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## **ENGINEERED LOGJAMS: AN ALTERNATIVE BANK-PROTECTION METHOD FOR US 101 ALONG THE HOH RIVER, WASHINGTON**

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### **Abstract**

The Washington State Department of Transportation (WSDOT) has repetitively made emergency scour-damage repairs along US 101 at the location on the outside of a meander bend in the channel-migration zone of the Hoh River near Forks, Washington. Four emergency projects that involved armoring the bank with large volumes of rock occurred at this location in the past few years, yet erosion continued and US 101 remained in imminent danger of being washed out.

Engineering analysis conducted by WSDOT indicated that relocation of the highway further from the channel-migration zone was economically infeasible. Therefore, bank-stabilization and river-deflection measures to protect the roadway were the only viable option. Because the "traditional" repairs were not effective, WSDOT developed an alternative solution for the site using engineered logjams (ELJs) in place of armoring bank-stabilization methods. The project has the added benefits of restoring salmon habitat and proving that sustainable engineering is not only possible, but can at times provide the most practical long-term solution.

ELJs emulate historic conditions and natural processes to rehabilitate aquatic and riparian habitat; provide erosion control, flood diffusion, and grade control; and increase sediment retention. Engineered logjams are an emerging technology based upon the premise of applying rigorous scientific and engineering principles to the design and construction of structures to protect infrastructure in a manner that emulates natural systems.

The Hoh River engineered-logjam project is the largest engineered-logjam project in the Pacific Northwest, and possibly the world. A series of 12 mid-channel and bank structures were installed. This action was intended to deflect and diffuse river flows to reduce the erosive forces acting upon the bank adjacent to the highway, as well as provide greater separation of the river from the highway shoulder.

The mid-channel logjam structures each include more than 100 logs (many with rootwads) with key log diameters of 36 to 48 inches. The core of each structure consists of steel H-piles, 65 logs, and 2,200 tons of rock. Each mid-channel structure is approximately 30 feet in height, 75 feet wide, and 70 feet long, with approximately 15 feet of the structure buried below the riverbed level. The structures include several large protruding logs that are used to hold smaller racked logs in place forming irregular faces. Exterior racked logs and naturally accumulating woody debris are key for complex habitat formation.

The design life of the engineered logjam structures is expected to be a minimum of 50 years. These structures will provide stable hard points that deflect river flow and provide a medium for the growth of native vegetation on logjam islands in the channel, while emulating natural logjams in many pristine river reaches in the Pacific Northwest.

The project was designed in the spring of 2004 and constructed from early July through mid-October 2004. Significant difficulties with the temporary river diversion, water-quality maintenance, and fish handling occurred during construction. Although winter flows have been lower than normal in this first year, indications are that the structures are performing as desired.

**Biographical Sketch:** Carl Ward received a B.S. in wildlife and fisheries biology from the University of Vermont (1987). He has been the WSDOT regional biologist/Olympic Region biology program manager since 1991. He manages a staff of biologists and an environmental-restoration work crew. Ward leads the team in the identification and evaluation of the effects of transportation design, construction, and operations on plants, wildlife, fisheries, threatened and endangered species, and associated habitats. The team also prepares and implements restoration, enhancement, and replacement mitigation plans for unavoidable impacts to natural resources. Prior to joining WSDOT, Carl worked in the private environmental-consulting field for four years in the assessment of wetlands, fish, and wildlife.