Harmful Algal Blooms (HABs) and report occurrences to the NYS HAB notification page. Although most algae are harmless, some species can produce toxins that are harmful to people and animals. Publicizing the risks and occurrences of HABs helps people and their pets avoid contact.

The Economy

Excess stormwater runoff can cause or increase the severity of flooding, with devastating economic consequences for local governments, businesses, and residents.

Case study: New York State

STATEWIDE STATISTICS
(1996-2018)

$129.9M
Annualized losses from flooding

77
Annualized # of flooding episodes

8
Annualized # of severe flooding episodes

46
Total flooding injuries

54
Total flooding fatalities

Flooding is the primary hazard in New York State. Some flood losses can be attributed to stormwater that either exceeds the capacity of drainage systems or increases the peak flows in streams and rivers. Economic losses include: damage to buildings and infrastructure, disruption of commerce, unemployment due to flooded workplaces, inundated transportation systems, agricultural losses, environmental damage, expenses for disaster relief, and flood cleanup costs.

Most of the costs of flooding are borne by the public and private sectors of local communities. Communities that have experienced a major flood take years—if not decades—to recover. Many small businesses never re-open.

The Economy

Outdoor recreation relies on healthy waterways and safe access, which can be threatened by uncontrolled runoff.

The scenic beauty and water-based recreation are central to the quality of life and tourist industry in New York's Finger Lakes Region. During a 2018 flash flood, runoff on steep slopes caused extensive erosion damage and washed debris and contaminants into Seneca Lake.

Case study: Seneca Lake NY

Annually, the US outdoor recreation economy provides:

$887 BILLION
in consumer spending

7.6 MILLION
American jobs

$125 BILLION
in federal, state & local taxes

Education

Excess stormwater runoff can cause missed school days during extended closures caused by flooded or damaged school buildings.

Flooding and washouts can also impact education through disrupted bus routes, flooding at or near students' homes, lack of internet access for schoolwork, and other infrastructural impacts.

CANISTEO

Kids saved from sinking school bus

By MARK WILSON
Hornell bureau chief

CANISTEO — Five people were rescued from the roof of a school bus nearly submerged in Friday's raging flood waters.

Bus driver Terry Bardeen had nearly finished her mission of returning children to their homes when the waters caught up with her on Steuben County Route 119, which is along the Canisteo River banks between Canisteo and Adrian.

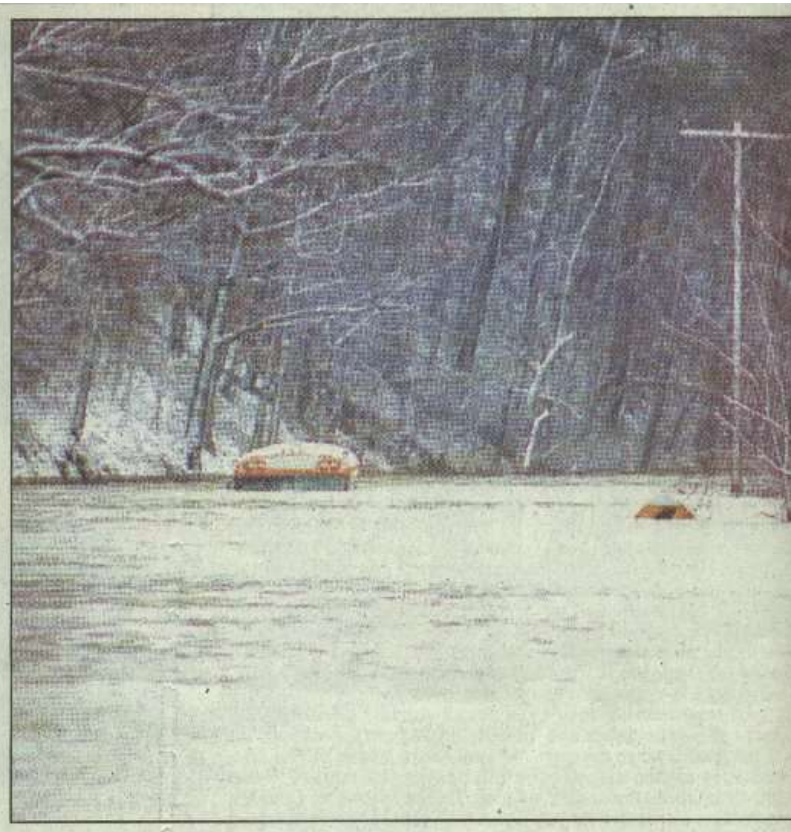
The flood waters surrounded the bus and started rising rapidly. Bardeen and four passengers – three students and a teacher – escaped through an emergency hatch, climbed to the bus roof and waited for emergency workers to rescue them and then carry them up a 40-foot cliff with ropes.

The three children, along with fifth grade science teacher Lon Chase who had volunteered to ride along, were on the bus and had been cut off from dry land by the swollen river waters.

"I thought I could make it through all right. It just got deeper and deeper. Once the bus quit it was apparent that the water was rising – and fast!" Bardeen said.

It was 11:30 a.m.

See SCHOOL, Page 6A



THE LEADER/PROVIDED BY JOHN BABBI

A school bus is submerged in water in the Canisteo River between Canisteo and Adrian Friday

Diversity, Equity, Inclusion, and Justice

While inadequate drainage infrastructure and flooding affect a wide range of demographics, it is most harmful to communities of color, low-income residents, renters, rural areas, and others wo do not have the resources to handle the damage and disruption that flooding causes.

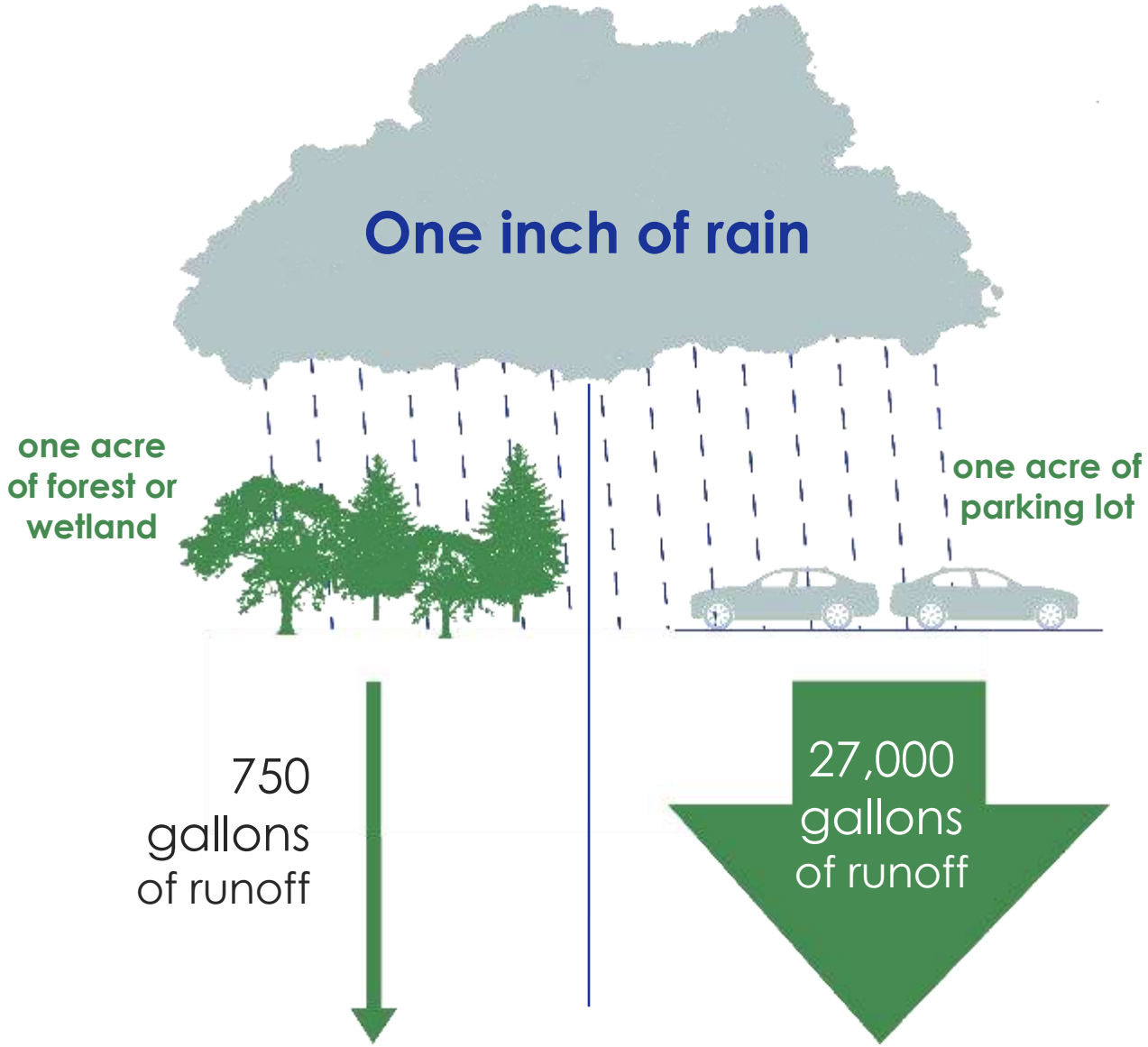
State and federal programs focused on diversity, equity, inclusion, and justice are trying to correct historic inequities in flood risks and programs for mitigating those risks. However, small municipalities with limited capacity still struggle to access available resources.

Stormwater Resiliency

Let's talk best practices and tools to increase your community's resiliency.

A benefit-cost analysis of natural hazard mitigation found that **every $1 invested in proactive mitigation steps saves $7** in emergency response and recovery costs in the future.

Natural Landscapes

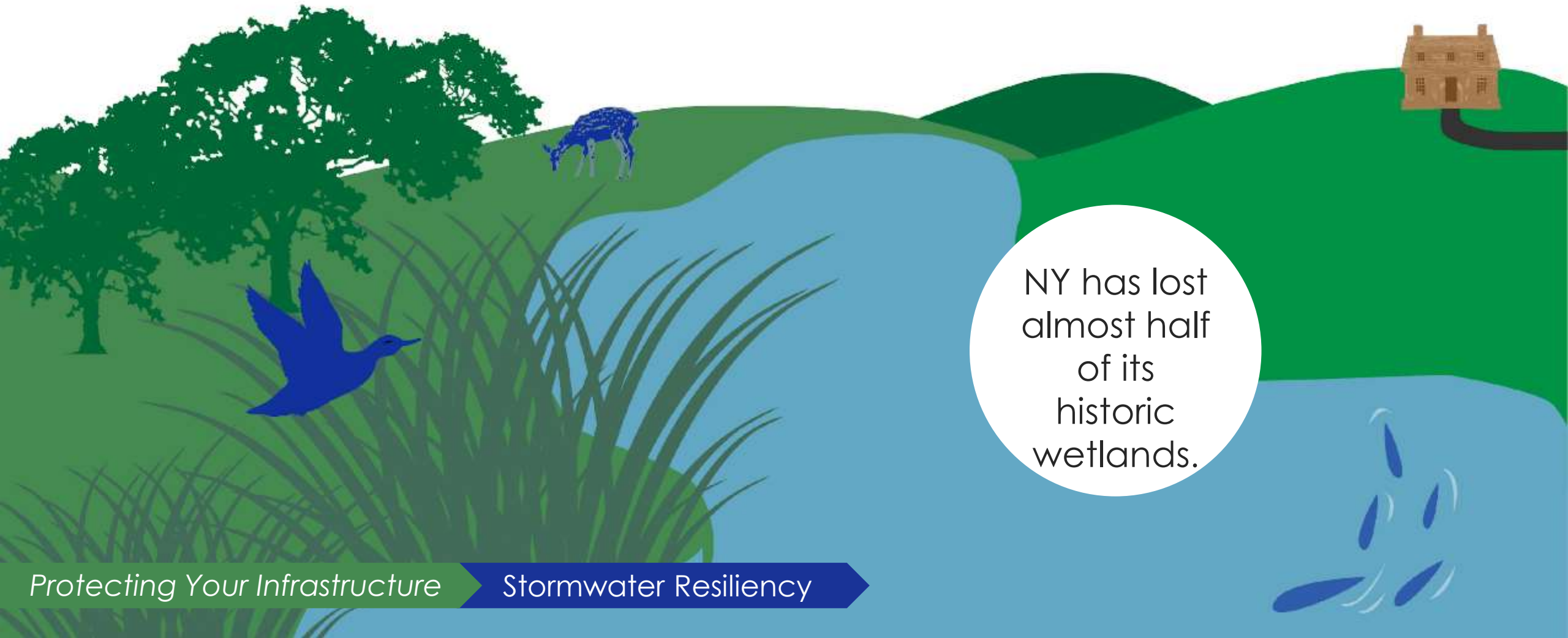


Natural landscapes, like forests and wetlands, reduce the amount of runoff that your community experiences.

Make a plan to protect sensitive natural areas and minimize impervious surfaces to keep your community resilient.

Wetlands

Wetlands are nature's flood insurance. Wetlands capture, filter, hold, and slowly release runoff—like a giant sponge—and can prevent damage to surrounding infrastructure.



Trees

Trees reduce runoff and can be beneficial almost anywhere in the community.

Trees beside local waterways can reduce polluted runoff by **30-98%.**

Nutrients

Microplastics

Bacteria

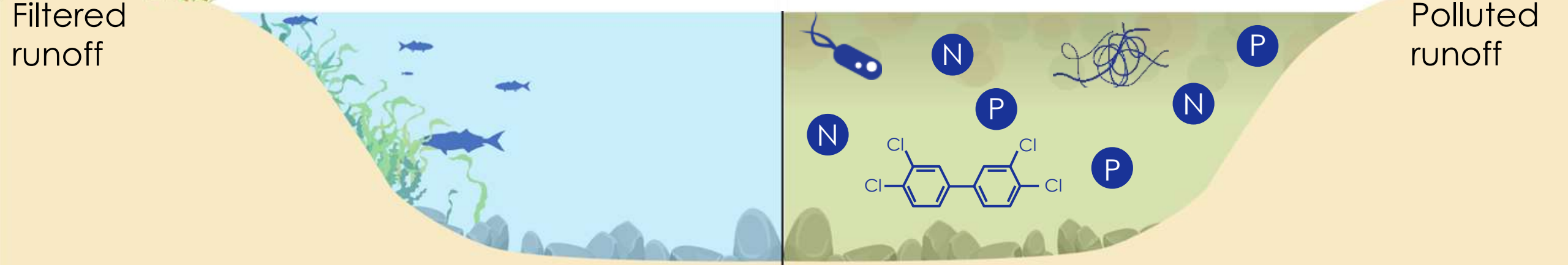
Agricultural biproducts

Sediment

Urban toxic contaminants

Filtered runoff

Polluted runoff



Green Infrastructure

Green infrastructure uses natural processes and technology inspired by nature to reduce runoff flows. It often has lower capital costs and public expenditures than traditional grey infrastructure.

- ***Avoid* the Impacts**

  Avoid or minimize disturbance by preserving natural features and using conservation design techniques

- ***Reduce* the Impacts**

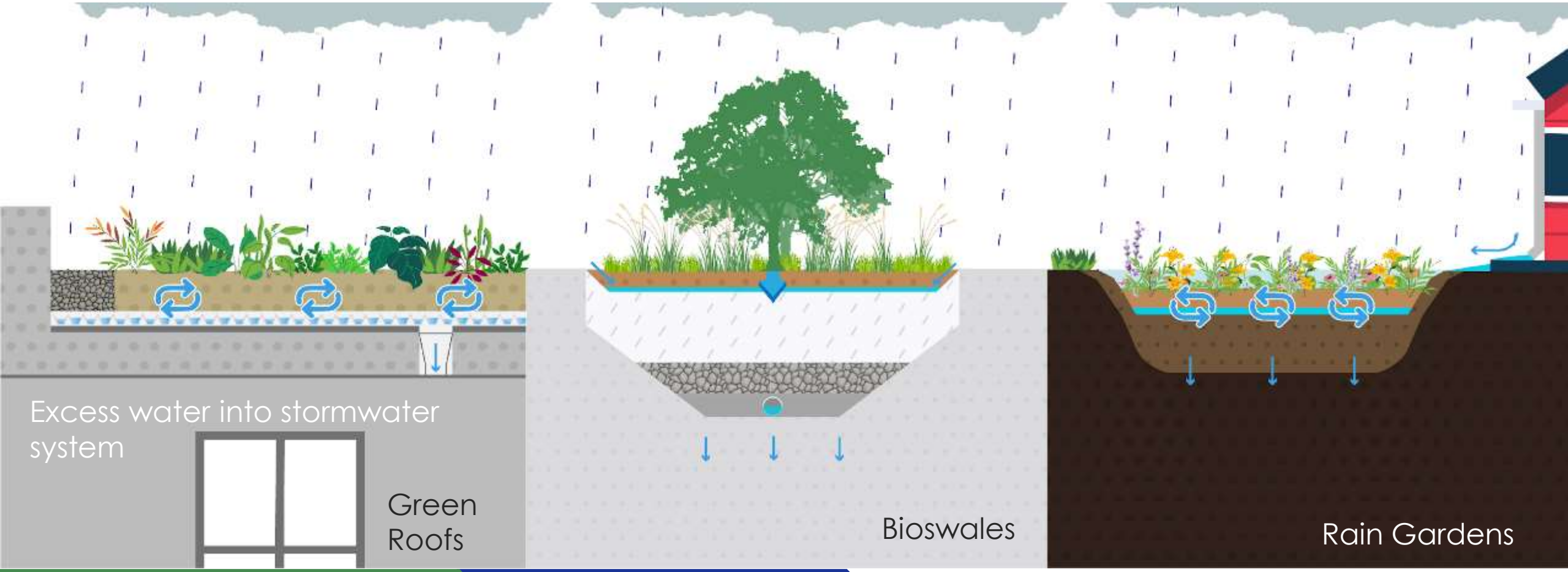
  Reduce the impacts of development by reducing impervious cover

- ***Mitigate* the Impacts**

  Manage the impacts by using natural features and runoff reduction practices to slow down the runoff and promote infiltration and evapo-transpiration

Green Infrastructure

Green infrastructure runoff reduction practices integrate natural systems to replicate pre-development hydrology. Examples of green infrastructure include:



Reduce Pollutant Load

In addition to managing the amount and speed of runoff, it is important to reduce the potential sources of pollutants that are washed off the land by stormwater. Land use activities should strive to minimize available pollutants and prevent soil erosion.

Key strategies for erosion and sediment control include:

- Avoid disturbing sensitive areas—such as steep slopes, streams, wetlands, and woodlots
- Minimize clearing and grading
- Phased grading
- Cultivate healthy soils
- Maintain healthy plant cover
- Runoff control practices
- Soil stabilization practices
- Sediment control practices

Sustainable Schools

Schools provide opportunities for installing best management practices (known as BMPs) while providing learning opportunities for students.

Case study: Binghamton, NY

When the MacArthur Elementary School in Binghamton was destroyed by 5 feet of floodwater in 2011, it was replaced with a sustainable, flood-resistant building. Rain gardens, bioswales, and native vegetation were planted near the elevated building to collect and cleanse stormwater. In addition to managing runoff, these green infrastructure practices also serve as an outdoor teaching tool.

Planning for the Future

Precipitation patterns are expected to shift in the coming years. And land use changes can alter runoff patterns. Is your community ready?

Planning for More Rain

The National Oceanic and Atmospheric Administration (NOAA) expects extreme precipitation events to continue becoming more frequent. The increase in stormwater will likely overwhelm the capacity of current roadway drainage and stormwater management systems.

Climate Connection

The northeastern U.S. experienced more than a 70% increase in heavy precipitation from 1958 to 2010 – greater than any other region in the country.

Climate Smart Communities

Climate Smart Communities is a New York State Program that helps local governments take action to reduce greenhouse gas emissions and adapt to a changing climate. The program offers free technical assistance and grants that can be used to anticipated increases in stormwater runoff.

Protecting Your Infrastructure | Planning for the Future

What You Can Do

Retrofit existing drainage problems / re-plumb roadside ditches. Reduce impervious surfaces and Implement green infrastructure strategies to reduce strain on your stormwater and roadside drainage systems.

Protect and restore natural features – steep slopes, wetlands, forests, tree canopy, floodplains and other natural landscapes. These areas act as nature's flood insurance, filter stormwater, and protect your community's infrastructure.

Update local codes, ordinances, plans, and standards to encourage best practices for drainage, erosion control, natural resource protection, steep slopes, and drinking water source protection.

Plant and maintain trees for multiple community benefits.

Thank you

Southern Tier Central
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