Key Topic #5: Legislation, Regulations, and Voluntary Measures

Learning Objectives

1. **Summarize** major U.S. policies and programs that address non-point source pollution, including the Clean Water Act (especially Sections 303 and 319) and Total Maximum Daily Loads (TMDLs).
2. **Differentiate** between regulatory and voluntary approaches to controlling NPS pollution and identify examples of each.
3. **Describe** how federal and state agencies support local communities in managing NPS pollution through funding, education, and technical assistance.
4. **Simulate** a decision-making process where students must select appropriate policy or program tools to manage a fictional watershed's NPS challenges.

Nonpoint Source Program

Available Assistance: Financial, Technical, Planning, Coordination, Facilitation

Statute: Clean Water Act and Safe Drinking Water Act

Program Type: Non-regulatory

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Main Website(s): Polluted Runoff: Nonpoint Source (NPS) Pollution

Helping states, territories, and tribes perform a wide variety of activities to prevent nonpoint source pollution from degrading water quality.

On this page:

About the Program

The 1987 amendments to the Clean Water Act established the Section 319 Nonpoint Source (NPS) Program to address NPS pollution. NPS pollution is caused when rainfall or snowmelt, moving over and through the ground, picks up and carries natural and human-made pollutants, depositing them into lakes, rivers, wetlands, coastal waters, and groundwaters. Increased precipitation from extreme weather will compound NPS pollution.

Types of Assistance

The NPS program provides grant money to states, territories, and tribes to support a wide variety of activities including technical assistance, financial assistance, education, training, technology transfer, demonstration projects, and monitoring to assess the success of specific NPS implementation projects. Receiving a NPS grant to implement projects for improving water quality first requires an EPA-approved watershed-based plan. More information about the NPS program is available in the National Nonpoint Source Program highlights report.

Program in Action

- Drinking Water Supplies: Restoration and Protection Activities in the Upper Branch of the Delaware River Protects New York City's Drinking Water Supply (pdf) (New York).
- Recreation: Urban and Rural Nonpoint Source BMPs Improve Water Quality in the Upper San Antonio River (pdf) (Texas).
- Fisheries: Sasco Brook Improves Due to Bacteria Source Reductions (pdf) (Connecticut).
- Wildlife: Community Partnerships Restore the Water Quality of Mill Creek (pdf) (Alabama).

How This Program Helps Build Resilience

NPS pollution is presently the dominant source of water quality pollution, causing harmful effects on drinking water supplies, recreation, fisheries, and wildlife. To address multiple pollutants and their risks, the NPS program promotes the use of watershed planning to protect and restore water resources (see Handbook for Developing Watershed Plans to Restore and Protect Our Waters). Watershed plans outline best management practices (BMPs) for implementation. BMPs can include bioretention systems, floodplain and stream restoration or stabilization, wetland creation, reforestation, and agricultural conservation approaches like cover crops and riparian buffers. In addition to improving water quality, nature-based practices can also create climate change adaptation and natural hazard mitigation co-benefits (e.g., resilience to droughts, floods, fires, urban heat islands, landslides, erosion, and harmful algal blooms). If plan priorities align, a partnership between hazard or risk reduction plans with watershed or water quality improvement plans could emerge. The annual number of projects implementing practices with climate/hazard mitigation co-benefits is reported as part of the Office of Water Climate Adaptation Implementation Plan. Over 300 Section 319 funded projects with potential climate co-benefits were reported in FY23.

The following success stories document specific examples of water quality improvements that remove stressors and therefore enhance the resilience of water bodies. More success stories about restoring water bodies impaired by NPS pollution can be found in an online database.

Connections to Other EPA, Federal, or Non-Governmental Efforts

The Federal Emergency Management Agency (FEMA) and the EPA have a Memorandum of Agreement that provides a collaborative framework for jointly working on activities related to both hazard mitigation and environmental management to create more resilient communities. The NPS program is currently working with FEMA's hazard mitigation assistance programs, which provide funding for eligible mitigation measures that help reduce disaster losses. Hazard mitigation actions or projects can also provide water quality improvements as a side benefit of reducing hazard risks. However, hazard mitigation projects are more likely to improve water quality if they are coordinated with other state or community water quality goals, strategies, or planned action items.

This information was pulled from EPAs website @ https://www.epa.gov/climate-change-water-sector/nonpoint-source-program.

Overview of Total Maximum Daily Loads (TMDLs)

On this page:

What is a TMDL?

A TMDL is the calculation of the maximum amount of a pollutant allowed to enter a waterbody so that the waterbody will meet and continue to meet water quality standards for that particular pollutant. A TMDL determines a pollutant reduction target and allocates load reductions necessary to the source(s) of the pollutant.

Pollutant sources are characterized as either point sources that receive a wasteload allocation (WLA), or nonpoint sources that receive a load allocation (LA). For purposes of assigning WLAs, point sources include all sources subject to regulation under the National Pollutant Discharge Elimination System (NPDES) program, e.g. wastewater treatment facilities, some stormwater discharges and concentrated animal feeding operations (CAFOs). For purposes of assigning LAs, nonpoint sources include all remaining sources of the pollutant as well as natural background sources. TMDLs must also account for seasonal variations in water quality, and include a margin of safety (MOS) to account for uncertainty in predicting how well pollutant reductions will result in meeting water quality standards.

Expressed mathematically, the TMDL equation is:

TMDL = ΣWLA + ΣLA + MOS

Where **WLA** is the sum of wasteload allocations (point sources), **LA** is the sum of load allocations (nonpoint sources and background) and **MOS** is the margin of safety.

Each pollutant causing a waterbody to be impaired or threatened is referred to as a waterbody/pollutant combination, and typically a TMDL is developed for each waterbody/pollutant combination. For example, if one waterbody is impaired or threatened by three pollutants, three TMDLs might be developed for the waterbody. However, in other cases, a single TMDL document may be developed to address several waterbody/pollutants combinations. Neither the CWA nor EPA's regulations define or limit the scale of TMDLs. Some states have been developing TMDLs on a watershed-scale basis. Such state TMDLs may also cover multiple watersheds.

What triggers the need for a TMDL?

According to the Clean Water Act, each state must develop TMDLs for all the waters identified on their Section 303(d) list of impaired waters, according to their priority ranking on that list.

Who is responsible for developing a TMDL?

As a general matter, states are responsible for developing TMDLs and submitting them to EPA for approval. Even if third parties assist in the development of the TMDL or its supporting analysis, such TMDLs must still be submitted to EPA by the states.

Under the CWA, the EPA reviews and either approves or disapproves the TMDL. If EPA disapproves a state TMDL, EPA must develop a replacement TMDL.

How are TMDLs developed?

The objective of a TMDL is to determine the loading capacity of the waterbody and to allocate that load among different pollutant sources so that the appropriate control actions can be taken and water quality standards achieved. The TMDL process is important for improving water quality because it serves as a link in the chain between water quality standards and implementation of control actions designed to attain those standards.

TMDLs are developed using a range of techniques, from simple mass balance calculations to complex water quality modeling approaches. The degree of analysis varies based on a variety of factors including the waterbody type, complexity of flow conditions and pollutant causing the impairment.

All contributing sources of the pollutants (point and nonpoint sources) are identified, and they are allocated a portion of the allowable load that usually contemplates a reduction in their pollution discharge in order to help solve the problem. Natural background sources, seasonal variations and a margin of safety are all taken into account in the allocations.

The approach normally used to develop a TMDL for a particular waterbody or watershed consists of five activities:

- Selection of the pollutant(s) to consider.
- Estimation of the waterbody's assimilative capacity (i.e., loading capacity).
- Estimation of the pollutant loading from all sources to the waterbody.
- Analysis of current pollutant load and determination of needed reductions to meet assimilative capacity.
- Allocation (with a margin of safety) of the allowable pollutant load among the different pollutant sources in a manner such that water quality standards are achieved.

TMDLs should clearly identify the links between the waterbody use impairment, the causes of impairment, and the pollutant load reductions needed to meet the applicable water quality standards.

Public participation in TMDL development

EPA’s regulations require public involvement in developing TMDLs, however, the level of citizen involvement in the TMDL process varies by state.

Local citizens sometimes know more about what is happening in their watersheds than state agencies, and this knowledge can be a valuable aspect of TMDL development. The public often contributes useful data and information about an impaired waterbody. The public can often offer insights about their community that may ensure the success of one pollutant reduction strategy over another. Citizen information and participation can improve the quality of TMDLs that are developed and can ultimately speed cleanup of impaired waters or secure protection of threatened waters. Public/stakeholder roles in the TMDL process can include:

- Providing data and information to the states.
- Reviewing and commenting on impaired water list.
- Reviewing and commenting on draft TMDLs.
- Assisting in the development of TMDLs.

What are the components of a TMDL document?

EPA issued review guidelines for TMDL submissions in *Guidelines for Reviewing TMDLs under Existing Regulations Issued in 1992*. Below is a TMDL Review Checklist with the minimum recommended elements that should be present in a TMDL document.

- Identification of Waterbody, Pollutant of Concern, Pollutant Sources and Priority Ranking.
- Applicable WQS and Numeric Water Quality Target.
- Loading Capacity.
- Load Allocations and Waste Load Allocations.*
- Margin of Safety.
- Consideration of Seasonal Variation.
- Reasonable Assurance for PS/NPS.
- Monitoring Plan to Track TMDL Effectiveness.
- Implementation Plan.
- Public Participation.

What happens after the TMDL is approved by EPA?

TMDL wasteload allocations (those pollutant allocations assigned to point sources) are generally implemented through EPA's National Pollutant Discharge Elimination System (NPDES) permits under CWA section 402. This section of the Act requires that point source discharges be controlled by including water quality-based effluent limits in permits issued to point source entities. Under EPA's permitting regulations, water quality-based discharge limits in NPDES permits must be "consistent with the assumptions and requirements" of wasteload allocations in EPA-approved TMDLs.

Non-point source load reduction actions are implemented through a wide variety of programs at the state, local and federal level. These programs may be regulatory, non-regulatory or incentive-based e.g., a cost-share program. In addition, waterbody restoration can be assisted by voluntary actions on the part of citizen and/or environmental groups. The EPA section 319 program provides grant money to the states to fund specific projects aimed at reducing the nonpoint source pollution.

Although states are not explicitly required under section 303(d) to develop TMDL implementation plans, many states include some type of implementation plan with the TMDL. When developed, TMDL implementation plans may provide additional information on what point and nonpoint sources contribute to the impairment and how those sources are being controlled, or should be controlled in the future.

This information was sourced from EPAs website @ https://www.epa.gov/tmdl/overview-total-maximum-daily-loads-tmdls#1.

Stormwater Runoff

When precipitation falls on roads, streets, rooftops and sidewalks, it can push harmful pollutants like fertilizer, pet waste, chemical contaminants and litter into the nearest waterway.

Mike Fritz from the Chesapeake Bay Program explains why stormwater runoff is a major source of pollution and what we can do to prevent it. (Produced by Matt Rath/Chesapeake Bay Program)

Overview

What happens to a drop of rain when it falls onto the ground? It may land on a tree and evaporate; it may land on a farm field and soak into the soil; or it may land on a rooftop, driveway or road and travel down the street into a storm drain or stream. Precipitation in an urban or suburban area that does not evaporate or soak into the ground but instead runs across the land and into the nearest waterway is considered stormwater runoff. Increased development across the watershed has made stormwater runoff (also called polluted runoff) the fastest growing source of pollution to the Chesapeake Bay.

How does stormwater runoff affect the Chesapeake Bay?

As stormwater flows across streets, sidewalks, lawns and golf courses, it can pick up harmful pollutants and push them into storm drains, rivers and streams. These pollutants can include lawn and garden fertilizers, pet waste, sand and sediment, chemical contaminants and litter.

Stormwater runoff can cause a number of environmental problems:

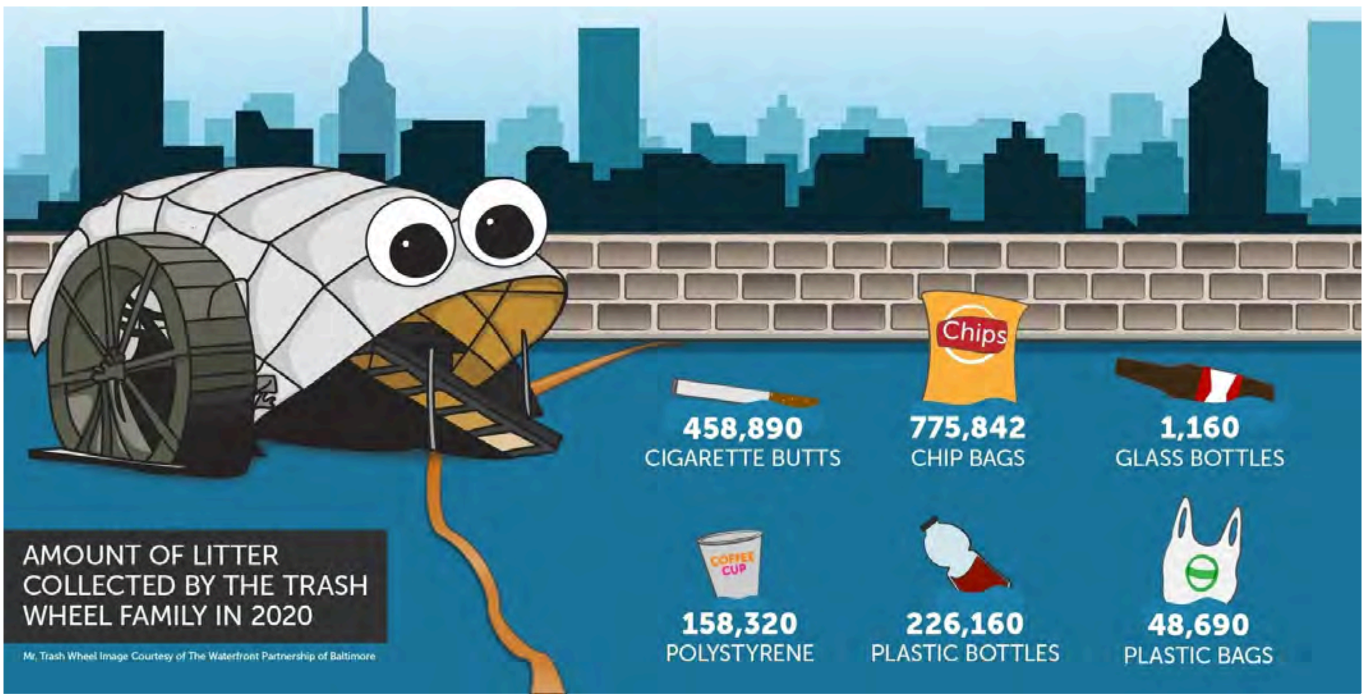
- Fast-moving stormwater runoff can erode stream banks, damaging hundreds of miles of aquatic habitat.
- Stormwater runoff can push excess nutrients (https://www.chesapeakebay.net/issues/threats-to-the-bay/nutrient-runoff) from fertilizers, pet waste and other sources into rivers and streams. Nutrients can fuel the growth of algae blooms that create low-oxygen dead zones (https://www.chesapeakebay.net/state/dead_zone) that suffocate marine life.
- Stormwater runoff can push excess sediment (https://www.chesapeakebay.net/issues/threats-to-the-bay/sediment-runoff) into rivers and streams. Sediment can block sunlight from reaching underwater grasses and suffocate shellfish.
- Stormwater runoff can push pesticides, leaking fuel or motor oil and other chemical contaminants (https://www.chesapeakebay.net/issues/chemical_contaminants) into rivers and streams. Chemical contaminants can harm the health of humans and wildlife.

Stormwater runoff can also lead to flooding in urban and suburban areas.

Forests, wetlands and other vegetated areas can trap water and pollutants, slowing the flow of stormwater runoff. But when urban and suburban development increases, builders often remove these natural buffers to make room for the impervious surfaces that encourage stormwater to flow freely into local waterways.

Litter from stormwater runoff

Litter such as plastic bags, cigarette butts and beverage bottles eventually get carried by stormwater into sewer systems or waterways. Litter detracts from an area's beauty, smothers aquatic plants and bottom-dwelling organisms, adds toxic contaminants to the water and makes animals sick. While nine in ten watershed residents never toss food wrappers, cups or cigarette butts onto the ground, about five percent of watershed residents sometimes, usually or always do.



Litter smothers aquatic plants and bottom-dwelling organisms, adds toxic contaminants to the water and makes animals sick. Trash traps like the water wheels in Baltimore capture and collect litter and debris. (Data provided by the Waterfront Partnership of Baltimore.)

▶ **Show image description**

Watershed organizations around the region rely on volunteers to remove litter from waterways, and many cities have installed trash traps to capture litter and debris. In Baltimore's Inner Harbor, a family of three water wheels (https://www.mrtrashwheel.com/meet-the-trash-wheels/) nicknamed "Mr. Trash Wheel", "Professor Trash Wheel" and "Captain Trash Wheel" collected 1,608 tons of trash between May 2014 and January of 2021. In 2021, the city's trash-collecting water wheel family will welcome it's fourth member: "Gwynnda the Good Wheel of the West". Gwynnda the Good Wheel is capable of collecting about 300 tons of trash and debris per year from the Gwynns Falls — more than the other three wheels combined.

What are impervious surfaces and why are they a problem?

Impervious surfaces are paved or hardened surfaces that do not allow water to pass through. Roads, rooftops, sidewalks, pools, patios and parking lots are all impervious surfaces.

Impervious surfaces can cause a number of environmental problems:

- Impervious surfaces can increase the amount and speed of stormwater runoff, which can alter natural stream flow and pollute aquatic habitats.
- Impervious surfaces limit the amount of precipitation that is able to soak into the soil and replenish groundwater (https://www.chesapeakebay.net/issues/groundwater) supplies, which are an important source of drinking water in some communities.
- Impervious surfaces that replace soil and plants remove the environment's natural ability to absorb and break down airborne pollutants (https://www.chesapeakebay.net/issues/air_pollution) .

According to the U.S. Environmental Protection Agency (EPA), the presence of roads, rooftops and other impervious surfaces in urban areas means a typical city block generates more than five times more runoff than a forested area of the same size.

Impervious surface data are used to measure the rate of development (https://www.chesapeakebay.net/issues/development) across the watershed and to identify high-growth areas and patterns of sprawling development. Between 1990 and 2007, impervious surfaces associated with growth in single-family homes are estimated to have increased about 34 percent, while the region's population (https://www.chesapeakebay.net/state/population) increased by 18 percent. This indicates that our personal footprint on the landscape is growing.

How much pollution does stormwater runoff send into the Chesapeake Bay?

Stormwater runoff is the fastest growing source of pollution to the Chesapeake Bay. According to data (http://www.chesapeakeprogress.com/clean-water/water-quality/watershed-implementation-plans) from the Chesapeake Bay Program's Watershed Model (https://www.chesapeakebay.net/what/programs/modeling) , stormwater currently contributes 17% of nitrogen (https://www.chesapeakebay.net/issues/threats-to-the-bay/nutrient-runoff) loads, 17 percent of phosphorus (https://www.chesapeakebay.net/issues/threats-to-the-bay/nutrient-runoff) loads and 9% percent of sediment (https://www.chesapeakebay.net/issues/threats-to-the-bay/sediment-runoff) loads to the Chesapeake Bay.

What you can do

To lessen the impacts of stormwater runoff on the Bay, consider reducing the amount of precipitation that can run off of your property. Install a green roof, rain garden or rain barrel to capture and absorb rainfall; use porous surfaces like gravel or pavers in place of asphalt or concrete; and redirect home downspouts onto grass or gravel rather than paved driveways or sidewalks.

Chesapeake Bay Program Goals

The Chesapeake Bay Program is committed to reducing the amount of sediment and nutrient pollution (https://www.chesapeakeprogress.com/clean-water/watershed-implementation-pla) from a number of sources, including stormwater, through its 2025 Watershed Implementation Plans (https://www.chesapeakeprogress.com/clean-water/watershed-implementation-plans) . In 2023, nitrogen, phosphorus and sediment pollution from developed areas (primarily stormwater runoff) accounted for 16%, 18% and 9% of the total pollution, respectively.

Track our work at ChesapeakeProgress.com (https://www.chesapeakeprogress.com/clean-water/watershed-implementation-plans)

FAQ

▶ **What is stormwater runoff?**

▶ **What are impervious surfaces?**

▶ **What can be done to ease the effects of development?**

[More FAQ > (/discover/faq)](/discover/faq)

Terms

▶ **Chemical contaminants**

▶ **Impervious**

▶ **Nutrients**

▶ **Precipitation**

▶ **Stormwater**

[All Terms > (/discover/glossary)](/discover/glossary)

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Mississippi River Gulf of Mexico Watershed Nutrient Task Force New Goal Framework

December 3, 2014

1. Updated Coastal Goal, Including Interim Target

For reference, the Hypoxia Task Force's (HTF) previous Coastal Goal is as follows:

> "Subject to the availability of additional resources, we strive to reduce or make significant progress toward reducing the five-year running average areal extent of the Gulf of Mexico hypoxic zone to less than 5,000 square kilometers by the year 2015 through implementation of specific, practical, and cost-effective voluntary actions by all Federal agencies, States, and Tribes, and address all categories of sources and removals within the Mississippi/Atchafalaya River Basin to reduce the annual discharge of nitrogen and phosphorus into the Gulf." - Gulf Hypoxia Action Plan 2008

The updated Coastal Goal, including an Interim Target, is as follows:

> We strive to reduce the five-year running average areal extent of the Gulf of Mexico hypoxic zone to less than 5,000 square kilometers by the year 2035. Reaching this final goal will require a significant commitment of resources to greatly accelerate implementation of actions to reduce nutrient loading from all major sources of nitrogen and phosphorus in the Mississippi/Atchafalaya River Basin (MARB). An Interim Target of a 20% reduction[1] of nitrogen and phosphorus loading by 2025 is a milestone for immediate planning and implementation actions, while continuing to develop future action strategies to achieve the final goal through 2035. Federal agencies, States, Tribes and other partners will work collaboratively to plan and implement specific, practical and cost-effective actions to achieve both the Interim Target and the updated Coastal Goal.

[1] *The percent reduction is relative to the average MARB nutrient loading to the Gulf of Mexico during the 1980-1996 period.*

2. Commitment to Accelerated and New Actions to Reduce Nutrients Basinwide

Since 2001, the effort to reduce nutrient delivery to the Gulf of Mexico has seen progress at the local level in many locations within the MARB. However, the lack of overall progress to reduce the size of the Gulf of Mexico hypoxic zone illustrates the significant scaling up of action needed to reach the Interim Target within the next decade. Achieving meaningful progress will require well-targeted programs that expand existing and build new partnerships while supporting information and education programs to promote on-the-ground implementation. The HTF continues to follow the 2008 Action Plan, but since we have not seen a measurable reduction in nutrient loads delivered to the Gulf of Mexico between 2001 and the present time, the HTF is providing a set of initiatives to achieve the new Interim Target.

The following near-term actions were identified by the HTF based on their potential effectiveness in achieving progress toward the Interim Target. These actions focus on accelerating the implementation of existing programs and ongoing activities, as well as expanding the capacity of the HTF agencies and partners.

- **State Nutrient Reduction/ Strategies:** All states that are part of the HTF have submitted draft or completed State Nutrient Reduction Strategies (state strategies) for addressing nutrients within the respective state. The focus now can shift from planning to implementation of state strategies and updating of the strategies, as needed, to document, track, and report on nutrient activities or to quantify the nutrient load reductions that accrue from implementation of the state strategies so that their contribution to meeting the Interim Target in aggregate can be assessed. In addition to each state's own measures, the HTF commits to develop and report on a standard subset of measures applicable to all states that can improve quantification of progress.

- **Federal Programs:** At the federal level, integrate, strengthen and quantify the nutrient load reductions from programs scaled at the basin level, including, but not limited to, the USDA Regional Conservation Partnership Program, USDA Mississippi River Basin Healthy Watershed Initiative, US Fish & Wildlife Service (FWS) Mississippi River Habitat Initiative, FWS Landscape Conservation Cooperatives, Water Quality Standards development, and floodplain restoration and management by federal agencies and state and private partners.

- **Quantitative Measures:** Implementation of effective actions to reduce nutrient loadings must be verified with improved tracking mechanisms and watershed monitoring and modeling tools supported by the HTF and member agencies. These mechanisms and tools should be capable of being applied basin-wide to quantify and predict the ultimate nutrient reduction benefits of actions taken by HTF agencies and partners. Progress would also continue to be assessed by a coordinated basin-wide inland monitoring program, coupled to a coastal and offshore monitoring program.

- **Funding:** Recommit to the principle of the previous HTF Action Plans to identify funding needs and sources associated with specific and quantifiable nutrient reduction actions, pursue additional funding, and integrate this information in annual agency budget processes for the Interim Target and Coastal Goal since neither the Interim Target nor the Final Goal can be achieved without significant additional resources.

- **Partnerships:** Continue to expand existing and new HTF partnerships and alliances to carry out ecosystem and watershed restoration actions that result in nutrient load reductions. Where possible, strategically coordinate these partnerships to help the HTF reach the 2025 Interim Target, as well as work with partners to quantify and account for the load reduction benefits of these partner efforts. Five key sets of partners will be necessary for success:

Universities – The Land Grant Universities (LGUs) within the Basin provide both support for critical research needs and outreach to many communities throughout the Basin, including in particular the agricultural community. LGUs are already partnering with individual states to address the diversity of nutrient sources and geographic, climatic and hydrologic variability of the MARB. In addition to these individual state partnerships, the LGUs are working collaboratively across the MARB to improve the consistency of communications and collectively advance technologies and knowledge needed to reach the HTF goals. LGUs across the HTF states have played a critical role in assisting with the development of state nutrient strategies, and they will continue to play an integral role in implementing these strategies as recognized by the Non-Funded Cooperative Agreement developed between the HTF and these universities. This agreement provides a partnership framework between the LGUs and HTF that will serve to focus efforts of mutual interest specific to the MARB and HTF efforts.

Farmers and Agricultural Organizations – Farmers are recognized for their long tradition of commitment to soil and water stewardship and have been a critical part of the development and implementation of state strategies in every state. Farm innovations and the examples set by early adopters help improve solutions and provide needed demonstration, accelerating the rate of adoption of actions that improve agricultural productivity and water quality. The members of the HTF will seek to promote and stimulate markets for farmer led actions that improve water quality and enhance ecological benefits and services. Reducing the loss of nutrients, while simultaneously providing economic, agronomic, and soil health benefits, will be a win-win, benefiting farm sustainability, as well as downstream waters.

Businesses – The ability of business to create products and services to meet the needs of the American people is unprecedented. Nitrogen inhibitors and other products already play key roles in keeping nutrients in the soil and getting those nutrients to plants. Additionally, many businesses are actively working to reduce their environmental impacts and have lessons to share that will enable other businesses to implement similar actions. For example, those industries that discharge significant nutrients can provide leadership in identifying and piloting cost effective process optimization or control technologies.

Cities and Communities – Municipal wastewater agencies and the communities they serve will be relied upon to improve performance of sewage treatment facilities as a component of state nutrient strategies. Groups such as the Mississippi River Cities and Towns Initiative illustrate the number of ways these cities rely on the river and its tributaries. Achieving the Coastal Goal will require reductions from all sources of nutrients and will benefit those who depend on the river for water, recreation and many other uses.

Other Non-governmental Organizations – Many non-governmental organizations have goals and missions that overlap and are consistent with those of the HTF and are working on initiatives related to water quality and nutrients in the MARB.

- **Research:** Research is a core need for creating and improving effective actions and reducing uncertainties. We will also need to develop new technologies and shifts in practices over the period of the Interim Target, the Final Goal, and beyond. The 2008 Action Plan highlights a number of relevant research areas. In addition, the effects of extreme weather events on the Gulf of Mexico hypoxic zone and on the actions taken to lessen nutrient inputs in the Basin must be studied. The need for science is complemented by a need for a greater inclusion of the social sciences, especially the emerging field of behavioral economics, to determine how to best promote sound practices and understanding of the importance of the health of the MARB and Gulf of Mexico to this nation.

- **Reporting to Congress:** In the Biennial Report to Congress commencing June 30, 2015, report on the progress made by the HTF federal agencies and states toward nutrient load reductions, lessons learned and appropriate actions. Present to Congress a clear view of the priority needs to meet those load reduction goals and how adaptive management will be used to track and, if necessary, revise the strategies set forth in the Gulf Hypoxia Action Plan.

https://www.epa.gov/sites/default/files/2015-07/documents/htf-goals-framework-2015.pdf

Deepwater Horizon – BP Gulf of America Oil Spill

On April 20, 2010, the oil drilling rig *Deepwater Horizon*, operating in the Macondo Prospect in the Gulf of America, exploded and sank resulting in the death of 11 workers on the Deepwater Horizon and the largest spill of oil in the history of marine oil drilling operations. Four million barrels of oil flowed from the damaged Macondo well over an 87-day period, before it was finally capped on July 15, 2010. On December 15, 2010, the United States filed a complaint in District Court against BP Exploration & Production and several other defendants alleged to be responsible for the spill.

This webpage provides information and materials on EPA's enforcement response to the Deepwater Horizon Oil Spill, settlements with several of the defendants, including the record-setting settlement with BP Exploration & Production for an unprecedented $5.5 billion Clean Water Act penalty and up to $8.8 billion in natural resource damages.

The information provided below is limited to EPA's enforcement-related activities only, and does not cover all legal or other actions against BP Exploration & Production and other parties for the spill, such as private party/class action settlements for medical claims and economic damages, or other actions against those responsible for the spill. The U.S. District Court for the Eastern District of Louisiana has established the Deepwater Horizon Oil Spill <https://www.laed.uscourts.gov/oilspill/oilspill.htm> website for this purpose. In addition, links for additional information on the spill, cleanup activities and other responses are provided below.

On this page:

- Case and Settlement Information
- Additional Information

Case and Settlement Information

- December 15, 2010: Civil complaint of the United States <https://epa.gov/enforcement/complaint-and-summary-judgment-deepwater-horizon-bp-gulf-mexico-oil-spill>
- February 17, 2012: $90 million civil settlement with MOEX Offshore 2007 LLC <https://epa.gov/enforcement/moex-offshore-2007-llc-settlement>
- February 22, 2012: Court order granting partial summary judgment of liability for the spill <https://epa.gov/enforcement/complaint-and-summary-judgment-deepwater-horizon-bp-gulf-mexico-oil-spill>
  - June 4, 2014: 5th Circuit decision affirming ruling on summary judgment - 5th Circuit Decision June 4, 2014 <https://epa.gov/enforcement/5th-circuit-decision-june-4-2014>
  - November 5, 2014: 5th Circuit decision denying panel reconsideration and affirming summary judgment ruling - Nondispositive Panel Opinion <https://epa.gov/enforcement/5th-circuit-decision-denying-panel-reconsideration-and-affirming-summary-judgment-ruling>
  - January 9, 2015: 5th Circuit order denying petition for rehearing en banc - Deepwater Horizon order denying petition for rehearing en banc <https://epa.gov/enforcement/deepwater-horizon-order-denying-petition-rehearing-en-banc>
- November 15, 2012: $4 billion criminal plea agreement with BP Exploration & Production <http://www.justice.gov/criminal/vns/docs/2012/11/2012-11-15-bp-guilty-plea-agreement.pdf>
- January 3, 2013: $1 billion civil settlement with Transocean Offshore Deepwater Drilling Inc., Transocean Deepwater Inc., Transocean Holdings LLC, and Triton Asset Leasing GmbH ("Transocean") <https://epa.gov/enforcement/transocean-settlement>
- January 3, 2013: $400 million criminal plea agreement with Transocean <https://www.justice.gov/sites/default/files/criminal-vns/legacy/2013/01/18/2013-01-03-transocean-plea-agreement.pdf>
- September 4, 2014: Phase One Trial: Findings of Fact and Conclusions of Law on Gross Negligence and Willful Misconduct <https://epa.gov/enforcement/phase-one-trial-findings-fact-and-conclusions-law-gross-negligence-and-willful>

- January 15, 2015: Phase Two Trial: Findings of Fact on Source Control and the Amount of Oil Spilled <https://epa.gov/enforcement/phase-two-trial-findings-fact-source-control-and-amount-oil-spilled>
- February 19, 2015: Ruling on Maximum Dollars-Per-Barrel Penalty Amount, as Adjusted by the Penalty Inflation Act <https://epa.gov/enforcement/ruling-maximum-dollars-barrel-penalty-amount-adjusted-penalty-inflation-act>
- October 5, 2015: $14.9 billion civil settlement with BP Exploration & Production <https://epa.gov/enforcement/consent-decree-deepwater-horizon-bp-gulf-mexico-oil-spill>
- November 30, 2015: $159.5 million Civil Penalty Ruling Against Anadarko Petroleum Co. <https://epa.gov/enforcement/civil-penalty-ruling-against-anadarko-petroleum-co>

Additional Information on the Deepwater Horizon Oil Spill

- Restoring the Gulf of America After the Deepwater Horizon Oil Spill <https://epa.gov/deepwaterhorizon>
- 2010 National Coastal Condition Assessment Results and Report <https://epa.gov/national-aquatic-resource-surveys/ncca>
- RestoreTheGulf: official federal government site for spill response and recovery <http://www.restorethegulf.gov/>
- Final Report <https://www.gpo.gov/fdsys/pkg/gpo-oilcommission/pdf/gpo-oilcommission.pdf> of the National Commission on the BP Deepwater Horizon Oil Spill
- Deepwater Horizon Joint Investigation Team <https://www.bsee.gov/site-page/deepwater-horizon-joint-investigation-team-releases-final-report>

Last updated on April 23, 2025

How China is designing flood-resistant cities

YouTube Video

https://youtu.be/nf-Yy3EuZi0?si=-zpo-pYbEwl-oc8d

Managing stormwater to improve Canadian cities' safety and resilience

Government of Canada Gouvernement du Canada

February 18, 2022 - Ottawa, Ontario

Adapting to new realities, in a changing climate

The population density in Canadian cities has continued to increase over time. Combined with rising sea levels and unpredictable precipitation, the pressure on municipal infrastructure to manage excess water has been increasing. Stormwater infrastructure plays a critical role in helping to prevent urban flooding. By studying how it performs during extreme storms, engineers can provide advice to help local authorities adapt their infrastructure and mitigate losses from flooding.

In this context, the City of Toronto worked with researchers from the National Research Council of Canada (NRC) who have technical expertise in infrastructure resilience supported by well-known, unique testing facilities. The objective of the project was to study how increased rainfall behaves on Toronto streets and how efficiently the existing infrastructure diverts water into the storm drainage system.

Recreating roads inside the testing facilities

Researchers from the NRC's Ocean, Coastal and River Engineering and Construction Research Centres worked together on this project as part of the Climate-Resilient Buildings and Core Public Infrastructure (CRBCPI) Initiative, and with funding support from Infrastructure Canada and the City of Toronto. Since 2016, the NRC has been working to develop decision-support tools such as national model codes, guides, standards and climate design data to help ensure buildings and core public infrastructure are designed and built to withstand the effects of climate change in Canada. In fact, the idea for the project arose from a workshop that the NRC organized with municipalities to identify research needs.

With expertise in adaptive and sustainable engineering solutions, and in structural and coastal resilience, the NRC has been supporting the development of technologies to mitigate the impacts of weather extremes and climate change, including flooding from coastal and inland sources.

The building of a road infrastructure physical model, using wood and tar paper.

At the NRC's [Coastal wave basin research facility] in Ottawa, NRC experts built a physical model of the City of Toronto's road infrastructure, using wood and tar paper. With a water pump and a flow straightener, they recreated several scenarios from typical light rain conditions to heavy rains and even extreme flood conditions. Through testing, researchers evaluated the infrastructure's ability to capture the water under various flooding conditions.

"It's always rewarding to help our clients answer important questions that allow them to make key decisions. It's also interesting to "play" in the lab and see what it's like to throw 1 ton of water on a roadway every 2.5 seconds. It's like having a waterfall running through your office," says research council officer and project manager, Louis Poirier.

Choosing the right grates for the best results

Various grates used as entrance points to the underground catch basins.

To manage this water and prevent overland flooding that can lead to basement flooding, surface grates and catch basins on the street play a crucial role. As the only visible part of a much larger infrastructure system, surface grates and catch basins collect stormwater (rain or melted snow) from streets and move it through a complex underground storm sewer system. The stormwater eventually flows into the environment—normally a river, stream or lake. Although all surface grates and catch basins serve the same purpose, which is to move stormwater off the roadway, each surface grate model offers unique advantages, suited for different results. Some of the common catch basin grate patterns residents may see while walking in their neighbourhood include the herringbone pattern, a square grid, or parallel rectangular bars. To aid drainage, the grates are often placed near intersections and along low points in the roads. Residents can help reduce flooding by keeping them clear of leaves, debris, and snow.

Using wave gauges to calculate the amount of water on the model road surface, the research team determined how much water was removed from the roadway for each catch basin in various conditions. Data was collected for numerous scenarios, including various surface grates pattern styles and different incident water depths. The results gathered from the testing phase will help the City of Toronto and other Canadian municipalities improve the numerical models of their storm drainage system, to better meet the challenges of managing extreme rainfall events.

Close-up picture of a large grate under water.

"We're looking forward to reviewing the data from this research and applying it to the City of Toronto's ongoing planning and future stormwater management and basement flooding-prevention projects. Thank you to the team at the National Research Council of Canada for your scientific and technical expertise, and for working with us on this exciting and innovative project," says Jennifer Spence, Project Manager with Toronto Water who, together with Senior Engineer Tom Dole, led this study for the City of Toronto.

Working together to make cities more resilient for all Canadians

With a changing climate and increasing urbanization, municipal authorities will need to continue to adapt to new realities. A better understanding of their existing infrastructure's performance will support informed funding decisions when it comes to expanding, upgrading or replacing existing systems. Planning for severe weather events and using prediction tools and physical testing of novel infrastructure will lead to improved flooding preparedness and resilience.

With infrastructure being the backbone of modern society, the federal government is investing to modernize Canada's infrastructure to ensure that it is sustainable, inclusive and resilient for future generations. As part of its Departmental Sustainable Development Strategy 2020 to 2023, the NRC is committed to supporting the federal sustainable development goals through research towards modern and resilient infrastructure. This project realized with the City of Toronto and the NRC will help Canada create safer and more sustainable environments for all Canadians.

From: National Research Council Canada

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