

Syncrude Canada Ltd.'s Base Mine Lake: the first pit lake in the oil sands

Carla, Wytrykush
Syncrude Canada Ltd.

Summary

An oil sands pit lake is an area where overburden and oil sand has been removed for mining and, subsequently, filled with tailings materials to allow development into an acceptable closure feature within the reclamation landscape. These lakes may contain any combination of oil sands process-affected water (OSPW; from the bitumen extraction process), freshwater, fluid fine tailings (FFT), treated fluid tailings and other solids (for example, coarse tailings sand or overburden). The Base Mine Lake (BML) is the first commercial scale demonstration of a pit lake in the mineable oil sands industry. It is located in the former original mine at Syncrude's Mildred Lake site. Following mining, the pit was filled with FFT (silt, clay, process-affected water and residual bitumen). Today, the FFT underlies a water layer composed of a mixture of OSPW and fresh water. The configuration of FFT overlain by a water cap in BML is defined as water capped tailings technology. Based on more than thirty years of previous research and modelling, the prediction is that with time, the water quality will improve and the FFT will remain physically isolated, and ultimately, the lake will be a component of the closure landscape.

Since lake commissioning in 2013, the lake exhibits conventional boreal dimixis, the mudline is distinct and the FFT is settling as predicted. Water quality is improving as demonstrated by the decreased concentrations of a number of key variables. As well, early in the lake's development, most water quality parameters are already present at concentrations less than provincial and federal guidelines for the protection of freshwater aquatic life. Based on standard acute bioassays, evidence to date indicates that the lake's surface water is no longer acutely toxic. There is no chronic toxicity for fathead minnows. An invertebrate community is developing in the lake. Residual bitumen is present in the water and on the shoreline.

An adaptive management approach insures stewardship of the lake to short and long term objectives. A comprehensive research and monitoring program supports lake adaptive management and is designed to understand trends in lake performance and the processes and mechanisms responsible for those trends. Knowledge gained from this program is valuable for the design, operation, and eventual certification of oil sands pit lakes across the region