We consider Graph-Constrained Coalition Formation (GCCF), a widely studied subproblem of coalition formation in which the set of valid coalitions is restricted by a graph. We propose COP-GCCF, a novel approach that models GCCF as a COP, and we solve such COP with a highly-parallel approach based on Bucket Elimination executed on the GPU, which is able to exploit the high constraint tightness of COP-GCCF. Results show that our approach outperforms state of the art algorithms (i.e., DyCE and IDPG) by at least one order of magnitude on realistic graphs, i.e., a crawl of the Twitter social graph, both in terms of runtime and memory.