

The Role of Connectivity Science in Informing Highway Infrastructure Planning in NB

Greg Quinn

Terrestrial Ecologist

New Brunswick Department of Transportation and
Infrastructure.



When does NBDTI consider connectivity science in planning and design?

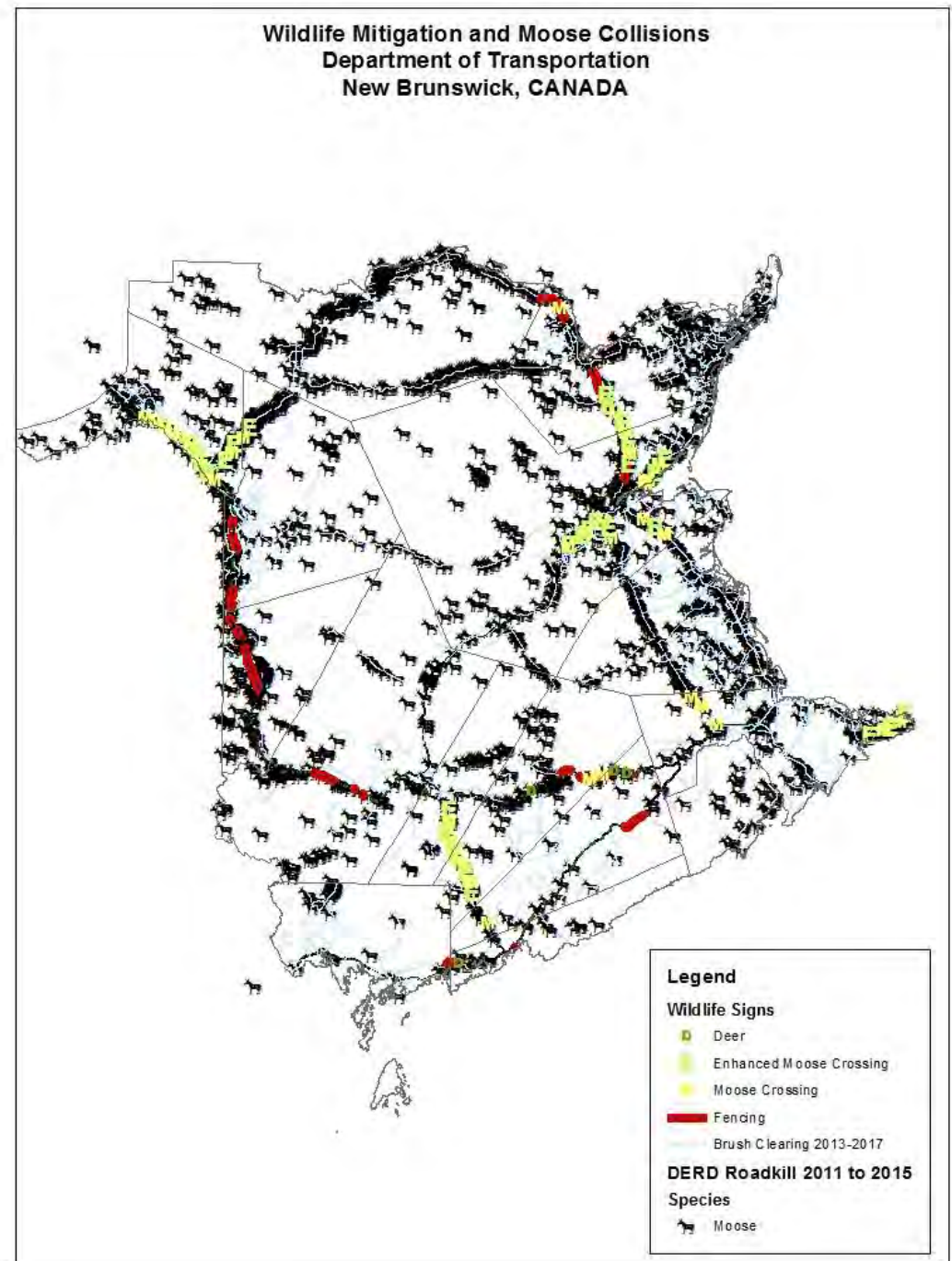
- When required by regulations or conditions of approvals.
- Where key sensitive environmental features have been identified.
- When the interaction with wildlife presents a public safety problem.
- When it's cost effective.

FISH HABITAT



Wildlife Vehicle Collision Mitigation

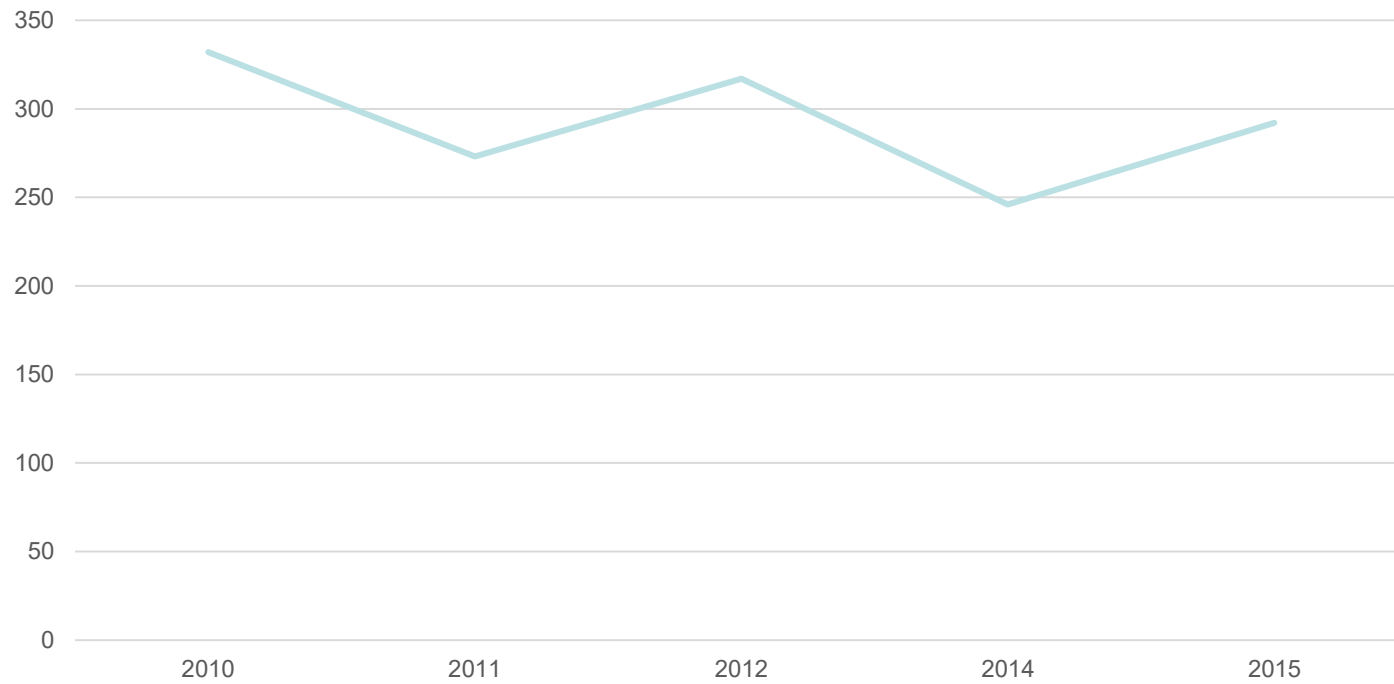
- 1) Identify problem areas and track collisions
- 2) Determine effective solutions
- 3) Design wildlife crossing structures



Crossings Design - 1:1 Openness Ratio (WxH/L)



Moose Collisions - RCMP



Route 7 Camera and Track Monitoring



Route 7 Monitoring Work



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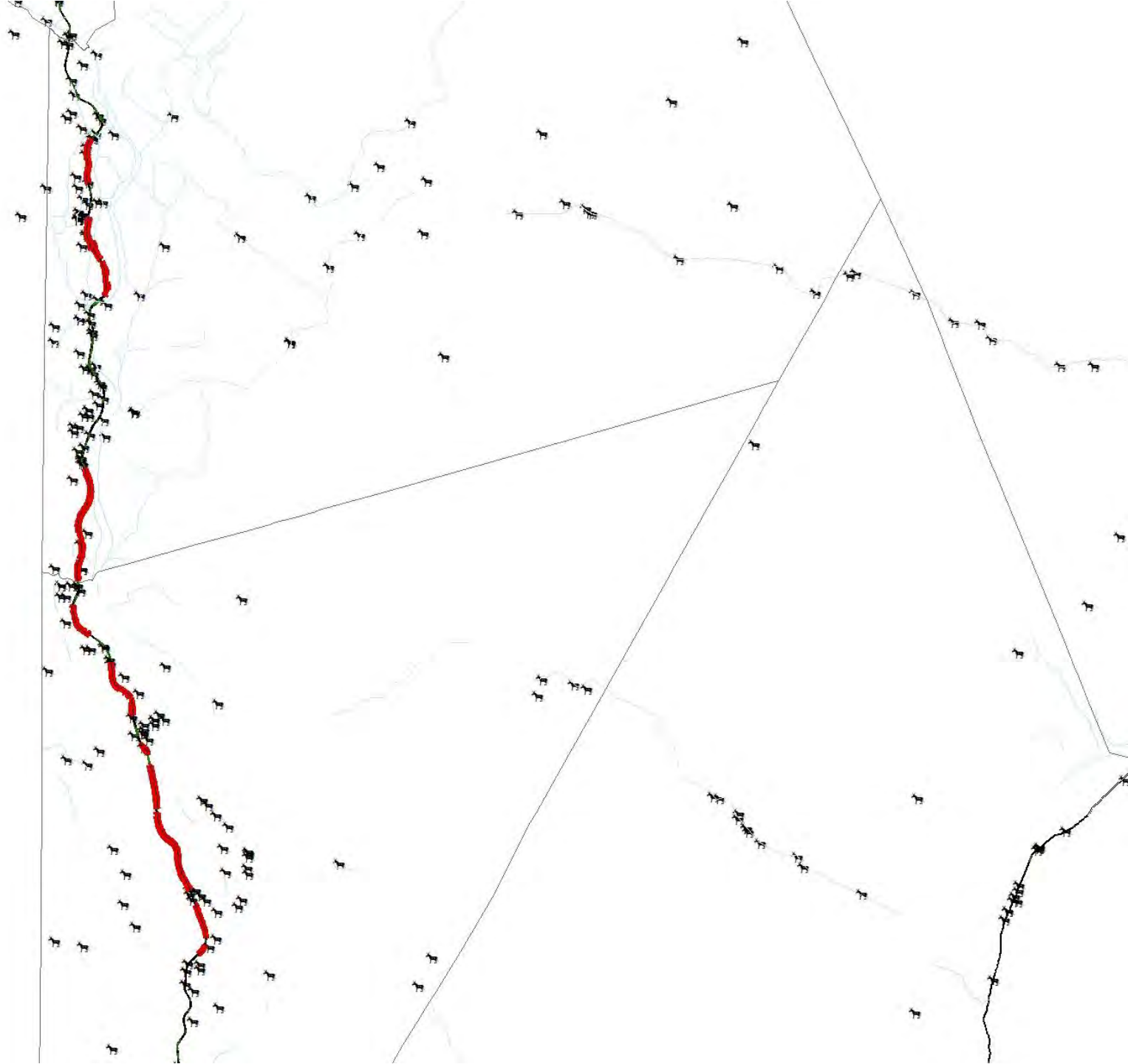
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Continued Monitoring





Opportunities for future roles of connectivity science in infrastructure planning

- We have a large dataset of large mammal data collision locations that is largely untapped.
- Movement and distribution of large and small animals in New Brunswick are not well understood.
- Wood Turtle population may be the most vulnerable species to road mortality in New Brunswick.

How can science better inform decisions?

- Focus on key areas and triggers for mitigation
- Outline mitigation that is proven effective in a similar ecological context
- Be locally applicable
- Quantify thresholds

Thank you

Culture Change at the Vermont Agency of Transportation (VTrans); How Partnerships, Trainings, and Innovation Helped Pave the Way to Successes in Road Ecology



Chris Slesar - VTrans Environmental Resources Coordinator



SETTLING A SWAMP FILL BY BLASTING

By: H. E. Sargent

Commissioner of Highways

During the summer of 1933, a method of disintegrating a swamp by blasting was employed.. By the use of explosives the muck was removed or liquified to such an extent that the fill material was able by its own weight to penetrate to hard soil.

The powder was fired upon completion of the days word and the result was very satisfactory, A rectangular shaped hole about four feet deep was formed throughout the entire section. The muck was blown out on the sides for two hundred feet..

Upon completion of the first blast, the filling was commenced. Under the fill along each side of the roadway was placed 8200 pounds of forty per cent dynamite in boxes. When the fill was completed to a depth of from six to eight feet, the dynamite was exploded. The muck remaining in the hole beneath the fill was pushed out on either side of the roadway allowing the fill to drop into place by its own weight.





Safety!

“Provide for the safe and efficient movement of people and goods via a safe, reliable, and multimodal transportation system...”

Wildlife-Vehicle Collisions are Expensive (~ \$1-4 Billion/Year)



© Susan C. Morse

A close-up photograph of a person's hand holding a small, dark-colored turtle. The turtle is resting on the palm, and its head and front legs are visible. The background consists of green foliage and a rocky ground surface. The word "Stewardship!" is written in a large, bold, black serif font in the upper right corner of the image.

Stewardship!

“Preserve, maintain, and operate the transportation system in a cost-effective and environmentally responsible manner.”

A photograph of a red salamander, likely a Hellbender (Cryptobranchus alleganiensis), resting on a gravel path. The path is made of grey gravel and is surrounded by a dense forest of green trees. The background is slightly blurred, emphasizing the salamander in the foreground. The overall scene is a natural, outdoor setting.

It is the right thing to do!

“...keep common species common....”
- Vermont’s Wildlife Action Plan

State and Federal Regulations



“Preserve, maintain, and operate the transportation system in a cost-effective and environmentally responsible manner.”



Flood Resiliency



DOTs can't do this alone!



Essex, VT 1962

DOTs can't do this alone!



Essex, VT 2012
Google earth

We need to work in partnerships!

LCPC
Seth Jensen

The Nature
Conservancy
Phil Huffman

Fish & Wildlife Dept.
Pete Emerson

VTRANS
James Brady

VTRANS Secretary
Joe Flynn

ANR Secretary
Julie Moore

Governor
Phil Scott

Lamoille County
Planning Commission
Rob Moore

D.E.C.
Staci Pomeroy

Wolcott Wildlife Shelf Project
2018



Robust Professional and Academic Dialog at ICOET, NETWC, and IENE

ICOET 2019

About

Past Conferences / Resources

Sponsors

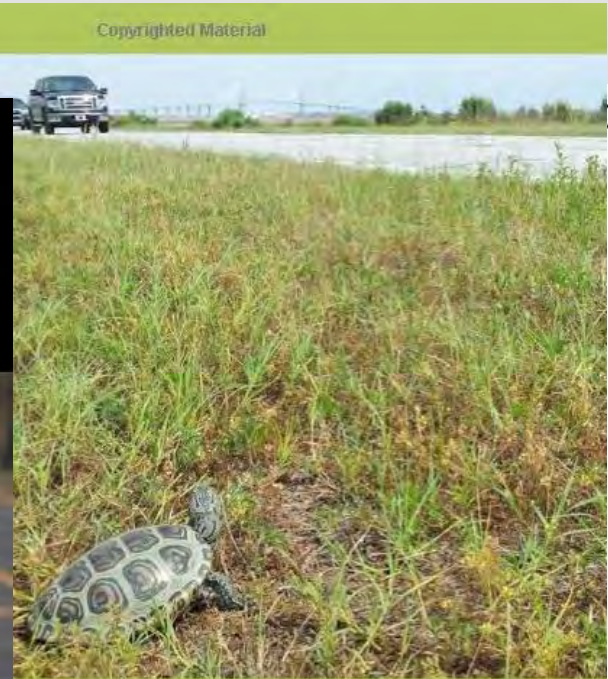
Contact

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Foreword by Richard T. T. Forman

SAFE PASSAGES



Conservation & Ecological Structure

Highways, Wildlife, and Habitat Connectivity

Edited by Jon P. Beckmann, Anthony P. Clevenger, Marcel P. Huijser, and Jodi A. Hilty

EDITED BY

Kimberly M. Andrews

Priya Nanjappa

and Seth P. D. Riley

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ICOET

Join us for the Department of Wildlife, is the forefront of the broad all modes with assistance National

New Abstracts

Develop help you

This year technical exhibits; to Lake T event, presentations types. Please also refer to the [Guidelines](#) for more detail on preparing your successful abstract.

submit an abstract, click on one of the links below.



mission



RESOLUTION 40-3

RESOLUTION ON ECOLOGICAL CONNECTIVITY, ADAPTATION TO CLIMATE CHANGE, AND BIODIVERSITY CONSERVATION

WHEREAS, the New England Governors and Eastern Canadian Premiers have shown international leadership through their collective action to address environmental protection and climate change, especially through work to expand use and production of renewable energy and other efforts to reduce greenhouse gas emissions; and

WHEREAS, the region's economy, culture, and identity are closely tied to and dependent upon its forests and water resources; and

WHEREAS, the region's cities and towns, infrastructure, and natural ecosystems are vulnerable to adverse impacts from climate change. Jurisdictions region-wide are taking steps to adapt to a changing climate, by making communities, infrastructure, and public investments more resilient; and

WHEREAS, the New England Governors and Eastern Canadian Premiers recognize the inherent connection between the region's forested landscape and its forest products economy, and the important role that private forest landowners play in the health and condition of its forests; and

WHEREAS, the Northern Appalachian-Acadian forest is globally significant as the most intact, contiguous temperate broadleaf forest in the world. The Northeastern coastal forest, including the coastal plain, and the Gulf of Saint Lawrence lowland forest provide a vital link for neotropical migrants of global significance. Boreal forests are globally important for millions of resident and migratory birds, including songbirds which depend on boreal forests during different stages of their lifecycles. Together, these forests span portions of all six New England states and five eastern Canadian provinces. Global climate change is a prominent threat to the long-term health of these vital ecosystems. The spread of invasive species and wildlife disease, often exacerbated by global climate change, is another key threat; and

WHEREAS, indigenous people historically have a strong connection to the land, and in the present day continue to recognize the traditional importance of a healthy environment to the social well-being and economic prosperity for future generations; and

WHEREAS, maintaining and restoring ecological connectivity is an important strategy for boosting the resilience of the region's native ecosystems and biodiversity, as well as its economy and human communities. Connected habitats provide the natural pathways necessary for fish, wildlife, and plants to move to meet their life needs and to find suitable habitat as climate conditions change. Intact

MEMORAN

AGENCY C

AGENCY OF
FISH AND W

TRANSPORTA

FISH AND

THIS MEMORANDUM OF A
this 19 day of October, 2010
and Wildlife Department ("VF&W"), and

WHEREAS, the parties desire to
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fragmentation resulting from the presence

WHEREAS, the parties desire to
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transportation infrastructure;

NOW, THEREFORE, the parti

1. Inter-agency Committee. The
chaired by the Secretary of Transportation
designate(s). The Committee will include r
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quarterly or as needed to oversee the activ

2. Identification of Transportat
parties will identify the impacts of highway
not limited to: (a) wildlife mortality from v
from the existing transportation system; (c)
reducing wildlife and aquatic organism pas
health.

3. Minimization of Transportat
address the issues identified in Paragraph 1
transportation impacts on fish and wildlife

(a) Investigating use of und
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and guide wildlife movement across

iques to help predict wildlife

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regulatory and environmental review

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acts on a case-by-case basis, with the
er overall ecological benefit.

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its to address air quality and its effect

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national, and international conferences.

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between transportation planning and

in effect for an indeterminate period
notice to the other party

ES AND NATURAL RESOURCES

TRANSPORTATION

AGENCY OF NATURAL RESOURCES

[Signature]
Susan McIntyre

[Signature]
Deb Markowitz
Secretary

TO FORM:

DEPARTMENT OF FISH & WILDLIFE

12/1/2014

[Signature]
AGENCY OVERAL

Louis Porter
Commissioner

“But we’ve always done it this way...”

Section 755 – Landscaping Materials

755.11 Erosion Matting, Is hereby modified by being deleted in its entirety and replaced with the following:

(a) Temporary Erosion Matting. Temporary erosion matting shall conform to one of the following specifications and corresponding properties found in Table 755.11A

1) **Mulch Control Netting**. A temporary biodegradable rolled erosion control product (RECP) composed of planar woven natural fiber.

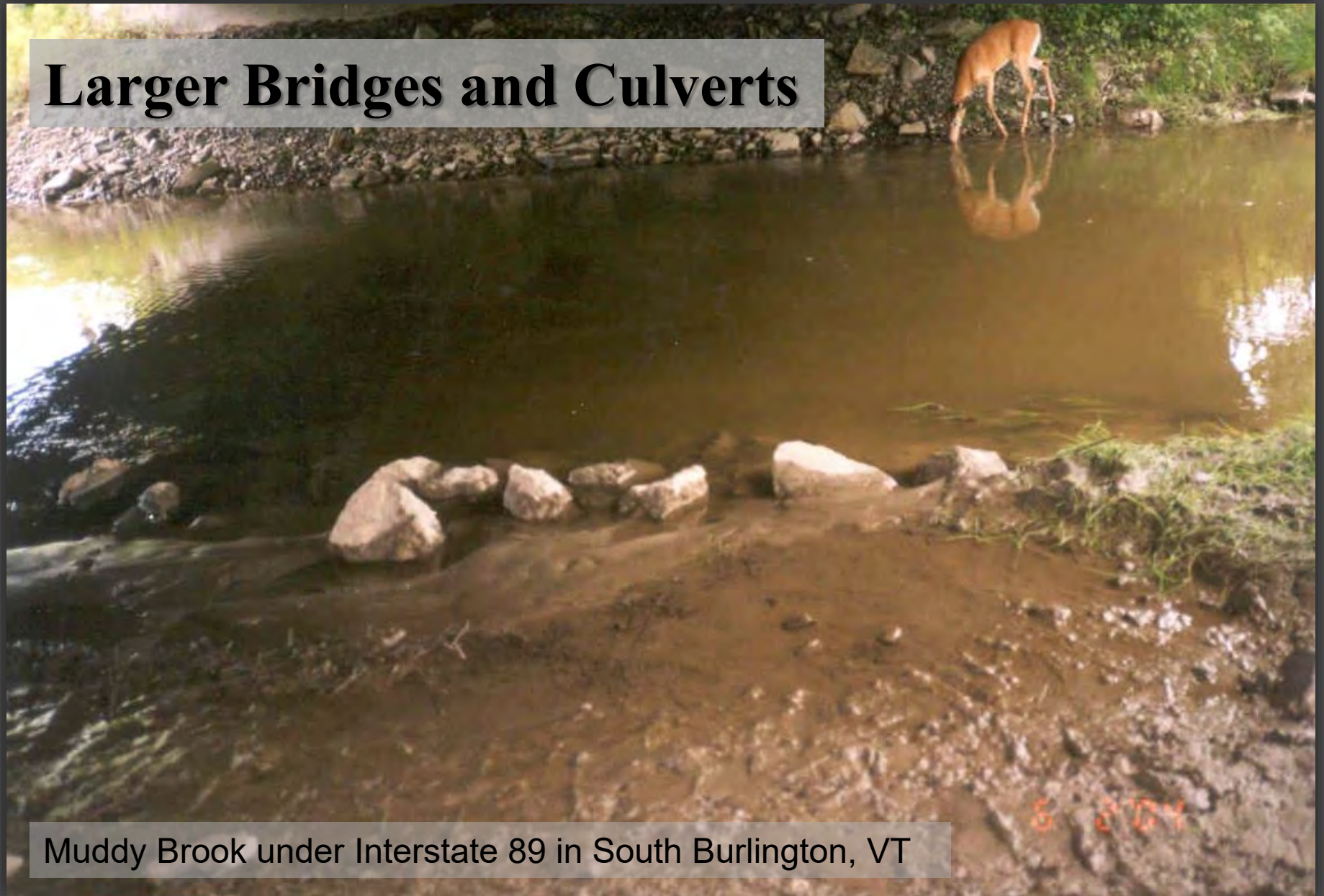
(2) **Erosion Control Blanket**. A temporary all natural biodegradable rolled erosion control product composed of processed fibers mechanically bound together to form a continuous matrix.

Opportunities for Habitat/Wildlife Improvements



New Construction – VT 279

Larger Bridges and Culverts



Muddy Brook under Interstate 89 in South Burlington, VT

8 2014

Modifying Existing Bridges With Fill on Top of Armor/Riprap



Wildlife Shelves in Culverts



Taking Advantage of Existing Habitat – This Can Be Easy and Inexpensive!



Spotted Turtle Crossings on the New England Central Railroad





Solutions from VTrans District Garages!





Habitat Provisions for a Rare Snake Population





Doug Blodgett

2006-05-23 07:17:09

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Monitoring and Data Collection





These Things Work!



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PC900 PROFESSIONAL



Thank You!



Questions? Comments?



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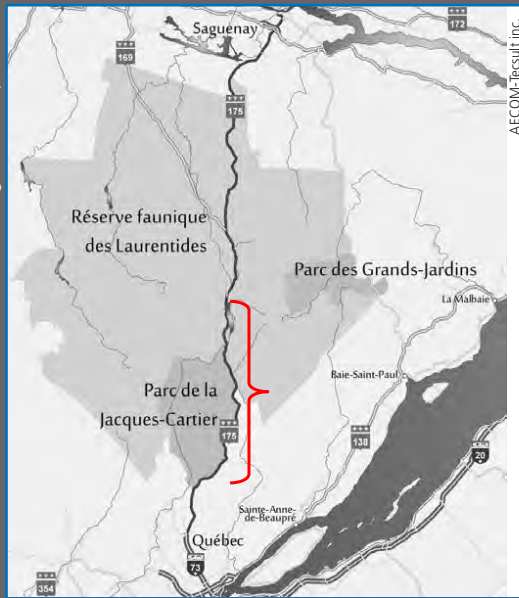
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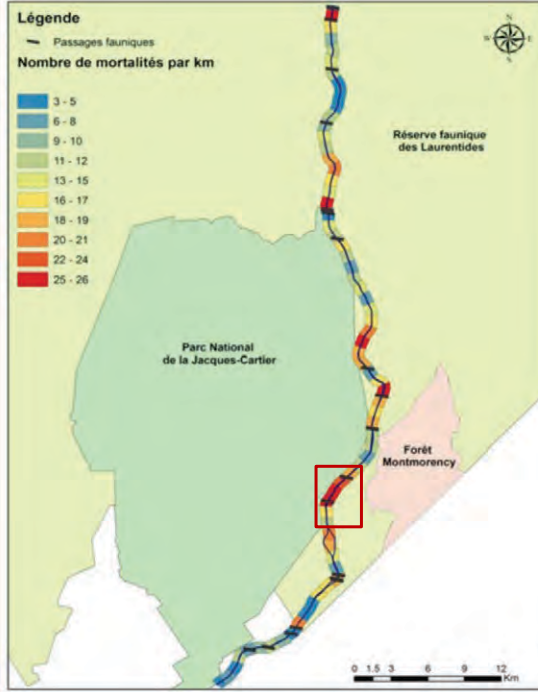


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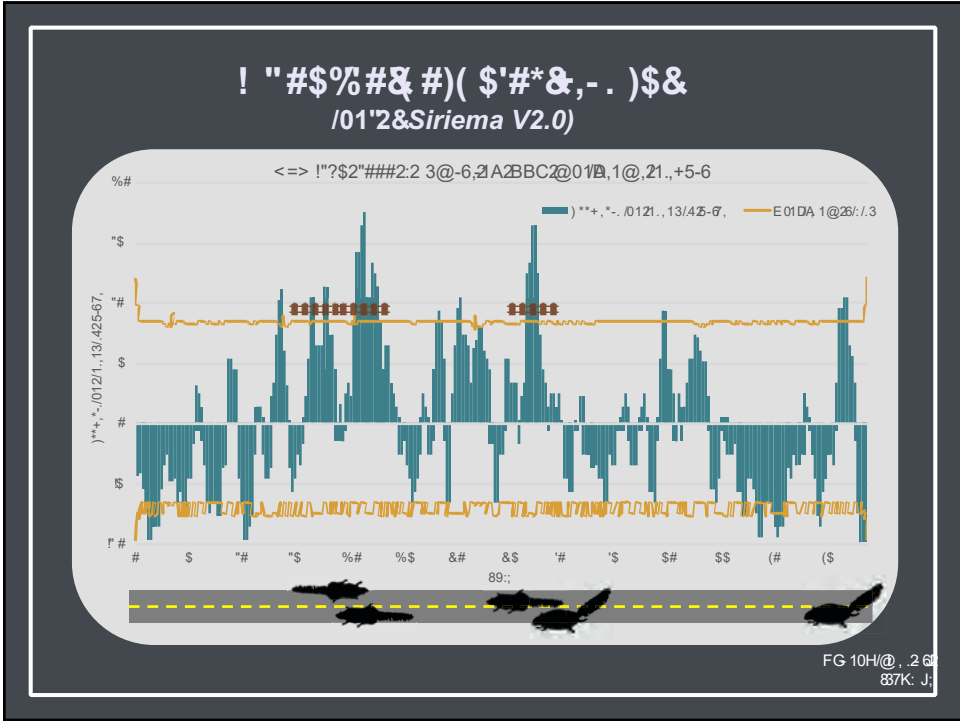
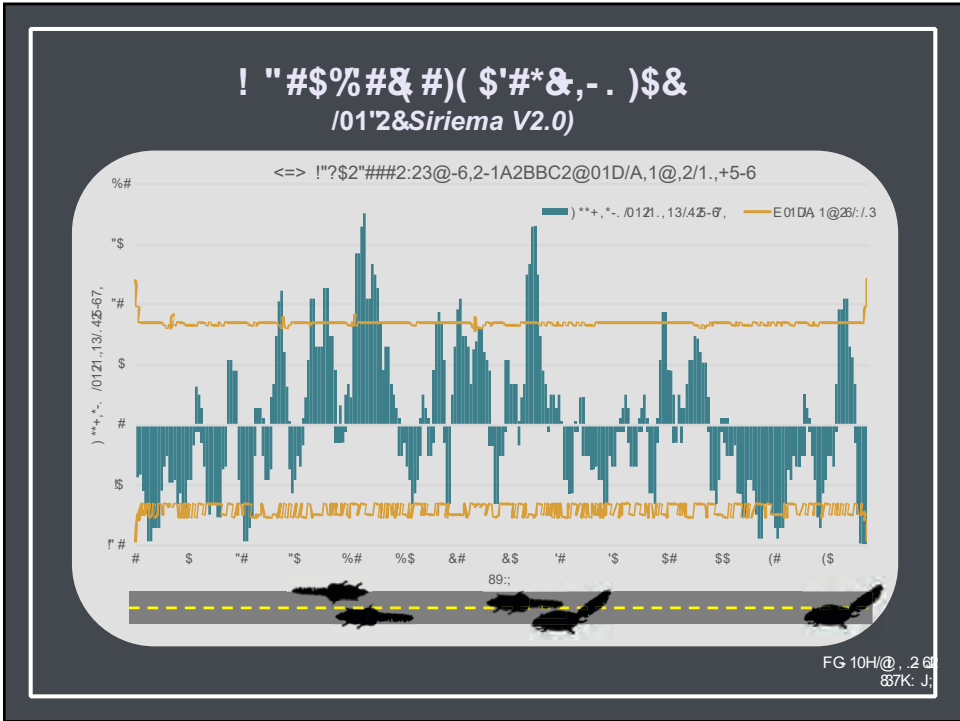
Road Mortality Software

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Hot Spot Identification

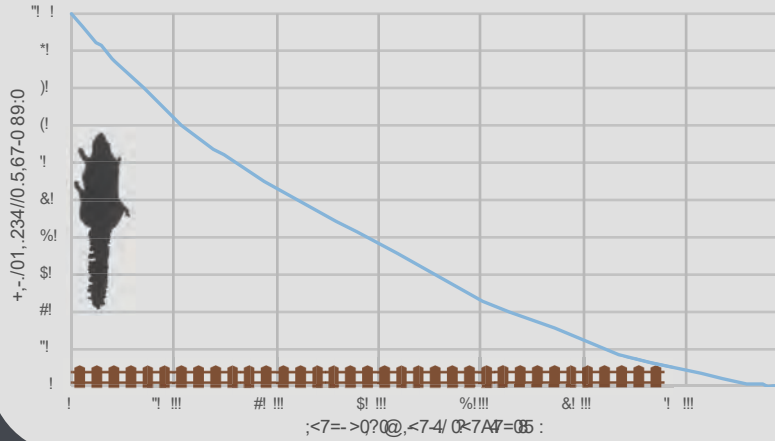
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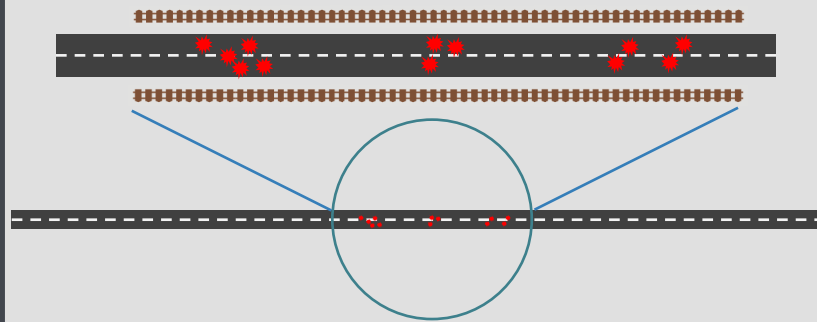


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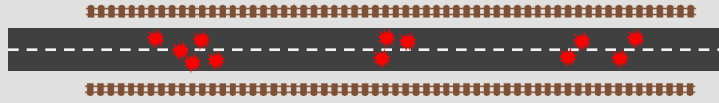


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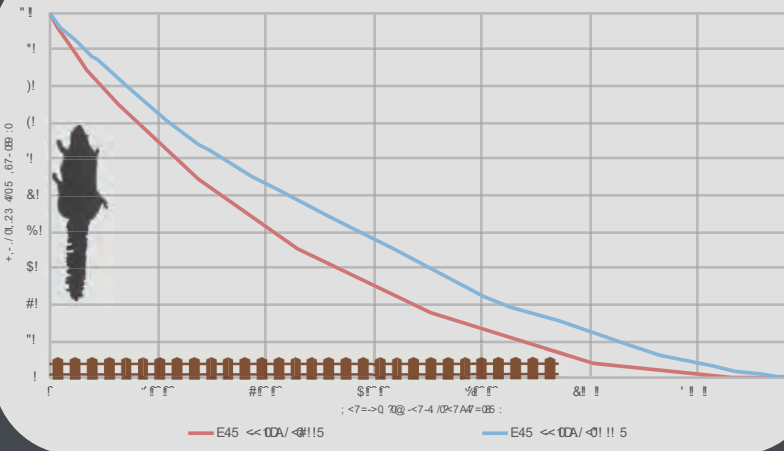


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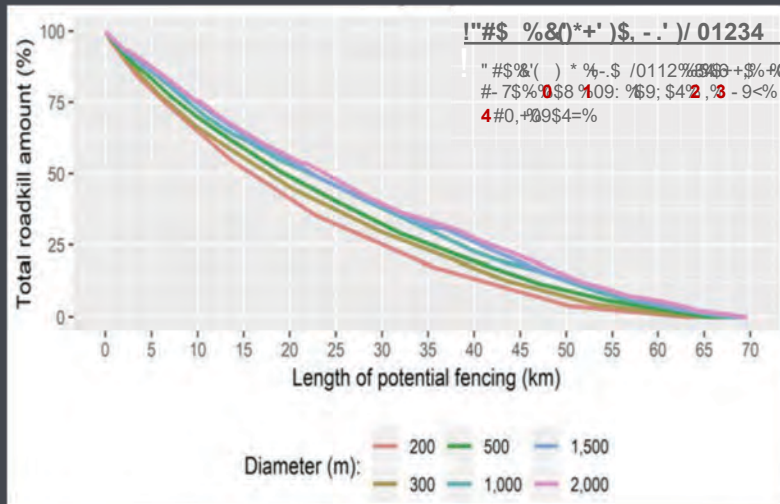


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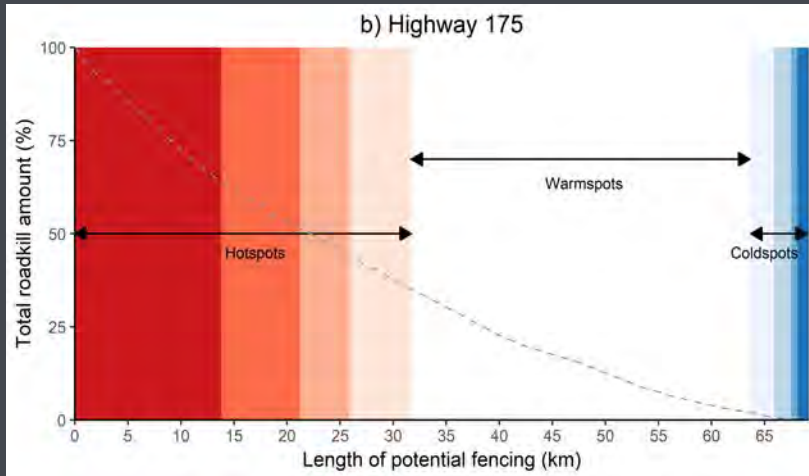
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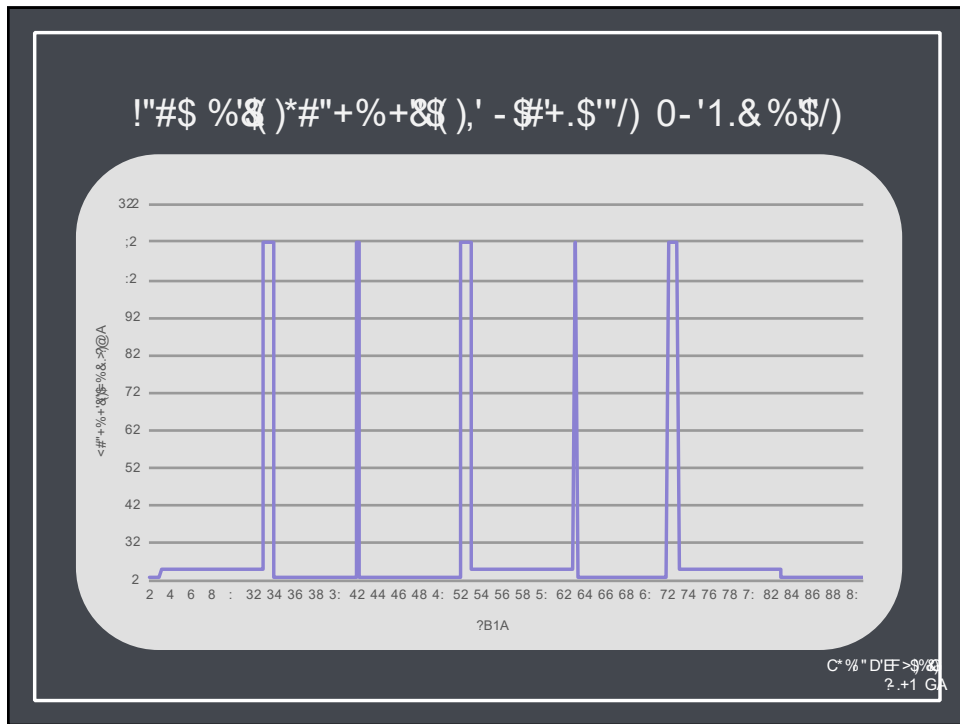
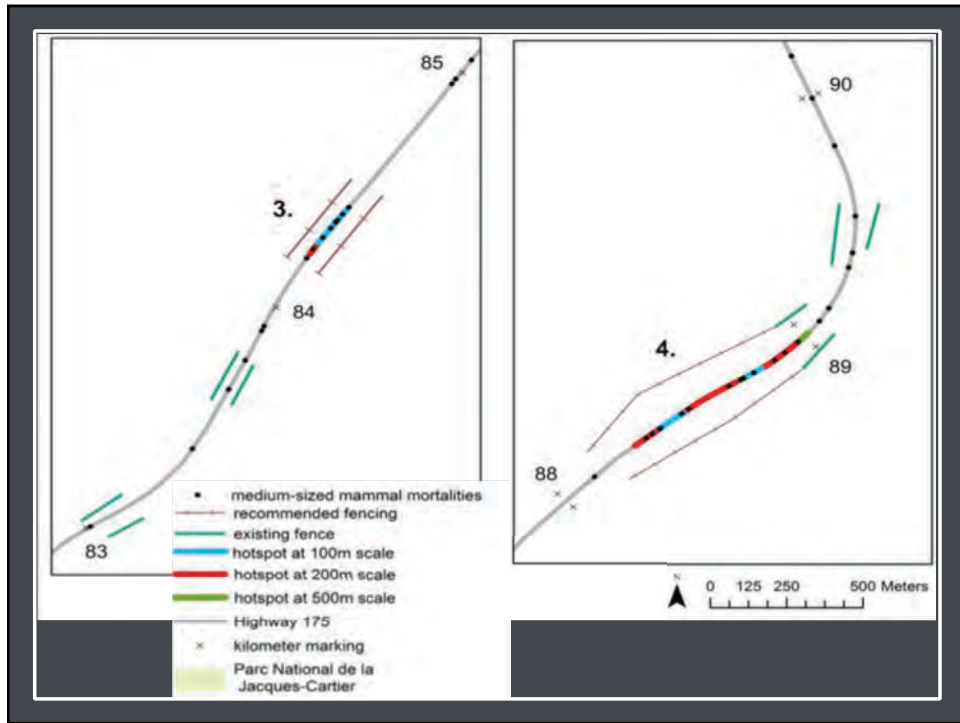
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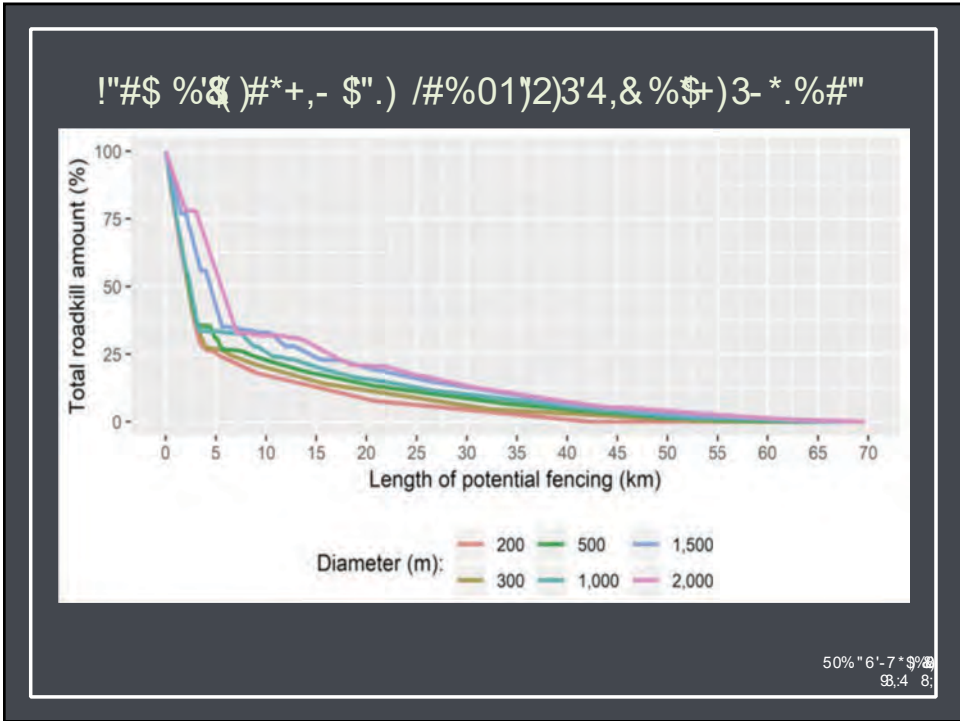
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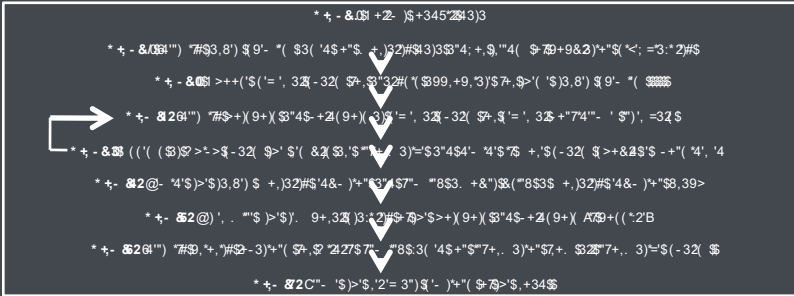
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**Implementing aquatic ecosystem restoration in
Massachusetts: *development of state-wide
approaches to increase connectivity through barrier
removal and improved infrastructure.***



COMMONWEALTH OF MASSACHUSETTS

**Division of
Ecological
Restoration**

Kristen Ferry

Habitat Restoration Program Manager

Massachusetts Department of Fish and Game
Division of Ecological Restoration

Outline

- Who we are & what we do--connectivity!
- Partnership approach for restoration projects
- Capacity building approach/Stream Continuity Program



Shawsheen River, Andover



Massachusetts Department of Fish and Game

Division of Ecological Restoration

Invested in Nature and Community



Who we are

- 19 staff. 16 in Boston; 3 at Westfield State University
- Project managers have 10+ years of experience
- Senior staff have 15-20 years of relevant experience
- Expertise in hydrology, wetland ecology, engineering, fish biology, natural resource economics, water quality



DER's Focus Areas

- **Aquatic habitat restoration**

- Dam removal
- Tidal wetland restoration
- Wetland restoration in retired cranberry bogs
- Culvert replacement/Continuity

- **Streamflow restoration**

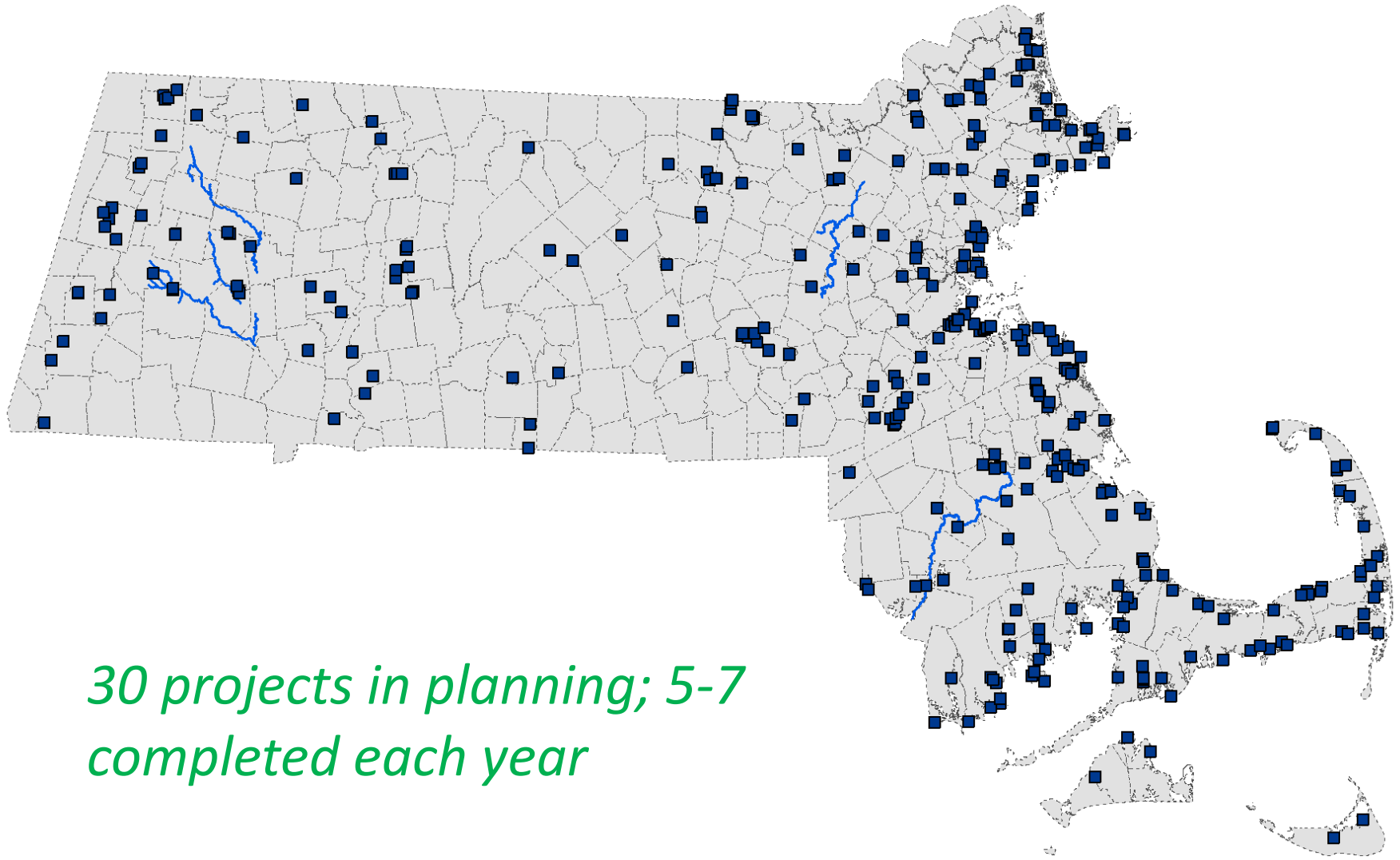
- **Water conservation**

- **Water quality protection**



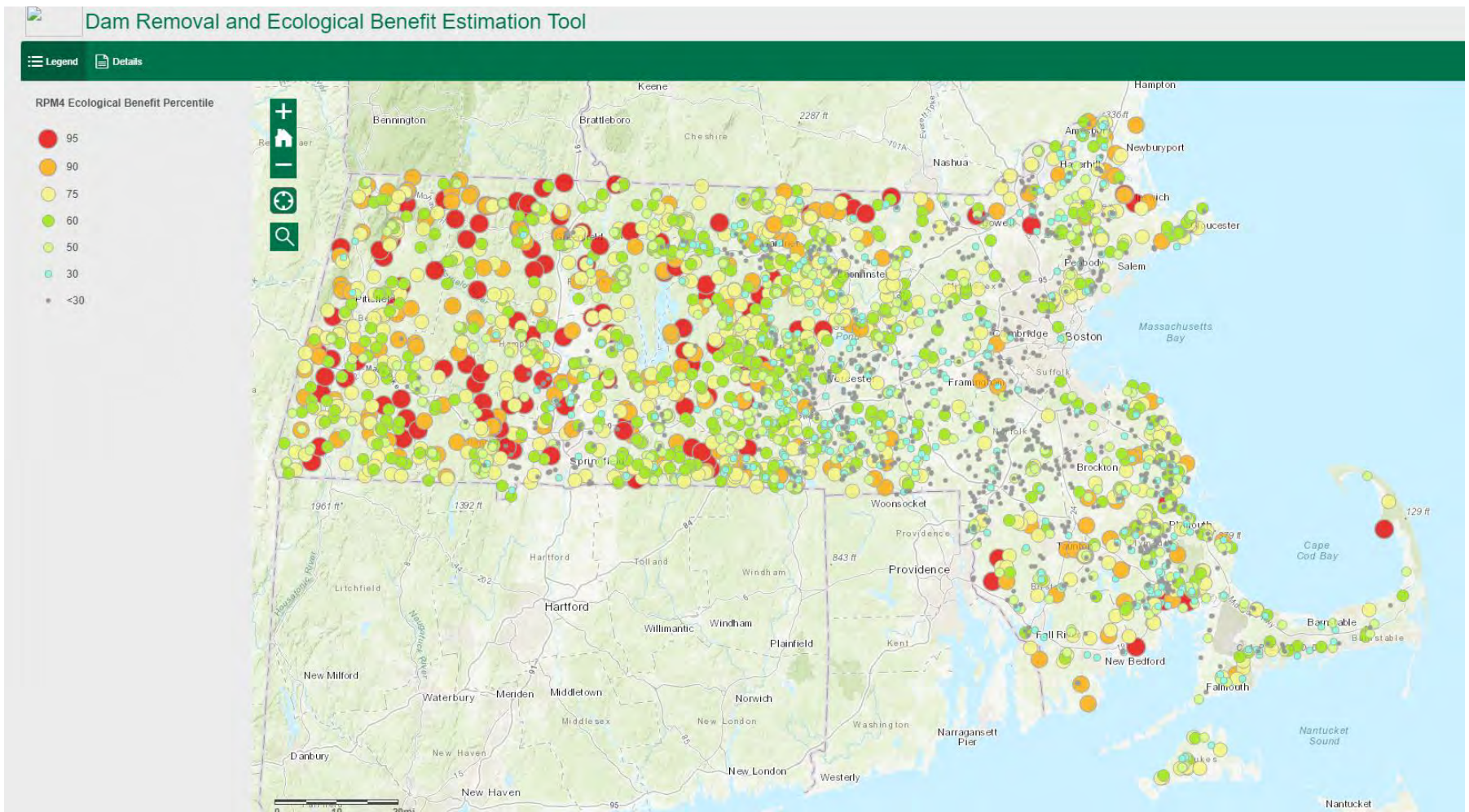
Culvert upgrade training, Northborough

DER works statewide



*30 projects in planning; 5-7
completed each year*

DER's work is prioritized by ecological benefit and community resiliency.



Example: Restoration Potential Model--scores and prioritizes dams for removal based on ecological benefit



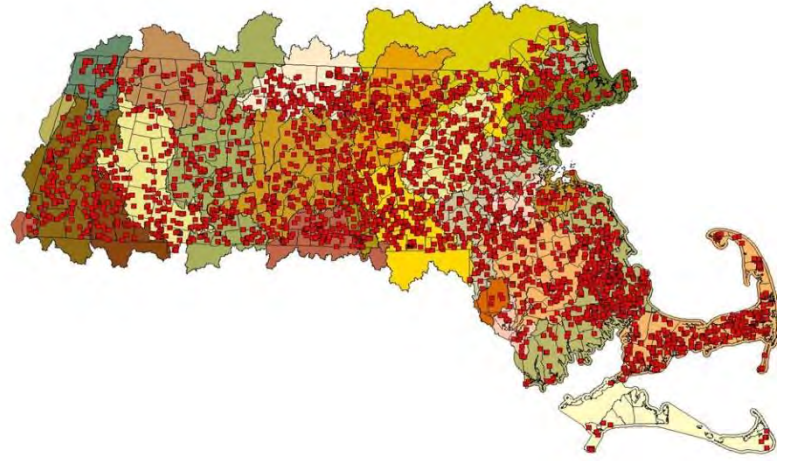
DER's work relates to NEG-ECP Resolution 40-3

- ✓ Connectivity
- ✓ Climate Resiliency



Dam Removal

More than 3,000 dams in MA



Cotton Gin Mill Dam Removal, East Bridgewater

- Most dams in MA have outlived their design lives and purpose.
- **Dams disrupt natural river processes**, block passage of fish and wildlife, and create hazards for communities.
- **Dam removal restores river function** and connectivity and increases climate resiliency for communities.

Accomplishments: 50+ dams removed

Ongoing Progress: 20 projects in planning

Dam Removal

Shawsheen River



Before Removal



During Removal



After Removal

Urban & Rural



Before Removal



During Removal



After Removal

Nissitissit River

Tidal Wetland Restoration

Muddy Creek, Route 28 Cape Cod



- **Tidal restrictions** cause salt marsh degradation, impaired water quality, and reduced access for fish and wildlife.
- **Restored tidal flow** via right-sized crossings improves connectivity, marsh health and migration, and protects communities against coastal flooding and erosive wind and wave action during storms

Accomplishments: > 2000 acres restored (809 ha)

Potential Need: 600-1000 undersized tidal crossings

Wetland Restoration on Retired Cranberry Farmland



Degraded wetlands and streams



Eel River Headwater (Plymouth)
Before and after restoration

Restored processes and ecosystems

- Legacy farming impacts degrade wetland ecosystems
- Restoration **repairs site hydrology** by removing fill, plugging ditches, and removing small dams

Accomplishments: > 350 acres restored (142 ha)

Potential Need: 13,250 acres (5,362 ha)

DER's Partnership Approach



DER's Partnership Approach

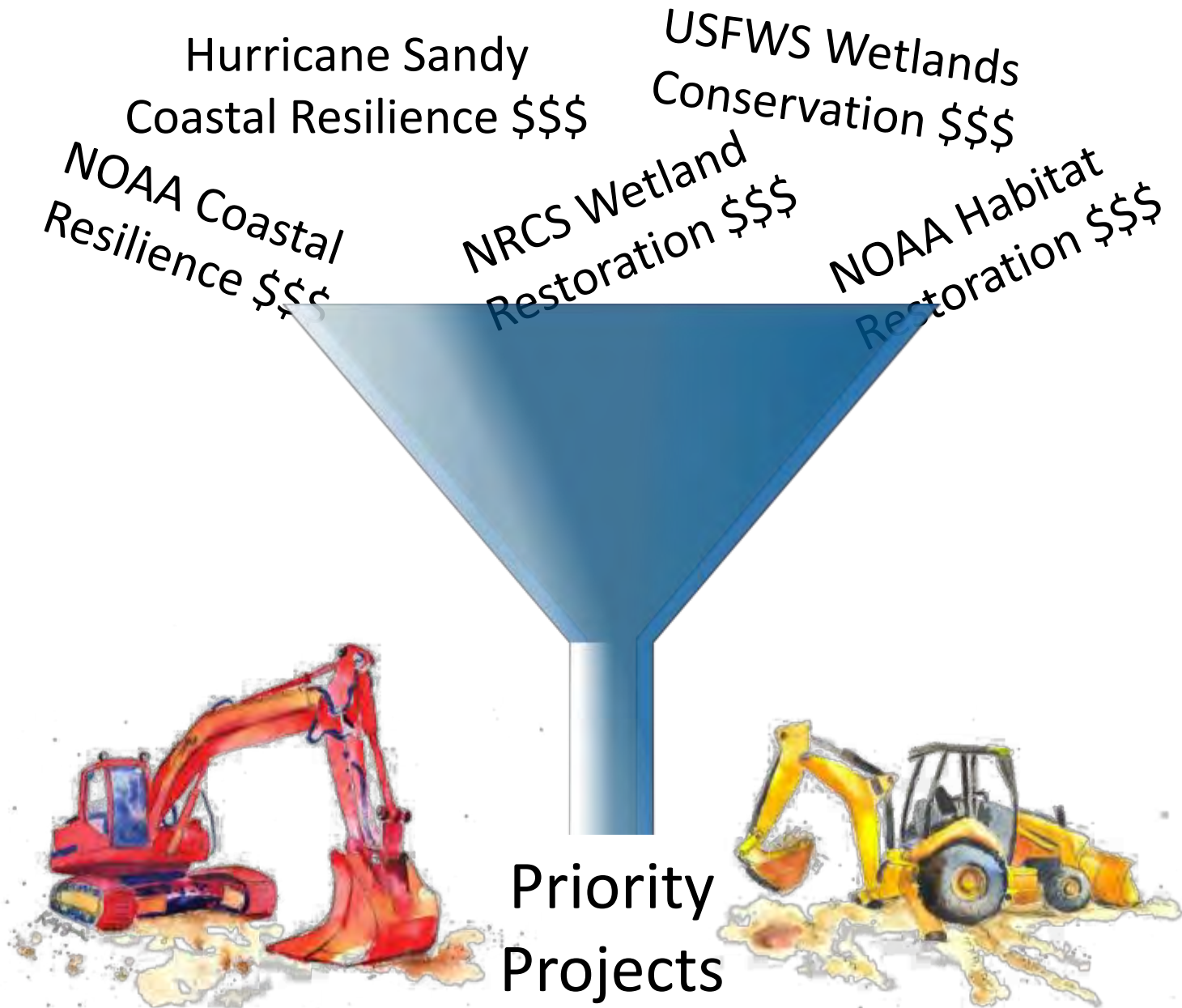
Priority Projects Program

- ❖ DER works with municipal, state, NGO, private landowners and land managers
- ❖ Competitive program

DER provides...

- Hands-on assistance identifying and scoping projects
- Oversight through design, and permitting
- Fundraising
- Contracted technical services and grants
- Support through construction

DER is a funnel for resources



Economic Output

- 12.5 jobs for every \$1 million invested
- Cost to remove dams and upgrade crossings less than repairing in-kind, long-term
- DER's leveraging makes climate adaptation less expensive for towns; saves money in the long term through increased resilience



Hunters Pond Dam, Scituate

Stream Continuity Program

Freshwater Culverts

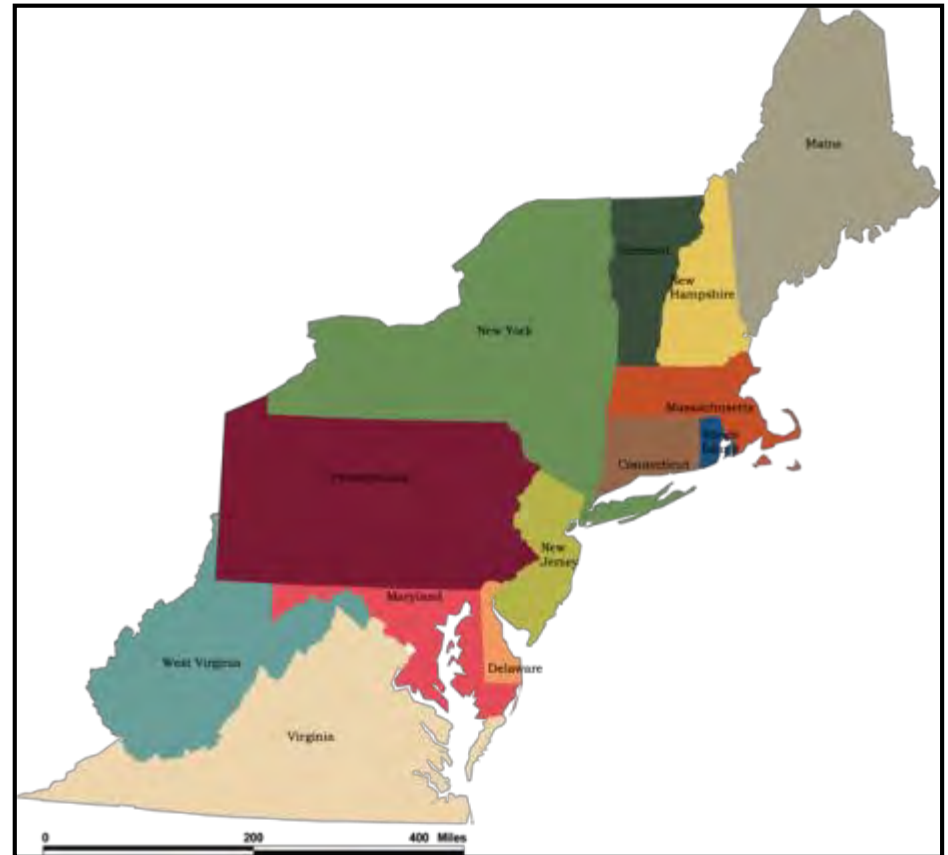


Build municipal capacity to replace undersized culverts through technical assistance, training, tool development, incentive grants, and coordination with regulatory agencies.



www.streamcontinuity.org

- ✓ Create a network in the North Atlantic region
- ✓ Develop a Unified Stream Crossing Assessment Protocol
- ✓ Create an infrastructure to support collection of road-stream crossing data



UMASS
AMHERST



We have history with road-stream continuity.

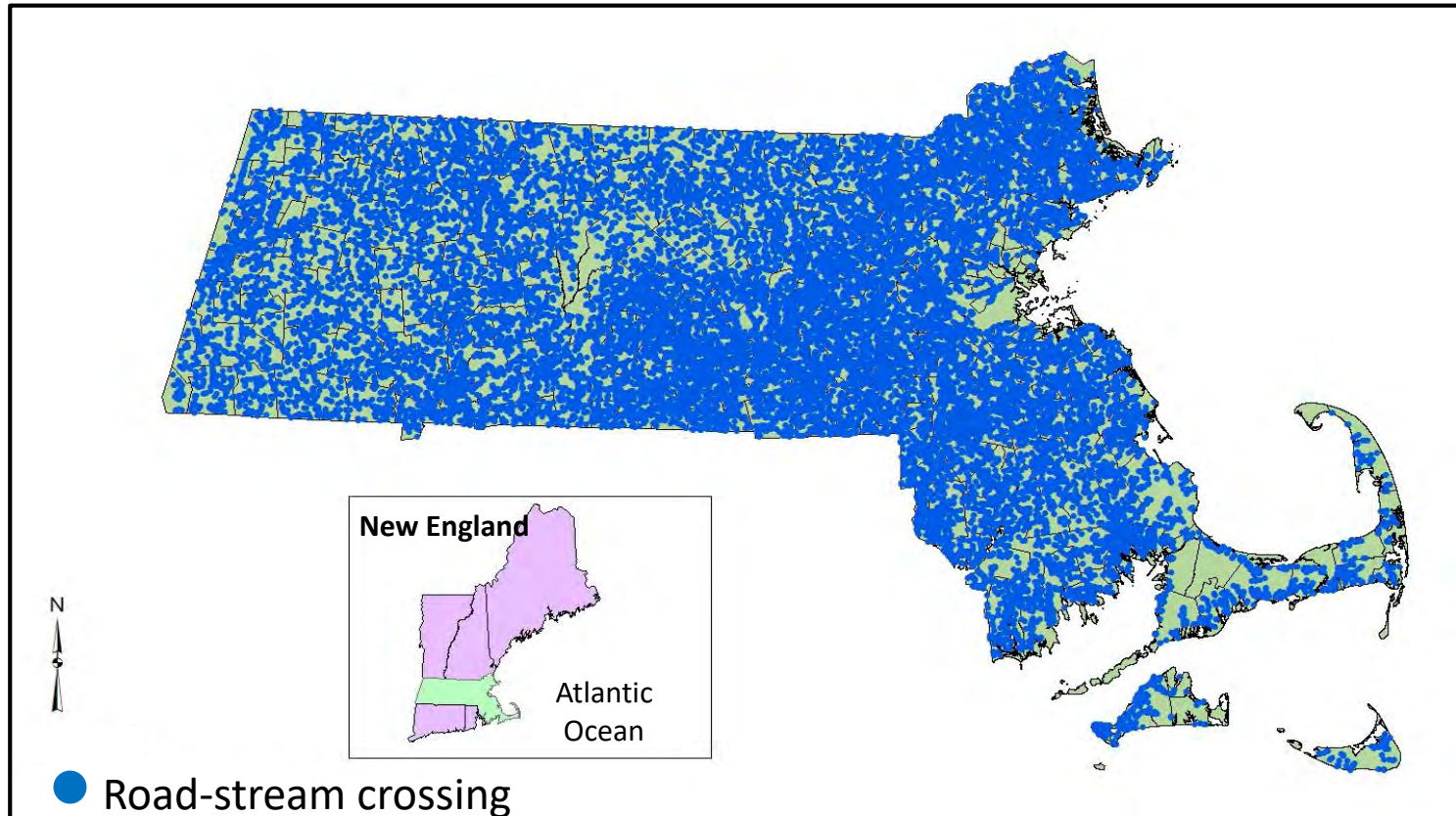


- Aquatic organism passage assessments, data & methods
- MA Stream Crossing Standards
- Trainings & technical assistance
- *Observation of increasing damage*

Stream Continuity Program (2014)

Objective: *Increase municipal capacity state-wide for replacing culverts
(MA Stream Crossing Standards)*

- 351 Municipalities
- 20,000+ culverts
- Mostly town owned, maintained & managed.



Massachusetts Stream Crossing Standards, 2011

0.82 Openness ratio

Large span, 1.2x bankfull width

Open arch



Natural substrate

Paul Nguyen

2 feet Embedment

Banks, dry passage

Comparable depth and velocity, up & downstream

Stream Continuity Program



How do we move the needle for culvert replacements?



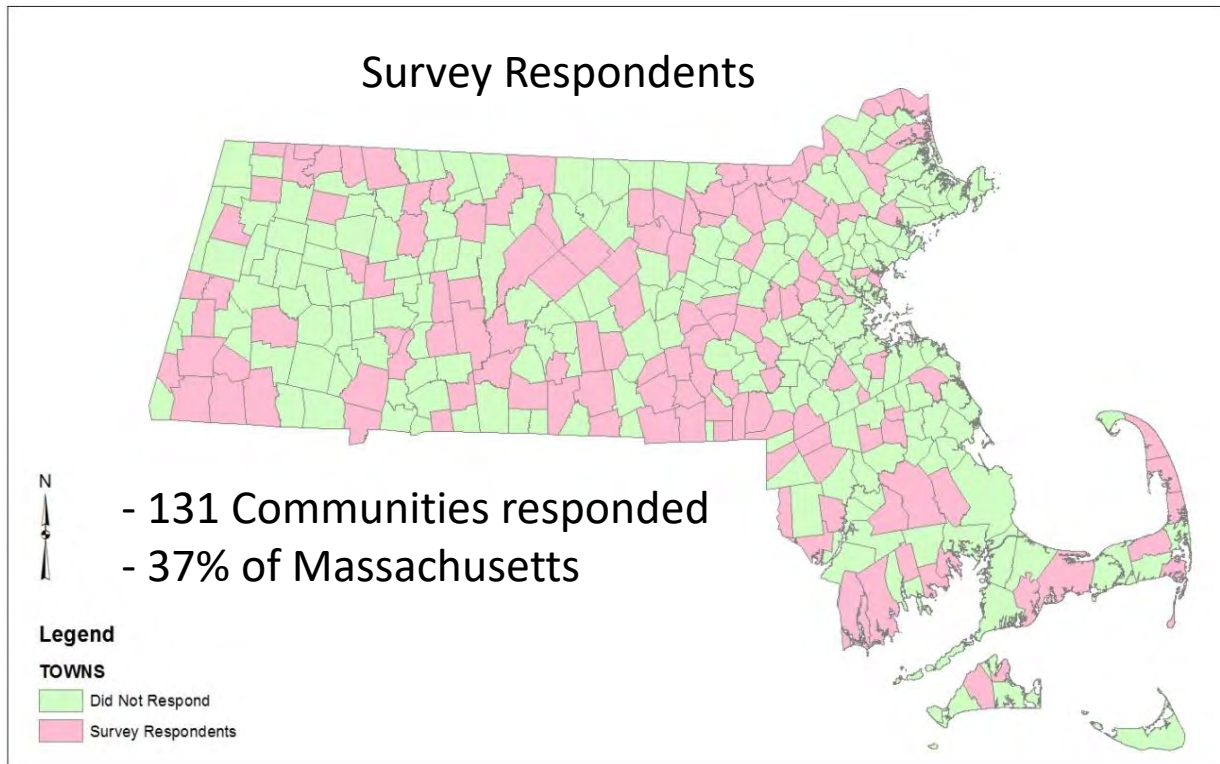
Current Approach:
One project, many partners
(e.g., dam removals)

New Model! →
Towns have capacity and
resources to replace culverts



Stream Continuity Program

Guiding Development: State-wide Municipal Needs Assessment
Examined challenges to culvert replacement & status quo



Primary
Challenges

- Cost (Construction and Design)
- State Engineering Review
- Environmental Permitting

Process!

Stream Continuity Program

Four Components (Initial)

- Direct technical assistance to municipalities for culvert replacement
- DER supported case study training sites—Training Initiative
- Development of technical tools and approaches
- Culvert Replacement Municipal Assistance Grant Program

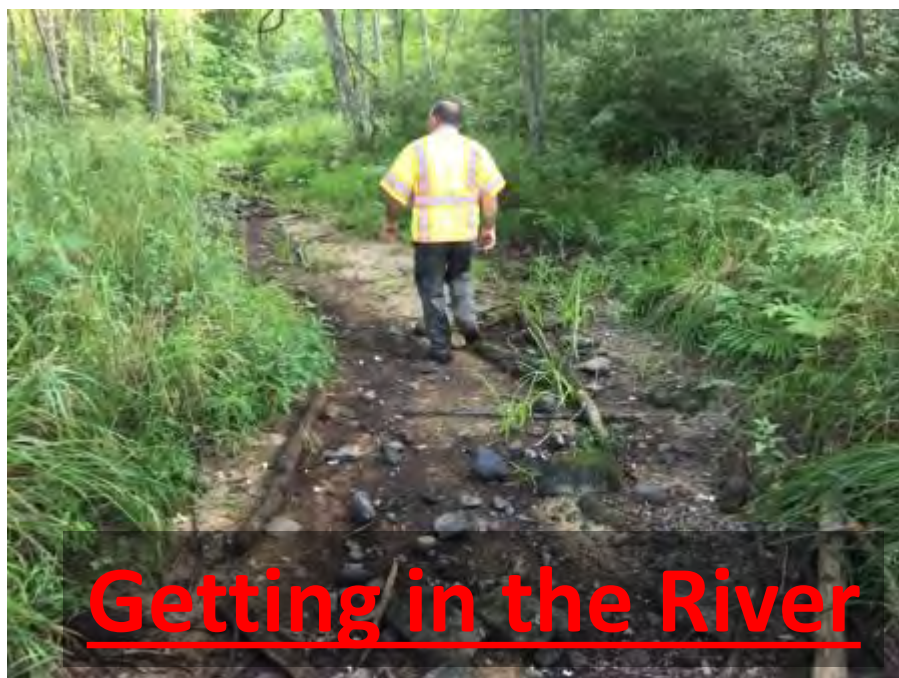


1. Providing Technical Assistance

What we do: site reconnaissance, survey & assessments, desktop review, resource sharing, assistance with regulatory coordination, limited design review, etc. LISTENING!!

What's eligible: Municipally owned/managed crossings; new projects

Crossings located in areas of high ecological value/sensitivity receive priority



Getting in the River

Dighton, MA

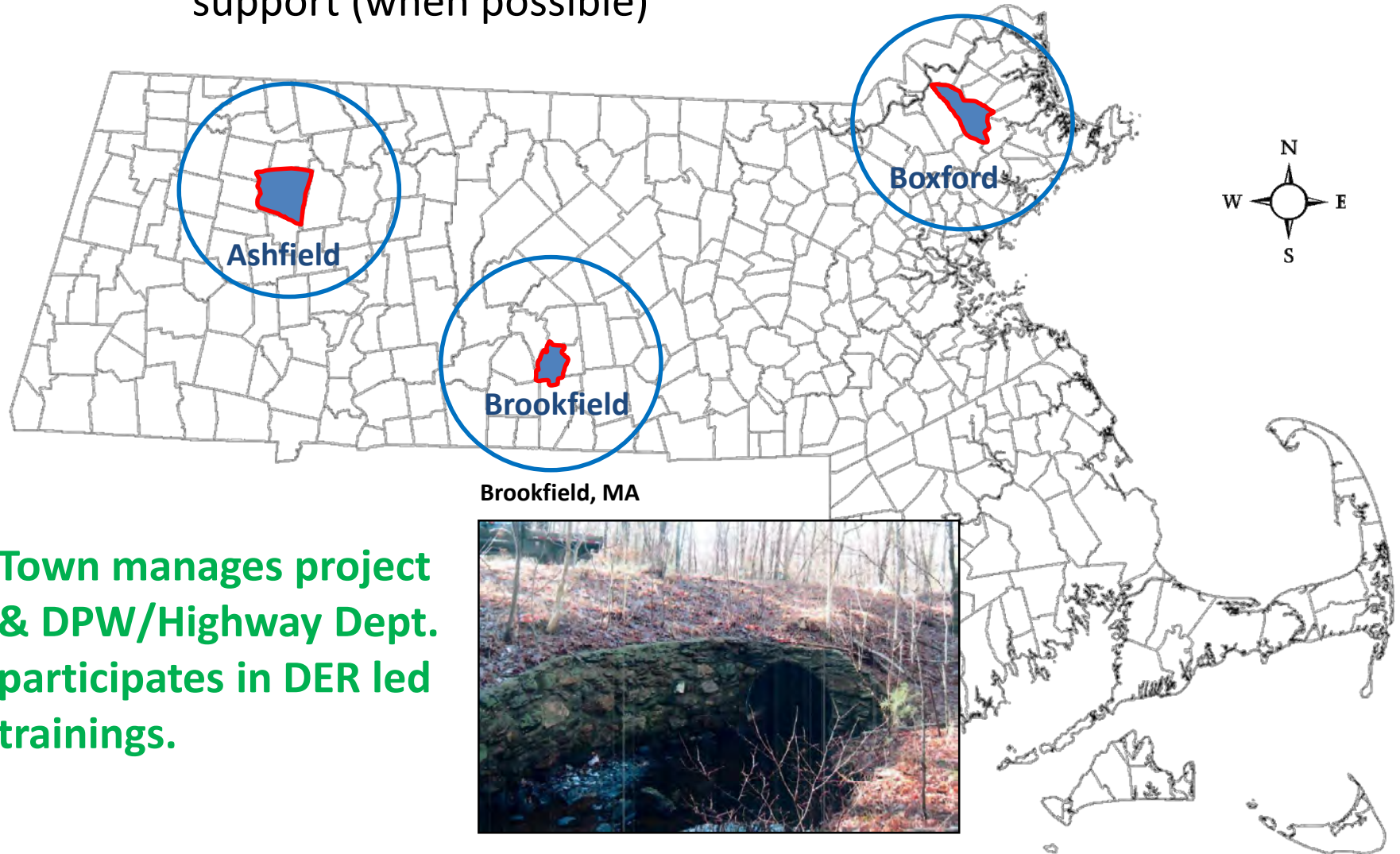


Getting in the Culvert

Dighton, MA

2. Culvert Replacement Training Sites

- Competitive opportunity for municipalities
- DER technical assistance through construction & financial support (when possible)



Town manages project & DPW/Highway Dept. participates in DER led trainings.

2. Culvert Replacement Training Sites

Goal: Reach as many towns as possible

Create avenues for town networking & easy access to training



3. Providing Tools and Approaches

Aids for culvert replacement implementation informed by technical assistance, Training Sites, and the grant program

Examples...

- Template bid requests and scopes of work
- General structure selection tool (Pros/Cons; \$-\$\$\$\$)
- Standard design details (e.g., natural stream bed design)



4. Culvert Replacement Municipal Assistance Grant Program

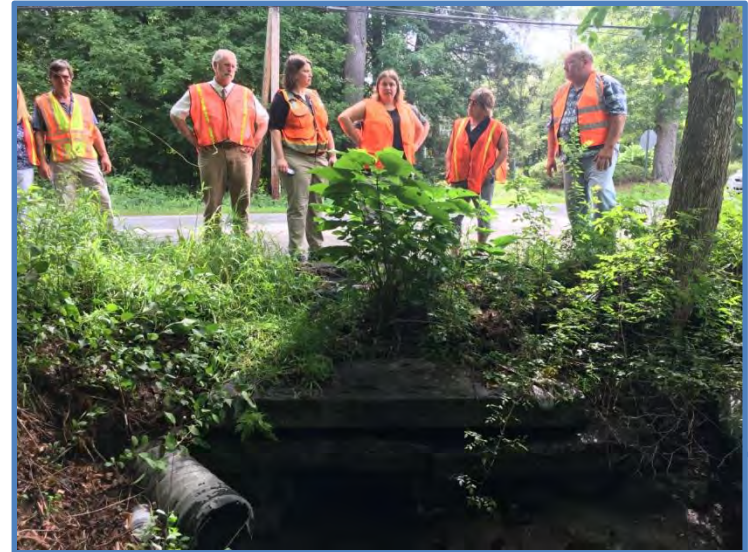
Incentive funding to help municipal Public Works/Highway Depts. jump start culvert replacements

- Culverts in **areas of high ecological value** and provide **public benefit**
- **All Phases of Culvert Replacement**
 - Field data collection
 - Design and permitting
 - Construction



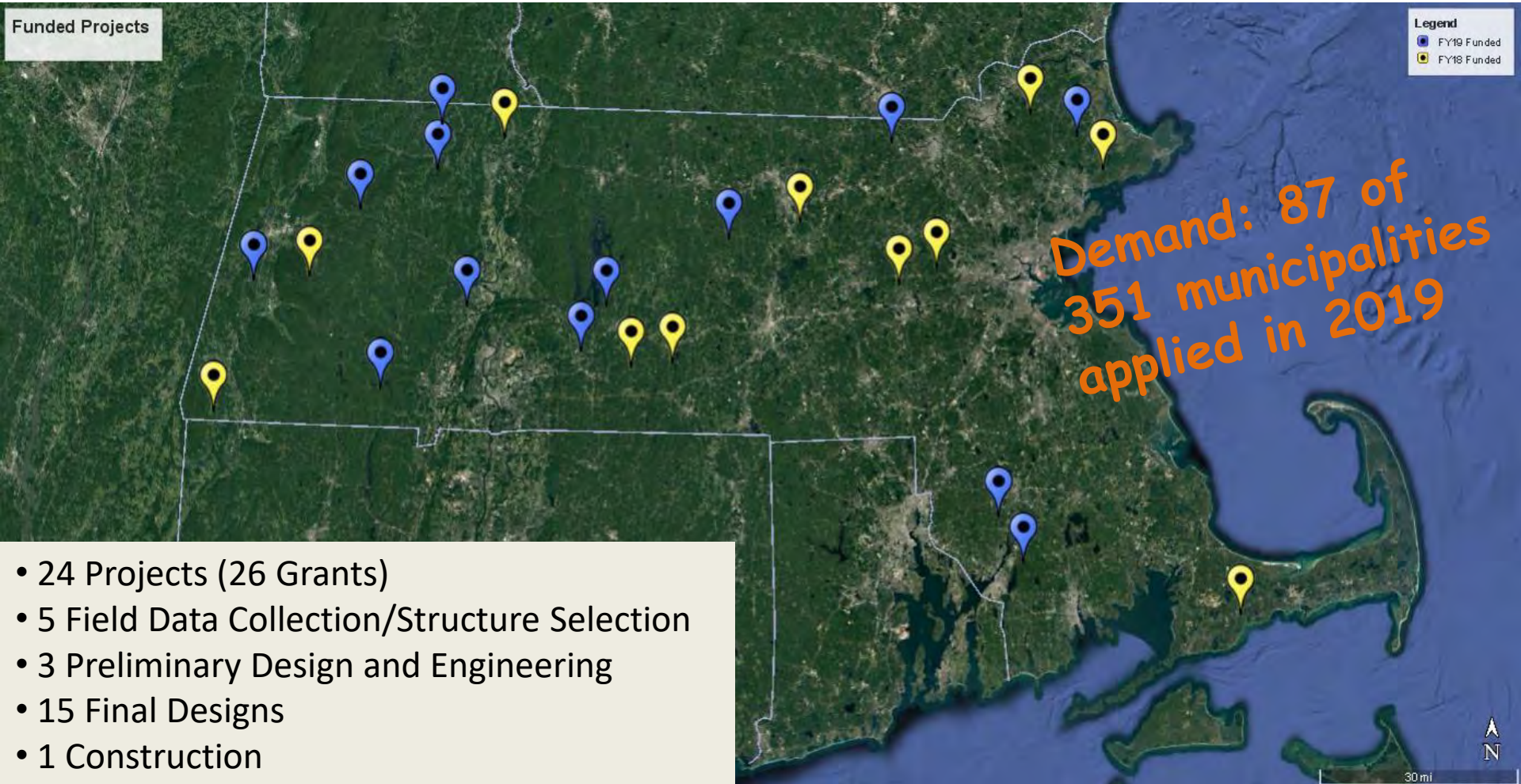
4. Culvert Replacement Municipal Assistance Grant Program

- ~ \$1M available annually
- Matching funds not required
- Grants range from **\$22,500-\$150,000**
- Only projects intending to **meet the goals of the Stream Crossing Standards**



4. Culvert Replacement Municipal Assistance Grant Program

Funded Projects, 2 Yrs



Summary



- **Partnership-based approach** is a proven model for implementation of habitat restoration projects, especially **large, complex projects**.
 - **Capacity building (*helping people help themselves*)** may be a better approach for implementation of projects involving **municipal infrastructure (high volume)**.
 - Partnerships are still critical!
 - Demonstrated \$\$ need
 - For communities, habitat restoration can be a mechanism for climate adaptation & resiliency.
- Next steps:** Expansion of capacity building to all restoration practices

Thank you!



Massachusetts Department of Fish and Game

Division of
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Invested in Nature and Community

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