

Comparison of Fundão Dam Breach Flow to Natural Floods Along Rio Doce Watershed

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On November 5, 2015 the Fundão Dam (Minas Gerais, Brazil) breached and downstream watercourses were affected by the scouring of sediments, transport and deposition of tailings, dam construction materials and other debris for approximately 680 kilometers along the Doce River watershed. The debris flood event path impacted the following reaches in succession: Santarém water dam; Santarém creek; Gualaxo do Norte river; Carmo river; Doce river; with final discharge into the Atlantic Ocean. Along this flow path the watershed area increased from around 10 km² to over 82,000 km², corresponding to the Fundão dam watershed and Linhares gauging station watershed respectively. In order to assess the potential physical impact of the flood wave due to the dam breach, peak flow rates that occurred after the breach were compared to the fitting curves of the flood frequency analysis undertaken for each of the gauging stations located in Doce river. Following the Fundão dam breach, measured flow rates of the debris flood event from different sections of the river were made available by CPRM, starting at Cachoeira dos Açulos gauging station, located in Doce river downstream Risoleta Neves HPP (Candongia dam), at 210 km from Fundão dam. Although existing gauging stations located upstream Candonga dam were damaged by the breach event, the peak flow were estimated at two sites assuming critical depth for the hydraulic conditions in these river sections. Results indicated that flood hydrograph was gradually attenuated along impacted watercourses, with greater reduction in peak discharge along Santarém creek and Gualaxo do Norte river. The dam breach debris flood event hydrograph reached Carmo river with a peak discharge value estimated as greater than 10,000-year return period. At Candonga dam, the hydrograph was attenuated by the reservoir and peak outflow was estimated as not greater than 100-year return period flow at the dam section. At the gauging stations analyzed downstream Candonga dam, peak flow during the debris flood event was estimated being no greater than a 1 or 2-year flood event. Overall, as the watershed area increases, so does the natural flow rates of the river, therefore it was expected that the physical impact of the debris flood event was progressively attenuated as it moved downstream, and the watershed and river channel width increased. Additional co-authors: Fernando Luís Fonseca de Oliveira Tomé (MSc) Title: Water Resources Specialist Company: Golder Associates Ltd. Phone: - E-mail: fernando2904@gmail.com Co-Author #5 Name: Alice Pereira Lima Title: Civil Engineering Company: Golder Associates Phone: +55 31 2121 9876 E-mail: alima@golder.com.br Co-Author #6 Name: Luiza Peron de Oliveira Title: Intern Environmental Engineer Company: Golder Associates Phone: +55 31 2121 9843 E-mail: LPoliveira@golder.com.br