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GROUND- AND SURFACE WATER MASS BALANCES TO ENSURE PROTECTION OF ST. LAWRENCE RIVER ECOSYSTEMS

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Knowledge of water fluxes to ecologically important ecosystems in rivers helps to protect them in case of pollution incidents. A mass balance study of this nature was carried out on Hoople Bay in the St. Lawrence River, about 150 km upstream of Montréal. Due to increased net primary production this ecosystem is an important spawning ground for fish and therefore environmentally fragile. Its three main water sources are (a) a small stream (Hoople Creek), (b) local ground water and (c) Main Channel water. The latter was enriched in 18O as a result of evaporation from the Great Lakes surface and also had different dissolved chloride (Cl-) concentrations when compared to the other sources. Its average values were -6.9 permil VSMOW and 0.56 mmol/L for isotopic composition and Cl-, respectively. The Hoople Creek and Hoople Bay waters ranged between -4.3 and -12.2 permil VSMOW for oxygen isotopic composition and 0.25 and 1.20 mmol/L for dissolved Cl-. The average oxygen isotopic composition of the ground water was -11.1 permil VSMOW, while its Cl- concentration was 2.81 mmol/L. These parameters led to an equation system that was solved with matrix operations to yield the contributions of the different water masses to Hoople Bay. Results show that the Main Channel contributed more than 50 percent during summer and fall and that ground water influx was below 10 percent throughout the year. The flux was reversed only after snowmelts and subsequent higher discharges from Hoople Creek. A spill scenario from ship traffic on the Main Channel would therefore strongly affect Hoople Bay at most times of the year. Only during spring is the ecosystem threatened

by pollution of local inland waters. The above technique is useful for investigating seasonal water flux variations to marginal ecosystems in rivers. It may also apply to mass balances of other water bodies.