ELECTRICAL RESISTIVITY AND INDUCED POLARIZATION TOMOGRAPHY CHARACTERIZATION OF HYPORHEIC ZONE EXCHANGE IMPACTING MERCURY TRANSPORT IN EAST FORK POPULAR CREEK, TENNESSEE

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Mercury (Hg) contamination of the headwaters of East Fork Poplar Creek (EFPC) in Tennessee has been reported for at least 30 years. This research aims to address the need to quantify the locations and uncertainty of Hg sources and fluxes into the EFPC stream at a focused reach-scale length of around 200 meters. The geophysical methods of, electrical resistivity tomography (ERT) and induced polarization (IP) were used to non-destructively characterize large volumes of the surface water – hyporheic water continuum of the bank and stream in preparation of a tracer test. The 12 transects of ERT and induced IP were collected with 3 meter electrode intervals, including 11 lines perpendicular and across the stream and one line parallel to the stream. The multi-gradient Wenner array was applied to measure the electrical properties to map out the subsurface heterogeneity underneath EFPC. The results revealed a two-layer system including a conductive and chargeable, clay-rich soil overlying a less conductive limestone bedrock with low chargeability. The bedrock, although fracture-flow dominated, likely has a lower hydraulic conductivity than the overlying soils, which may limit the transportation of Hg through the groundwater system. A buried paleochannel was discovered below and adjacent to the current creek, which could impact the storage and transport of groundwater and solutes, such as Hg. These results illustrate the potential for electrical methods to support subsurface and hyporheic zone characterization of surface water and groundwater exchange.