

Identifying Leachate Plumes Using Geophysical Methods: A Case Study from Open Municipal Solid Waste Dumpsite in Badulla

K.K.V. Dulmini¹, S.A. Samaranyake^{1*}, S.N. De Silva², D.T. Udagedara¹,
H.M.D.A.H. Bandara³, K.V.G.S. Perera³

¹*Department of Science and Technology, Uva Wellassa University, Badulla, Sri Lanka*

²*Geological Survey and Mines Bureau, Pitakotte, Sri Lanka*

³*National institute of Fundamental Studies, Hanthana Road, Kandy, Sri Lanka*

Badulla dumpsite is one of the major open municipal dumpsites in Sri Lanka. However the dumpsite has not been constructed according to the modern engineering techniques and it has no liner to prevent seepage of leachate. Therefore leachate pockets can be built up in the subsurface and they can flow directly to a nearby surface water body (Badulu oya) through surface and subsurface channels, due to elevation difference. Therefore mapping leachate plumes and their flow paths have high interest in the environmental management and prevention of surface water pollution. Hence in this study leachate flow paths were delineated by using resistivity imaging with controlled inversion parameters and magnetic mapping techniques. The geophysical findings of the leachate characters, were supplemented with physico-chemical parameter analysis of collected leachate samples from solid waste dumpsite and leachate drainage channel. Leachate plumes were demarcated by 2D resistivity technique, and a unique correlation was established between ground magnetic results and resistivity imaging. 3D resistivity contour plot synthesized by 2D resistivity imaging profiles, confirms that leachate plumes and their flow paths are confined to near surface, almost throughout the dumping area. Moreover high electric conductivity values of leachate produce unique signature in resistivity image. Chemical parameters such as biochemical oxygen demand, chemical oxygen demand and phosphate are above the tolerance limits for the discharge of industrial wastewater into inland surface waters. This study reveals the appearance of subsurface leachate plumes in Badulla dump site and their flow paths. It is recommended to build a retaining wall in the identified direction of leachate flow path down to the depth of bedrock in order to prevent seepage of leachate to Badulu oya and accumulated leachates should be treated prior to discharge.

Keywords: Geophysical methods, 2D and 3D resistivity, Magnetic method, Leachate plume delineation, Physico-chemical analysis