Research Project Brief

Report 26-R39: The Effect of In-Stream Construction Activities on Turbidity, Suspended Sediment, and Sediment Loads

VTRC Virginia Transportation Research Council

Background

Transportation construction activities involving in-stream work can mobilize sediment and elevate turbidity, which can impact sensitive aquatic species such as freshwater mussels. Although cofferdams are used to isolate construction areas and limit sediment mobilization, their installation and removal create some degree of sediment release because of unavoidable streambed disruptions. Depending on the project, mussel assessments or surveys may be required at downstream distances of 80 m (260 feet), 400 m (1,300 feet), or 800 m (2,600 feet).

Research Objectives

This study aimed to determine the transport distances of sediment associated with the installation and removal of cofferdams. Related objectives were to (1) compare the impact of cofferdam-related construction events on sediment loads and (2) to document factors that affect recovery times and sediment loads.

Approach

Two in-stream construction projects were monitored. Each site represented different but commonly used cofferdam types with soil and substrate characteristics similar to those preferred by Virginia's freshwater mussels. Seven monitoring transects were installed at each site up to 2,600 feet downstream. Each transect was equipped with one or three turbidity sensors. Grab samples were also collected to determine suspended sediment concentration. Estimates of suspended sediment loads that were generated from the cofferdam-related construction events were calculated.

Outcomes

Across both sites, peak turbidity occurred immediately downstream of cofferdams and returned to background within 50 to 100 feet and 5 to 90 minutes following the construction activity. Construction-related sediment loads ranged from 3 to 636 pounds, with more than 75% transported within the first 50 feet. Sandbag and Jersey barrier cofferdams produced higher turbidity and loads than sheet piles because of greater streambed disturbance. In contrast, precipitation-driven sediment loads were one to three orders of magnitude higher than those from construction..

Research Benefits

These results can inform decisions regarding impact area determinations and distance requirements for habitat assessments and surveys for protected mussel populations. For example, based on the results of this study, the area reviewed by USFWS staff for certain projects might be less than the larger distances currently used.

Principal Research Scientist(s)

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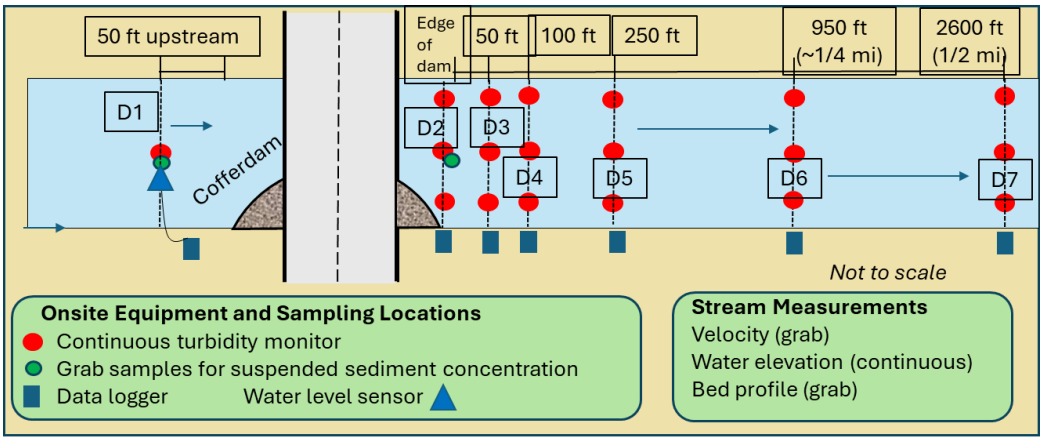
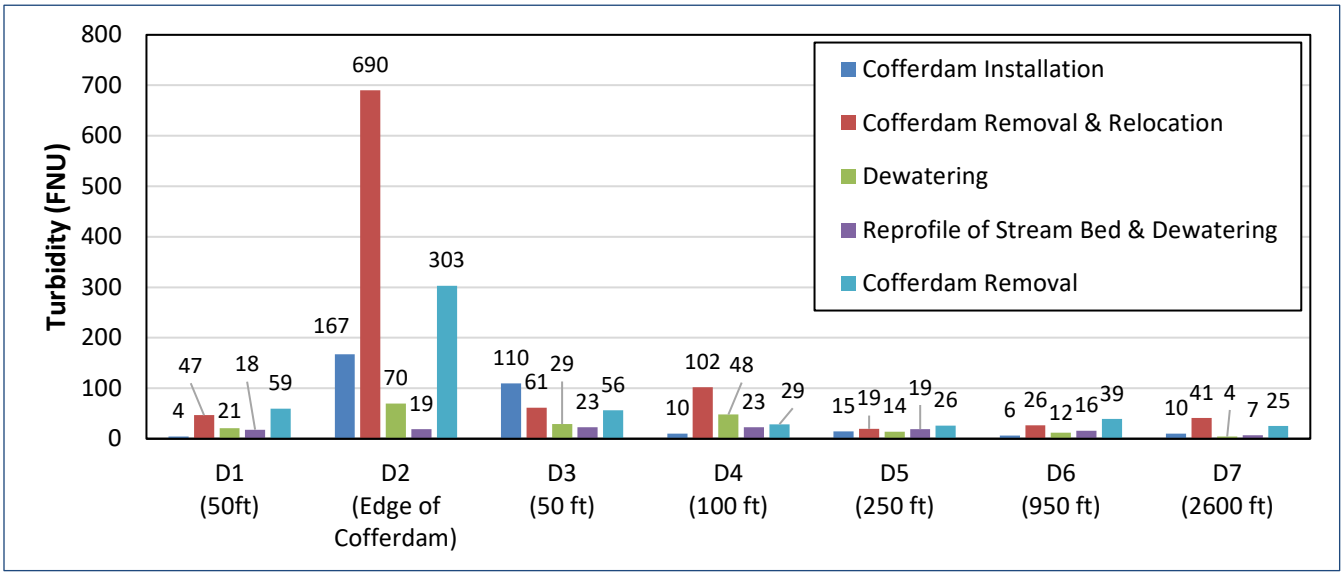
Bridge Replacement Projects Monitored

Bridge replacements using a sheet pile cofferdam in Farmville (left) and jersey barrier and sandbag cofferdam in Louisa (right)

Research Findings





Localized Turbidity Effects

Transects D1–D7 showed sediment plumes near certain cofferdam activities, with average turbidity up to 690 FNU (784 mg/L suspended sediment concentration). Turbidity declined rapidly downstream, reaching background levels within 50 to 100 feet.

Precipitation-related sediment loads were typically 10 to 100 times larger than construction-related loads.

Best Practices and Implications

Impacts from cofferdam installation and removal can be minimized by shortening disturbance duration, scheduling work during low-flow periods, and minimizing streambed disturbance. The limited sediment transport and rapid return of turbidity to baseline suggest that mussel impact assessment distances for similar projects may be shorter than previously assumed.