# Hydraulic Relationships Controlling Sediment Contamination Behind Grand Coulee Dam

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CH2M HILL is assisting the United States Environmental Protection Agency (EPA) with a remedial investigation and feasibility study (RI/FS) of sediment contamination within a 150-mile reach of the Columbia River in Washington State. This reach encompasses the Lake Roosevelt National Recreation Area behind Grand Coulee Dam and a free-flowing section of the river south of the U.S-Canada Border. Contaminants being assessed include metals, PCBs, dioxins/furans, PAHs and pesticides. Over 400 samples were collected in 2005 from river, lake, and beach sediments along prescribed transects in depths of up to 400 feet of water. Results show that metals are the primary contaminants of interest. The largest identified source of metals is the smelting complex operated by Teck Cominco Metals, Ltd., located a few miles north of the U.S.-Canada Border. Historic discharges dating back to the late 1800s include 13 million tons of sand-sized smelter slag, liquid effluent, spills, bypasses, and emergency releases. Discharge of slag to the river ceased in 1995.

Operation of Grand Coulee Dam since 1940 has significantly changed river hydrodynamics and has been the primary controlling mechanism for the distribution of sediment contaminants. The annual reservoir drawdown for flood control associated with high spring snow-melt related river flows changes the river/reservoir cross-sectional area and flow velocity, and periodically exposes side banks to differing erosional forces depending on the degree of drawdown. This has resulted in an almost predictable distribution of sediment grain size throughout the river/reservoir system. The sand-sized slag and associated metal contaminants have become distributed in reduced-energy eddy areas within the first 10 miles below the border, within pockets of the old submerged river channel (thalweg) over the next 20 miles, and within a large continuous thalweg deposit along the next 10 miles. Silt and smaller-sized sediment and associated contaminants have become progressively deposited within the final 100 miles of reservoir where flow velocities become increasingly slower. The upper 40 feet of side bank sediment over this 100-mile reach are less contaminated than lower elevations having been periodically washed of fine-grained sediment due to the rising and lowering reservoir level, wave action, and exposure to the weather.