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This study set out to quantify the effects that low probability, extreme precipitation events have on surface water quality. The 2-dimensional process-based CE-QUAL-W2 model was used to simulate water quality constituents in the Wachusett Reservoir. Three hypothetical storms were modeled with precipitation depths of 4 inches (5-year return interval), 6 inches (50-year return interval), and 8 inches (100-year return interval) over a 24-hour period. These events were imposed on hydrograph data from 2011 over historic precipitation events during the spring and summer while the reservoir was unstratified and stratified, respectively. The analysis focused on organic matter since performance and cost of the treatment processes employed on this water are most sensitive to changes in this constituent. For the Wachusett Reservoir, elevated levels of organic matter lead to significant increases in the amount of chlorine and ozone needed for treatment.

For the simulated spring storms, average TOC, UV-254, and algae concentrations surpassed the maximum springtime values for 2011 by 23%, 36%, and 115%, respectively. For the simulated summer storms, average TOC, UV-254, and algae concentrations surpassed maximum summer values for 2011 by 44%, 177%, and 60% respectively. This study is important because future climate projections suggest that extreme weather events including low-probability precipitation events may become more common. These extreme precipitation events can lead to increased erosion & transport of water quality constituents as this study has shown. In turn, these events can impact the steps we need to take to treat our water.

Jeznach, L. C., Hagemann, M., Park, M.-H., & Tobiason, J. E. (2017). Proactive modeling of water quality impacts of extreme precipitation events in a drinking water reservoir. Journal of Environmental Management, 201, 241–251. doi: 10.1016/j.jenvman.2017.06.047