Streamflow Variability and Treatment System Effectiveness in a Changing Climate[1]

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Abstract: Mining impaired watershed are frequently treated with passive or active treatment schemes that treat multiple discharges in one location or over-treat in one location to manage acid mine drainage (AMD) inputs at nearby locations. Treatment system effectiveness can vary based on the flow regime of the AMD input, the treatment train itself, and the receiving water body. Using the Stoertz Water Quality Evaluation Method, the impact on treatment system effectiveness, measured as increase in net alkalinity and decrease in Fe + Al + Mn concentration in the receiving water body, at varying flow conditions has been determined. Long-term monitoring locations used for this evaluation have data for at least five years, up to fifteen years. While results varied between watersheds, two main patterns stood out. First, in watersheds receiving AMD from larger underground mine workings, critical chemical conditions were reached in low flow periods in the summer. This time period is coupled with low flow conditions which may limit the flow through treatment systems if they are not fed directly from the AMD source (e.g. a source pond fed steel slag leach bed), whereas systems fed directly from an AMD source (e.g. lime doser) met the treatment need in critical conditions given enough flow to transport and dissolve the alkaline material. Second, in watersheds with primarily surface mining impacts, critical chemical conditions were reached in the rising leg of storm conditions. The effectiveness of treatment systems varied in these conditions. Long-term discharge data at three USGS gauge stations associated with mining impaired watersheds in southern Ohio were analyzed to determine both the inherent variability in flow between years and to identify any trends in flow variability with changing climate. While not statistically significant, increased summer rainfall is apparent, potentially changing the timing and nature of critical chemical conditions in treated AMD streams.[3]

Additional Keywords: climate change, acid mine drainage, coal mining, remediation.

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3. Work reported here was conducted near 39°22’44” N, 82°15’57” W.