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WATER SUPPLY RELIABILITY ASSESSMENT USING MONTE CARLO SIMULATION

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ABSTRACT: Often times, reliability of water supply is defined using deterministic measures of conservative assumptions, which does not necessarily account for uncertainties in multiple parts of the system. By excluding some uncertainties inherent in the system, the performance of the system cannot be adequately understood. This presentation will demonstrate how Monte Carlo simulation of a water supply system can be used to support more robust decision making. Monte Carlo is a powerful tool for modeling the reliability of a system. This method uses statistics to mathematically model a real-life process and then estimate the likelihood of possible outcomes. The results of such an analysis can be used to provide economic justification for reliability improvements to an existing water supply system. A hypothetical system being modeled consists of climate, runoff, reservoir operations, water use, and contracted water supply. Uncertainty is propagated through the system model by coupling climate, farming practices, and economic factors together in the causality sequence. Climate uncertainty affects farming practices and operations of the reservoir. Farming practices affect water use, which in turn impacts price of water and hence operations of the water supply system. Uncertainty propagates through the system and cause-effect of this uncertainty and operations is cyclical within the system. A highly visual modeling platform is used to conceptualize this process and results show how this process is useful for decision making under increasing uncertainty and conflicting priorities. Overall system reliability is compared to various levels of future expenditures for water supply projects. Reliability is defined using conflicting priorities to protect the system against risk of water supply shortages and flood damages.

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