

## **PitMod: The Lorax Pit Lake Hydrodynamic and Water Quality Model**

**Authors :** Silvano Salvador, Maryam Zarrinderakht, Alan Martin

**Abstract :** Open pits, which are the result of mining, are filled by water over time until the water reaches the elevation of the local water table and generates mine pit lakes. There are several specific regulations about the water quality of pit lakes, and mining operations should keep the quality of groundwater above pre-defined standards. Therefore, an accurate, acceptable numerical model predicting pit lakes' water balance and water quality is needed in advance of mine excavation. We carry on analyzing and developing the model introduced by Crusius, Dunbar, et al. (2002) for pit lakes. This model, called "PitMod", simulates the physical and geochemical evolution of pit lakes over time scales ranging from a few months up to a century or more. Here, a lake is approximated as one-dimensional, horizontally averaged vertical layers. PitMod calculates the time-dependent vertical distribution of physical and geochemical pit lake properties, like temperature, salinity, conductivity, pH, trace metals, and dissolved oxygen, within each model layer. This model considers the effect of pit morphology, climate data, multiple surface and subsurface (groundwater) inflows/outflows, precipitation/evaporation, surface ice formation/melting, vertical mixing due to surface wind stress, convection, background turbulence and equilibrium geochemistry using PHREEQC and linking that to the geochemical reactions. PitMod, which is used and validated in over 50 mines projects since 2002, incorporates physical processes like those found in other lake models such as DYRESM (Imerito 2007). However, unlike DYRESM PitMod also includes geochemical processes, pit wall runoff, and other effects. In addition, PitMod is actively under development and can be customized as required for a particular site.

**Keywords :** pit lakes, mining, modeling, hydrology

**Conference Title :** ICMWM 2023 : International Conference on Mine and Water Management

**Conference Location :** Montreal, Canada

**Conference Dates :** May 15-16, 2023