The subject of this study is the Fluvisol profile, developed in the Stara Loza water wellfield area of the Zagreb aquifer. The main objectives of the investigation were: 1) to determine the sorption characteristics of lead, zinc, copper and cadmium using a batch experiment and 2) to build isotherms of potentially toxic metals (PTMs) in soil horizons of Fluvisol. The soil texture is silt loam of a light yellow colour, and granular structure. The pH values of the soil vary from 7.97 to 8.38. Cation exchange capacity (CEC) has higher values in the first three horizons. Based on the results of the experiment, linear sorption isotherms were created for all the soil horizons. Freundlich distribution coefficients are determined from sorption isotherms, and the sequence is Pb > Cu > Cd > Zn. The comparison of sorption isotherms has determined that lead has the best sorption in the soil. Sorption of potentially toxic metals decreases with depth.