Abstract: In this work, we study geometrical and physical properties of exact spacetimes that belong to non-expanding Plebański–Demiański class. It is a family of solutions of type D that also belong to the Kundt class, and contain seven arbitrary parameters including a cosmological constant. We present here the results of three extensive articles, each focusing on a different aspect of the problem. In the first article, we investigate the meaning of individual parameters in the non-expanding Plebański–Demiański metric. First, we set almost all parameters to zero and obtain Minkowski and (anti-)de Sitter backgrounds. Afterwards, we allow other parameters to be non-zero and we study the $B$-metrics, non-singular “anti-NUT” solutions and conclude with the full electrovacuum Plebański–Demiański metric. In the second article, we focus on the de Sitter and anti-de Sitter backgrounds where we present and analyse 11 new diagonal metric forms of (anti-)de Sitter spacetime. We find five-dimensional parametrizations, draw coordinate surfaces and conformal diagrams. In the third article, we show that the $AII$-metric together with the $BI$-metric describes gravitational field around a tachyon on both Minkowski and (anti-)de Sitter backgrounds. Finally, in order to better understand the global structure and extensions of the $BI$-metric, we examine its geodesics.