Effects of Reduced Controlled Releases from Lake Thurmond on Salinity Intrusion in the Lower Savannah River Estuary

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Abstract. If drought conditions persist in Georgia and South Carolina through 2008, the Savannah River Reservoirs may reach Level 4 of the Savannah River Drought Contingency Plan. Level 4 allows for a reduction of discharges from Thurmond Dam to the net tributary inflow to the reservoir. To decrease the effect of the reduced releases on downstream resources, a stepped approach is being proposed to reduce the flow in increments of 500 cubic feet per second (ft^3/s) intervals. The current minimum release of 3,600 ft^3/s would be followed by reductions to 3,100 ft^3/s and 2,600 ft^3/s.

The reduced flows were simulated with two previously developed models of the Lower Savannah River Estuary to evaluate the potential effects on salinity intrusion. The models are the Model-to-Marsh Decision Support System (M2MDSS, Conrads and others, 2006) developed by the U.S. Geological Survey (USGS) and the Environmental Fluid Dynamic Code (EFDC; Hamrick, 1992; Tetra Tech, 2005) developed by U.S. Environmental Protection Agency and Tetra Tech. The empirical M2MDSS was trained using data-mining techniques, including artificial neural network (ANN) models. The 3-dimensional mechanistic model, EFDC was calibrated and validated using continuous data collected in the summers of 1999 and 1997, respectively, and confirmed using a 7 years of continuous data from seven USGS gages in the estuary.

For any modeling effort, empirical or deterministic, the reliability of the model is dependent on the completeness of the datasets and on the quality of the data and range of measured conditions used for training or calibrating the model. Often models used for environmental regulation or planning simulate conditions beyond the range of data used to calibrate or train a model. It should be noted that both models must extrapolate beyond the range of data used to train and calibrate the models to simulate the proposed decreases in controlled releases.

The end of the previous drought (2002) was selected as the baseline condition for the simulations with the model. Salinity intrusion at the I-95 Bridge on the Savannah River coincided with the 28-day cycle semi-diurnal tidal cycles. The majority of the salinity intrusions during 2002 were less than 0.2 practical salinity units and the durations were for two hours or less for one or two tides. With the flows reduced to 2,600 ft^3/s, the majority of salinity intrusions are greater than 6.0 practical salinity units and the durations occur for several hours and for several high tides over four or five days. The increase in the salinity resulting from the reduced flows may have potential impacts on the freshwater tidal marsh of the Savannah National Wildlife Refuge. The increased salinity in the Lower Savannah River Estuary, and associated increases in chloride concentrations, also may impact freshwater supplies for the City of Savannah and Beaufort-Jasper Water and Sewer Authority.

References:

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