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Field observations of hyporheic exchange on a large tidally influenced river: The Fraser River, British Columbia, Canada

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The Fraser River is a large river dominated by nival flows up to 11,000 m^3s^{-1}. At its delta, it is deep [10 to 15 m], fast flowing [up to 3 ms^{-1}], influenced by tides and, its bed has been altered to a great extent by a century of industrial activity, principally log storage. This environment presents considerable logistical challenges. All fieldwork must be performed from a floating platform and only semi-permanent instrumentation or instantaneous sampling is possible. Our site is offshore of a wood-pole preservation facility where groundwater has been contaminated with creosote. The creosote plume traces the groundwater flow paths beneath the river to where it discharges upward through the river bed. Silts and wood debris from log storage operations cap the sand aquifer from the river bank to the location of fresh groundwater discharge. Saline groundwater in the offshore portion of the aquifer marks the outermost boundary of fresh groundwater discharge. Our objectives are to delineate zones of hyporheic exchange on the river bed and to assess the influence of tides on flow patterns within the hyporheic zone. We use bulk resistivity measured with a specially designed push-in probe to delineate the distribution of types of ground waters and stratigraphy. We also measured the electrical conductivity (EC) of groundwater independently using a novel drive-point multilevel well. Differential heads were measured using a manometer and drive-point wells equipped with pressure sensors. Sediment samples were also collected with a drive-point piston sampler equipped with a freezing shoe. The bulk resistivity profiles and fluid EC profiles worked extremely well to delineate those portions of the aquifer dominated by fresh groundwater and those dominated by saline groundwater to depths of 8 meters below river bed (m.b.r.b.). The data suggest that the fresh groundwater discharge zone occurs within a 10 m-wide band parallel to the

river and that the depth of the hyporheic zone maybe some where between 0.75 to 1.5 m.b.r.b. Although the hydraulic head data set shows reversals in groundwater gradient during flooding tides, fluid EC profiles only show moderate change during a tidal cycle. Water-sample chemistry is being used to assess mixing trends between fresh groundwater, river water and saline groundwater.