NEW YORK STATE | Department of Environmental Conservation

Hudson River Estuary Action Agenda 2021–2025

OPPORTUNITIES FOR ACTION

Kathy Hochul, Governor | Basil Seggos, Commissioner

About the Hudson River Estuary Program and the *Action Agenda*

The Estuary Program helps people enjoy, protect, and revitalize the Hudson River estuary and its valley. The *Action Agenda* proposes strategies and actions to be taken by the program and collaborating partners through 2025.

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Letter from the Commissioner

New York is blessed with abundant natural resources that helped shape our state and nation. The Hudson River serves as both a resource and an influence in our economy, and continues to support local communities, key industries, and millions of people. It is vital that we continue to protect and restore the river and its watershed to ensure these natural resources remain vibrant and beneficial for residents, visitors, and businesses.

This *Action Agenda* outlines New York's goals for the conservation of the Hudson River estuary and its watershed. It sets a course to address the challenges we face in improving water quality; protecting fish, wildlife, and habitats; and providing access for recreation. It identifies two cross-cutting issues that will affect every aspect of our work—climate change and environmental justice.

New York has become a global leader in building climate resilience and addressing the causes of climate change. Governor Kathy Hochul is bolstering New York State's commitment to the work of creating a more fair and just society.

In New York, the Hudson Valley has emerged as a region that fully embraces these two complementary priorities. With this *Action Agenda*, the New York State Department of Environmental Conservation (DEC) is working to better address longstanding systemic inequities and build a more climate-resilient environment.

With the strong support of government partners, civic and environmental groups, and local residents, DEC has developed an effective team to achieve results for the Hudson estuary and its watershed.

The following pages feature opportunities for action that will protect, restore, and improve this vital state and regional resource. I encourage you to read this *Action Agenda* to learn about the successes we have achieved, the challenges facing the estuary, and the strategies and goals we will advance over the next five years.

We look forward to your support as we work to implement a shared, targeted, and inclusive vision for the future of this historic, national treasure.

Sincerely,

Basil Seggos, Commissioner

Table of Contents

Letter from the Commissioner iii

DEC's Hudson River Estuary Program Mission 1

Acting on Our Values 3

The Hudson River Estuary Management Advisory Committee 4

About the Estuary and Its Watershed 5

Climate Change and Environmental Justice 7

Challenges and Opportunities for the Decade Ahead 9

About the *Action Agenda* 2021–2025 11

A Vital River Ecosystem 15
- Benefit: Sustainable Estuarine Fisheries 15
- Benefit: Robust River Habitats 18
- Benefit: Clean Hudson River Water 21

A Thriving and Resilient Watershed 25
- Benefit: Healthy Tributaries 25
- Benefit: Climate-Adaptive Communities 27
- Benefit: Conserved Natural Areas for Wildlife, Source Water, Climate Resilience, and Scenery 29

People Living Well with Nature: Recreation, Education, and Inspiration 33
- Benefit: An Informed and Engaged Public 33
- Benefit: An Accessible Hudson River for People of All Ages and Abilities 35

DEC's Hudson River Estuary Program Mission

DEC's Hudson River Estuary Program helps people enjoy, protect, and revitalize the Hudson River estuary. Created in 1987 through the Hudson River Estuary Management Act (ECL 11-0306), the program focuses on the tidal Hudson and its adjacent watershed, from the federal dam at Troy to the Verrazzano Narrows in New York City, including the upper New York-New Jersey Harbor. The program works with many groups to develop knowledgeable and effective stewards of the estuary, using an understanding of the river's ecology as a foundation for its work.

The *Action Agenda*, which is periodically updated, forms a conservation and restoration blueprint to guide the program. It expresses a shared vision for the region, as defined by diverse groups of people who live and work along the river and in its watershed. Implementation of the *Action Agenda* relies on partnerships. Federal and state agencies, as well as local municipalities, nonprofits, academic and scientific institutions, businesses, landowners, and dedicated volunteers, all play a role.

The Estuary Program's role is to develop the essential actions necessary to achieve that vision and to organize, support, and guide our many partners to realize the goals of the vision. By engaging, informing, and empowering these communities, organizations, and individuals, the Estuary Program produces positive impacts on the Hudson River estuary and its watershed to ensure a healthy and thriving ecosystem for the benefit of the people. Partnerships can include collaborations with state agencies, grants to community groups, and assistance provided by program staff.

The Estuary Program offers a variety of programs to support our partners, including:

- Education and training;
- Technical assistance and grants; and
- Research, monitoring, and mapping.

The program is funded through the New York State Environmental Protection Fund (EPF) in partnership with Cornell University and the New England Interstate Water Pollution Control Commission (NEIWPCC). Local partners can receive grants from the Hudson River Estuary Program to help achieve the overall vision and to implement the strategies and actions.

With this *Action Agenda*, DEC is focusing the program mission on more fully addressing environmental justice and building a more climate-resilient environment, using the Estuary Program's successful model of science-based collaborative partnerships.

Acting on Our Values

With this *Action Agenda*, DEC expresses its intention to act on a core value of respect for the living environment and for human life sustained in this ecosystem for over 10,000 years. As an agency charged with stewardship of these lands and waters, we understand the way the Hudson nurtures an abundance of life. For many of us, the river and its valley evoke an inspiring connection. Their beauty and mystery are a source of joy that we seek to pass on to future generations. This recognition guides our work and continues a tradition expressed by those who first made this their homeland—the Muhheaconneok (Mohican) and Lenape (Delaware) People, original stewards of this river and valley whose descendants remain engaged with it today. It is a tradition we now continue in our yearly celebration of Earth Day and in events such as "A Day in the Life of the Hudson and Harbor."

Living in harmony and balance is something we learn from nature and can practice with others. We understand that our common humanity transcends our differences and pledge through this *Action Agenda* to foster deeper human connections as part of our stewardship practice. Throughout millennia, many different people from around the globe have made this ecosystem their home, and the strands of their cultures are woven into the fabric of our present-day communities. Native People are still here and are vibrant and thriving, contributing their traditional knowledge despite centuries of dispossession, discrimination, cultural appropriation, and diaspora. Many others celebrate their love of this place, including populations who also may have painful associations with discrimination they have experienced here. We all benefit from sharing, sustaining, and safeguarding the river and valley, and from deepening our connections with each other and with nature. The river supports our happiness, our health of mind, and our physical well-being.

Therefore, in the spirit of reflection, and in support of generations to come, we express our commitment to continue building authentic relationships with the Original People of this Hudson River valley and with all who have ties with the river today. As we plan for the future, we will welcome home those who came before us and also join in celebration with many different groups of people who love this river and valley as we do, so that we may continually improve as stewards of the land and rivers we share.

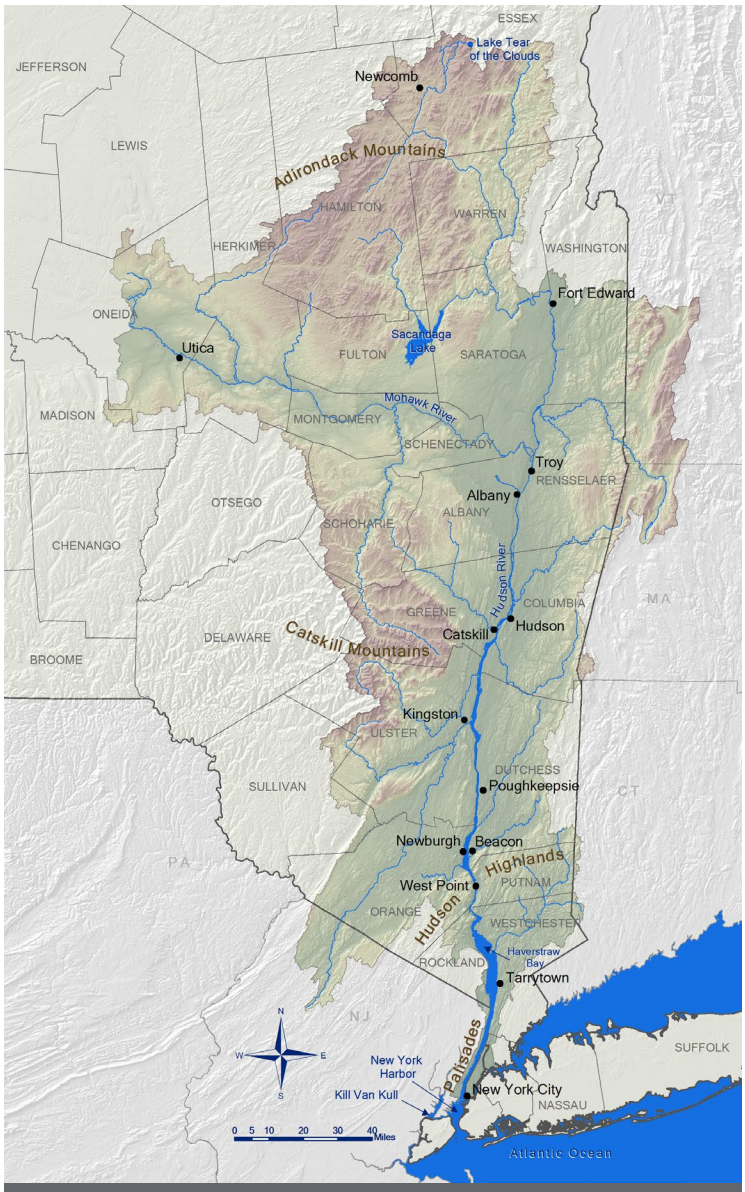
The Hudson River Estuary Management Advisory Committee

The Hudson River Estuary Management Advisory Committee (HREMAC) provides guidance to the program. It helps New York State define goals and evaluate progress. Committee members also provide a communication bridge to a wider group of partners, communities, and stakeholders. Numerous government agencies participate as *ex-officio* members of the committee to provide coordination and to help deliver our *Action Agenda* results. At the time of publication of the *Action Agenda*, the members are:

HREMAC Members		
Stuart Findlay, Committee Chairman Cary Institute of Ecosystem Studies	**David Decker** Constitution Marsh Audubon	**Peter Park** SUNY Farmingdale
Corey Allen Habitat for Humanity of Greater Newburgh	**Todd Erling** Hudson Valley Agri-Business Development Corp.	**George Schuler** The Nature Conservancy
Allan Beers Rockland County Dept. of Environmental Resources	**Walter Garschagen** Sea Tow	**Dan Shapley** Riverkeeper
Andy Bicking Scenic Hudson	**Oded Holzinger** Groundwork Hudson Valley	**Richard Slingerland** Historic Hudson River Towns
Jim Bonesteel Rensselaer Plateau	**Karen Imas** Waterfront Alliance	**Steve Stanne** Hudson River Sloop Clearwater
Janet Burnet Ramapo River Watershed Council	**Lucille Johnson** Vassar College and Environmental Consortium of Colleges & Universities	**Emily Svenson** Hudson 7
Carla Castillo Hudson Valley Regional Council	**Jon Kramer** Hudson River Foundation	**Shino Tanikawa** NYC Soil & Water Conservation District
Scott Croft Hudson River Boat and Yacht Club Assoc.	**Suzette Lopane** Westchester CountyDept. of Planning	**Ed Skorupski** Recreational Angler, Outdoor Writer
Martin Daley Capital District Regional Planning Commission	**John Mylod** Commercial Fisherman	
HREMAC Ex-Officios		
Peter Brandt U.S. Environmental Protection Agency	**Jamie Ethier** NYS Department of State	**Audrey VanGenechten** NYS Department of Health
Diana Carter NYS Office of Parks, Recreation and Historic Preservation	**Scott Keller** Hudson River Valley Greenway	**Peter Weppler** U.S. Army Corps of Engineers
Chris DeRoberts New York Power Authority	**Jessica Kuonen** NY Sea Grant	
Noreen Doyle Hudson River Park Trust	**Rob Pirani** NY-NJ Harbor & Estuary Program	

About the Estuary and Its Watershed

The Hudson River estuary stretches 153 miles, from Troy to New York Harbor—nearly half of the river's 315-mile course between Lake Tear of the Clouds in the Adirondacks and the tip of Manhattan Island. Twice daily, the ocean's tides are felt all the way up to the Troy dam. With this rise and fall come changes in the direction of flow. Salty seawater pushes up the estuary from the ocean, diluted by freshwater from the upper Hudson and tributaries. In the northern reaches, the estuary is a freshwater tidal environment. More than 200 species of fish are found in the Hudson estuary ecosystem. Coastal migratory fish, like striped bass, sturgeon, and shad, depend on spawning and nursery habitat here. Bald eagles, herons, waterfowl, and other birds feed from the river's bounty. Tidal marshes, mudflats, and other habitats in and along the estuary support a great diversity of life. People also flourish here thanks to the river's rich natural resources. The Hudson provides drinking water for cities, supports the region's tourism and business economies, and offers a destination for swimming, fishing, and boating. It inspires people with its natural beauty.



The Hudson River watershed is 13,400 square miles. The Estuary Program focuses on the 5,200 square miles from the Verrazzano Narrows below Manhattan Island to the head of tide at the federal dam in Troy.

The land area of the Hudson's watershed covers nearly 13,400 square miles, roughly the size of Massachusetts and Connecticut combined. Rain that falls in the watershed eventually ends up in a stream that flows to the Hudson. More than 14 million people live in the counties adjoining the estuary, an area that roughly corresponds to its watershed.

The Mohawk River is the Hudson's largest and best-known tributary stream. The Estuary Program focuses on the lower half of the Hudson, south of its confluence with the Mohawk—the stretch of tidal river from the federal dam in Troy to the Verrazzano Narrows, including the Upper New York-New Jersey Harbor, as well as the East River and the Harlem River, which flow around Manhattan Island into the harbor. We also include the surrounding Hudson River Valley, which encompasses 5,200 square miles of the river's overall watershed.

Climate Change and Environmental Justice

Two cross-cutting issues affect every aspect of the program mission, presenting both challenges and opportunities: climate change and environmental justice. These issues are interconnected.

Climate change: Here in New York State, we are experiencing climate change faster than the national and global averages. Since the Hudson River is tidal, our waterfront communities face increasing flooding from strong storms and inundation risks from sea-level rise. Water levels have risen a foot on the Hudson over the last 100 years. This rise is predicted to accelerate.

Sea-level rise, storm surge, coastal flooding, water quality, and water quantity issues arising from climate change will affect drinking water supplies, watershed land uses, river access, and recreation. Examples of these climate impacts include drought; higher water temperatures; low flows; and greater frequency and intensity of rainfall, resulting in stormwater runoff, erosion, sedimentation, and sewage overflows, all of which have the potential to contribute to an increase in algal blooms.

The 2019 Climate Leadership and Community Protection Act (Climate Act) sets groundbreaking requirements to have 100% zero-emission electricity by 2040 and reducing greenhouse gas emissions to 85% below 1990 levels by 2050. The Climate Act also requires landmark investments in disadvantaged communities, which will be defined and identified by the Climate Justice Working Group (CJWG) established by the Climate Act. Please visit https://www.nyserda.ny.gov/ny/disadvantaged-communities to view the interim map of disadvantaged communities in New York State.

Communities in the Hudson Valley are also climate leaders: 120 of the 261 communities in our watershed are registered Climate Smart Communities (CSCs) as of January 2021. The Estuary Program is actively encouraging this participation in the CSC program. In addition, the program is empowering our communities by piloting new, innovative programs like climate-adaptive design, planning for sea-level rise in municipal comprehensive plans, and advancing nature-based sustainable shorelines. Climate leadership is becoming an element of the region's identity. More than 194 climate adaptation actions have been completed in 120 watershed municipalities since 2015. Overall, our technical assistance to communities has leveraged $20 million in funding, mostly from the state, for climate resilience projects.

Diversity, equity, inclusion, and justice (DEIJ): People with different capabilities, resources, and interests experience the river in different ways and can be affected by decisions made without their input. All areas of the Hudson River Estuary Program's mission must be carried out in a more inclusive way, considering diversity, equity, inclusion, and justice. Populations disproportionately impacted by environmental hazards must be included at all stages of the decision-making process. We will seek input from our EJ communities, as well as people of all abilities. A DEIJ Road Map for the Estuary Program is being developed that will guide every aspect of the program. The Road Map will be a living document that can be updated as we continue to learn and improve our program delivery. DEC welcomes the feedback of partners who wish to see the draft Road Map and help us improve it.

We recognize that meeting our collective conservation goals will have social impacts, both positive and negative, locally and regionally. Although we are accustomed to focusing on positive impacts like cleaner water and air and more access to education and recreation, our program and partners are becoming more aware of the potential negative impacts of our work.

One potential negative consequence of conservation work is called “green” or “environmental” gentrification and is the process by which cleaning up the environment and other forms of greening leads to increases desirability and local property values, thereby attracting wealthier buyers and displacing lower-income residents.

The Estuary Program is committed to understanding, and, where possible, mitigating the potential for the negative social consequences of our conservation work. Our vision for success includes reaching more underrepresented groups with our programming and working together with more diverse partners to design and pilot holistic and thoughtful solutions to achieving our targets.

Challenges and Opportunities for the Decade Ahead

The Hudson Valley and the estuary are poised to provide models for new approaches to the management of ecosystems. Over the last 30 years, DEC has continuously invested in building the knowledge and skills of municipalities, non-governmental organizations, elected officials, schoolchildren, and others so they can become good stewards of our unique ecosystem for the benefit of the people who live, work, and recreate here. DEC has informed and empowered many partners through science, training, technical assistance, and grants. We have a strong track record of success, and several programs we piloted are now being adopted statewide.

Today, the challenges we face create opportunities for action, including:

- Wastewater infrastructure: Water and sewer systems are aging. Repairs and upgrades to ensure adequate capacity for current and future growth and climate conditions in the watershed are expensive. The opportunity to modernize our systems is greatly enhanced by the sustained funding for the Clean Water Infrastructure Act in New York State.
- Land use and sprawling development patterns: Changes in land use and impacts of sprawl affect the region's water resources, tourism economy, wildlife habitats, and scenery. In a recent opinion poll conducted by the Estuary Program, when asked what they value most about this region, residents cited its natural beauty as number one. Land use choices within the watershed can impact the quality of water downstream, the availability of drinking water, the ecosystem of the river, and our ability to adapt to the changing climate.
- Fish and wildlife: Actions up and down the Atlantic coast affect the Hudson's signature fisheries. The ways that other states manage coastal fisheries have a direct impact on what we can achieve here. Fortunately, governance structures exist for interstate decision-making, and DEC actively participates in this process. Invasive plant and animal species continue to arrive and affect the productivity of the ecosystem, including habitat for fish and wildlife. Working with DEC's invasive species programs and partners continues to be a priority. The growth of wildlife-related recreation is a positive factor for this region.
- Legacy contaminants: Polychlorinated biphenyls (PCBs) and other industrial contaminants are a continuing cause for concern. Gradually, these contaminants are being cleaned up. New York State is demanding a complete cleanup of PCBs from the river, to address this threat to human health and the environment.
- Recreation: Increasing numbers of residents and tourists are using the Hudson for swimming and other activities, raising concerns about water quality conditions. Conflicts between small craft and commercial marine traffic may increasingly occur. Climate extremes are likely to increase sewer overflows that result in worsening water quality, while at the same time, people will seek to swim in the river for relief from extreme heat. Members of disadvantaged communities are less likely to have access to official bathing areas where water quality and water safety are more carefully managed.

The solutions to these issues must include diverse management actions and involve everyone. The Hudson River Estuary Program, with its model of leadership through partnership, is prepared to take on this challenge and take advantage of new opportunities to restore our environment.

About the *Action Agenda* 2021–2025

The New York State Department of Environmental Conservation (DEC) developed this *Action Agenda* update for 2021–2025 with the input of many community groups and citizens throughout the region. The outcomes included here are measurable and achievable by 2030. They build on a strong record of success in achieving progress in each of our core areas of expertise, as expressed in previous *Action Agendas*. Copies of our progress reports are available online at www.dec.ny.gov/lands/4920.html.

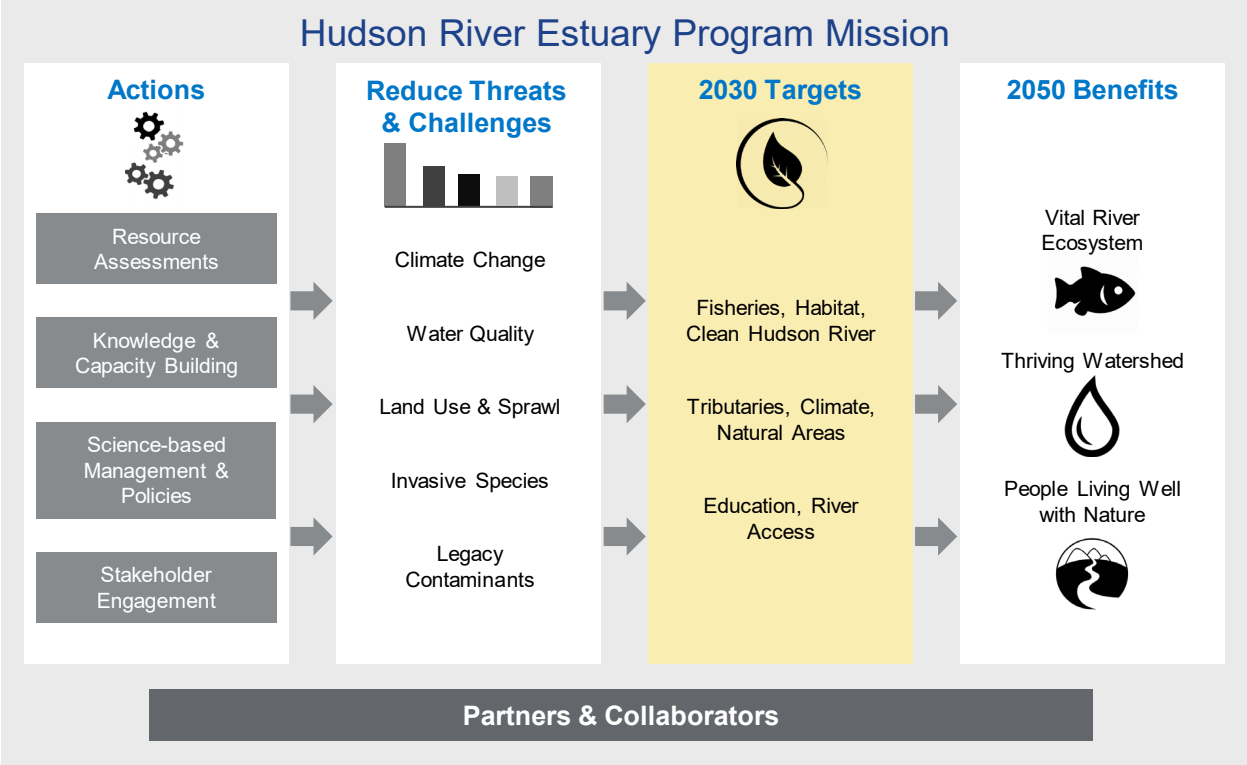
The *Action Agenda* sets objectives that can be achieved through collective action and collaboration among government and non-governmental partners. No one organization or agency can fund all the science, education, and conservation initiatives needed to protect and restore the Hudson and its watershed. This document is a collective vision with opportunities for and needed actions by many partners. The implementation of the *Action Agenda* is an ongoing process subject to modifications as we progress. It embraces the actions needed to conserve the Hudson River estuary and its larger ecosystem, including, where relevant, the connected ocean and estuarine waters surrounding the estuary—the lower New York Bay, the Bight, and the Long Island Sound—as well as the Mohawk River and the upper Hudson. A companion *Action Agenda* has been developed and is being implemented for the Mohawk River Basin to guide stewardship of this major tributary. Similarly, the *New York Ocean Action Plan* guides the actions that the State and its partners will take to conserve ocean waters and ocean life. New York State's DEC is also a partner in the New York-New Jersey Harbor and Estuary Program, whose *Action Agenda* focuses primarily on the saltier, more urban bi-state waters of the estuary from south of the Governor Mario M. Cuomo Bridge to Sandy Hook, New Jersey.

DEC encourages partners reading this *Action Agenda* to consider how their vision for the Hudson can be woven into this shared strategy for the future of the river and for the benefits it provides the people who live in, work in, and enjoy this remarkable place. This document establishes measurable long-range targets for 2030. It proposes Strategies and Actions to be taken from 2021–2025 by New York State and collaborating partners.

After five years, our collective progress will be assessed, and the *Action Agenda* will be refreshed and updated, as needed, to adjust for changing circumstances. New or updated actions will be defined for 2026–2030 to meet the 2030 Targets and their associated Measures of Success.

The chapters of this document are built around the key benefits people receive from a strong and vibrant ecosystem:

- A Vital River Ecosystem
  - Sustainable Estuarine Fisheries
  - Robust River Habitats
  - Clean Hudson River Water
- A Thriving and Resilient Watershed
  - Healthy and Resilient Tributaries
  - Climate-Adaptive Communities
  - Conserved Natural Areas for Wildlife, Source Water, Climate Resilience, and Scenery
- People Living Well with Nature: Recreation, Education, and Inspiration
  - An Informed and Engaged Public
  - An Accessible Hudson River for People of All Ages and Abilities



The *Action Agenda* has been developed over the years based on our successful model of engaging, informing, and empowering communities, organizations, and individuals to produce positive impacts on the Hudson River estuary and its watershed to ensure a healthy and thriving ecosystem for the benefit of the people. An understanding of ecology is the foundation of our work, which begins with resource assessments.

Implementation of the *Action Agenda* is supported by multiple state agency funding sources, especially an appropriation in New York's EPF. The program offers grants to fund many of the science, education, and conservations initiatives that are needed.

Each chapter is structured to include:

- Goals: The goals are aspirational and long-term.
- 2030 Targets: These also build from previous *Action Agendas* and the *Comprehensive Restoration Plan.* They identify specific, measurable outcomes to be achieved over the next decade to achieve the goal. The 2030 targets are the primary focus of the strategies and next steps that will guide our work under this *2021–2025 Action Agenda*.
- Measures of Success: To track progress in achieving long-term changes that ensure a healthy and thriving estuary ecosystem, each of our 2030 Targets includes specific success measures for 2025 and 2030. Progress on programmatic achievements are reported annually in a *Program Coordinator's Report*. Environmental indicators will be reported every five years in *State of the Hudson* reports. Such indicators are chosen to reflect the condition of the ecosystem and to show change over time. After five years, our collective progress will be assessed and the *Action Agenda* will be updated, as needed, to adjust for changing circumstances. New or updated actions will be defined for 2026–2030 to meet the Targets and their associated Measures of Success.

- Strategies and Actions: Strategies are the collective actions that define how we will achieve our short-term measures of success and, ultimately, our 2030 Targets and Goals. The actions DEC plans to take over the next five years to achieve the 2030 Targets will be used to set our priorities and guide our spending. After five years, the Action Agenda will be refreshed and updated to adjust for changing circumstances, and a new or updated set of actions will be defined through 2030.

- Adaptive Management and Monitoring: The Estuary Program continually practices adaptive management, adjusting our strategies and actions across all program elements to meet new challenges and opportunities as they arise. Comprehensive ecosystem monitoring programs will be further developed to include biological, physical, and selected social measures which could enhance adaptive management going forward by defining ecosystem threats, understanding the impacts of existing and emerging stressors, and informing and evaluating management decisions and progress toward the Goals and Targets identified in the plan.

A Vital River Ecosystem

The estuary is the focus of our program, along with the uses it supports and the benefits it provides to people. This section of the *Action Agenda* addresses the interdependent components of the tidal ecosystem—the fish, the habitats, and water quality.

Benefit: Sustainable Estuarine Fisheries

Background

Wildlife-related recreation in New York generates about $5 billion annually, and a well-managed estuary ecosystem supports important economic opportunities for employment, recreation, and tourism. However, today, blue crabs and river herring support the only remaining active in-river commercial fisheries, and the status of the Hudson's more popular recreational fisheries—shad, striped bass, and black bass—is mixed.

To manage and restore signature species, the program and its partners have established long-term tracking and monitoring programs that provide necessary data on spawning and recruitment, habitat, food sources, river movement, and stock status. Programs to identify and remove dams and barriers that limit the movement of migratory fish, such as herring and eel, are also underway. Ensuring that river fishes are safe to eat depends on the continuation of remediation programs for contaminants, including PCBs, cadmium, and dioxins.

As the climate changes and the sea-level rises, the habitat for migratory fishes will also change, since it is affected by rising temperatures, shifts in salinity and water depths, and the potential loss of tidal wetland and aquatic vegetation acreage. Climate change has already affected the distribution and migratory movement of marine fish along the coast and will continue to do so into the future. Research will help inform management of a changing ecosystem.

Goal

Populations of signature Hudson River fisheries are robust and balanced with the larger ecological community, and contaminant levels are declining in all targeted species. These conditions will support both ecological and economic vitality, while restoring fishing traditions for our signature fish: American shad, striped bass, Atlantic sturgeon, river herring, blue crab, American eel, and black bass.

Key trends, challenges, and opportunities

- Human impacts on fish populations include the introduction of invasive species, climate change, habitat loss, sturgeon-vessel interactions, water quality impairment, fishing harvest, catch-and-release, and bycatch in Hudson River and ocean fisheries.
- Impacts of in-water construction on fish habitat include energy pipelines, shoreline hardening, and shallow-water habitat loss.
- Hard structural responses to increasing flood risk, like surge gates, dams, and floodwalls, threaten aquatic and shoreline habitat, and could impact critical migration pathways.

2030 Target

By 2030, fish populations and contaminants in fish are effectively monitored and managed; Atlantic sturgeon and American shad are making measurable progress toward recovery goals; striped bass show a reverse in the apparent decline in size and number of spawning adult females; and river herring populations are at sustainable levels. Blue crab and black bass are sustainably managed, key habitats needed to support signature fish populations during critical life stages and seasons are identified, protected, or restored.

Measures of Success

- By 2025, our understanding of Atlantic sturgeon spawning habitat locations and seasonal habitat use has been refined, the Atlantic States Marine Fisheries Commission (ASMFC) Atlantic sturgeon management plan has been implemented, and sturgeon are making measurable progress toward interim recovery goals. By 2030, they are on track to meet 2050 management goals for sustainable fisheries developed by the ASMFC.
- By 2025, river herring populations are at sustainable levels, and by 2030, that status has continued.
- By 2025, factors contributing to the failure of American shad populations to recover have been determined, and a shad management plan with identified benchmarks has been adopted. By 2030, shad are making measurable progress toward interim recovery goals.
- By 2025, an index of abundance for the Hudson River striped bass spawning stock has been developed. Factors contributing to the recent decline of striped bass populations have been determined and are actively being managed in accordance with the ASMFC management plan. By 2030, striped bass show a reverse in the apparent decline in size and number of spawning adult females.
- By 2025, a black bass management plan has been developed and implemented, and by 2030, black bass are sustainably managed.
- By 2025, a blue crab management plan has been developed, and by 2030, blue crab are sustainably managed.
- Annually, the "Best Technology Available" standard has been implemented or scheduled in order to minimize or avoid fish kills at industrial and municipal facilities that use water withdrawals for non-contact cooling and for the remaining steam electric power plants.
- By 2025, contaminants (PCBs, dioxins, cadmium) in blue crab have been reduced to levels at or approaching safety for human consumption, as established by the New York State Department of Health (DOH), and by 2030, contaminant level remain at or below these levels.
- By 2025, plans are in place to address potential invasions of invasive/exotic fauna, and by 2030, they have been minimized through preventive measures such as education, outreach, regulatory efforts, and control projects.

Strategies and Actions to Implement the *Action Agenda*

Strategy 1: Continue cutting-edge fisheries science and research to inform adaptive management decisions and test new collection techniques to reduce uncertainty

- Conduct research to improve our understanding of management, life history, ecology, and biology; prioritize threats to migratory species, including climate change, and mitigate those threats.
- Research Atlantic sturgeon spawning habitat locations and seasonal habitat use.
- Determine the prevalence and strain of mycobacteria in Hudson River striped bass and assess the importance of mycobacteria on the Hudson River striped bass population and fishery.

- Monitor signature species annually using the best available science, with data archived, documented, and used to identify trends and to inform management options.
- Conduct research and outreach for American eel conservation.
- Refine the index of Atlantic sturgeon juvenile abundance and monitor the spawning stock population on a regular basis.
- Complete a population estimate for shortnose sturgeon and assessment of trends since the 1990s to monitor the Hudson River population status.
- Annually monitor trends and report levels of contaminants in commonly eaten fish annually to inform the DOH Fish Consumption Advisory.
- Collect new baseline PFAS monitoring data for fish.
- Develop a robust sampling design to measure the index of abundance for Hudson River striped bass spawning stock. Evaluate sampling protocols and modifications that will produce better fish indices of abundance and reduce uncertainty around the index.
- Use current sampling and the index modifications above to produce a revised sampling method to improve the accuracy of the fish abundance indices.
- Seek to establish long-term partnerships and resources to support annual monitoring of fish populations and lower food web communities.
- Develop a research agenda for management of Hudson River fishes.

Strategy 2: Engage stakeholders through outreach

- Develop a plan—in consultation with key stakeholders—to prevent the movement of invasive aquatic species into the Hudson River watershed and canal system.
- Improve communication about fisheries issues to the general public and fishing community. Explore existing public facing activities (i.e., Climate-adaptive Design (CaD) workshops, DOH outreach, Hudson River Environmental Conditions Observing System (HRECOS) network, marine registry) to identify opportunities to improve outreach on timely fisheries topics.
- Increase awareness of anglers about signature fisheries' issues and health risks from eating contaminated fish.
- Engage responsible parties in the development of plans for investigating and remediating in-river sediments and major upland source areas.

Strategy 3: Participate in interstate fisheries management decision-making councils and commissions and adopt management actions to sustain fisheries

- Participate in the adaptive coastwide fisheries management process with the ASMFC.
- Update regulations as needed to sustain fisheries.
- Improve data collection to inform and improve the efficiency and effectiveness of the permitting process for activities that affect Hudson River fish and their habitats; for example, by creating uniform work windows for dredging. Ensure enforcement of existing regulations protective of Hudson River fish and their habitats.

- Require that future Hudson River power-generating, municipal, and industrial facilities have closed-cycle cooling systems to avoid fish kills and meet the Best Technology Available standard pursuant to 6 NYCRR §704.5 and §316(b) of the Clean Water Act. This standard requires minimizing adverse environmental impacts by preventing fish from being impinged on intake screens and from being entrapped in the water withdrawal system. Have schedules to achieve the Best Technology Available standard at existing power plants that have not yet met the standard.

Benefit: Robust River Habitats

Background

The Hudson River estuary supports extraordinary biological diversity and provides important benefits to people. Its complexity of habitats includes shoreline wetlands, aquatic vegetation beds, and the bottom of the river itself. These natural systems are vital for the estuary ecosystem. They also serve our communities by reducing flooding, purifying drinking water, providing wildlife-dependent recreational opportunities for people of all abilities, and supporting all the social, economic, and ecological benefits associated with these activities.

Over the past several years, the Estuary Program, in close collaboration with the Hudson River National Estuarine Research Reserve (HRNERR) and other partners, has established a baseline for analysis of ecosystem change in the watershed over time. Oysters have suffered a significant decline, with less than 0.01% of the historical population existing today. There are at least 12,000 acres of shallow and intertidal habitats, including 7,500 acres of tidal wetlands and 4,600 acres of aquatic vegetation, providing essential habitats for fish, shellfish, birds, and other estuary wildlife. Approximately 53% of the estuary's shoreline between the federal dam at Troy and the Governor Mario M. Cuomo Bridge is currently hardened or engineered.

Now we need to better understand estuary-watershed connections. Multiple consequences of climate change will manifest on practically all Hudson Valley habitats. Wetland elevations may not keep pace with sea-level rise, and habitats and species will migrate. River habitats, if properly managed, can provide significant human benefits, including storm protection, water quality improvement, and carbon sequestration. The establishment of the Hudson Eagles Recreation Area presents opportunities for habitat conservation and restoration.

The Hudson River National Estuarine Research Reserve is one of 29 reserves established by the National Oceanic and Atmospheric Administration (NOAA) to promote informed management of the nation's estuaries and coastal habitats. It improves the health and vitality of the Hudson River estuary by protecting estuarine habitats through education, estuary training, research and monitoring, and stewardship and restoration programs. As such, it is a key partner with the Estuary Program in delivering multiple goals of the *Action Agenda*.

Goal

Conserve, protect, and enhance river and shoreline habitats to assure that life cycles of key species are supported to sustain a healthy ecosystem.

Key trends, challenges, and opportunities

- Invasive species and contamination will continue to degrade the ecosystem value of essential habitats. Climate change is likely to increase precipitation, storm intensity, storm surge, water temperatures, and the potential for harmful algal blooms.
- Sea-level rise and increased coastal erosion are projected to continue and potentially accelerate.

- Wetlands migration pathways are not sufficiently protected.
- Shoreline development trends will impact habitats and the ecosystem.

2030 Target

By 2030, conservation or restoration projects have improved 50 acres of oyster habitat, 30 acres of shallow/intertidal habitats, 2 miles of shorelines, and 750 acres of wetland migration pathways. Newly discovered invasive species have been treated, where feasible, to prevent establishment, and contamination sources identified as affecting ecosystem function are actively being removed.

Measures of Success

- By 2025, 10 new acres of oyster habitat have been enhanced/restored in Hudson River Park's Estuarine Sanctuary, and by 2030, 50 new acres of oyster habitat have been enhanced/restored in the brackish waters of the estuary, an increase over the 2020 baseline of 16 acres restored to date in the NY/NJ Harbor and the Tappan Zee reach of the estuary.
- By 2025, 20 new acres of shallow/intertidal habitats have been enhanced or restored, and 30 acres by 2030, an increase over the baseline of 103 acres restored since 2005.
- By 2025, habitat value (increased structural complexity and vegetation) has been increased for at least one new mile of shoreline, and by 2030, the number of new miles has doubled, an increase over the 2015 baseline of 3,250 linear feet of habitat value increased to date through sustainable shoreline best management practices (BMPs).
- By 2025, 375 new acres of floodplain pathway for wetland migration have been conserved by New York State, and by 2030, that number has doubled to provide future habitat in response to sea-level rise.
- By 2025, invasive species infestations and pathways have been identified and prioritized, with treatments proposed or implemented, where feasible, and monitored for success. By 2030, newly discovered invasive species have been treated to prevent establishment.
- By 2025, geospatial data on contaminants and habitat value are integrated to prioritize removal of contaminated source areas that can affect ecosystem function. By 2030, prioritized areas are actively being remediated.

Strategies and Actions to Implement the *Action Agenda*

Strategy 1: Assess and prioritize management options and restoration opportunities

- Shallow/intertidal habitats/wetland migration
  - Assess whether Hudson River marshes are keeping pace with sea-level rise using Surface Elevation Tables. Assess long-term changes in water level using the Turkey Point tide station. Identify Hudson River bathymetry change using updated surveys of the Hudson River sediment environment.
  - Map oyster habitat in the Hudson River and evaluate the use of enhanced oyster reefs by oysters, finfish, and other nekton as a conservation benefit.

- Prioritize critical habitat for protection and restoration, including pathways for marsh migration in light of predicted climate change.
- Map submerged aquatic vegetation and tidal wetland habitat with change analyses to identify drivers of change and prioritize future restoration.
- Study the feasibility of, and develop a methodology for, restoring submerged aquatic vegetation through transplanting local native vegetation.
- Assess habitats in the Hudson River and tributary mouths to determine species use and identify habitat needed to support species of greatest conservation need.

- Shoreline
  - Evaluate restored wetlands and shorelines using the *Hudson River Sustainable Shorelines Project Rapid Assessment Protocol Manual* to inform development and design of future projects.
  - Assess shoreline character to compare to the 2005 shoreline assessment.
- Invasive species/contaminants
  - Establish an early detection-rapid response network and control newly discovered invasive species before they spread to other locations.
  - Enhance harmful algal bloom monitoring throughout the Hudson River estuary with trial deployment of nutrient probes and online notification and reporting of harmful algal blooms through DEC's NYHABS notification map.
  - Collaborate on mapping the distribution of round goby and Chinese mitten crab in coordination with other involved DEC programs.
  - Identify and evaluate invasive plant management options in areas impounded by causeways.

Strategy 2: Build capacity in the resource management community

- Enhance the scientific knowledge, technical capacity, and skills and certifications of professionals involved in making decisions that affect the habitats, shore zones, water quality, and other natural resources of the Hudson River estuary.
- Build support for conservation actions by providing training and technical assistance on tidal wetland vulnerability to climate change and on factors influencing their resiliency, including migration and sediment accretion.
- Develop and deliver education and outreach strategies about invasive species pathways targeting relevant stakeholders.
- Foster communities of practice for restoration practitioners, shoreline designers, and resource managers by providing certified training, technical assistance, and facilitation.
- Identify Sustainable Shorelines initiative BMPs and promote their use in the regulatory process and in the shoreline design community, especially for areas proposed for shoreline hardening in developed areas.

- Support research projects and publications that address critical scientific questions about species, habitats, and restoration through the coordination of HRNERR Research Focus Areas, grants management, fellowships, and the National Estuarine Research Reserve Science Collaborative.
- Maintain continuous water quality and meteorological stations at Norrie Point and Tivoli Bays, and deliver data through the National Estuarine Research Reserve Centralized Data Management Office website and the HRECOS.
- Collaborate with partners to evaluate potential stewardship and restoration opportunities and develop conceptual plans for priority projects.
- Connect and integrate with other federal and state programs to maximize available resources and synchronize funding opportunities.

Strategy 3: Plan and implement projects to improve, restore, and build resiliency

- Create a database of restoration sites to coordinate potential projects with funding sources.
- Shallow/intertidal habitats/wetland migration
  - Work with partners to acquire lands adjacent to the Hudson River based on identified sea-level rise migration pathways.
  - Work with State partners to establish protections using administrative means, such as reinvigorating and creating Memorandums of Understanding (MOUs).
- Shoreline
  - Support and manage community restoration projects proposed and implemented by local governments, nonprofits, and private property owners.
- Invasive species/contaminants
  - Work with partners such as DEC's Invasive Species Program and PRISMs to manage existing invasive species with available and effective control methods.
  - Identify and implement actions that will reduce the introduction of new invasive species and manage the spread of aquatic invasive species.

Benefit: Clean Hudson River Water

Background

Over the last 50 years, water quality in the Hudson River estuary dramatically improved, benefiting drinking water supplies, recreation, and habitat. Today, remaining challenges include aging infrastructure, polluted runoff, and sewer overflows. Climate change and related weather patterns also affect many aspects of water management, including the availability of water supplies, timing and volume of sewer overflows, levels of non-point source pollution, risk of harmful algal blooms, formation of disinfection byproducts, and impact of rising sea levels on wastewater infrastructure in shoreline communities. To account for this, we need to update our understanding of water quality impacts on the tidal Hudson River to inform management decisions.

DEC is working with local communities to identify steps to address chronic sanitary sewer overflows (SSOs), combined sewer overflows (CSOs), polluted runoff, and aging municipal water and wastewater treatment infrastructure. DEC continues to characterize wastewater infrastructure needs. Collaborations among concerned residents, interested businesses, dedicated nonprofit organizations, and government agencies at all levels are needed to continue progressing toward our long-range goal of ensuring that Hudson River water quality supports drinking water, swimming, fishing, navigation, and ecosystem needs.

Goal

Water quality in the Hudson River estuary will be suitable for swimming and recreation, will support fish and aquatic life, and will provide clean water to communities relying on the Hudson for drinking water.

Key trends, challenges, and opportunities

- New funding sources enable the significant investments needed for aging wastewater and stormwater infrastructure improvement as well as landscape practices to address water pollution from diffuse sources.
- Estuary water quality and ecosystem function is impacted by the downstream movement of a wide range of inputs and stressors originating from tributaries and the watershed.
- Where tributaries meet the Hudson River mainstem, habitat, recreation, and water supplies often converge, so water quality needs to support these uses.
- Sea-level rise and climate change have implications for wastewater infrastructure and ambient water quality, including the potential for an increase in harmful algal blooms.

2030 Target

By 2030, an updated characterization of Hudson River estuary water quality is complete. Priority wastewater infrastructure, stormwater management projects, and non-point source pollution abatement contributing to improved water quality conditions within tidal tributary mouths and in the Hudson riverfront communities have been identified and implementation has begun.

Measures of Success

- By 2025, updated water quality monitoring has been completed using accepted DEC methods, and any trends of concern have been identified. By 2030, a characterization is complete, and plans have been developed to address such concerns.
- By 2025, all permittees with chronic SSOs are in compliance with permits, consent orders, and associated schedules, and by 2030, they are implementing corrective plans if required.
- By 2025, all nine permittees with CSOs are on schedule to meet their priority Long Term Control Plan (LTCP) actions, and by 2030, all nine are making progress in addressing overflows to attain water quality standards.
- By 2025, 15 wastewater infrastructure improvement and stormwater management projects are underway that address priority water quality and resilience concerns within tidal tributary mouths, the Hudson mainstem, and river cities, and by 2030, that number has doubled to 30 projects underway.

Strategies and Actions to Implement the *Action Agenda*

Strategy 1: Measure and monitor pollutants of concern

- Using approved DEC methods, identify pollutants of concern or resource conditions (e.g., nutrients, emerging contaminants,bacteria, and low dissolved oxygen, etc.) in need of attention.
- Using approved DEC methods, implement monitoring programs to better understand conditions. Continue using HRECOS, including stations in the Mohawk Valley.

Strategy 2: Update Priority Waterbodies List

- Using approved DEC methods, update the Waterbody Inventory/Priority Waterbodies List, as needed, to reflect conditions based on the most recent monitoring information.

Strategy 3: Assess and prioritizewater quality project and wastewater needs

- Identify areas of importance for protection and restoration of Hudson River source water intakes.
- Complete Hudson River water quality monitoring to better characterize baseline conditions, inform finer-scale investigations, and update the Priority Waterbodies List.
- Identify water quality improvement projects on tributaries and mainstem to maximize water qualityimprovement.
- Incorporate climate change considerations into water quality improvement project needs and opportunities.
- Characterize wastewater infrastructure along the Hudson River estuary to inform public decision-making.
- Engage with communities affected by negative water quality impacts to provide outreach and gather feedback, including the possibility of community science projects to advance the results from DEC's assessment of the Hudson River estuary.
- Develop a research agenda, and support research that builds capacity for partners, programs, and priorities.
- Communicate monitoring results to partners and the public, including communities that rely on the Hudson for drinking water.
- Share monitoring and CSO data with partners, such as marine fisheries managers and DOH to enhance coordination.

Strategy 4: Implement water quality improvements

- Assist municipalities, soil and water conservation districts, landowners, and other regional entities in partnership or collaboration with watershed groups to implement projects that address wastewater infrastructure improvements, stormwater BMPs, and landscape practices to reduce water pollution from diffuse sources.
- Implement water quality improvement projects that align with agency priorities.
- Coordinate our actions with the *Ocean Action Plan* and the *Mohawk River Basin Action Agenda* for ecosystem benefits.
- Develop programs to assist in abating conditions that foster nearshore ocean acidification.

A Thriving and Resilient Watershed

The estuary watershed is a living system that carries water from mountain slopes, across land, and into the streams that join the Hudson along its shorelines. Beginning at the water's edge and extending up to the high peaks that surround the Hudson and form its renowned valley, the watershed is also where people live. Land-use decisions and conservation actions in the watershed impact the estuary. Through management of land and water uses in the Hudson Valley, residents and visitors will benefit from a healthy, resilient ecosystem that supports their well-being. Helping watershed communities and nature to thrive is the focus of this section of the *Action Agenda*.

Benefit: Healthy Tributaries

Background

Clean water is vital to all aspects of life in the Hudson Valley, including drinking water for communities, infrastructure for economic growth, clean headwater streams, and estuary waters supporting robust fisheries and recreation. A healthy estuary requires a healthy watershed containing intact riparian corridors, floodplains, wetland complexes, and forests. The Hudson River's tributaries contribute essential freshwater and nutrients to the estuary. However, many stressors still affect watersheds and tributaries: impervious surfaces, loss of vegetative cover, polluted runoff, failing wastewater systems, barriers to fish movement, water withdrawals, pollutant discharges, harmful algal blooms, and air pollution. Climate change, with more intense rainfall and drought, will impact stream health, aquifer recharge, availability of water supplies, flooding, and stormwater discharges.

The Estuary Program has provided essential support for watershed planning to address these issues. The program has assessed more than half of the road-stream crossings within the estuary watershed, re-vegetated over 24 miles of tributary stream buffers, supported stream barrier removals, and funded flooding assessments. With state support, watershed groups, municipalities, and other partners have been identifying key water quality stressors affecting tributaries, developing plans, and supporting implementation projects in the tributaries. Supporting effective watershed protection and restoration principles sustains the tributaries and the estuary, and protects wildlife habitat, and the health and well-being of people who live here.

Goal

Impaired tributaries will be identified and improved. Healthy rivers and streams will be maintained, delivering high-quality freshwater and habitat connections to the estuary and to drinking water sources. Hudson River tributaries will support aquatic life as well as human uses.

Key trends, challenges, and opportunities

- Climate change and changing weather patterns are affecting all aspects of water management in ways that are both predictable (increase in high-precipitation events and associated runoff, warmer water, etc.) and unpredictable.
- Local municipalities have limited capacity to address many of the water resource challenges, and they need help to ensure long-term availability of clean water.
- The presence of active watershed groups has been associated with improved water quality in many places, and supporting them is an opportunity for improved stewardship.
- Culverts and dams act as a barrier to fishand wildlife movement and can exacerbate flooding. Many are in poor condition, creating opportunities to improve flows and habitat and address climate impacts.

- Streamside buffers face pressure from development and vegetation removal. Conserving and restoring these buffers offers the opportunity to mitigate climate change, conserve fish and wildlife habitat, and facilitate wildlife movement.

2030 Target

By 2030, communities are actively engaged in understanding and prioritizing the restoration and protection of at least 20 watersheds for water quality, source water, flooding, and natural resources. The Estuary Program and partners will: mitigate culverts and remove dams to restore at least 25 miles of stream connectivity habitat and mitigate flooding risks, plant at least 10 miles of streamside vegetation to restore water quality and habitat, conserve at least 3,000 acres of land to protect drinking water sources, and advance water infrastructure improvement projects to reduce SSOs and ensure municipalities are in compliance.

Measures of Success

- By 2025, the stream segments of three or more watersheds have been fully assessed to identify potential water quality impairments, and by 2030, a Nine Element Watershed (9E) plan, a TMDL, or a plan for the development of BMPs that address impaired waters is underway in 5 tributaries with impacted stream segments.
- By 2025, five or more new miles of streamside vegetation have been planted, and revegetation goals have been established that indicate effectiveness of streamside plantings. By 2030, that number has doubled, with a cumulative total of 35 miles since the Trees for Tribs program began in 2007, with at least 5 miles demonstrating effectiveness.
- By 2025, culverts have been assessed in 75% of the watershed, sites have been prioritized for restoring connectivity and resiliency, and implementation has started to restore 5 miles of habitat in priority locations. By 2030, 25 miles of stream have been restored through dam removal and culvert replacement. (At the start of 2021, 60% of the culverts in the watershed were assessed.)
- By 2025, 10 watersheds have one or more of the following: a watershed-based assessment, characterization, intermunicipal cooperative agreement, management plan, Drinking Water Source Protection Program plan, stream habitat study, or flood risk and mitigation studies (e.g., Resilient NY flood studies). By 2030, that number is doubled.
- By 2025, all permittees with chronic SSOs are in compliance with permits, consent orders, and associated schedules, and by 2030, they are implementing corrective plans, if required.
- By 2025, at least 1,000 acres have been conserved for source water protection, and by 2030 that number has tripled. Watershed protection is encouraged for drinking water protection, including an emphasis on Environmental Justice communities.

Strategies and Actions to Implement the *Action Agenda*

Strategy 1: Monitor and assess water quality

- Monitor water quality (such as water chemistry, aquatic life, and contaminants of emerging concern) in tributaries to help prioritize needed actions.
- Assess the condition of streams for habitat connectivity and flood resiliency.

- Create monitoring efficiencies and new scientific knowledge through collaboration and partnership with DEC's Division of Water, the Interstate Environmental Commission, the U.S. Geological Survey, watershed groups, and research and educational institutions.

Strategy 2: Inform and engage stakeholders through outreach

- Raise watershed awareness and capacity and build support for improvements through learning networks and working groups, including outreach to community-based groups working to protect local waterbodies, such as watershed groups, and to traditionally underserved communities that are impacted.
- Facilitate local, inclusive participation in Drinking Water Source Protection plans and grantprograms, including land acquisition in source watersheds.

Strategy 3: Build capacity of partners to implement best management practices

- Provide technical assistance and scientific information to watershed groups, municipalities, and county and regional partners, enabling them to work within and across municipal boundaries to conduct watershed management planning, at the appropriate scale, to address community concerns and priorities, and to implement projects for water quality improvement, flood resiliency, wastewater management, habitat restoration and barrier mitigation, fish passage, and sustaining water resources.
- Collaborate with local and county highway departments and New York State's Department of Transportation (DOT) to conduct flood mitigation and road-stream crossing assessments to identify and prioritize flood-prone areas and mitigation strategies (e.g., culvert replacements) under existing and projected climate and land-use change scenarios.
- Develop a research agenda and support research that builds capacity for partners, programs, and priorities.

Strategy 4: Implement priority projects

- Implement priority projects in watershed plans or community plans to restore and protect tributary resilience and water quality, including streamside buffer and floodplain restoration, stormwater green infrastructure projects, wastewater improvements, habitat restoration, culvert replacement, dam removal, land acquisition, and land conservation practices.

Benefit: Climate-Adaptive Communities

Background

Changing development patterns, types of industry, modes of transportation, and sources of energy have shaped the communities and estuary ecosystems we see today and will shape those we live in tomorrow. How resilient our waterfront communities are to changing conditions and how our communities manage their environment will be central to their health and the health of the Hudson River estuary. Our high-risk waterfront communities are those that have dense populations and high-value infrastructure in the floodplain, and those where the climate crisis is introducing new and uniquely compounding challenges.

The Estuary Program, in partnership with the DEC's Office of Climate Change, New York's Department of State, and other agencies and regional partners, has supported the revitalization of many river shoreline communities and the piloting of innovative flood adaptation strategies. We are supporting the U.S. Army Corps of Engineers' evaluation of coastal risk management strategies for the New York-New Jersey Harbor and Estuary. With rapid climate change, the potential for counterproductive choices is significant. Sustained programming is needed to help

communities adapt or relocate existing structures from the floodplain. Continued strengthening of partnerships and collaboration are needed to address this challenge.

Goal

Hudson Valley communities are thriving, resilient models for adapting to climate change using natural, nature-based, and socially equitable solutions.

Key trends, challenges, and opportunities

- Given the high value of waterfront property, full build-out is occurring on the waterfront, including areas that may be inundated by the end of the century.
- Homes and businesses may be abandoned due to nuisance flooding if communities do not adapt.
- Significant infrastructure is in the flood zone: roads, bridges, railroad tracks, water, and sewage treatment plants. More infrastructure will be at risk as the floodplain expands.
- Municipalities have limited capacity and resources to do the necessary adaptation planning on their own.
- Social vulnerability may increase rapidly over time in high flood-risk areas, and green gentrification may displace vulnerable populations.
- Natural and nature-based approaches can have numerous benefits, including reducing the risks of erosion and flooding and reducing or sequestering greenhouse gases that cause climate change.

2030 Target

By 2030, all high-risk local governments have a climate adaptation plan and are implementing resilience actions to tackle rapid climate change through the end of the century.

Measures of Success

- By 2025, 100 new Climate Smart Communities (CSC) adaptation and resilience actions have been completed that increase adaptive capacity and physical climate resilience, and by 2030, 250 have been completed. (Baseline is zero. Measurement is for new projects started after January 1, 2021.)
- By 2025, 10 communities have completed Climate-Adaptive Design Phase I (Engaged Studio), or a similar process, and 5 have completed Phase II (Design Advancement). By 2030, 15 communities have completed Phase I, or a similar process, and 10 have completed Phase II. (Baseline is five Phase 1s and two Phase 2s completed as of January 2021).
- By 2025, 27 (10%) local governments are working together in the Flood Resilience Network, and by 2030, 53 (20%) local governments are working together in the Flood Resilience Network. (Baseline is 14 local governments or 5%, as of January 2021.)
- By 2025, 100% of new adaptation plans include natural and nature-based solutions and consider social equity factors, and are developed using inclusive engagement best practices. By 2030, this has continued annually. (Baseline is zero. Measurement is for new projects started after January 1, 2021.)

Strategies and Actions to Implement the *Action Agenda*

Strategy 1: Distill, streamline, and disseminate adaptation practices for ease of adoption

- Explore innovative efforts around the country to advance adaptation practices.
- Collaborate with regional partners on innovative adaptation strategies, pilot new approaches with communities, and evaluate their success.

Strategy 2: Increase partner capacity to support implementation of municipal resilience actions

- Support county-level efforts to help communities complete Climate Smart Communities adaptation and resilience actions.
- Work with partners to provide seed funding or creative financing opportunities that help communities overcome key municipal barriers to adaptation action, and foster intermunicipal efforts.
- Build the Flood Resilience Network, composed of leading waterfront communities learning and working together on their adaptation strategies.
- Explore partnerships with a diversity of community-based organizations to increase awareness and understanding of the implications of adaptation approaches on disadvantaged communities.

Strategy 3: Help advance federal, state, and local policy to promote resilient communities and nature-based approaches

- Support development and implementation of state and federal policy initiatives, such as Climate Smart Communities, the Climate Act, Community Risk and Resilience Act, and assessments of region-wide coastal risk management approaches.
- Connect and integrate with other federal and state programs to maximize available resources and synchronize funding opportunities.

Benefit: Conserved Natural Areas for Wildlife, Source Water, Climate Resilience, and Scenery

Background

The communities of the estuary watershed are as diverse as its natural areas and habitats, but they all share three key characteristics. First, they all connect to the estuary, either directly on its shorelines or tributaries, or through the living landscape of forests, fields, wetlands, and streams that constitute its watershed. Second, the residents of all communities benefit from these ecosystems, which help to keep drinking water and air clean, moderate temperature, store carbon, absorb floodwaters, and provide wildlife and fish habitat, scenery, and opportunities for outdoor recreation. Finally, all communities rely on local decision-makers and volunteers—town boards, planning and zoning boards, conservation advisory councils, and open space commissions—to play a significant role in determining the fate of natural areas and biodiversity.

While New York State, land trusts, municipalities, and conservation non-governmental organizations have successfully conserved approximately 18% of the watershed, significant areas that support nature and human needs remain vulnerable to land-use change.

The Estuary Program and its partners have helped local land-use planners balance future growth with protection of priority lands and waters, providing current scientific data and added capacity for conservation planning.

Further assistance and capacity building are needed to reach new communities and underrepresented groups, strengthen partnerships, and increase plan implementation to achieve conservation of the region's irreplaceable natural assets.

Goal

Lands and waters that are recognized as regional priorities for wildlife and fish habitat, clean water, climate resilience, and scenery are incorporated into conservation and land-use plans and policies in the watershed. Through acquisition, key sites are permanently protected, and connectivity of conserved habitats and natural areas in the estuary watershed is achieved.

Key trends, challenges, and opportunities

- Natural areas like forests and wetlands contribute to the well-being of watershed residents by supporting water quality, climate resilience, habitat, and scenery.
- Many natural areas are unprotected and vulnerable to incompatible land-use change, climate change, and invasive species. Emerging land-use trends like renewable energy siting present new challenges and opportunities to address the causes of climate change and implement solutions.
- Natural carbon sequestration in forests and wetlands is anticipated to play a significant role in meeting the carbon capture goals of the Climate Leadership and Community Protection Act.
- Municipal capacity and budgets are often insufficient to adequately address conservation of natural areas.
- Multiple jurisdictions often result in conservation planning that lacks coordination.

2030 Target

By 2030, at least 50 new practices, plans, and policies are created and adopted by government agencies, non-governmental organizations, and land-use decision-makers in the estuary watershed to conserve areas recognized as regional conservation priorities for habitat, connectivity, clean water, climate resilience, and scenery, and 20,000 acres of priority natural areas in the watershed are protected through land acquisition.

Measures of Success

- By 2025, at least 12,000 acres of natural area in the watershed, including 2,000 acres along the estuary, have been newly conserved by New York State and partners. By 2030, those numbers increase to 20,000 and 3,000 acres, respectively. (At the start of 2021, approximately 617,000 acres, or 18% of the watershed, were protected.)
- By 2025, five new planning projects have been completed to support landscape-scale conservation, regional biodiversity priorities, and habitat connections (e.g., core forests, stream corridors, wetland complexes, source watersheds). By 2030, the number of completed connectivity planning projects increases to 10.

- By 2025, two municipalities in the watershed have successfully established new local land acquisition programs (e.g., Community Preservation Act or open space bond) for the protection of conservation priorities, and by 2030, that number increases to five municipalities.
- By 2025, new or updated conservation practices, plans, and policies have been completed in 25 municipalities, including 10 in Significant Biodiversity Areas, on the estuary shoreline, or in other areas identified as conservation and/or environmental justice priorities, and by 2030, those numbers increase to 50 and 20, respectively.
- By 2025, 40% of municipalities with natural resource inventories (NRIs) completed since 2015 have used their NRIs for a conservation plan or policy (e.g., open space plan or conservation overlay zone) or comprehensive plan. By 2030, that number increases to 50%. (At the start of 2021, 30% of the 20 NRIs completed since 2015 were used in a plan or policy.)

Strategies and Actions to Implement the *Action Agenda*

Strategy 1: Scientific study and research

- Use current science and data to update our understanding and ability to identify priority lands and waters, and to adapt approaches for successful stewardship, conservation, and protection.
- Increase our ability to disseminate current data and recommendations on conservation priorities to decision-makers.

Strategy 2: Increase decision-maker capacity

- Deliver science-based training, technical assistance, and tools to increase the capacity of government agencies, non-governmental organizations, and land-use decision-makers for stewardship, conservation, and protection of priority lands and waters.
- Raise awareness, increase knowledge, and build support for conservation planning through outreach, community science, learning networks, innovative and intermunicipal partnerships, and community of practice. Increase engagement of underrepresented groups.

Strategy 3: Increase and diversify resources for conservation action

- Increase opportunities for municipalities and land trusts to secure resources for implementation of local and regional conservation plans and acquisition of priority lands and waters.
- Connect and integrate with other federal and state agencies and programs to maximize available resources and synchronize funding opportunities.

People Living Well with Nature: Recreation, Education, and Inspiration

The estuary provides outstanding opportunities for recreation and tourism for people of all ages and abilities. It also inspires us with its natural beauty and its majesty. This section of the *Action Agenda* focuses on helping people use the river, understand how it can best be managed, and become informed stewards.

Benefit: An Informed and Engaged Public

Background

Access to environmental education is essential to inform, inspire, and engage residents and visitors so they become good stewards of the estuary and its watershed. The Estuary Program, in close partnership with the Hudson River National Estuarine Research Reserve, ensures people have the knowledge and tools to go from exploring their river to making good decisions.

The Estuary Program implements a wide range of programs that introduce participants to the fundamentals of river ecology and current research. Community science programs (sometimes called “citizen science”), in-school programs, and online resources bring the river alive, while shoreside programs give students hands-on experiences in river science. Programs are supported with trainings, lesson plans, grants, and professional development for teachers and educators to build an informed community. DEC is committed to keeping our programs accessible and inclusive. At all levels, education is a crucial step in helping people keep the Hudson River estuary and watershed a thriving and vibrant place to live.

Goal

Effective curricula and programs have empowered a diverse audience of students, educators, communities, and decision-makers to engage in environmental stewardship actions, enabling them to demonstrate greater knowledge of their river and its benefits. Barriers to inclusion have been addressed to ensure access to all our programs.

Key trends, challenges, and opportunities

- Time with technology is supplanting time outdoors.
- Teachers have to meet an increased number of new requirements, and they have limited time for adding new curriculum. However, new science standards correlate well with environmental education practices.
- Not all communities have adequate river access for educational programming.
- Environmental program staff and program participants sometimes do not represent the full diversity of the valley’s demographics and perspectives.
- There is general, renewed interest in the Hudson River after decades of environmental abuse.
- Student learning outcomes improve when they directly contribute to relevant science and real-life stewardship.
- Conservation is enhanced when all community members have access to stewardship education and are empowered to act.

2030 Target

By 2030, effective curricula and programs have engaged 250,000 students, educators, volunteers, and decision-makers in Hudson River environmental education, so that 35% of program participants include a diverse audience reflective of the valley's local communities and visitors. At least 25% of schools in the watershed are studying the Hudson in depth, and 10 environmental education facilities are providing high quality river education, with the result that 50% of Hudson Valley residents demonstrate an understanding of priority estuary management needs.

Measures of Success

- By 2025, effective curricula and programs have engaged 125,000 students, educators, volunteers, and decision-makers in Hudson River environmental education, and by 2030, that number has doubled, (an increase over our previous engagement of 100,000 people for the period 2015–2020)
- By 2025, 10 or more locally based facilities for learning about the river have been enhanced with state-of-the-art exhibits, as well as improved programs, materials, and visitor experiences, and by 2030, continued investments are made in enhancing these 10 facilities, sustaining our 2015–2020 level of support with deeper engagement at participating facilities.
- By 2025, at least 30% of participants who have been engaged in education programs delivered by the Estuary Program or through grants and technical assistance to partners are from environmental justice areas—an increase over the 25% 2020 baseline—and by 2030, that number has doubled.
- By 2025, at least 10,000 people have participated in community science and public programs focused on the Hudson River and its watershed—an increase over our 2020 baseline of 2,000 annually—and by 2030, that number has doubled.
- By 2030, up to 25% of school districts in the estuary watershed, and 50% of districts that border the shoreline, have participated in river studies at multiple grade levels or in-depth study within a grade, sustaining our 2015–2020 level of support with deeper engagement at participating schools. Annually, at least 80% of educators trained will implement or intend to use our professional development content in their classrooms.

Strategies and Actions to Implement the *Action Agenda*

Strategy 1: Engaging local volunteers and visitors

- Survey Hudson Valley residents to assess overall needs and changes in understanding, behavior, and attitudes about the Hudson over time.
- Expand online, multilingual and multimedia resources to engage individuals and groups.
- Provide meaningful community science and stewardship opportunities for volunteers.
- Continue adult learning programs to meet specific needs of and opportunities for mature audiences.
- Coordinate with the DOH and fishing-focused organizations to promote awareness of fish advisories.
- Implement public field programs to engage persons of all ages and abilities in festivals, open houses, and fieldwork, including the *Hudson River Almanac*, HRECOS real-time monitoring, and community engagement at the Norrie Point Environmental Center.

Strategy 2: Educating students and young people

- Continue to create meaningful stewardship, field, and school programs, and K–12 experiences, such as the annual “A Day in the Life of the Hudson and Harbor” and the Hudson River Eel Project to expose students to their local waterbody and engage them in contributing to conservation and restoration.
- Provide assistance to local colleges and universities to enhance opportunities for students to expand on their interests in science and public policy research about the Hudson River.
- Increase and diversify the use of digital platforms to enhance learning and accessibility.
- Expand resources and opportunities for high school student research and stewardship.
- Enhance evaluation efforts to better capture engagement within and beyond initial field or classroom experiences.

Strategy 3: Empowering teachers and educators

- Support professional development opportunities for educators to provide them with the tools and expertise to multiply their experiences within their classrooms.
- Provide curriculum development for classroom teachers and educators that engages students in multiple levels of Hudson River content and reaches teachers and classrooms from a wide diversity of geography and demographics throughout the watershed. Craft materials that span disciplines of science, engineering, technology, and math (STEM), English Language Arts (ELA), and social studies.
- Align river education with New York State Learning Standards to make our materials as useful and inclusive as possible. Coordinate with larger state efforts in pedagogy and accessibility.

Strategy 4: Building education capacity and excellence

- Establish shared Hudson River key understandings and conservation actions. Use them to promote a natural history-based sense of place and a wider understanding and stewardship of the estuary, as well as shared messages, lesson plans, and information about the river.
- Raise awareness and capacity, and build support for improvements through learning networks and working groups of environmental educators, partners, and river centers to improve and increase community engagement throughout the watershed, including the New York Harbor.
- Address barriers to inclusion in the environmental education community and improve access to educational programming by people of different abilities, languages, and demographics.

Benefit: An Accessible Hudson River for People of All Ages and Abilities

Background

The Hudson River estuary and its shores offer exceptional opportunities for outdoor recreation. As water quality has improved over the last 40 years, the demand for river access has risen accordingly. Today, nearly every community along the estuary has some form of public access to the river despite site limitations due to steep slopes and the presence of railroad tracks. More than 100 sites now provide a variety of opportunities to experience the river through boating, fishing, hiking, swimming, river

watching, wildlife-related recreation, and river cruising, as shown on the DEC website: https://www.dec.ny.gov/lands/112137.html.

However, new challenges stemming from climate change require action to ensure there will continue to be access for everyone. River access sites will be on the front line of rising sea levels.

The Estuary Program's recent focus has been and will continue to be to encourage managers of access sites to maintain and improve these special places, making them more accessible to all users, including people with disabilities and environmental justice communities, as well as making them more resilient to flooding, sea-level rise, and storm surge. There are still some communities that have limited or no access to the river within a convenient traveling distance for their residents. Efforts will continue to identify these areas of need and improve access opportunities where these gaps exist.

Goal

Develop, maintain, and improve a regional system of access points for fishing, boating, swimming, hiking, education, river watching, tourism, and wildlife-related recreation, and build connections that enable residents and visitors of all ages and abilities to have rich and diverse river experiences. Access sites are resilient to flooding and sea-level rise.

Key trends, challenges, and opportunities

- The demand for new river access continues to increase, and with it, the need to address ongoing inequities in access to the natural environment and to ensure that inclusive, diverse, and positive experiences are made available to a broader spectrum of people and neighborhoods.
- Protecting and maintaining existing access sites is costly and often is not adequately addressed in municipal budgets.
- Some communities, particularly in disadvantaged neighborhoods, have limited access to the river and, at existing sites, find it challenging to meet maintenance needs, provide basic services such as restrooms, and offer programming.
- Deepwater docks/ports for educational vessels and river cruising are in need of maintenance or do not meet the needs of today's larger vessels.
- Flooding and sea-level rise is occurring now and will increase in scope and severity, affecting nearly all river access sites.
- Public swimming beaches are very limited, and people are swimming at locations in the estuary and its tributaries, such as docks and shorelines, that are not monitored for public health.
- Extreme weather is likely to impact water quality more frequently in more areas of the tidal Hudson. Private marinas and boat clubs are having difficulty with dredging due to the cost, which cannot be covered with state grants.
- Limited public transportation to river sites makes it difficult for people in some neighborhoods and people with disabilities to access the Hudson River.
- Municipal, commercial, transportation, energy, and recreational uses create conflicting demands on the Hudson River's resources. This is ongoing and is anticipate to intensify in the future.

2030 Target

By 2030, at least 20 new or existing public Hudson River estuary and harbor access sites have improved accessibility to the river, addressing inclusivity, diversity, and the visitor experience for everyone, including people with disabilities, older adults, and families. The impacts of flooding, storm surge, and sea-level rise, and related land-use changes on the amount and condition of river access sites has been evaluated, and at least 20 ecologically sound flood-resiliency plans have been developed for sites in need.

Measures of Success

- By 2025, accessibility for people of all ages and abilities has been improved at 10 new or existing Hudson River estuary and harbor access sites by the State and partners, and by 2030, accessibility has been improved at a minimum of 20 new or existing sites, with 50% having the ability to serve (via location or programmatically) disadvantaged communities, sustaining or exceeding our 2015–2020 level of support.
- By 2025, ecologically sound flood-resiliency plans have been developed for 10 access sites in the anticipated 2050 floodplain, with 50% being in underserved areas, an increase over the 2020 baseline number of four such sites. Implementation of resilience practices is underway at three sites by 2025. By 2030, those numbers have doubled.

Strategies and Actions to Implement the *Action Agenda*

Strategy 1: Assess and prioritize

- Conduct a gap analysis/needs assessment to identify areas in need of additional public access, access types needed, as well as language access, signage, and wayfinding, and identify where improvements are needed to existing sites.
- Conduct a flood vulnerability assessment of access sites within the 500-year floodplain anticipated by 2050, and prioritize those most in need of flood resiliency planning.
- Investigate how recreational use of the Hudson River may change in the future and how climate change may impact conditions, such as water quality, and opportunities for uses, such as swimming.
- Identify ease of accessibility to bathing beaches for potential environmental justice areas or other historically underserved communities and analyze future accessibility of bathing sites, under sea-level rise scenarios. Develop recommendations to address these issues.
- Support spatial planning to identify and mitigate user conflicts in and along the estuary.

Strategy 2: Best management practices, technical assistance, and capacity building

- Use the Flood Resiliency Handbook for Public Access Sites Along the Hudson River and the Climate-adaptive Design lookbooks as tools when assisting site planners and site managers.
- Develop criteria and outline a structure for what an ecologically sound flood-resiliency plan would entail.
- Support working groups which include representatives from disadvantaged groups and people with disabilities, for site managers to address resilience needs for current and future flooding, storm surge, and changes in land use. These groups also will help with ADA transition planning for accessibility improvements at access sites.
- Provide online information to the public about access opportunities, using easily accessible formats.
- Increase the use of technology, including translations into other languages.
- Produce a handbook to help site managers and planners improve accessibility for paddle sports.
- Routinely inspect, assess, and maintain Hudson River state-owned access sites or sites with cooperative Memorandums of Understanding for safety and accessibility (DEC and New York State's Office of Parks, Recreation and Historic Preservation).
- Support the DOH's Hudson River Fish Advisory Outreach Program in educating the public about eating Hudson River fish.
- Work with local PRISMs and DEC's Bureau of Invasive Species and Ecosystem Health on invasive species management at impacted river access sites.
- Support appropriate projects and plans to increase access across the railroad tracks.

Strategy 3: Implement construction/site improvements

- Provide state grant support for both accessibility and resilience, including:
  - New site development;
  - Improved/upgraded sites and site maintenance;
  - Improved wayfinding, signage, and communications to and at sites in multiple and appropriate languages; and
  - Ecologically sound flood resiliency plans for access sites within the 500-year floodplain anticipated by 2050.
- Strengthen grant requirements for projects to be climate resilient by 2050 and beyond, and for compliance with the Americans with Disabilities Act and the U.S. Access Board's Standards for Accessible Design.
- Support development of access in disadvantaged communities, urban areas, and to underserved populations, including people with disabilities. Support communities in providing public transportation to access sites.
- Connect and integrate with other federal, state, and local programs to maximize available resources and synchronize funding opportunities.

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