This paper presents a new approach based on a fully coupled procedure in which the lubricant flow and the plastic deformation of the metallic material in metal forming are solved simultaneously. The proposed method is an alternative to conventional modelling techniques which allow studying the effect of a broad range of parameters directly on the friction conditions. The approach is applied to strip reduction of a sheet with mesoscopic surface pockets in order to investigate the escape of lubricant from the pocket by means of Micro Plasto HydroDynamic Lubrication and MicroPlasto HydroStatic Lubrication. For the investigation on Micro Plasto HydroStatic Lubrication, the friction along the tool–workpiece contact interface and the back tension are taken as parameters, and the backward escape Micro Plasto HydroDynamic Lubrication is investigated by variations in lubricant viscosity by means of a combined numerical and analytical model, and by variations in drawing speed. Good agreement is found with the experimental observations.