New York State experienced four record-breaking floods between 2011 and 2013, causing billions of dollars in damage. Culverts, the structures that carry streams underneath roads, are often at the epicenter of flooding and infrastructure failure. Right-sizing these structures bolsters community resilience to climate change while saving money, and improving habitat for fish and wildlife.

Road-Stream Crossing Benefits

**Cost Effective and Community Smart**
Right sizing road-stream crossings brings tangible economic benefits for communities' bottom lines. While upgraded culverts can cost more in the short term, improved crossings require less frequent maintenance and last longer. Accordingly, when maintenance and replacement are factored in, as well as increased intense storm frequency, the average annual cost of an upgraded crossing is often lower over its lifetime than that of an undersized crossing over the same time frame. Improved crossings can reduce costly flood damage to homes and businesses while also supporting local jobs across a wide array of sectors.

**Climate-Ready**
Across the Northeast U.S., climate scientists predict rising temperatures and an increase in the frequency of intense storms. This will result in periods of extreme high stream flow, which can scour streambeds, lead to the catastrophic failure of road-stream crossings, and degrade water quality. In addition, high flows are a chief concern to communities and their transportation departments because they can result in localized flooding, cause costly damage to infrastructure such as roads and culverts, and create dangerous road conditions. A major report from the National Cooperative Highway Research Program about climate change impacts on U.S. road networks recommends redesign of culverts to accommodate fish passage and new patterns of precipitation. The NYS 2100 Commission, established by Governor Cuomo following Tropical Storm Sandy, recommends upgrading culverts to protect against future storms.

**Fish-Friendly**
Rising temperatures are expected to diminish available coldwater habitat for fish. New York State’s ClimAID report highlights the vulnerability of brook trout in the Adirondacks to climate warming since the species is already near the southern extent of its range. Fish need unimpeded access to smaller, cooler upland tributaries to help them adapt to climate change. Anglers need healthy fish populations for fishing. Many communities need river-based recreation to thrive economically. Replacing undersized- and poorly-designed culverts with structures that allow streams to be streams underneath roads is a key, achievable climate adaptation strategy. Natural flows also protect water quality by reducing sediment, minimizing shoreline scour, and allowing debris and high flows to pass through.

Federal Highway Administration
Climate Change Resilience Pilot Program

As 1 of 24 projects selected to participate in the Federal Highway Administration program, NYS Department of Transportation and The Nature Conservancy worked together to identify ways to incorporate climate vulnerabilities into transportation and design plans. The project focused on developing a decision support tool that integrates the agency’s triple bottom line of addressing ecological, economic, and social needs.
Path to Success

Concentrating work to upgrade culverts in strategic locations with multiple benefits can help direct limited resources to places with the greatest expected return on investment. The Nature Conservancy, in collaboration with partners, has developed and tested a systematic way to identify high priority culverts for replacement based on projected environmental and community benefits. This approach, which has been documented in a short video, *Rethinking Culverts*, creates a win-win for highway departments, communities and freshwater habitat and includes the following steps:

**Science**
Regional and local prioritization tools identify environmentally important culverts based on multiple criteria like NYS designated trout streams and miles of connected freshwater habitat. Climate tools help predict the capacity of current and future floods. Local highway departments identify flood-vulnerable culverts and structures that require frequent maintenance or pose safety concerns.

**Inventory**
The Nature Conservancy and NYS Department of Environmental Conservation (DEC) play leadership roles in a thirteen-state partnership of public and private organizations working to assess and prioritize road-stream crossings for replacement. The North Atlantic Aquatic Connectivity Collaborative shares a common field inventory protocol and database to support regional priority setting. DEC is implementing these methods across New York.

**Action**
Since 2014, TNC and partners have replaced or retrofitted seven culverts in New York’s Lake Champlain Basin with climate-ready and fish-friendly designs. The new structures connect over 90 miles of river habitat and have been sized to carry higher flows of water, in order to mitigate future flood damage, improve safety on local road networks, reduce maintenance costs for communities, and improve water quality through the reduction of erosion and sediment build-up (see photos, next page).

A Nature Conservancy technician recording culvert data including structural information (e.g., size, shape, material) and whether fish and other aquatic organisms can move through it. This approach helps scientists prioritize road-stream crossings for replacement or upgrades by ranking various benefits. © TNC

Road damage at a culvert caused by flooding during Tropical Storm Irene. In addition to repair costs, failures like this can also result in lost income for businesses, block emergency services, and disrupt community life. © American Rivers/TNC (Amy Singler)
Demonstration project: Flood-resilient, fish-friendly culvert upgrade, Essex County, NY

Roaring Brook was constricted and its cool headwaters disconnected from the Ausable River until two undersized pipes (top) were replaced with a wider, natural-bottom structure to withstand higher volumes of water passage and allow the stream to flow naturally (bottom).

Photos ©The Nature Conservancy (Erika Bailey)
Opportunities for New York to Lead

We don’t know when the next superstorm will hit, but we do know storm intensity is increasing and air tempera-
tures are rising. We have the tools and knowledge to make New York’s road and rivers more resilient to climate
cchange. Expanding this work will benefit local economies while protecting important fish species, and transforming
the way government approaches infrastructure projects. These are some of the critical ways New York can lead
the way.

Incentivize and provide communities with the ability to plan and budget long term while also being climate
-smart.

Invest in science to guide decision-making. Couple climate data with community priorities to ensure taxpayers
get the most for every transportation dollar their highways departments spend.

Provide grants and low-cost financing for engineering expenses,
construction costs, and equipment in ways that can address the needs
of multiple communities simultaneously.

Coordinate the efforts of multiple agencies to streamline permit-
ting and administrative requirements.

Leverage funding and in-kind support from other agencies and part-
nerships, such as:

- NYS Department of Transportation, Transportation Alternatives
- Federal Highway Administration, Climate Change Adaptation
  Program
- U.S. Fish and Wildlife Service, National Fish Passage Program;
- North Atlantic Landscape Conservation Cooperative
- The Eastern Brook Trout Joint Venture
- NYS Department of Environmental Conservation
- Federal Emergency Management Administration’s Hazard Mitigation
  Grant Program
- NYS Department of State Local Waterfront Revitalization Program
- NYS Office of Emergency Management

“I’ve spent my whole career doing
construction, so seeing something
come together like this, where we’ve
done more than just fix a culvert, it’s
very fulfilling to me. It’s something
you tell your kids about rather than
just, ‘Well, I went to work today.’”

- Jim Dougan, Deputy Superinten-
dent of Essex County Department of
Public Works

Demonstration projects completed to date are thanks to:

Partners: Ausable River Association, 
Essex County Department of Public Works, 
Essex County Soil and Water Conservation 
District, New York State Department of En-
vironmental Conservation, New York State 
Department of Transportation, Towns of 
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Wildlife Service.

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Interior, New York State Department of 
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Fish and Wildlife Service’s National Fish 
Passage Program, and Wildlife Conserva-
tion Society’s Climate Adaptation Fund 
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tion. Partner organizations also contributed 
staff time and resources for project plan-
ning, permitting, site assessment, fish moni-
toring before and after completion of the 
project, and technical oversight. 