



Fish Habitat, Impact Mitigation and Restoration Efforts in Connecticut



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Stream and River Mesohabitat

- Pool



Stream and River Mesohabitat

- Riffle



Stream and River Mesohabitat

- Run



Stream and River Microhabitats

- **Boulders**
- **Gravel**
- **Large Woody Debris**
- **Root Wad**
- **Undercut Streambank**

Boulder Microhabitat



Gravel Microhabitat



Large Woody Debris Microhabitat



**LWD >4 in. diameter
> 6 ft. Length**

- (1) Scour creates deeper irregular habitat
- (2) Velocity refuges downstream of wood
- (3) Overhead cover
- (4) Helps form step-pool habitats in high gradient streams

Large Woody Debris Microhabitats



(5) Micro-ecosystem

Periphyton attaches to wood, food for aquatic insects
fish feed on insects

(6) Sediment Regulation

Helps hold streambed substrates in place, deposition
bars form upstream of LWD

Rootwad Microhabitat



Undercut Streambank Microhabitat



Riparian Habitat

- Riparian habitat is that section of land that adjoins a surface water.
- Riparian habitat is most commonly associated with rivers and streams but also includes the shoreline areas around lakes and ponds.
- A well vegetated riparian habitat is critical to the “health” of the aquatic ecosystem.



Riparian Corridor Function



Riparian Corridor Function

- **Provides a Vegetative Filter which Naturally Protects Streams from Soil Runoff**



➤ Limiting nutrient in FW

➤ WQ can be degraded when filtering capacities impacted

➤ Research shows that 85% of available phosphorous is attached to soil particles



Riparian Corridor Function

- **Provides Shading Which Prevents Increases to Stream Water Temperatures**



Riparian Corridor Function

- **Vegetation and Roots Protect and Stabilize Streambanks from Erosion**



Riparian Corridor Function

- **Provides Large Woody Debris to Streams which Enhances Fish Habitat**



Riparian Corridor Buffer Guidelines

IFD Policy - Standard Setting Method

- **Maintain a 100 ft. wide vegetated undisturbed buffer along perennial streams**
- **Maintain a 50 ft. wide vegetated undisturbed buffer along intermittent streams**

Bridge and Culvert Replacements



Improperly Installed Culverts Impede Upstream Fish Passage and Eliminate Instream Habitat



- Shallow Water Conditions
- Increased Water Velocities
- Blockage - Perched Culverts

Shallow Water Conditions

- Water depth too shallow.
- “Sheet flow” barrier.



Increased Water Velocities

- Water speed too great.
- “Velocity” barrier.



Blockage - Perched Culverts

- Fish cannot ascend due to water drop at culvert outlet.
- “Physical” barrier.

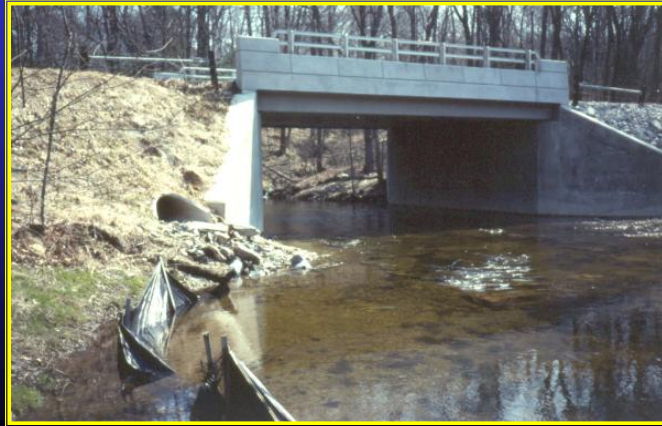


Stream Crossing Guidelines

- **Replace Existing Bridge with Bridge**
- **Replace Existing Culverts with:**
 - *Span Bridge*
 - *Inverted ‘U’ or Arch Culvert*
 - *Culverts sunken below grade*

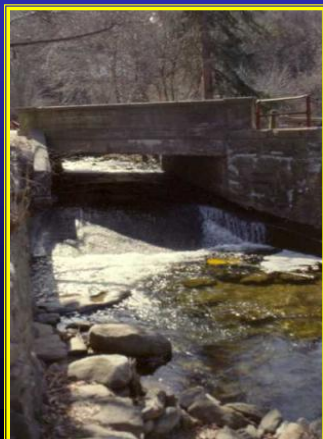
Stream Crossing Guidelines

- **Replace Existing Bridge with Bridge**



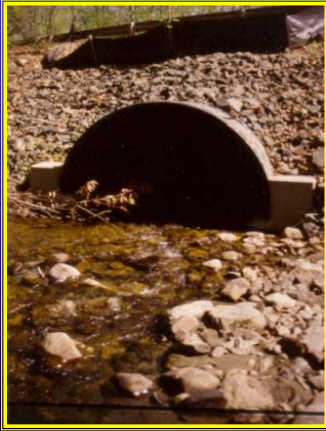
Stream Crossing Guidelines

- **Replace Existing Culverts with:**
 - **Span Bridge**



Stream Crossing Guidelines

- **Replace Existing Culverts with:**
 - **Inverted “U” or Arch Culvert**



Stream Crossing Guidelines

- Replace an existing culvert with a culvert modified with criteria established for the following:



Culvert Elevation

- The invert of a box culvert should be set no less than **1-foot** below the existing streambed elevation.



Culvert Elevation

- The invert of a round culvert less than 10 feet in diameter should be set **1 to 2 feet** below the existing streambed elevation.
- For round pipe greater than 10 feet in diameter, the culvert invert should be set **one-fifth of the pipe diameter** below the streambed elevation.



Culvert Elevation

- For multiple culvert situations, one or more of the culverts should be installed as per the guidelines for single culverts.



- Deflectors may need to be installed in the stream to concentrate low streamflow into and through the recessed cell.

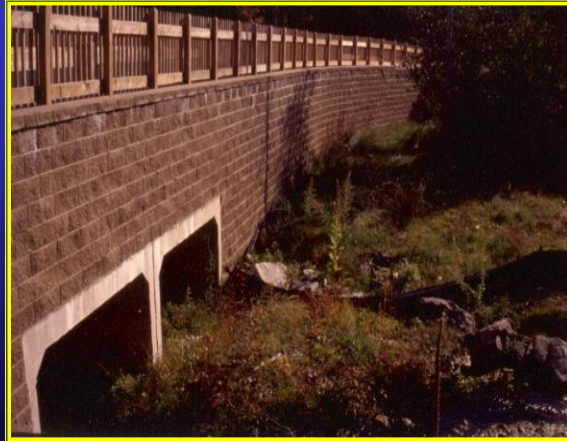
Culvert Gradient

- The culvert gradient should be no steeper than the streambed up- or downstream of the culvert.



Culvert Alignment and Length

- The culvert alignment should be similar to that of the stream and the culvert kept to a short of length as possible.
- Vertical headwalls rather than fill slopes should be installed at the culvert inlet and outlet to reduce the total culvert length.



Openness Ratio

- The Openness Ratio (**OR**) of the culvert should be ≥ 0.25 .
- $OR = \frac{\text{Cross-sectional area}}{\text{Length}}$
- OR measurements are made in **meters**.



Culvert Material

- Corrugated metal culverts rather than concrete culverts are preferred.
- The corrugations create a roughness that aids in the retention of streambed material.



- Roughness elements (e.g. baffles, cast-in-place blocks) can be added to concrete culverts for the retention of streambed material.

Substrate Preservation/Restoration

- Streambed material excavated for the culvert placement should be stockpiled and be replaced within the culvert following its installation.



Modifications to Existing Culverts

- Culvert Retrofits with Fishways



Modifications to Existing Culverts

- Baffles



Stream Crossing BMP's

- **Seasonal Construction Window**



**Unconfined instream activities
allowed from June 1-September 30**

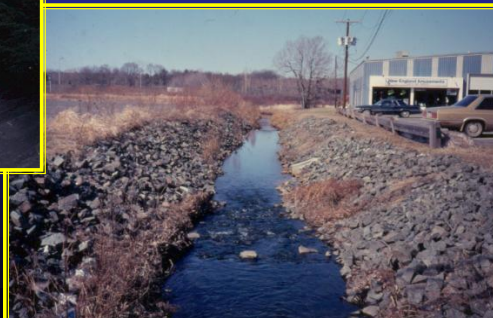
- no conflict with spawning & egg incubation period
- no conflict with migration
- low flow, easy water handling

Habitat Restoration & Enhancement Efforts

- **Numerous man-made alterations in CT resulting in habitat degradation**



**Bottom Line: Many habitats
are in need of repair!**



Definitions

- **Habitat Enhancement** : An improvement of habitat & ecological conditions over existing conditions. *Example: Improve availability of cover for adult trout*
- **Habitat Restoration**: Return of habitat & ecological conditions to a close approximation of its condition prior to disturbance.
Example: stabilize eroding streambank/ unstable channel, dam removal
- **Strict restoration difficult to achieve since “prior conditions” are often unknown !**

Benefits of Habitat Restoration & Enhancement

- Improve water quality, e.g. stop erosion, sedimentation
- Improve stream channel and streambank stability
- Improve riparian zone functions
- Create “more” and “better” instream fish habitats
- More habitat equals more fish - documented by our fish surveys
- Enhance recreational fishing opportunities

Streambank Stabilization Treatment

Triple Tier Coconut Log Installation at Toe



Install with duckbill anchors, cable & gripples



Hop River Project Evaluation

Before Construction



1 Month Post Construction-2002



2 Years Post Construction-2004



Vegetation growth on logs



Vortex rock weir construction



Function to:

1. Redirect flow to channel centerline
2. Reduce nearbank shear stress & increase mid channel shear stress
3. Maintain scour in pools

Habitat Restoration & Enhancement Efforts

- Vortex Rock Weir Habitat Structures, Merrick Brook



Deflect Flow
Away From
Streambanks
Towards
Centerline

Habitat Restoration & Enhancement Efforts



J-Hook Weir

Deflect flow away from bank & towards centerline



Rootwad Installation



Trench method

Function to:

1. Deflect flow away from banks
2. Provide overhead fish cover



Secure with boulders

Habitat Restoration & Enhancement Efforts

- **Root Wad Habitat Structures, Merrick Brook**



**Deflect Flow
Away From
Streambanks**

Habitat Restoration & Enhancement Efforts

- **Cross-Log Habitat Structures, Stony Brook**



Cabled Log Jams



Habitat Restoration & Enhancement Efforts

- Wing Deflector Habitat Structures, Stony Brook



Narrow Stream Width & Increase Sinuosity



Scour

Velocity Refuge

Habitat Restoration & Enhancement Efforts

Boulder Placement , Hop River



Create velocity refuges & feeding stations



Habitat Restoration & Enhancement Efforts

- **LUNKER Habitat Structures, Railroad Brook**



LUNKERS create undercut bank microhabitat cover



Habitat Restoration & Enhancement Efforts

- LUNKER Habitat Structures, Railroad Brook



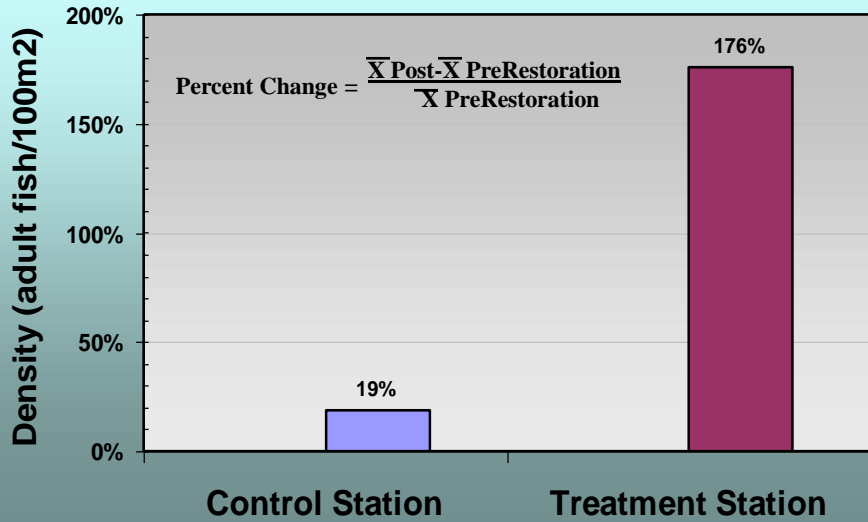
Completed LUNKERS after Construction



2 years post construction

Railroad Brook , Adult Brook Trout Monitoring

Percent Change in Adult Brook Trout Density
1997-2002



Technical Assistance Available

- **On Site Consultation: Fish passage at road crossing/habitat issues, stream restoration**
- **IFD Informational Publications**
- www.ct.gov/dep See our restoration projects
- **Email: brian.murphy@po.state.ct.us**

