

From Creek to Tank: Minnow Environmental Develops Exposure Laboratory for EEM Compliance

CHALLENGE

A Canadian mine needed to conduct an EEM fish study, but the unpredictable presence and low numbers of juvenile chinook salmon in the receiving creek made traditional in-situ studies impossible.

SOLUTION

Minnow Environmental designed an onsite exposure system, using hatchery-raised fish in controlled flow-through tanks to conduct effluent exposure tests with robust sample sizes.

RESULT

The custom exposure system provided reliable data with a high level of statistical power, enabling the mine to meet EEM requirements and demonstrate that effluent impacts were below critical effect sizes.

A Canadian mining operation faced a significant challenge in meeting the requirements of its Environmental Effects Monitoring (EEM) program under the Metal and Diamond Mining Effluent Regulations (MDMER). The creek receiving the mine's effluent was an intermittent home to juvenile chinook salmon. However, the salmon's presence in the creek was seasonal, intermittent, and in low numbers, making traditional onsite fish studies nearly impossible.

Over two EEM phases, Minnow Environmental, a Trinity Consultants Canada team, worked with the mine to attempt a traditional fish study, but the intermittent and variable usage of the creek habitat prevented meaningful results. Recognizing the need for an alternative approach to meet the MDMER requirement for a fish study to assess potential effects of mine effluent on fish, the mine's leadership asked Minnow to create a viable alternative that would allow the company to conduct controlled effluent exposure studies and meet the mine's challenging EEM requirements.

CHALLENGE

The mine's receiving creek presented a novel challenge for the company's EEM program. The creek was home to juvenile chinook salmon, but only briefly and in unpredictable numbers as the fish migrated to the sea. The intermittent presence and low numbers of salmon made it nearly impossible to conduct traditional fish studies.

Minnow initially attempted an in-creek study as required according to the Technical Guidance for EEM, but results confirmed that adequate sample sizes and consistent exposure measurements could not be achieved due to the variability in fish presence. Without a viable way to monitor exposure effects, the mine faced difficulty fulfilling its regulatory obligations under the EEM program, which requires assessing effluent impacts on fish and fish habitats.

The mine needed an alternative approach that could provide reliable, statistically robust data while overcoming the limitations posed by the creek's unique conditions.

SOLUTION

To solve the problem, Minnow partnered with an aquaculture expert to create a custom onsite exposure laboratory. This innovative system allowed Minnow to perform controlled effluent exposure studies using hatchery-raised juvenile salmon transported to the mine site. The system consisted of two 1,000-liter flow-through tanks, where the fish were divided into two groups: one exposed to effluent and one exposed to reference (control) water. The tanks were carefully calibrated to ensure that temperature, flow, and other conditions were identical across both groups, with effluent exposure as the only variable.

This approach allowed Minnow to use a much larger sample size—around 150 fish—than would have been possible in the creek. A larger dataset ensured the statistical power needed to detect meaningful differences between the effluent-exposed and reference groups. The exposure period of one month was based on findings from earlier studies of presence and occupancy, ensuring relevance to natural conditions observed in the creek.

Daily monitoring by the mine's environmental team and weekly oversight by the aquaculture expert ensured the system's reliability. Parameters such as temperature, flow rates, and fish health were closely controlled to avoid introducing confounding variables, such as temperature imbalances or disease outbreaks. At the end of the exposure period, Minnow assessed the fish for survival and growth, comparing results between the effluent-exposed and reference groups.

RESULT

The Minnow team demonstrated exceptional flexibility and problem-solving skills, transitioning from conventional methods to an innovative approach that addressed the unique challenges of the specific creek environment. The study results showed a slight difference in fish condition between the effluent-exposed and reference groups (which were detectable due to high statistical power), but the differences were below critical effect sizes. This confirmed that the effluent was not causing adverse effects on fish health, meeting regulatory requirements and supporting the mine's environmental management objectives.

This project highlights Minnow's deep understanding of EEM requirements and its ability to develop creative, science-driven solutions when traditional approaches fall short. By designing a custom onsite exposure system, Minnow not only resolved a complex problem but also set a new standard for addressing similar challenges in EEM programs, delivering measurable and defensible outcomes tailored to client needs.

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