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Municipal Climate Adaptation Guidance Series: Stream Smart Crossings

JOEL GREENWOOD, KENNEBEC VALLEY COUNCIL OF GOVERNMENTS

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Mid-Coast Regional Planning Commission
Northern Maine Development Council
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Introduction

Stream-Smart road crossings maintain fish and wildlife habitat while protecting roads and public safety. And, they prepare us for the large and frequent storm events that have been washing out roads around the state and the northeast.

Many hundreds of miles of streams flow through Maine. These streams are habitat for a variety of fish, birds, insects, reptiles, mammals, and amphibians, and they provide recreational opportunities and economic benefits to Maine residents. Maine also has an extensive network of roads that is vital to the social and economic health of our communities. Wherever a road crosses a stream, a bridge or culvert made that crossing possible. Most bridges allow streams and the wildlife that they support to pass freely under them but incorrectly sized, poorly placed or damaged bridges and culverts can prevent fish and wildlife from accessing food, breeding areas and other important habitat, particularly on smaller streams. Fortunately, efforts are underway to improve road-stream crossings. With proper stream crossing sizing and installation, streams can function naturally, fish and wildlife can freely migrate, and roads can be improved.

Principals for Stream-Smart Road Crossings

- If using a culvert, set the bottom of the structure at the natural, pre-disturbance stream bed elevation
- Size the span of the crossing to avoid pinching the stream channel and preferably, exceed the natural channel width
- Maintain natural slope and alignment of the stream channel
- Ensure that the crossing maintains natural substrate within the structure.
- Designed with appropriate bed forms and streambed characteristics so that water depths and velocities are comparable to those found in the natural channel at a variety of flows
- “Openness” of the structure should be greater than 0.82 feet (0.25 meters) in order to make the structure more likely to pass small, riverine wildlife such as turtles, mink, muskrat and otter that may tend to avoid structures that appear too constricted
- Banks should be present on each side of the stream matching the horizontal profile of the existing stream and banks

UNDERSIZED CROSSINGS
restrict natural stream flow, causing several problems including scouring and erosion, high flow velocity, clogging, and ponding.

SHALLOW CROSSINGS
have water depths too low for many organisms to move through them and may lack appropriate bed material.

PERCHED CROSSINGS
are above the level of the stream bottom at the downstream end. Perching erodes streambeds and can prevent wildlife from migrating upstream. They can result from either improper installation or from years of downstream bed erosion.

scouring and erosion

high flow velocity

clogging

ponding

low flow areas

damaged culvert

Common Problems with Road Stream Crossings

Road-stream crossings that do not allow fish and wildlife to freely migrate are most often undersized structures that would not meet today's design criteria for fish passage. This is primarily because designs were historically based on standards only intended to protect roads.

In many cases, crossings that were once wildlife-friendly are now barriers to migration because of:

- Clogging at inlets,
- Scouring and erosion around outlets,
- Deteriorating construction materials, or
- Stream channels shifting out of alignment with the structure.

These problems result in further long- lasting effects on natural systems by:

- Degrading stream water quality, and
- Isolating large portions of habitat, which in turn alters natural dispersal patterns for fish and wildlife.

Incorrectly sized, poorly placed, or damaged bridges and culverts tend to have a shorter service life. They usually require frequent maintenance and extensive repairs that place a significant demand on the limited resources of towns, forestry companies, and other private landowners.

Safe, stable, and fish and wildlife friendly stream crossings, on the other hand, can accommodate wildlife and protect stream health while reducing expensive erosion and structural damage.

Key features of good road-stream crossings

Good road-stream crossings simulate the upstream and downstream characteristics of the natural stream channel. Well-designed crossings:

- Use *natural substrate* within the crossing;
- Match the natural *water depths* and *velocities*; and
- Are *wide and high* relative to their length. Structures should be at least 1.2 times the natural stream bank width so they can retain natural substrates and allow fish, wildlife, floods, and debris to pass.

Bridges and open-arch designs are the preferred structure types because they allow characteristics of the natural stream channel to be simulated. Replicating the slope, dimensions and streambed material creates water depths and velocities similar to the natural channel. These structures are also capable of handling a range of flows and will allow most organisms to freely pass through them.

Why upgrade road-stream crossings?

Stream crossing designs have improved. Structures based on today's designs:

- **Require less frequent repairs.** Upgrading Maine's road-stream crossings will reduce long-term maintenance costs and periodic losses of use. Newer designs also last longer. For example, open-arch culverts can last in excess of 75 years.
- **Help wildlife access stream natural areas.** Upgrading will in turn improve fishing, hunting, and wildlife observation opportunities for Maine's residents and visitors.
- **Handle a wider range of flows.** Climate change is increasing the amount and intensity of precipitation. A study in Keene, New Hampshire revealed that 30 to 80 percent of the city's culverts were likely to fail under projected flow conditions. Upgrading will prevent or minimize the potential negative impacts of increased flow conditions on Maine's infrastructure.

For more information on Stream-Smart road crossings go to:
http://maineaudubon.org/streamsmart/