Assessment of Contaminant Dispersion in Aquatic Environments

Effluent and Thermal Discharge Impact Assessment in Receiving Waters

Trinity Consultants' Minnow Aquatic Environmental Services team has the expertise to conduct in-depth aquatic impact assessment of effluent discharges from industrial and municipal facilities such as mining operations, pulp and paper mills, wastewater treatment plants, and power plants. Our related capabilities include:

- Mixing zone analysis and modeling (e.g., CORMIX™, Visual Plumes) - To help understand the dilution of discharged effluent in the immediate mixing zone and provide recommendations to obtain maximum dilution using state-of-the-art mixing zone models. After determining effluent concentration at the edge of the mixing zone, hydrodynamic and water quality models can be used to analyze effluent behavior in the far-field.
- Effluent and thermal plume delineation (dye tracing study and modeling)
- Assimilative capacity determination and TMDL (total maximum daily load) development - Under Section 303 (d) of the U.S. Clean Water Act, we can help understand the capacity of a waterbody to accept and dissipate pollutants without adverse effect, and, using the USEPA TMDL Modelling Toolbox, determine the maximum amount of a pollutant that it can receive while still meeting a water quality standard

Hydrodynamic Characterization and Water Quality Modeling

Hydrodynamic characterization is the study of physical characteristics (e.g., currents, circulation, and stratification) in waterbodies. When combined with water quality modeling, it provides spatial and temporal distributions of physical, chemical, and biological water quality parameters.

We have the capability to conduct hydrodynamic characterization and water quality modeling studies of streams, rivers, reservoirs, lakes, and coastal waters. Modeling

Figure 1: Acoustic Doppler Current Profiler (ADCP)

results are validated with field data acquired by deploying state-of-the-art sensors such as flow meters, acoustic Doppler profilers, CTDs, drogues, thermistors, and YSI data loggers. Our related capabilities include:

- Flow monitoring and water circulation pattern characterization - Characterizes the hydrodynamic condition of a waterbody by field-deployment of suitable instruments, such as measuring the flow rate of a creek/river using a flowmeter, or the spatially variable current and circulation pattern of a lake using an ADCP (Figure 1) and GPS-enabled drogues
- Chemical and thermal stratification analysis - Analyzes the chemical and thermal stratification from long-term deployment of thermistors or conductivity meters. Uploaded data may, for example, characterize the long-term thermal stratification pattern of a small lake (Figure 2).

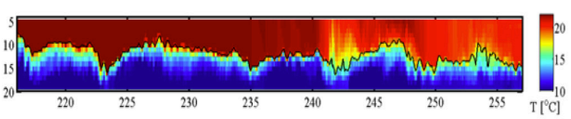
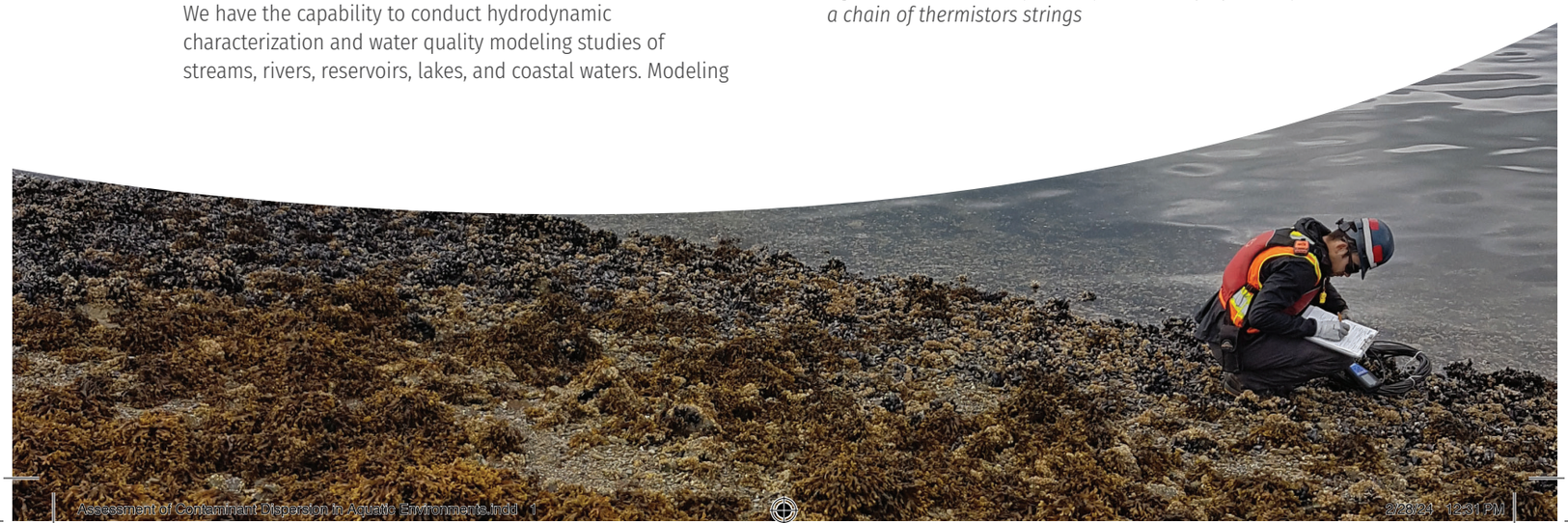


Figure 2: Thermal stratification from the deployment of a chain of thermistors strings



- 1-D, 2-D, and 3-D water quality modeling (Qual2K, EFDC, DYRESM, MIKE-3) - Provides the spatial and temporal distribution of physical, chemical and biological water quality parameters using appropriate water quality models for a waterbody

Site Water Balance and Contaminant Transport Modeling

The Minnow team has the expertise to develop dynamic numerical models for site water balance and contaminant transport for industrial facilities (e.g., mine sites) using GoldSim™ simulation software. These models can enable the prediction of water quality across a site and over time (future, operating, or closed) and can model the many inputs and scenarios that a facility may consider. With this tool, a site can analyze the relative importance of sources of contaminants, make water quality predictions for compliance points, and make water and potential reclamation management decisions. Using the Monte Carlo simulations, predictive data can be probabilistic (Figure 3).

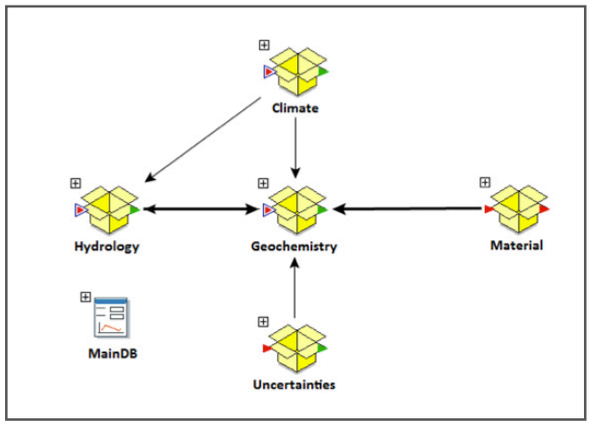


Figure 3a: Inputs and interactions for contaminant transport modeling using GoldSim™

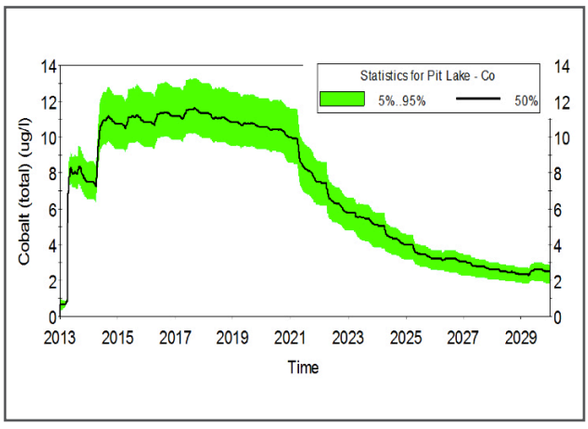


Figure 3b: GoldSim™ model output of probabilistic contaminant concentration in receiving water

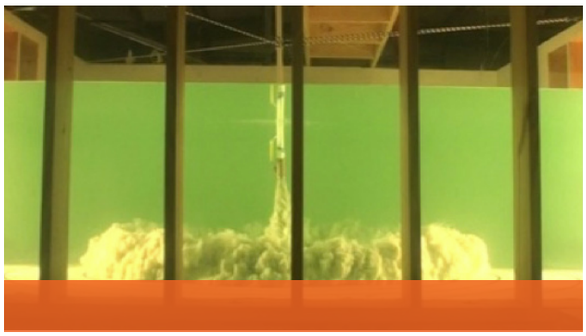


Figure 4: Physical modelling of open water slurry disposal

Slurry Disposal, Tailing Water Discharges, and Sediment Transport

Minnow provides specialist solutions to particle/sediment-related environmental problems, including:

- Evaluation and impact assessment of slurry/tailing water disposal in receiving water - With a state-of-the-art sediment dispersion model and site-specific hydrodynamic data, we can analyze the potential zone of influence of a release (Figure 4), and the increase in total suspended solids (TSS) and turbidity in the receiving water. With additional field evaluation of aquatic habitat (e.g., periphyton, invertebrate, fish communities), the modeling results can be used to assess the potential effects on the aquatic life.
- Sediment dynamics (transport, erosion, and deposition) studies - We solve aquatic sediment-related problems by identifying sediment sources, transport pathways, and areas of deposition/erosion using a combination of modeling and field studies
- Assessment of the stability of contaminated sediment under changing environmental conditions (sediment geochemical assessment) and sediment deposition rates using sediment traps, and stable isotope dating (i.e., 210Pb dating) and additional time markers

Learn how the Minnow team can assist you with an assessment of contaminant dispersion in aquatic environments.

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