Combining conductivity and flow velocity profiles to chemical balances in studying contaminant mixing and dilution in stream waters influenced by mine water discharges

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Electrical conductivity (EC) is useful as a general measure of stream water quality and can be utilized to compare and detect influence of contaminant sources. Mine water discharges to recipient stream affect not only the flow rate in the river but also water quality and conductivity. In natural stream waters, the depth and the shape of the river changes constantly and influences the water flow and behavior of contaminants.

The aim of the study was to test the utility of hydrological profiling device, CastAway-CTD (SonTek Inc) to indicate the influence of mine water discharges, as well as mixing and dilution in a stream affected by treated dewatering and process effluent waters from a Finnish gold mine. Seasonal CastAway-CTD measurements were conducted during 2014 to measure EC and water temperature in vertical and horizontal cross-sections of the stream. Also flow rate and velocity profiles of the cross-sections were measured by River Surveyor M9 device (SonTek Inc) in pursuance of CastAway-CTD measurements. Water and chemical balances were calculated for the stream catchment based on the measured field data and detailed water quality analyses.

Combination of hydrological and flow velocity profiling of stream channel cross-sections is a promising tool to pinpoint how contaminants behave and locate. The method describes how changes in the stream morphology and flow velocity affects to behavior, mixing and dilution of contaminants. The results show that in small tributary streams mixing and dilution of mine water discharges depends on both the discharge method and the location of discharge point as well as salinity of the mine water discharges.