Title : Assessment of Sedimentation Pond Seepage at Akara Mine, Phichit Province Using Electrical Resistivity Tomography and Hydrochemical Analysis

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ABSTRACT

This study assessed potential seepage from Sedimentation Pond 12 at the Akara Mine, Phichit province, to surrounding water resources using electrical resistivity tomography (ERT) and hydrochemical analysis. The ERT survey employed a dipole–dipole configuration with 1.5 m electrode spacing along a 330 m profile. The resulting two-dimensional resistivity section was interpreted together with borehole lithology and hydraulic head data. Groundwater flow direction coupled with an interpreted hydrogeologic cross section were analyzed to verify hydraulic connectivity between the pond and the shallow aquifer. The results suggest that the shallow groundwater system and Sedimentation Pond 12 are linked to the same unconfined aquifer. The subsurface was interpreted as three hydrostratigraphic units: (1) an upper lateritic layer (5 m thick) forming the shallow unconfined aquifer and hydraulically connected to the pond; (2) an intermediate clay and weathered rock (15 m thick) acting as an aquitard; and (3) underlying bedrock associated with a deeper confined aquifer.

Hydrochemical analysis was based on 21 surface water samples, 12 shallow groundwater samples (unconfined aquifer), and 12 deep groundwater samples (confined aquifer). Physical and chemical properties were measured, and hydrochemical facies were identified using Piper and Stiff diagrams. Dominant geochemical controls on water chemistry were evaluated using Gibbs diagram. Surface water exhibited pH of 5.62–8.98, electrical conductivity (EC) of 100–4,900 µS/cm, and total dissolved solids (TDS) of 50–2,450 mg/L, with a dominant calcium–sulfate (Ca–SO_4) water type. Shallow groundwater showed pH of 5.25–6.30, EC of 30.5–1,255 µS/cm, and TDS of 15.2–627.3 mg/L, and was predominantly characterized by a calcium–bicarbonate (Ca–HCO_3) water type, with one downgradient well exhibiting a

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Ca–SO_4 type. Deep groundwater exhibited pH of 6.05–6.76, EC of 155.5–502.1 µS/cm, and TDS of 77.7–244.6 mg/L, and was characterized by a Ca–HCO_3 water type. Gibbs plots suggests that surface water and shallow groundwater chemistry are primarily influenced by rainfall recharge, runoff, and mining-related inputs, whereas deep groundwater chemistry is mainly controlled by water–rock interaction.

Given the lateral continuity of hydrogeologic units and the hydraulic connection between the pond and the lateritic unconfined aquifer, shallow groundwater is the most likely receptor if seepage occurs. Overall, the results suggest a plausible seepage pathway from the pond to the shallow unconfined aquifer, with potential risk to nearby agricultural areas. Therefore, continuous groundwater monitoring is recommended to manage potential long-term environmental impacts.

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