Stream Continuity in the Taunton River Watershed

Spring Street, East Bridgewater

Protecting
Aquatic Passage
from headwaters
to Mount Hope Bay

Mill Brook, Bell Rock Road, Fall RIver

Under natural conditions in a stream or river, water, organisms and organic material move freely. Change occurs constantly.

Seasonal cycles of flooding and low flow affect the movement. Over years, other natural changes to the system occur – depth of water, flow velocity, stream configuration, temperature, water chemistry and shifting habitats.

Maintaining the health and diversity of aquatic life requires keeping these systems intact.

These natural conditions and changes allow processes that support aquatic life to function.

Stream continuity is the uninterrupted connection of a river network where the natural physical characteristics of the stream have not been significantly altered and few or no barriers exist that would hinder or block movement up and downstream.

Many aquatic species must keep moving to survive. They need dependable travel lanes.

Reasons for travel:

- Need to find food
- Need to find a mate
- Need cover from predators under banks or in vegetation
- Need specific spawning or nursery habitat habitat as seasons change and areas freeze or dry up
- Need to move from frozen areas in winter
- Need to find shady and wet areas during droughts and extreme heat
- Need emergency shelter from intense storms, human intrusion

Something is amiss

Humans can disrupt efficient systems that nature has designed, with adverse or even disastrous consequences. Many manmade stream crossings on roads or railways are good examples of this tendency.

Poorly designed or constructed stream crossings can impede or block wildlife passage, preventing individual organisms from performing critical functions necessary for survival. If the conditions persist, local populations of specific species may be threatened.

To address these and other challenges to preserving the Commonwealth’s natural resources, the Commonwealth of Massachusetts, the University of Massachusetts, Amherst and environmental groups including Mass Audubon worked together. Three important programs were developed.

The CAPS Program
The Critical Linkages Program
The Stream Continuity Program

Conservation Assessment and Prioritization System (CAPS)

Blueprint for preserving open space and river systems

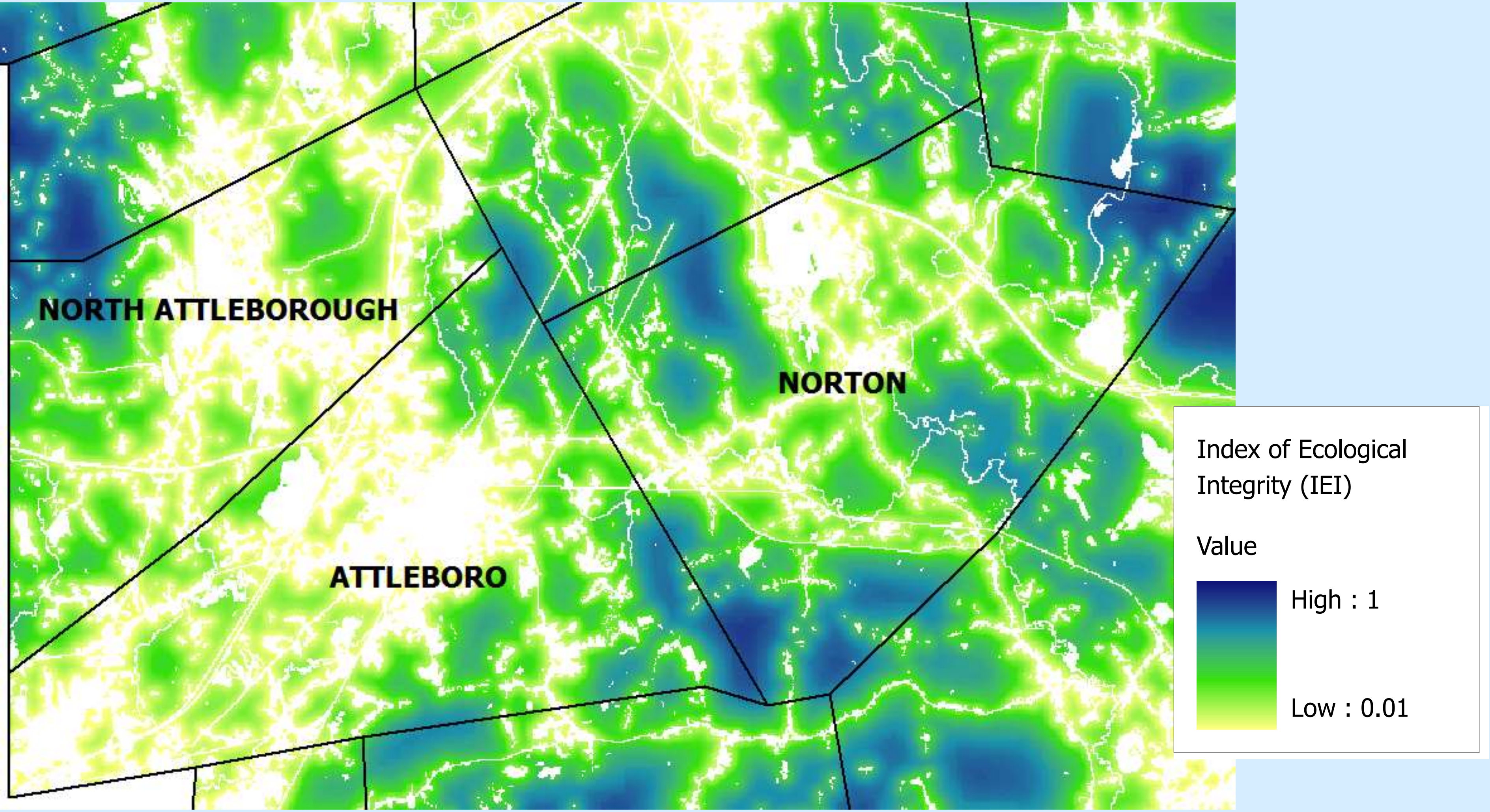
“Ecological integrity” is a measure of ecological resilience of ecosystems, including forests, wetlands, rivers and other open space.

CAPS was developed by researchers at the University of Massachusetts, Amherst, Department of Natural Resources Conservation and Mass Audubon. The program evaluates developed and undeveloped elements of the Massachusetts landscape and assigns a score, or “Index of Ecological Integrity (IEI).”

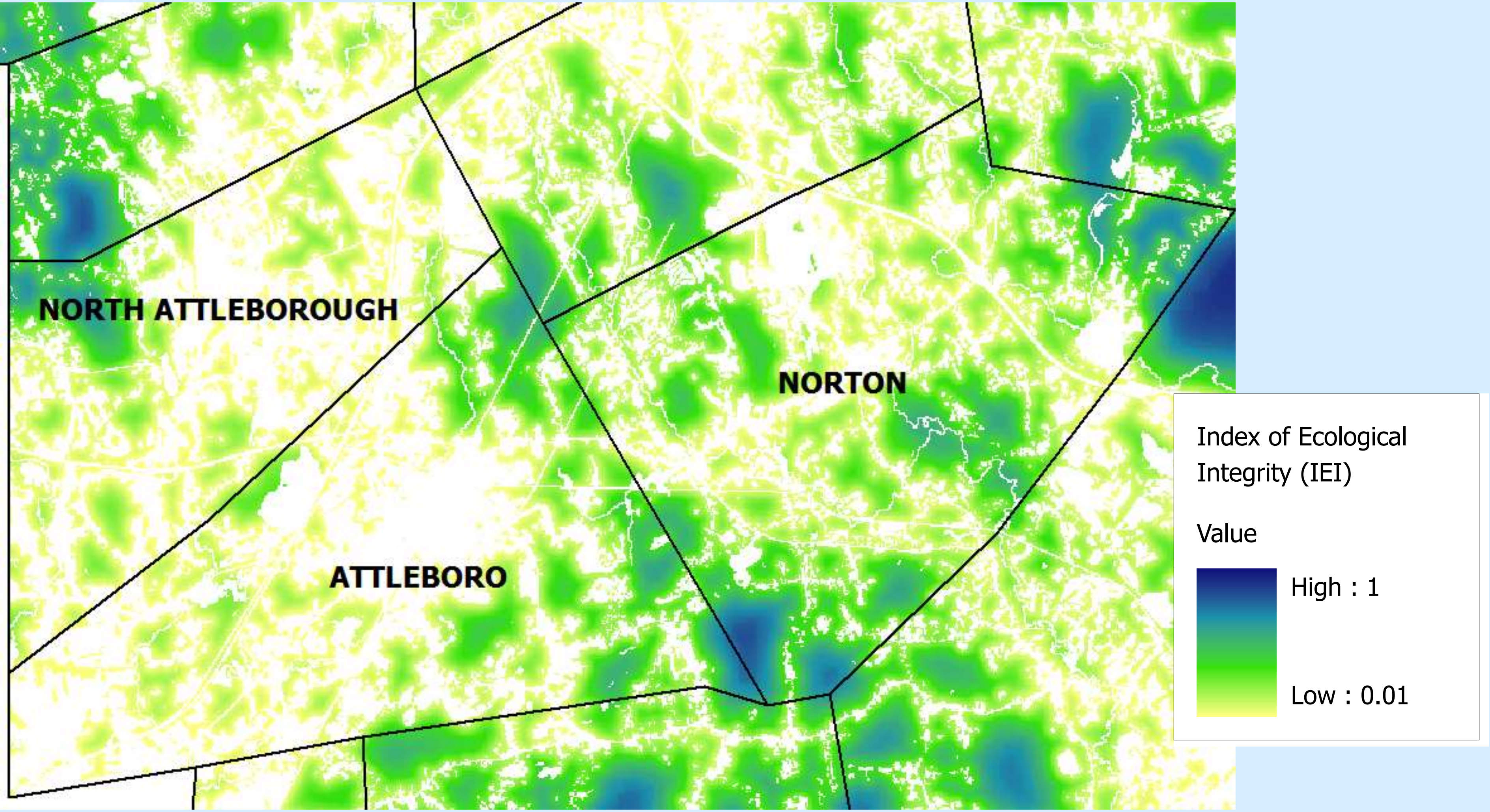
The highest rankings go to large intact ecological systems - forests, wetlands, rivers and streams – that are not fragmented by roads or other human development, or are connected to each other by a natural corridor, and are not impacted by nutrient loading to aquatic systems or other adverse impacts.

CAPS presumes that if we preserve these areas statewide, we can conserve more species and ecological processes for generations to come.

Ecological Value in 1971



Ecological Value in 2005



Critical Linkages Project

Under the direction of Dr. Scott Jackson, this Project conducted aerial surveys of the entire Commonwealth. Photographs of over 23,000 stream crossing locations were analyzed by a computer model to predict the condition and passability of crossings.

- Computer assigned an Aquatic Score that predicts degree to which crossing creates a barrier to passage for aquatic organisms.
- Using IEI score from CAPS and the Aquatic Score, the project calculates an "Impact" score for each identified crossing.

This Impact Score estimates the **ecological restoration potential** of the crossing – i.e., the amount of improvement in the ecological health of the stream if the crossing structure were removed or replaced

Sites were ranked in 5 Tiers, with Tier 1 indicating highest potential for ecological restoration.

Stream Continuity Project

The goal of the Project was to verify high priority projects for bridge or culvert replacement. To accomplish this, the Project would conduct field assessments of stream crossings to determine whether the predictions made from the Critical Linkages aerial surveys were accurate.

The Project developed common protocols and training for assessing road crossings and rail crossings of streams, and a regional database of field data. Survey teams filled out a " Field Data Form" for each stream crossing that was inventoried, photographed crossings and entered data in UMass Stream Continuity Database.

The Database generated an Aquatic Score for each site using 12 variables from the field assessment. This score ranges from 0 to 1.0. 1.0 indicates that the crossing allows full passage. 0 indicates a total barrier to passage.

Based on Aquatic Score, crossings were determined to create **severe, significant, moderate, minor or insignificant** barriers to passage of fish and wildlife

Stream Continuity Project: Survey teams filled out a " Field Data Form" for each stream crossing that was inventoried.


Field Data Form: Road-Stream Crossing Inventory

Data entry by ______ Date ______
Reviewed by ______ Date ______

Coordinator ______ Crossing ID# ______
Stream/River: ______ Road: ______ Town: ______
Flow condition: ☐ Unusually low ☐ Typical low-flow ☐ Average flow ☐ Higher than average

GPS Coordinates (lat/long):
☐ Decimal degrees N__ __ . __ __ __ __ __ W__ __ . __ __ __ __ __
OR ☐ Degrees, minutes, seconds North: D ______ M ______ S ______
West: D ______ M ______ S ______

Date: ______ Location: ______ Observer: ______
Photo IDs: ______

Road/Railway Characteristics

Road surface: ☐ Paved ☐ Unpaved ☐ Railroad
Road type: ☐ 1-Lane road ☐ 2-Lane road ☐ Multilane road ☐ Divided highway ☐ Railroad ☐ Buried stream

Crossing/Stream Characteristics *(during generally low-flow conditions)*

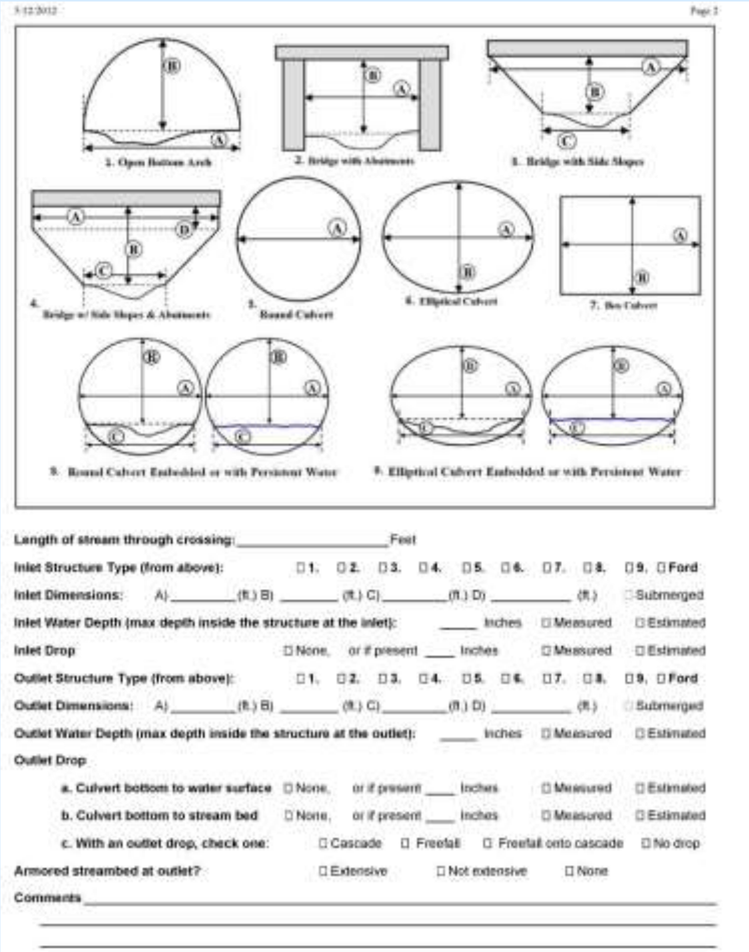
Crossing type: ☐ Ford ☐ Bridge ☐ Open bottom arch ☐ Single culvert ☐ Multiple culverts (# ____) ☐ Removed ☐ No crossing
Condition of crossing: ☐ New ☐ Excellent ☐ Fair ☐ Poor
Does the stream at the crossing support fish? ☐ Yes ☐ Not likely ☐ Don't know
Is the stream flowing? ☐ Yes ☐ No
Crossing span: ☐ Severe constriction ☐ Mild constriction ☐ Spans bank to bank ☐ Spans channel & banks
Tailwater Scour pool: ☐ None ☐ Small (wider or deeper than stream) ☐ Large (width or depth 2X stream)
Crossing alignment matches stream? ☐ Yes (flow aligned) ☐ No (skewed)

Culvert/Bridge Cell Characteristics *(Culvert/cell #1, use page 3 for additional culverts or cells)*

Structure embedded? ☐ Not embedded ☐ Partially embedded ☐ Fully embedded ☐ No Bottom
Structure substrate: ☐ None (smooth) ☐ None (rough/corrugated) ☐ Inappropriate ☐ Contrasting ☐ Comparable
Internal features ☐ None ☐ Slip lined ☐ Baffles/Sills ☐ Weir(s) ☐ Support structures
Physical Barriers to fish and wildlife passage: ☐ Severe ☐ Moderate ☐ Minor ☐ None
Describe any barriers: ______
Is there a clear line of sight through the structure? ☐ Yes ☐ No
Does the structure provide dry passage suitable for use by terrestrial wildlife? ☐ Yes ☐ No
If yes, what is the maximum structure height in the portion that offers dry passage? ______ Feet
Comments ______

For the following questions use as a reference a portion of the natural stream channel that is outside the influence of the crossing structure and not otherwise altered.

Water depth matches stream? ☐ Yes (comparable) ☐ No (deeper) ☐ No (shallower) ☐ Dry
Water velocity matches stream? ☐ Yes (comparable) ☐ No (slower) ☐ No (faster) ☐ Dry
Crossing Slope matches stream? ☐ Yes (comparable) ☐ No (flatter) ☐ No (steeper)


1. Open Bottom Arch
2. Bridge with Abutments
3. Bridge with Side Slopes
4. Bridge w/ Side Slopes & Abutments
5. Round Culvert
6. Elliptical Culvert
7. Box Culvert
8. Round Culvert Embedded or with Persistent Water
9. Elliptical Culvert Embedded or with Persistent Water

Length of stream through crossing: ______ Feet
Inlet Structure Type (from above): ☐ 1. ☐ 2. ☐ 3. ☐ 4. ☐ 5. ☐ 6. ☐ 7. ☐ 8. ☐ 9. ☐ Ford
Inlet Dimensions: A) ______ (ft.) B) ______ (ft.) C) ______ (ft.) D) ______ (ft.) ☐ Submerged
Inlet Water Depth (max depth inside the structure at the inlet): ____ Inches ☐ Measured ☐ Estimated
Inlet Drop ☐ None, or if present ____ Inches ☐ Measured ☐ Estimated
Outlet Structure Type (from above): ☐ 1. ☐ 2. ☐ 3. ☐ 4. ☐ 5. ☐ 6. ☐ 7. ☐ 8. ☐ 9. ☐ Ford
Outlet Dimensions: A) ______ (ft.) B) ______ (ft.) C) ______ (ft.) D) ______ (ft.) ☐ Submerged
Outlet Water Depth (max depth inside the structure at the outlet): ____ Inches ☐ Measured ☐ Estimated
Outlet Drop
a. Culvert bottom to water surface ☐ None, or if present ____ Inches ☐ Measured ☐ Estimated
b. Culvert bottom to stream bed ☐ None, or if present ____ Inches ☐ Measured ☐ Estimated
c. With an outlet drop, check one: ☐ Cascade ☐ Freefall ☐ Freefall onto cascade ☐ No drop
Armored streambed at outlet? ☐ Extensive ☐ Not extensive ☐ None
Comments ______

Sample of Stream Continuity Database Page

Survey ID	Crossing Code	Date Observed	Last Updated	Town	Stream	Road	Evaluation	Culvert
3005	xy419535497 1280015	2008/01/08	2008/01/24	Attleboro MA	Bungay River	Holden Street	Insignificant barrier	1
3057	xy419374197 1290251	2008/02/15	2008/02/21	Attleboro MA	Bungay River	Olive Street	Insignificant barrier	1
3059	xy419506407 1284387	2008/02/15	2008/02/21	Attleboro MA	Bungay River	Bank Street	Insignificant barrier	1
6364	xy419310357 1245070	2012/10/24	2013/02/19	Attleboro MA	Unknown	Pike Avenue	Significant barrier	1
6365	xy419223107 1237215	2012/05/30	2013/02/19	Attleboro MA	Chartley Brook	Wilmarth Street	Significant barrier	1
6373	xy419539417 1257873	2012/10/11	2013/02/19	Attleboro MA	Unknown	Pleasant Street	Minor barrier	1
6382	xy419370877 1255283	2012/10/24	2013/02/19	Attleboro MA	Unk	Bishop Street	Moderate barrier	1
6383	xy419227587 1244807	2012/10/24	2013/02/19	Attleboro MA	Unknown	Thayer Farm Road	Minor barrier	1
6384	xy419416997 1250161	2012/10/24	2013/02/19	Attleboro MA	Unknown	Pike Avenue	Minor barrier	2
6385	xy419427167 1266266	2012/10/24	2013/02/19	Attleboro MA	Unknown	Garfield Avenue	Moderate barrier	3
7384	xy419520997 1262592	2013/07/09	2013/10/23	Attleboro MA	unknown	East Access Road	Moderate barrier	1
7590	xy419417447 1239039	2012/10/24	2013/11/11	Attleboro MA	Chartly Brook	Peckham Street	Significant barrier	1
8469	xy419236407 1240211	2013/07/09	2013/12/06	Attleboro MA	Unk	Sheridan Circle	Minor barrier	1

The Taunton River Watershed

Portions of 43 cities or towns; 562 square miles;
hundreds of miles of major tributaries and small streams

Taunton River

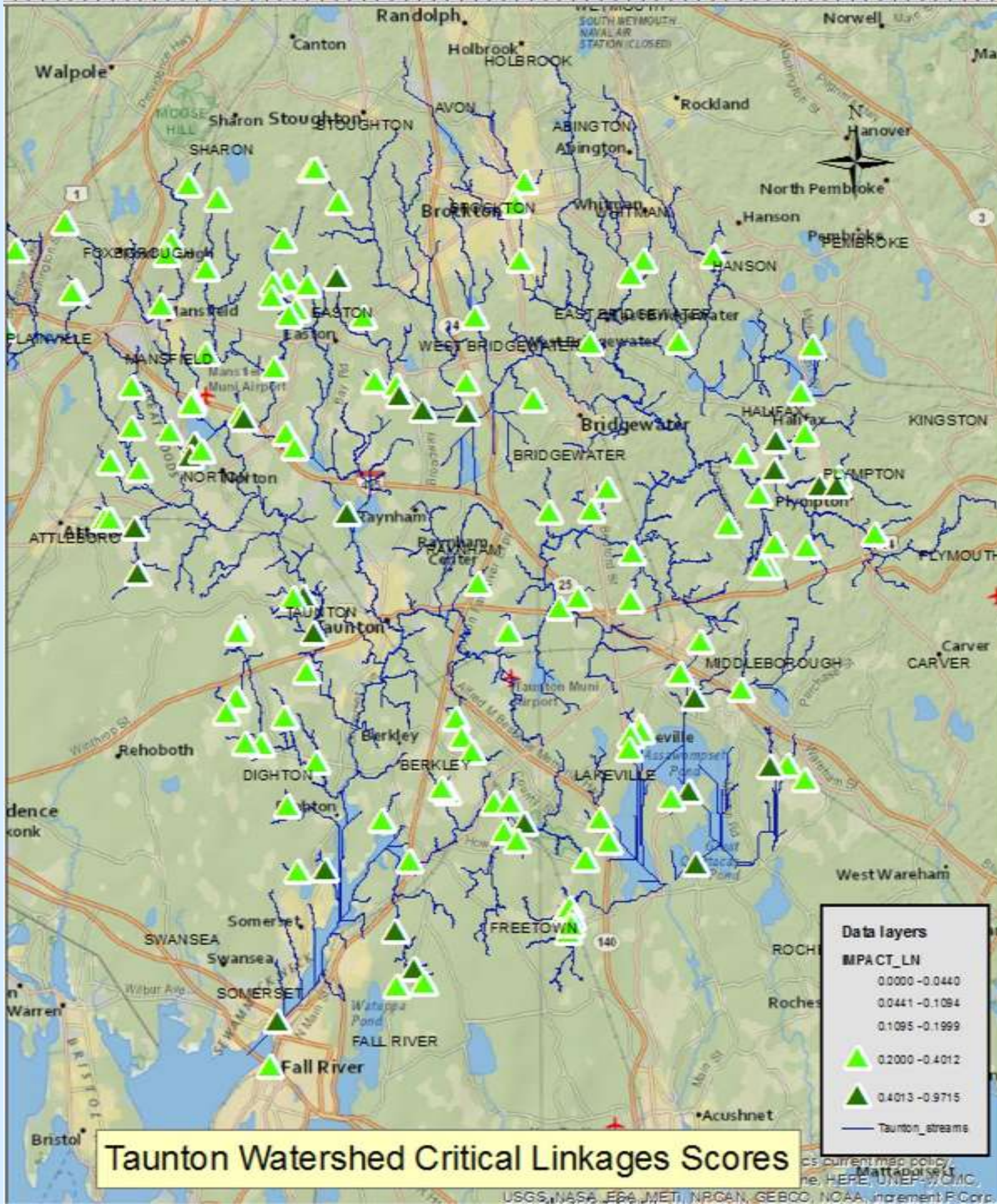
Designated as a Federal Wild and Scenic River in 2003

40 miles of free-flowing water

Taunton River Watershed Stream Continuity Project

Over 1200 crossing sites in the Taunton River Watershed were identified by the Critical Linkages Program in. 24 received Tier 1 Impact Scores, and 119 received Tier 2 Impact Scores

2006-2013: Volunteers surveyed 518 stream crossings in the Taunton River Watershed to determine if they create a barrier to fish and wildlife passage. Selection of sites was primarily based on Critical Linkage Impact Scores.



Taunton Watershed Critical Linkages Scores

Many crossings that were evaluated preserve the natural condition of the stream or river, or cause minimal alteration.

Spring Street, East Bridgewater

Forest Street, West Bridgewater

Washington Street, Easton

Others don't.

Mountain Street, Mansfield

East Foxboro Street, Sharon

Blocked or collapsed culverts prevent wildlife from passing though and lead to severe flooding following intense rainstorms preventing wildlife from passing through.

Culverts that are elevated above normal stream heights prevent wildlife from moving upstream. In addition, they cause water impoundment.

Drops in elevation at the inlet or outlet of a culvert create barriers for passage of small fish and other organisms, such as turtles.

Inlet at North Walker Street, Taunton

Water impoundment causes algae bloom, lowered dissolved oxygen levels, and other pollution problems. These areas are also prime breeding ground for mosquitoes.

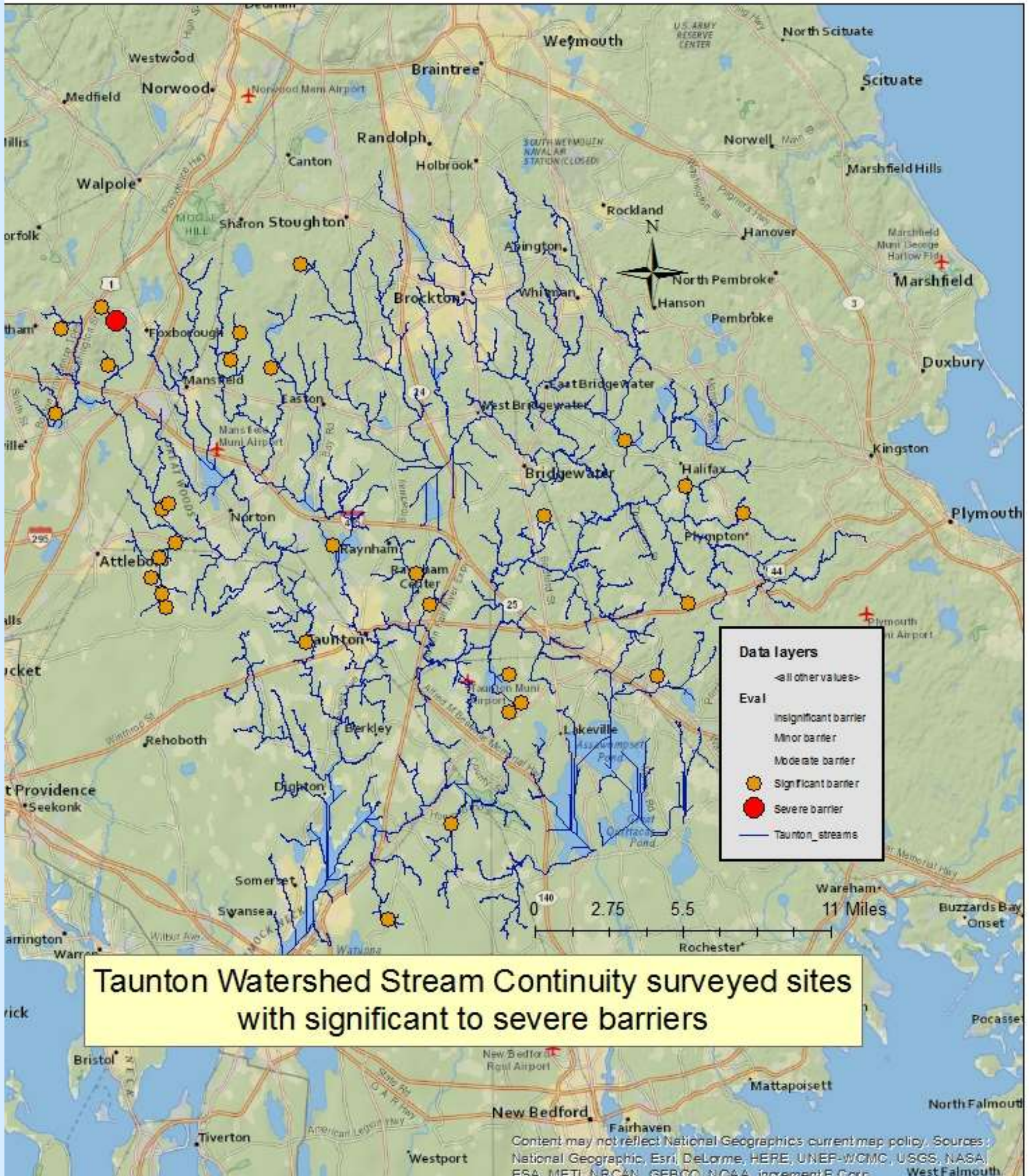
Findings

Of the crossings assessed in the Taunton River Watershed, 45 were bridges, 18 open-bottom arches, 2 fords, 237 single culverts and 199 multiple culverts

- **One severe barrier to passage**: culvert on Cocasset Brook at Lakeview Road in Foxborough
- **31 significant barriers to passage** located in seventeen municipalities;
- **108 moderate barriers to passage;**
- **239 minor barriers to passage;**
- **125 insignificant barriers to passage.**

The Stream Continuity Project focused on sites with high potential for ecological restoration. Other crossings may present problems for communities in terms of flood risks, creation of stagnant water, mosquito breeding, pollution or severe erosion.

Factors evaluated in the surveys that are likely to be relevant to these issues include: condition of crossing, streamflow constriction, skewed alignment and others. Our full report includes town-by-town tables of crossings where these factors were observed.



Taunton Watershed Stream Continuity surveyed sites with significant to severe barriers

Potential for ecological restoration
(Most valuable restoration per $$$)

Our results identified 31 “significant barrier” crossings and the one “severe barrier” crossing. We wanted to determine which of those would be likely to yield the highest value of ecological restoration if they were replaced, so we returned to the Critical Linkages Impact scores which consider the ecological value of the area in which the crossing is located.

Of the 32 sites, 10 of the 32 sites fell within the Critical Linkage Tiers 1 or 2,indicating they are located within areas of high ecological value.

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Top Sites for Restoration

1. Palmer Brook, Franklin Street, Halifax: 0.7831. Three round culverts, each with outlet drop.

2. Chartley Brook, Peckam Street, Attleborough: 0.6820. The outlet is clogged, collapsed or submerged. Large cement barriers block both sides of the crossing.

3. Chartley Brook, Wilmarth Street , Attleborough: 0.6244. Severe restriction, large scour pool.

4. Mill Brook on Bell Rock Road, Fall River: 0.5971. Four culverts in poor condition, severe constriction with skewed alignment. All inlets are clogged collapsed or submerged, as well as two outlets.

5 and 6. Two unnamed streams, Bay Street in Taunton: 0.5053. Inlet drops of 31" at both crossings.

7. Fall Brook, North Walker Street, Taunton: 0.4938. Inlet drop of 36"

8. Poquanticut Brook, Mill Street, Easton: 0.3444. Single culvert in collapsing condition, blocked with big rocks and tree limbs.

9. **Wading River off Walker Street, Norton:** 0.2771.

10. Tributary to Meadow Brook, Thurston Street, Wrentham : 0.2309. Two round culverts with outlet drops.

Why weren't more sites in my town surveyed?

The numbers of surveyed sites per watershed town ranged from 1 to 54

Reasons for this range may include:

- difference in total land area or percentage of town's land area within Taunton River Watershed;
- varying terrain and topography;
- towns with large areas of open space (e.g., Hockomock Swamp) may have fewer road crossings per stream mile ;
- cranberry bogs are often channelized or otherwise altered; most were excluded.

Were densely developed areas underrepresented, and if so, why?

Densely developed areas are likely to have many crossings. Those crossings may have received low Critical Linkage Scores because:

- they are not contiguous to undeveloped or low-development areas with high Ecological Integrity;
- streams are channelized or piped.

Were potentially significant sites omitted?

Several crossings on rail lines were not assessed based on safety issues. A future goal is to work with rail line owners to conduct assessments on these crossings.

Cities and Towns, Officials and Residents Have a Key Role in Restoring Stream Continuity

Mayors/Selectmen and Selectwomen, City Councillors:

Provide leadership and make key decisions

Departments of Public Works: plan and supervise repair and replacement of local streets and roads; can incorporate upgrade or replacement of problem crossings in road projects in the early planning stages

Planning Boards: review and approve plans for new roads and in some cases review repair/replacement of existing roads; also responsible for preparing municipal Master Plans

Conservation Commissions: review and permit all projects that involve work in wetland resource areas, including rivers and streams

Emergency Management Personnel: prepare and submit Local Hazard Mitigation Plans to the Federal Emergency Management Agency (FEMA) and implement those plans during extreme weather events.

What you can do

Observe local stream crossings for yourself. Use the Field Data form as a guide for what to look for, and record your own observations. Convey any concerns to DPW, Conservation Commissions, Water Departments Please share information with us about crossings that were not surveyed in this project, or if your observations differ from the information recorded in the database.

Visit the Stream Continuity Database: www.streamcontinuity.org/cdb2 for a first-hand look at the observations made on your local streams.

Advocate in your town for upgrade or replacement of crossings that create barriers to aquatic passage as well as those that cause flooding, stagnation or pollution, and are potential mosquito breeding areas. Support efforts of local boards and officials who attempt to advance these projects.

Your efforts to help will be appreciated.