Micromachining technologies are now being employed in various industries for generation of precise features on engineering components. Among these processes, micro electrical discharge machining is a ‘non-contact’ machining technology suitable for material removal from electrically conductive materials characterized by considerable wear of the tool used for material removal. This paper presents an investigation involving modeling and estimation of the effect of settings for generation of discharges in stable conditions of micro-EDM on the phenomenon of tool electrode wear. A stable sparking condition during the process is achieved with varying voltage (V), capacitance (C), threshold (T), and discharge frequency (f). The tool electrode wear model has revealed that the energy of the sparks interacting with the tool surfaces control the phenomenon through the settings of capacitance followed by the voltage. The variables controlling the current settings for generation of stable discharges are not found to interact with each other to generate a variation on the tool wear. An increase in feed rate from 2 to 6 μm/s causes a decrease in TWR by 17%. The analysis and modeling approach helps achieve a condition for the minimum tool wear for this micro-EDM process configuration.