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Analyzing Conductivity Profiles in Stream Waters Influenced by Mine Water Discharges

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Conductivity is useful as a general measure of stream water quality. Each stream inclines to have a quite constant range of conductivity that can be used as a baseline for comparing and detecting influence of contaminant sources. Conductivity in natural streams and rivers is affected primarily by the geology of the watershed. Thus discharges from ditches and streams affect not only the flow rate in the river but also the water quality and conductivity. In natural stream waters, the depth and the shape of the river channel change constantly, which changes also the water flow. Thus, an accurate measuring of conductivity or other water quality indicators is difficult. Reliable measurements are needed in order to have holistic view about amount of contaminants, sources of discharges and seasonal variation in mixing and dilution processes controlling the conductivity changes in river system.

We tested the utility of CastAway-CTD measuring device (SonTek Inc) to indicate the influence of mine waters as well as mixing and dilution occurring in the recipient river affected by treated dewatering and process effluent water discharges from a Finnish gold mine. The CastAway-CTD measuring device is a small, rugged and designed for profiling of depths of up to 100m. Device measures temperature, salinity, conductivity and sound of speed using 5 Hz response time. It has also built-in GPS which produces location information. CTD casts are normally used to produce vertical conductivity profile for rather deep waters like seas or lakes. We did seasonal multiple Castaway-CTD measurements during 2013 and 2014 and produced scaled vertical and horizontal profiles of conductivity and water temperature at the river.

CastAway-CTD measurement pinpoints how possible contaminants behave and locate in stream waters. The conductivity profiles measured by CastAway-CTD device show the variation in maximum conductivity values vertically in measuring locations and horizontally in measured cross-sections. The data from field measurements was combined with detailed water quality analysis and processed by data analysis with Matlab to produce more holistic information about the behavior, mixing and dilution of possible contaminants at the river. Moreover, the results can be used to improve water sampling procedures for more representative sampling and to plan continuous monitoring site locations and measuring device mounting places.