$$\tilde{V}(\Psi) = 18\gamma M^3 k^2 \sinh^2\left[\frac{1}{\sqrt{12\gamma M^3}}\left(\Psi - \Psi_{\rm P}\right) + \ln\left(\frac{c_2 - \omega_m}{c_2 + \omega_m}\right)\right] \quad .$$