Engineered Log Jam Monitoring

along NH Route 16 in Errol, New Hampshire

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Background

Conventional practices for lateral instability (bank erosion) with roads and highways that exist close to streams are to armor such locations (rip rap, concrete, sheet pile). These solutions are expensive, do not provide ecosystem value, and result in high mitigation fees.

Natural channel design structures, such as engineered log jams (ELJ), offer a greener, less expensive alternative to armor solutions providing equivalent streambank protection, but also creating habitat.

There is no demonstrated and documented information about engineered log jam solutions in New Hampshire. Although ELJ are employed in the Pacific northwest, there is limited national monitoring information.

Magalloway Riverbank Stabilization Project - 2021

Construction of a 200-foot Engineered Log Jam (ELJ) for permanent slope stabilization of the Magalloway riverbank in Errol, New Hampshire.

Pre-construction 6/26/2020

Post-construction 11/8/2021

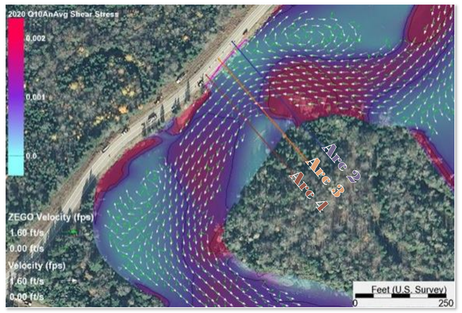
Objective

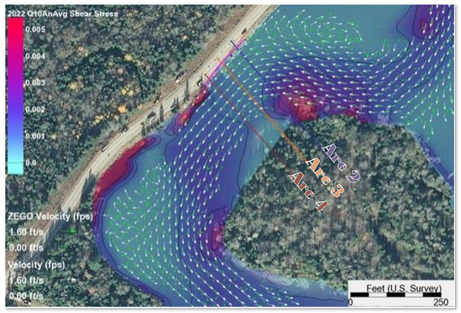
To document the pre- and post-construction hydraulics, sediment, and ecosystem metrics associated with an engineered log jam designed and constructed to arrest streambank erosion.

Conclusion

The ELJ along the Magalloway River has arrested streambank erosion and greatly improved the terrestrial ecosystem characteristics. There is more numerous wildlife use of the terrestrial part of the streambank post-construction (insect, avian, mammal). The ELJ now creates a wildlife corridor at its location where previously none realistically existed. There is insufficient data to determine if the ELJ had any impact on aquatic resources. The ELJ does not appear to have dramatically altered near bank hydraulics. Episodically the ELJ is an armored feature capable of withstanding the near bank shear stresses that occur at the site. From observations, the ELJ also withstands the increased wave attack from boat wakes.

Hydraulic Modeling



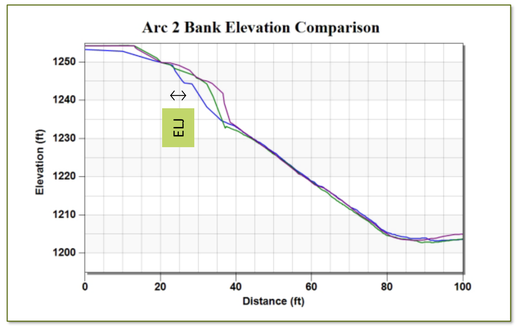


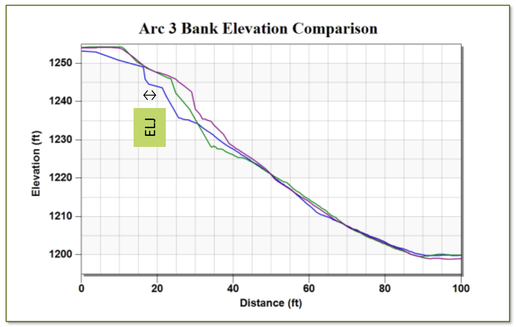
Three transects, or arcs, that extend from the ELJ to the other side of the river are shown here in blue, orange, and red.

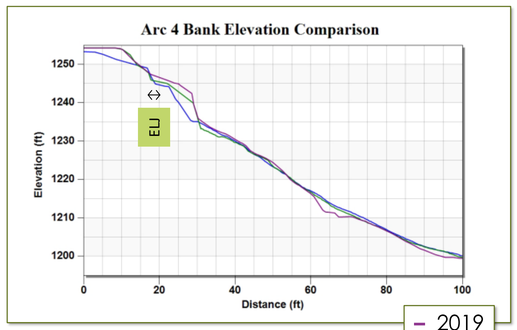
Pre-construction (2020) and post-construction (2022) velocity vectors (white arrows) compared to the Zego boat* observed velocity (green arrows). Coloration legend shows shear stress (psf).

Hydraulic Topography

Bathymetric data is plotted below for the three transects, magnifying the ELJ stream bank from pre- to post-construction.





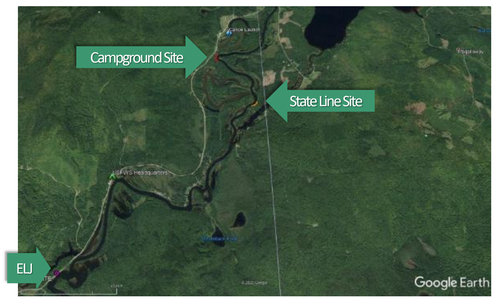


Note: For each Arc, the ELJ is at a varying distance: Arc 2, 23.25ft to 26.25ft; Arc 3, 16.25ft to 18.25ft; and Arc 4, 16.75ft to 19.0ft.

Streambank Erosion

In 2019, two sites upstream of the ELJ were selected for erosion comparison.

1. ***Campground Site:*** located on a tight meander bend like the ELJ with unvegetated, failed banks and fallen trees
2. ***State Line Site:*** includes a bank height greater than the ELJ with excessive erosion evidenced by undercut, unvegetated, steep banks and fallen trees



Measured Erosion Rates at Streambank

Campground	0-1.0 ft/year
State Line	1.5 ft/year
ELJ	1.0 ft/year

Particle Distributions

Location	Uniformity Coefficient, C_u	Classification
Route 16 ELJ:		
EP1 Upper	3.8	Medium sand
EP1 Lower	19.5	Medium sand
EP3 Upper	5.9	Medium sand
EP3 Lower	3.4	Medium sand
Campground:		
EP4 Upper	2.9	Fine sand
EP4 Lower	2.9	Medium sand
EP3 Upper	3.2	Medium sand
EP3 Lower	7.1	Coarse sand

Sediments were sampled at the locations of the erosion pins. The uniformity coefficient is the ratio between the particle size for which 60-percent passes and that at 10-percent passing ($C_u = D_{60} / D_{10}$), and for the most part is in single digits indicating very uniform material.

Riparian Wildlife

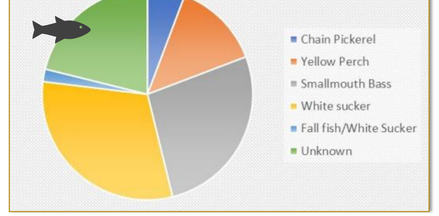
Pre-Construction observations:

- Burrowing animals
- Insects
- Mostly inhospitable streambank

Post-Construction activity includes:

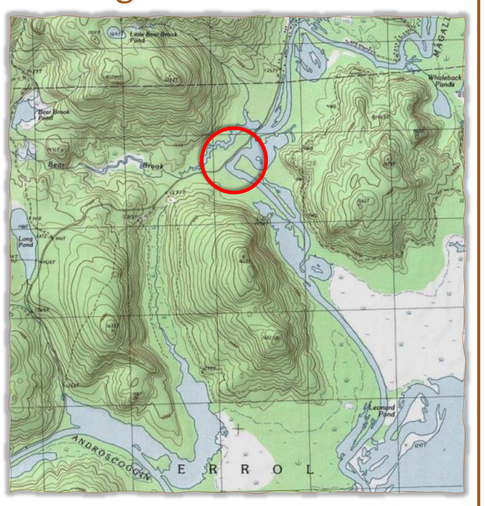
- Hoof and footprints
- Burrowing
- Herbivory
- Droppings

Aquatic Wildlife



Note: Aquatic wildlife was not observed post-construction due to poor water clarity.

Log Jam Location



Log Jam was constructed along Route 16 in Errol, NH, because extreme bank erosion required road relocation and streambank stabilization. The research expands to monitoring of the ELJ and adjacent Magalloway River.

Report Link: *NHDOT/UNH Engineered Log Jam Monitoring Report*

*Zego boat survey system, an automated boat-mounted sonar system used to measure the bathymetry below the waterline.